AIR COMBAT COMMAND

U.S. AIR FORCE

Installation Development and Design (ID2) Handbook

Nellis and Creech Air Force Bases, Nevada

ID2

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1 Introduction

This ID2 Handbook addresses planning, design and construction criteria guidance for Nellis and Creech Air Force Bases (Nellis AFB and Creech AFB) (Figure 1-1) so that implementing Sustainable Development and High Performance Green Building Design (SD&HPGBD) objectives become primary considerations along with building site, context, program needs and function.

Located in Clark County, Nevada, Nellis AFB is located northeast of the City of North Las Vegas. The base is located approximately eight miles northeast of downtown Las Vegas and covers more than 14,000 acres. The base is home to the U.S. Air Force Warfare Center, which oversees operations of the 57th Wing, the 98th Range and 99th Air Base Wings at Nellis AFB, Nevada, and the 53rd Wing at Eglin Air Force Base, Florida.

Located in Clark County, Nevada, Creech AFB is located 43 miles northwest of Nellis AFB. The base covers 2,070 acres. The base is home to the 432d Wing under Air Combat Command's 12th Air Force. The 432d Wing and 432d Air Expeditionary Wing (AEW) consists of combat ready airmen who fly the MQ-1 Predator and MQ- 9 Reaper aircraft to support American and Coalition warfighters. The remotely piloted aircraft systems provide real-time reconnaissance, surveillance, and precision attack against fixed and time-critical targets.

The development vision for Nellis AFB is to:

Maintain, revitalize, and expand facilities to support 21st Century Air Force missions that play a predominant role in protecting and preserving the national interests of the United States of America. It is imperative that we recognize our goals and objectives and develop built-in flexibility to support changing requirements.

The combined missions of Nellis AFB, Creech AFB and Nevada Test and Training Range[1] (NTTR) *are to ensure national security through advanced training and operational testing activities*.

1.1 Document Scope, Applicability, and Audience

Current guidance removes design process short-circuits by realigning constraints, changing mandates into a performance framework and limiting prescriptive requirements to those critical in meeting Command and Installation functional requirements. Prior editions of design guidance, both at the Command and Installation level, relied heavily on mandates and prescriptive formulas relating to the building form, aesthetics and materials, and this often narrowed design-phase investigations into plan arrangement exercises.

Installation-level development and design guidance focuses on the identification of regional and local design characteristics, common building methods and preferences, architectural context, landscape standards, infill and building density opportunities, future vision and the establishment of installation-centric preferences, and strategies. Building aesthetics and character cannot be fully established prior to conducting the concept charrette, as aesthetics develop and evolve in response to multiple drivers. Designing and then evaluating aesthetics and architectural character are highly subjective and must be approached on a project-by-project basis.

Companion information to this document is provided in the form of an Installation 3D mass model, photographic log database and the Installation Sustainability Assessment (ISA). The Installation 3D mass model is dimensionally accurate and reflects overall building massing, height and form. The photographic log database includes all structures on the installation, with the exception of family housing units and utility sheds. The ISA serves to provide a current-state snapshot of the Installation's "green posture" and will serve as a way to measure changes over time. Indicators should change for the better over time as more green design strategies and processes are put into place.

1.1.1 Applicability

Publication of this handbook serves to supersede previous installation-level design guidance. All external references to installation-level guidance documents now refer to the Installation Development and Design (ID2) Handbook. The ID2 serves to inform Future Year Development Plan site selections, Area Development Plan (ADP) designs, Requirements Document investigations and Concept Charrette Document packages. The ID2 will be summarized in the installation Electronic General Plan (eGP).

Architect-engineer scope of work descriptions, request for proposal solicitations and design-bid-build and design-build contracts shall explicitly identify Headquarters (HQ) Air Combat Command (ACC)/A7P SD&HPGBD requirements and objectives as functional requirements.

[1]The Nevada Test and Training Range is a training facility of the United States Air Force located in the desert of southern Nevada in the United States. It is the largest of its kind in the US, with 4,687 square miles (12,140 km2), and is operated by the USAF Warfare Center's 98th Range Wing.

NELLIS AIR FORCE BASE

Vicinity Map

Figure 1-1

The ID2 shall be referenced in all design and/or construction solicitations to inform contractors of its existence, and to ensure that the goals underlying the ID2 are incorporated into all new projects. This reference should inform contractors that the ID2 document does not mandate facility aesthetics, character, or form, but rather that it contains broad design considerations relative to the installation's built environment. The reference should include a statement that the contractor's responsiveness to these considerations is an important evaluation factor when reviewing proposals, as well as subsequent design submittals.

1.1.2 Audience

This ID2 Handbook provides criteria and considerations used in the planning and development and design of projects. These criteria and considerations are in addition to technical criteria readily available to professional architects, planners, engineers and interior designers. This document and companion information sources shall be used as primary references in all planning/siting considerations, building renovation projects and new construction projects.

1.2 Development and Design—A Holistic Approach

1.2.1 HQ ACC/A7P

The Command's vision is to lead by example and serve as a role model for SD&HPGBD in the Air Force, Department of Defense (DoD) and the federal government. When "Green Design" is infused into every facet and decision, immediate and long-range benefits will be realized. The benefits will include creating healthier working environments, reducing the installation's carbon footprint and enhancing the enduring quality of facilities while lowering the total cost of facility ownership. To this end, development and design strategies must incorporate a myriad of factors and influences. This will ensure solutions embody green building design and are appropriate to the site, sensitive to the built and natural context, reflective of functional needs and responsive to aesthetic considerations.

Green design is not optional. Implementing green building design (functional constraints) objectives is required to produce a complete and usable facility or a complete and usable improvement to an existing facility. A green building design approach forms the functional and technical foundation for all performance requirements, development considerations, and design constraints made, referenced, or otherwise used in this document.

"Green design" is synonymous with "quality design." Quality design strategies produce results that conserve energy; make efficient use of resources; produce visually appealing structures; reduce environmental degradation; create built environments that are livable, comfortable, safe, enduring, and productive; and shrink the environmental impact of our operations.

1.3 Development and Design—Requirements and Evaluation Metrics

1.3.1 HQ ACC/A7P Requirements

Command-level requirements are described in ACC Instruction, ID2 (publication forthcoming). This document establishes SD&HPGBD objectives as primary functional constraints, prescribes HQ ACC/A7P review and oversight processes, identifies architectural and engineering design considerations, and promulgates performance and prescriptive constraints.

1.3.2 Installation Requirements

The ID2 aligns with command-level guidance and is intended to be a vital component in developing strategies appropriate to smart growth development and the building site, sensitive to the built context, reflective of building program and scale and responsive to object/background importance. It should also fully implement SD&HPGBD objectives. The ID2 describes constraints and identifies objectives necessary to accomplish quality design. Topics and focus areas include installation context, architectural context, an Illustrative Plan, overarching development and design guidelines, site selection and development considerations, landscape design issues, architectural design objectives and technical constraints.

Technical constraints can be generally categorized either as "Non-Negotiable," such as compatibility with existing fire-alarm communication or keying systems, or "Negotiable," such as a concrete masonry unit (CMU) generally used throughout the installation. "Non-Negotiable" constraints should not directly or indirectly predetermine building aesthetics, character, or form or limit/restrict investigation of high performance green building design strategies.

1.3.3 HQ ACC Development and Design Review Board (D2 Board) Evaluation Metrics

Projects meeting threshold levels established in the *ACC Instruction* (publication forthcoming) will be evaluated by the HQ ACC D2 Board. D2 Board evaluations seek to

validate conformance with requirements established by Command-level guidance and this document and seek to validate adherence to principles of quality design. These principles include optimizing benefits from site selection and energy use, protecting and conserving water resources, utilizing environmentally preferable products, enhancing indoor environmental quality and optimizing operational and maintenance practices. All development and design solutions must embody an *"appropriate response"* and reflect a responsible use of public funds.

Evaluations of aesthetics and architectural design are inherently subjective, and the D2 Board reserves latitude in evaluating design strategies on a project-by-project basis. Design aesthetics, architectural character, and appropriate building form cannot be prescriptively determined in advance of conducting a concept development charrette, as these characteristics arise only after consideration and synthesis of all design drivers. Setting aesthetic preconditions short-circuits design development and will be avoided.

1.3.4 HQ ACC D2 Board Evaluations

D2 Board evaluations may produce recommendations (non-mandatory), directives (mandatory), or a combination of both. In extreme cases, D2 Board directives may include project stoppage in order to address continued or critical failures in meeting functional constraints.

Directives must be implemented, unless in very rare and extenuating circumstances a waiver is first endorsed by the D2 Board and then approved by HQ ACC/A7. Waiver requests must be submitted by the Base Civil Engineering Squadron Commander, must clearly document the basis for non-compliance, and describe actions that will be taken to offset the deviation. Issuance of a waiver does not establish precedent or a basis for justifying other projects' non-compliance.

1.3.5 Installation Evaluation Metrics and Evaluations

Installation metrics are those used by the D2 Board with additional interest in evaluating the implementation of installation-centric technical requirements. Installation evaluations may result in recommendations (non-mandatory), directives (mandatory), or a combination of both.

1.4 Organization of this Document

This ID2 Handbook is organized into five main chapters:

- **Chapter 1, Introduction—**Familiarizes the reader with the need, scope and applicability, requirements and organization of the document
- **Chapter 2, Installation Image—**Provides insight into the existing conditions found on base, specifically in areas where new development can be accommodated
- **Chapter 3, Development Considerations—**Provides information regarding opportunities and constraints found within the development areas
- **Chapter 4, Illustrative Plan—**Provides a view of potential development opportunities in the next 10 to 20 years
- **Chapter 5, Development and Design Guidelines—** Highlights approaches to areas of SD&HPGBDs, site development and architectural design
- **Appendices—**Identify specific technical considerations and constraints and other supporting materials

2 Installation Image

This chapter presents a discussion of the installation context, which identifies the natural and manmade condition present at the installation. It is within these conditions that planning, design, and construction decision are made. The context discussion is followed by a discussion of design goals that help define the future "image of the base." Also identified and evaluated are the physical elements of the installation that make up the current "image" of the base. These elements include paths, edges, nodes, landmarks, and districts. This report uses the element framework established in Kevin Lynch's *The Image of the City*, which was first published in 1960 by the M.I.T. Press.

The physical elements that make up an image of a community or military installation form an impression of the installation for military and civilian personnel, families, and visitors. The sense of place that is established through the combination of paths, edges, nodes, and landmarks adds to the quality of life for installation residents and workers. The way these elements are treated can add to the knowledge or perception of the important locations on the installation and provide visual directions for traversing the installation.

- A well-established hierarchy of roads (or paths) provides a driver with strong clues as to whether they are in the right location. An important element of road hierarchy is how the streetscape is treated. Roads should be limited, serve a defined purpose and, in most instances, the streetscape should be shared with pedestrians.

  The hierarchy of paths also extends to the pedestrian environment. Paths should provide a pleasant way to walk, bike or jog throughout the installation and should be designed appropriately for their task, which ranges from simple access to a building, an installation-wide bike trail or pedestrian plazas and walkways in high-density nodes.

- Edges can physically separate areas and function, but edges can also form screens to reduce or eliminate views of certain areas. Edges can be used to frame a visitor's perspective of an installation, frame nodes, and highlight landmarks.

- Nodes are associated with multiple image elements, such as locations where decisions are made or locations that draw higher densities of people. A node is in many cases distinctly different from many other locations on an installation because that area is a relatively constant center of gravity for social or work-related gatherings. Nodes can be highlighted and identified through the establishment of a landmark.

Although signage is necessary to assist people in wayfinding, landmarks are an important way to direct people from one place to another. Landmarks serve many purposes, from inspirational to simple functional structures. Height, scale, and site are typical elements of a landmark; however, they are not always used to the maximum extent.

2.1 Installation Context

Planning, design and construction decisions need to be based on the fundamental tenets of sustainable design[1]. They also require an understanding of natural resource conditions from the region to the site, geographically-specific environmental priorities, and the needs of personnel to effectively complete their tasks.

2.1.1 Resource Overview

Nellis AFB and Creech AFB lie in interior western North America. With the Sierra Nevada Range approximately 90 miles to the west and the Wasatch Range 135 miles to the east, Nellis AFB and Creech AFB lie within the Colorado River drainage area. Separated from the moderating influence of the Pacific Ocean by hundreds of miles and by the lofty Sierra Nevada, Nellis AFB and Creech AFB are dominated by a continental climate with pronounced winter and summer seasons and low rainfall. The bases are separated by a distance of 43 miles.

The climate at Nellis and Creech AFBs is typical of the desert southwest.

- The climate is arid with an average humidity of 21 to 39 percent and a precipitation of approximately 4 inches annually.

- Most of the rainfall occurs during January-February and July-August.

- Summers are hot, with maximum temperatures commonly in the range of over 100°F.

- Winters are mild with daytime maximum temperatures reaching 60°F and minimum temperatures averaging about 35°F.

[1]Sustainability is generally considered to be the integration of ecology, sociology, and economics in addressing master planning and building design; however, master planning and design for military installations requires additional considerations. Sustainable planning and design solutions for military installations are directly linked to mission sustainment, quality of life for personnel and families, conservation of natural resources and economic realities.

- Each summer, usually during a brief, two-week period, the infusion of warm moist tropical air causes scattered thunderstorms and flash flooding.

- Evaporation rates are very high and have been estimated at approximately 58 to 69 inches per year.

Most of the soils at Nellis AFB are alluvial soils produced by erosion and wash of soils from surrounding mountains. The upper soil layer is light brown sandy loam with gravel and clay-rich sand. The average depth of topsoil ranges from 6 to 24 inches. Below 24 inches are strata of caliche, which are often impenetrable to water and physical disturbance. Soils at Creech AFB are predominantly alluvial, derived from carbonate parent material. With a poorly developed A horizon, the B horizon has a cumulic character due to the substantial influx of silt and clay-sized particles.

There are no natural perennial or intermittent streams, lakes, or springs on Nellis or Creech AFBs. Three groundwater wells on Creech provide the base with all its potable water. The source of approximately 29 percent of the potable water used on Nellis is groundwater. Although there has been no formal determination, investigation into the identification of wetlands on both Nellis and Creech AFBs indicate there are no jurisdictional wetlands.


Desert Tortoise

Of the four species cited as found on Nellis AFB in the 2010 Integrated Natural Resources Management Plan (INRMP), only the Desert Tortoise is protected under the Endangered Species Act. There are two sensitive plant species, the Las Vegas Bearpoppy and Las Vegas Buckwheat. During The Nature Conservancy's surveys of rare plant species on the NTTR (including Creech) in 1992 and 1994, no species were identified that are currently federally-listed as threatened or endangered. However, there are approximately 20 rare species that have conservation goals. The 2010 INRMP also provides conservation goals for seven animal species.

2.1.2 Design Information

The following is location information for bases:

- Nellis:
  - Latitude = 36° 14′ 10″ North and Longitude = 115° 2′ 3″ West
  - Altitude Above Sea Level = 1,900 feet
  - Cooling Design: 0.4 percent cooling design dry bulb is 115 F at a WB temp of 67.6 F
  - Heating Design: 99.6 percent heating dry bulb temp is 28.2 F (99 percent temp is 31.5 F)
  - Summer Cooling Tower Designs: 0.4 percent evaporation wet bulb at a mean coincident dry bulb of 72.5 F wet bulb at 95 F dry bulb
  - Wind Load Criteria: 90 MPH
- Creech:
  - Latitude = 36° 35′ 14″ North and Longitude = 115° 40′ 24″ West
  - Altitude Above Sea Level = 3,133 feet
- Las Vegas:
  - Heating Degree Days = 2,276 (based on 65° F)
  - Cooling Degree Days = 3,168 (based on 65° F)
  - Sun Altitude Angles = Noon on 21 December = 30.4°; Noon on 21 June = 77.3°
  - USDA Plant Hardiness = Zone 8b -9a (15 -25° F)
  - Annual Precipitation = 4 inches
  - Wind Power Classification = 1 - 2 (weak-marginal)
  - Annual Clear Days = 210
  - Annual Cloudy Day = 73

2.2 Installation Goals and Objectives

It is the goal of this document to enrich the unique character of each district while simultaneously establishing base-wide policies that create overall clarity and harmony and are grounded in sustainable design principles. These Design Compatibility Objectives have been formulated to:

- Bring current base policy into conformance with the Air Combat Command (ACC) Design Standards.
- Further the development of a base-wide "corporate image" through the creation of a base-wide campus atmosphere that encourages walking, increases development density and provides a variety of outdoor spaces to enhance the quality of life for Airmen, families and civilian personnel.
- Create an architectural style that responds to the climatic influences of the area and reflects appropriate materials and scale in context to surrounding buildings.

2.3 Installation Development

Although Nellis AFB has a massive land base, the developed areas are limited to the Main Base (Area I), west of the flightline, Area II to the north and Area III, which is west of Las Vegas Boulevard (see Figure 2-1). The Main Base contains most of the facilities at Nellis AFB. This area is a combination of community service and commercial facilities, administrative, housing, and some operations. The flightline is on the east side of Main Base, Area I. Area II is a former federal detention facility that has been converted primarily for use by RED HORSE and the 58th Rescue Squadron. Area III is a mix of family housing, tenant facilities, and large solar array.

Creech AFB is located 43 miles north of Nellis AFB and is undergoing a significant transformation. The installation is essentially being rebuilt to accommodate security requirements for its mission. Creech AFB will generally be divided into two areas: Mission Operations and Main Base (see Figure 2-2). The Mission Operations area is to the northeast and the Main Base area will occur through redevelopment in the current area bordering Highway 95.

2.4 Image Elements

Figure 2-3 illustrates the overall pattern of elements at Nellis AFB (image elements for Creech AFB are discussed in Section 2.4.5.7). Installation image elements include paths, edges, nodes, landmarks, and districts. They are the basic pattern of installation form and the way personnel and visitors perceive and relate to the installation.

2.4.1 Paths

Paths can be essentially defined as movement corridors that provide access throughout the installation. This definition of a path does not include jogging paths with an enclosed loop system.

The off-street jogging/walking trail is a closed-loop system in the recreation area.

At Nellis AFB, paths include roads and sidewalks. They function as a basic orientation to the installation by providing the means to access most areas on base. Beyond their basic utility as a mover of people, paths provide visual experiences and wayfinding. Although there is a basic utility to the roadway system and pedestrian paths, the streetscape is a significant element to a visitor's perception of an installation as well as an enhanced quality of life benefit for Airmen and families.

Because the Main Base has a compact development pattern, there is only one road that typifies an "arterial." Washington Avenue is only three blocks in length, but it is a four-lane, divided road. Because this road leads directly into the community center, or "Town Center" of Nellis AFB, it does accommodate a large volume of traffic. All other roads are two-lane. The primary paths at Nellis AFB are Washington Avenue, Fitzgerald Boulevard, Tyndall Avenue, and Ellsworth Avenue. Primary paths on the installation are illustrated in Figure 2-3.

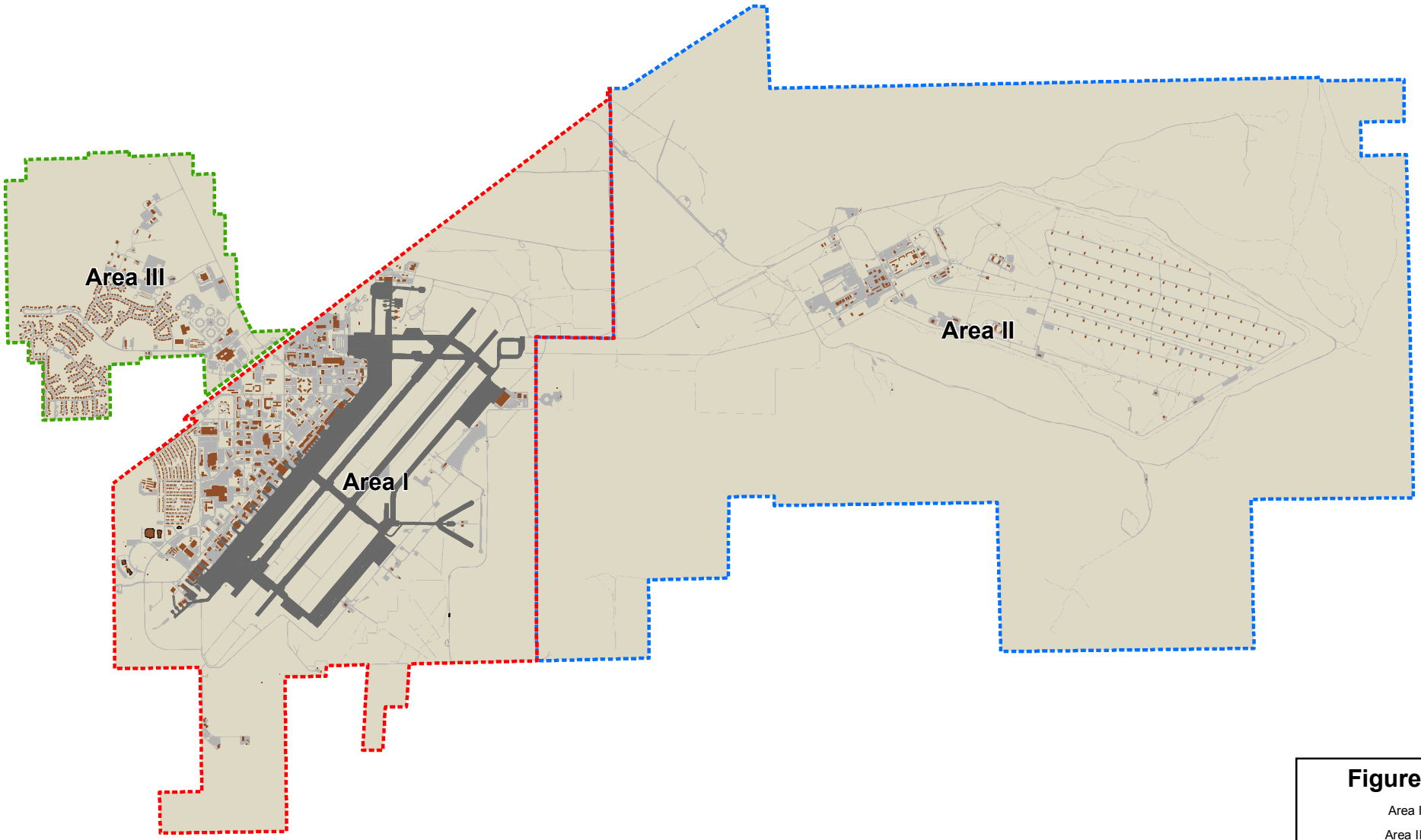
The primary roads direct the highest volume of traffic to their desired destinations on the installation. The secondary and tertiary funnel vehicles to the primary roads.

The streetscape along Washington Avenue is a high-volume road that also has a well established sidewalk system.

- Because primary roads are high-volume paths, they should have a limited number of curb cuts to minimize safety hazards. Most curb cuts should be along secondary and tertiary streets.
- On-street parking should not be constructed along primary roads. There are few areas with on-street parking and over time they should be eliminated.

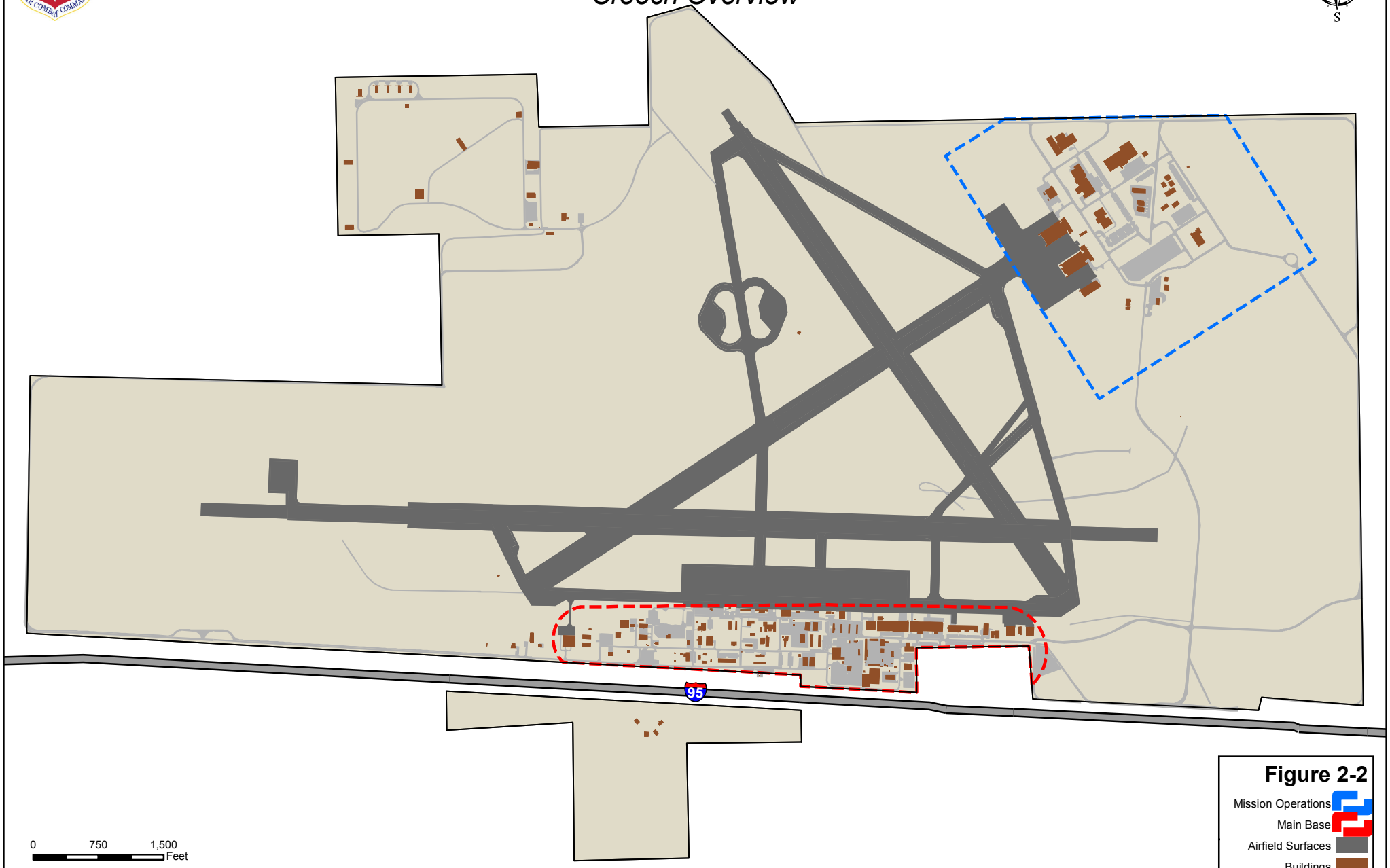
NELLIS AIR FORCE BASE

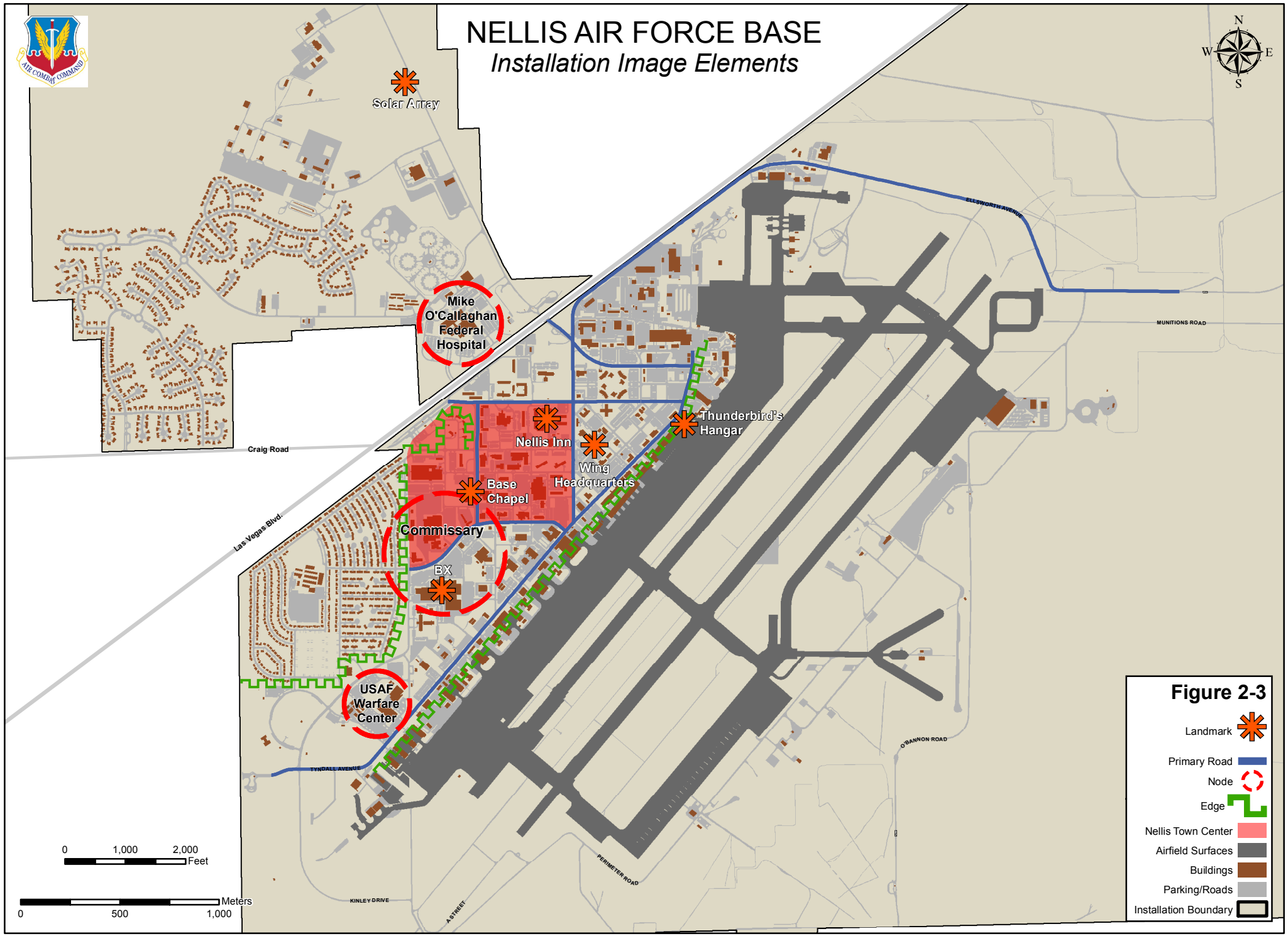
Installation Overview



CREECH AIR FORCE BASE

Creech Overview




NELLIS AIR FORCE BASE
Installation Image Elements
Solar Array
Mike O'Callaghan Federal Hospital
Craig Road
Las Vegas Blvd.
Nellis Inn
Wing Headquarters
Thunderbird's Hangar
Base Chapel
Commissary
BX
USAF Warfare Center
TYNDALL AVENUE
KINLEY DRIVE
A STREET
PERIMETER ROAD
O'BANNON ROAD
MUNITIONS ROAD
ELLSWORTH AVENUE
N
W
E
S
0 1,000 2,000 Feet
0 500 1,000 Meters
Figure 2-3
Landmark
Primary Road
Node
Edge
Nellis Town Center
Airfield Surfaces
Buildings
Parking/Roads
Installation Boundary

- Over time, and in conjunction with new facility construction, the installation should upgrade certain portions of the road system—such as the inappropriate geometry of some intersections—to improve overall circulation and safety. The first step in improving the overall circulation system would be to prepare a Traffic Study or Transportation Plan. The plan could also address the issue of traffic flow and potential use of stoplights and roundabouts at certain intersections.

To minimize vehicle accidents, on-street parking should eventually be eliminated, particularly along primary roads such as Devlin Boulevard.

Primary roads are focused on moving higher volumes of traffic throughout the installation, but at Nellis AFB they also provide a strong sidewalk system. Although pedestrian amenities and sidewalks are well established along the installation road system, there is no installation-wide bike trail system.

The pedestrian system includes "short-cuts" for pedestrians over storm water drainage channels.

- The Nellis AFB Transportation Plan should include recommendations for an installation-wide bike trail that links family and unaccompanied housing with installation facilities.

2.4.2 Edges

Edges are elements that form physical or visual boundaries between areas. They can be simple walls, fences, vegetation, or infrastructure. Typically, these features are not as dominant in a person's mind as primary paths, such as primary roads, but they can be significant organizing features for land form. Edges are illustrated in Figure 2-3.

Typical CMU wall between parking lot and family housing area.

The most prominent edges on the installation are formed by solid concrete masonry unit (CMU) walls. The walls are prominent features on the perimeter of family housing areas, the flightline and installation perimeter. The fences around the perimeter of the family housing areas provide safety as well as mitigate noise and visual impacts associated with general vehicle traffic, on- and off-base development, and industrial activities.

CMU wall adjacent to Building 252 establishing flightline perimeter/ edge.

The flightline areas have edges formed by CMU fencing that is primarily for security. Flightline fencing is generally integrated with facilities, so CMU color schemes are compatible.

2.4.3 Nodes

Nodes are typically destination areas. A prime example of a node at Nellis AFB is the Base Exchange (BX) and Commissary. These large facilities are within the community commercial area, which is a place where people congregate particularly during lunch and on Saturdays. The community commercial functions are generally located within the central portion of the installation; however, there is not a strong pedestrian connection between the facilities. There is a well established sidewalk system connecting the community commercial area with unaccompanied housing, but there is not a strong connection to family housing. Primary nodes are illustrated in Figure 2-3.

The BX anchors the Town Center destination node because the facility attracts a large number of people throughout the day. The scale of the BX also makes it a well-known landmark on the installation.

Another destination with concentrated activity is the area centered on the CAOC-N and Red Flag (Buildings 202 and 201). During training exercises this area generates considerable vehicular traffic.

Although there are no nodes on the installation that are based on a compact development pattern, it is a concept that should be considered. A higher density of buildings—within the constraints of Antiterrorism/Force Protection (AT/FP)—and a strong pedestrian realm, would further encourage walking between facilities. Such a setting will encourage longer stays within a community center area and provide opportunities for social contact and gatherings in all areas.

- The Town Center should be enhanced to form a compact node of diverse functions or services—similar to a small town center—which would increase the reasons for personnel and families to extend their stay in the area.

Building 201 is one of several buildings at the south end of Tyndall Avenue that draw a significant amount of vehicle traffic during training exercises.

- Compact nodes of buildings should be complemented with outdoor gathering areas that further enhance the public realm and quality of life. This type of node, with well thought-out pedestrian movement amenities, should reduce the reliance on automobiles. Although automobiles cannot be ignored, they should be subordinate to the pedestrian realm within a compact node of diverse functions and services.

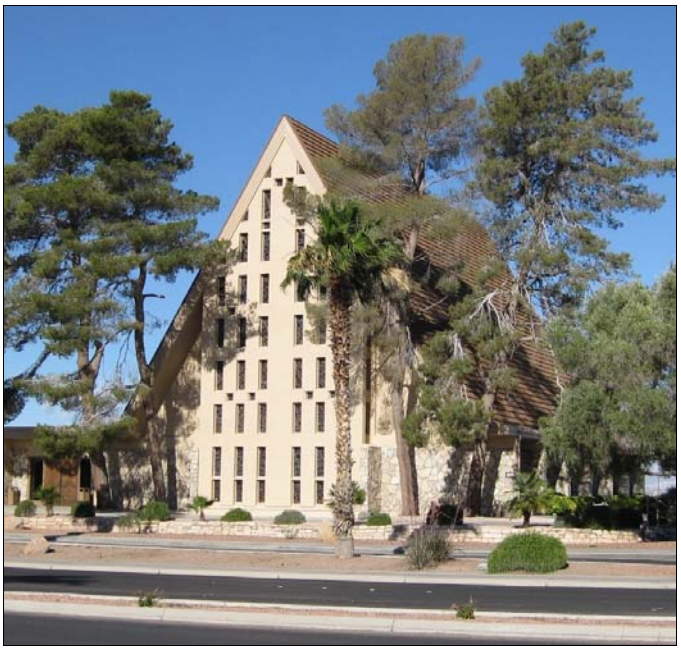
2.4.4 Landmarks

Landmarks are generally the most common reference point for people. In some cases, they are simple objects, such as a sign or tree, or they can be more complicated, such as some type of structure. They can also be symbolic, such as a flagpole in a traffic circle or static aircraft displays. Although landmarks can be simple objects, they can also be important to wayfinding for personnel and visitors because they can be seen from a distance. Landmarks are illustrated in Figure 2-3.

Dominant buildings in a landscape are often very important landmark elements. Civic buildings, such as Wing Headquarters and the chapel, should be strong landmarks on an installation. A dominant building along Washington Avenue is the chapel. This facility has a unique design and has a short setback from the road.

Another landmark is the Thunderbird's hangar and squadron operations facility. This is a facility that stands out along the flightline due to its unique color scheme, and because it is home to one of the most recognizable military units in the U.S.

The Visitor Quarters (Nellis Inn) on Fitzgerald Boulevard is an example of a landmark based on building size.



The Chapel is a landmark facility in the Town Center.

The Thunderbird hangar is not typical of the Nellis AFB flightline, but is considered a landmark.

The Nellis Inn is a massive building in comparison to surrounding facilities.

- Dominant buildings and facilities important to daily living and installation operations should be evaluated during the programming and design process to determine if they function as landmarks. The early determination of a building's "status" will affect site orientation.

Nellis Control Tower east of the main base is a landmark structure.

- The terminus of roads should become a high priority location for landmarks. A landmark building at a road terminus would require additional AT/FP site improvements to maintain security. Options for road terminus landmarks would be static displays and memorials.

2.4.5 Districts

These design guidelines seek to foster the creation of a "corporate image" for Nellis AFB through the development of a "campus atmosphere" on the base proper. The plan for achieving this "campus atmosphere" is the implementation of simple and clear principles of planning, architecture, and landscape architecture throughout the base.

The planning principles generally include the development of guidelines for integrating buildings and open space. The guidelines coordinate street hierarchy, building massing and heights, and functional zoning and sub-zoning for the creation of unified districts. The criteria will include adopting common setback requirements for the reinforcement of street edges, establishing direct relationships between buildings, entrances, and street frontage. The criteria will provide guidance regarding appropriate adjacencies at district edges. Incorporating these planning guidelines will contribute to the creation of a clearly identifiable AFB with a legible physical matrix similar to that found on college campuses, corporate office parks, and traditional American small towns.

Architecturally, the guidelines will discuss the palette of exterior materials current in use and the future applicability of these materials at the bases. This will not limit but will assist in the creation of a holistic image for the base. Common district-wide policies towards sloped roofs and common fenestration types and patterns will further reinforce the "campus atmosphere."

Districts are intended to be areas within the installation that have a common identifiable character. Although there is typically a common design theme for a district, some facilities may not reflect the overall character of a district. As an example, Building 20—when first constructed—was primarily a glass-clad structure, which was not a typical building for any district on Nellis AFB. The Thunderbird's facility is an example of a color scheme that is in complete contrast with all other buildings along the flightline.

The districts[2] are illustrated in Figure 2-4 with the common characteristics of a district signifying a place. Districts identified for Nellis and Creech AFBs include:

- Mixed Use Central Core
- Flightline
- Facilities Engineering and Logistics Readiness
- Recreational Areas
- Area II (RED HORSE)
- Area III
- Creech AFB

As shown in Figure 2-4, there are transition areas between most of the districts. These districts can be identified by their blended, lighter shading. The districts will allow designers to utilize design elements and building forms from each of the bordering districts for a new facility. The ability to integrate design elements from neighboring districts increases as the shading gets lighter, which is in the middle of the transition zone.

2.4.5.1 Mixed Use Central Core

The buildings in the Mixed Use Central Core, which are shown in Figure 2-5, vary greatly in almost every respect. This area of the base contains a vast array of functional building types, including restaurants, warehouses, dormitories, administrative and operations buildings, a church, clubhouses, medical and park areas. This district accounts for most of the land area of Nellis AFB Main Base, Area I.

Architecturally, the buildings consist of simple one-story structures with sloping roofs, large single-story flat-roofed warehouse type structures, multi-story pitched roof dormitories, and multi-story flat-roofed office buildings. Roofing materials range from built-up roofs to standing seam metal to clay/concrete tile. Exterior wall surfaces also vary widely. The material palette includes stucco and concrete masonry units on the smaller structures, metal panels on industrial buildings, and precast concrete and glass curtain walls on larger, office-type facilities. With few exceptions, the ratio of wall to window is appropriate for the tough desert region of the base. Most buildings have "punched out" windows of fairly modest size and scale.

New construction, including the simulator facilities, utilizes the desert theme for landscaping, which minimizes irrigation requirements.

Although landscaping within the Mixed Use Central Core varies as much as the architectural styles and use, there is one theme that is beginning to transform this district—xeriscape. More recent landscaping has a desert theme, with drought-tolerant plants and earth-tone gravel. The change to a desert theme has resulted in a reduction in the amount of turf, which requires significant irrigation to maintain. Yet most of the existing landscaping is site specific, with few elements linking the central core together as a whole. The exception to xeriscape, or desert theme as noted above, is the streetscape of Washington Avenue, which serves as a dramatic entry into the community commercial, or "Town Center," of the installation. This streetscape is dominated by palm trees that frame the four-lane boulevard.

Currently, there is a lack of updated guidance for establishment of a sub-zone, or Town Center. An Area Development Plan (ADP) was prepared several years ago; however, like most ADPs they may be overcome by events (OBE) after a few years. In an update to the ADP, the identification of an overall streetscape plan together with the revisualization of a Town Center can unify the overall district. Redevelopment of the community commercial area into a Town Center would provide most, if not all basic services (retail, services, medical and institutional), just like a small town.

[2]Family housing areas are not included in the districts' narrative because they have been privatized. Design elements for housing are determined through collaboration between the Air Force and the developer.

NELLIS AIR FORCE BASE

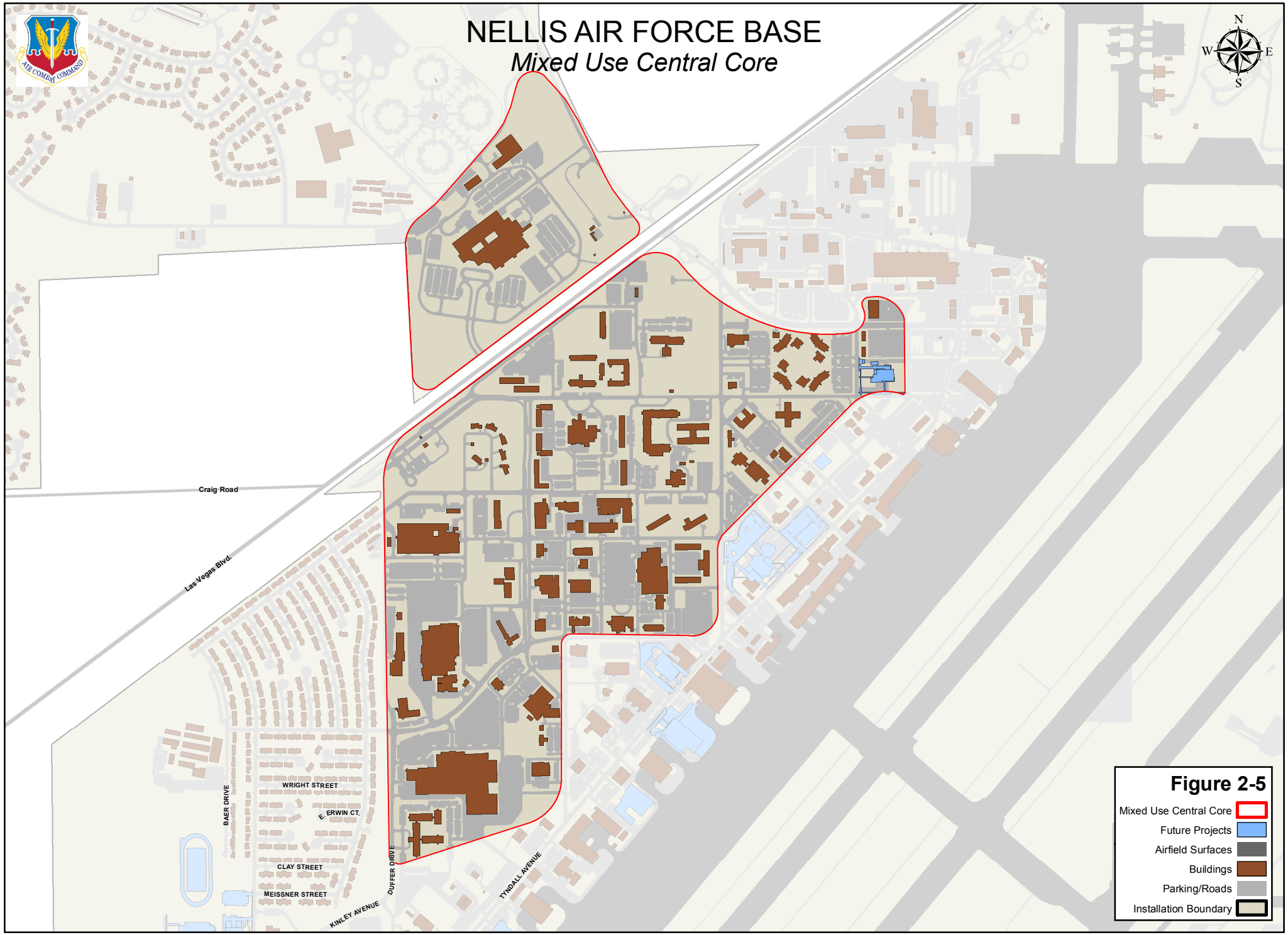
Districts

Figure 2-4

- Airfield Surfaces
- Buildings
- Parking/Roads
- Areas Not In A District
- Installation Boundary
- Area II District
- Area III District
- Facilities Engineering & Logistics Readiness District
- Flightline & Operations District
- Mixed Use Central Core District
- Recreation District

0 0.5 1 Miles

Meters
0 1,000 2,000


NELLIS AIR FORCE BASE
Mixed Use Central Core
N
W
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Craig Road
Las Vegas Blvd.
BAER DRIVE
WRIGHT STREET
E. ERWIN CT.
CLAY STREET
MEISSNER STREET
KINLEY AVENUE
DUFFER DRIVE
TYNDALL AVENUE
Figure 2-5
Mixed Use Central Core
Future Projects
Airfield Surfaces
Buildings
Parking/Roads
Installation Boundary

Many of the facilities in this district should function as gathering places for living, working, and shopping and generally support higher densities of people than the other districts on the installation. The types of facilities and land use activities within this district would be similar to those found in a small downtown.

When taken in that context, a development pattern for the district can be visualized. A typical Town Center has a higher density of buildings, some that are multi-story structures. The higher density of buildings is supported by a pedestrian circulation system that encourages walking or riding bikes to a variety of facilities within the district. The vehicle circulation system is acknowledged, but downplayed, and vehicle parking is subordinate to buildings and the landscape.

A central location would be an inviting gathering place that could physically tie all nearby facilities to a central gathering place.

The architectural treatments should conform to the split-faced block, standing seam metal roofs, deep set windows, protected entries, trellis shading, and small courtyards.

2.4.5.2 Flightline and Operations

The Flightline and Operations District is shown in Figure 2-6. The flightline consists of a linear array of buildings along the southeastern edge of the base. Its northern boundary is Tyndall Avenue, which runs parallel to the flightline. Tyndall serves as the main street for the flightline, providing both pedestrian and vehicular access to all the buildings. These buildings consist mainly of hangar type structures fronting the aircraft parking apron. Smaller support facilities, located between the hangars and Tyndall Avenue, are used for maintenance, fire training, and supplies storage. The flightline is primarily industrial in character, the majority of buildings consisting of large metal panel structures with sloping metal roofs. These buildings form a clear and coherent visual presence for the primary mission of the base. The support facilities tend to be less homogeneous.

In general, the flightline buildings have a well-developed presence facing towards the runways, but this image is only hinted at when viewed from Tyndall Avenue because of the lack of a clear system of pedestrian and vehicular entrances. However, the recently constructed F-22 facilities should serve as a model for this area. These facilities create a sense of presence along Tyndall Avenue and an expression of the importance of the flight by providing a clear sense of entry for both pedestrians and vehicles. Extending the architectural and planning principles implicit in these facilities down the length of Tyndall Avenue will establish both a clear public presence and a coherent organizational pattern for the entire flightline along Tyndall Avenue.

Recently-constructed flightline facilities should strongly influence future facility design and landscape plantings.

This F-22 facility has a strong presence on Tyndall Avenue because of a heightened presence for the entrance and pedestrian connection.

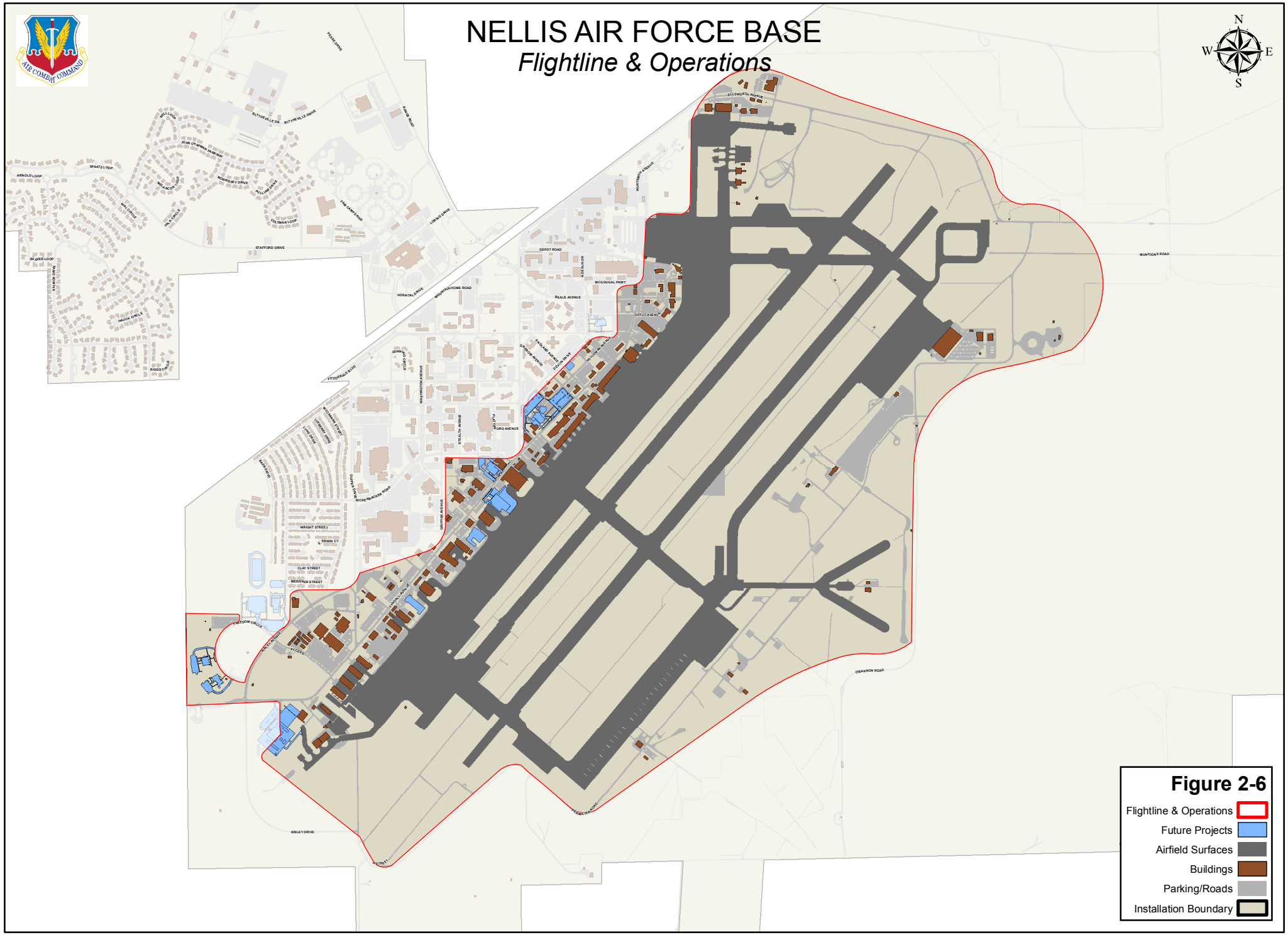
Concrete masonry security walls have been constructed between hangars and support buildings to provide a visual screen and spatial definition. Minimal landscaping occurs between the back of older flightline structures and Tyndall Avenue. This is partially due to limited or no space available for landscape. Landscaping for the desert environment should be used when new facilities are constructed.


The Fabrication Facility is a unique design that will influence future construction along the flightline.


Banding reflects the nearby mountains and landscaping in the appropriate desert theme.

NELLIS AIR FORCE BASE

Flightline & Operations



2.4.5.3 Facilities Engineering and Logistics Readiness

The Facilities Engineering and Logistics Readiness District is shown in Figure 2-7. This area of the base is a fairly compact region of one-story structures serving as support for the entire base. The buildings consist of offices and maintenance structures. They are simple and utilitarian. The primary materials include a mix of concrete masonry units and metal panels, with either very low-sloped roofs or flat roofs. Door and window openings are "punched out," and well proportioned to both their internal function and the exterior environment.

Concrete masonry unit walls are used to screen storage areas from streets and building entrances. Spaces between the buildings are typically paved to allow for vehicular circulation and access to the loading areas. Landscaping is limited within these areas and has, for the most part, been appropriately used at the front of buildings and around perimeter walls. The landscaping adjacent to the buildings and walls does not reflect the current direction of landscape architecture on the base.

Older landscape design.

As with the Mixed Use Central Core, development in the Facilities Engineering area appears haphazard. There appears to be no overall plan regarding functional zoning, building massing, or street hierarchy.

Mix of concrete block and metal panel in the Facilities District.

Establishing a consistent relationship between building and street frontage is the most important planning policy needing implementation in the Facilities Engineering District. Adoption of this policy will reorient the existing usage patterns of buildings in this district so that buildings front onto the public street system and enclose vehicular service courts towards the interior of the block.

2.4.5.4 Recreational Area

The Recreational Area District is primarily oriented around large, grassy areas into which are inserted a variety of features with the Sports and Fitness Center as the focal point for this area (Figure 2-8). Ball fields, running tracks, picnic shelters, and barbecue pits populate an otherwise open expanse of lawn. The open-air shelters are simple pitched roof structures supported on columns. The roofs are either clay tile or standing seam metal, and the columns are either wood or split face concrete block.

The Sports and Fitness Center is the focal point for this district.

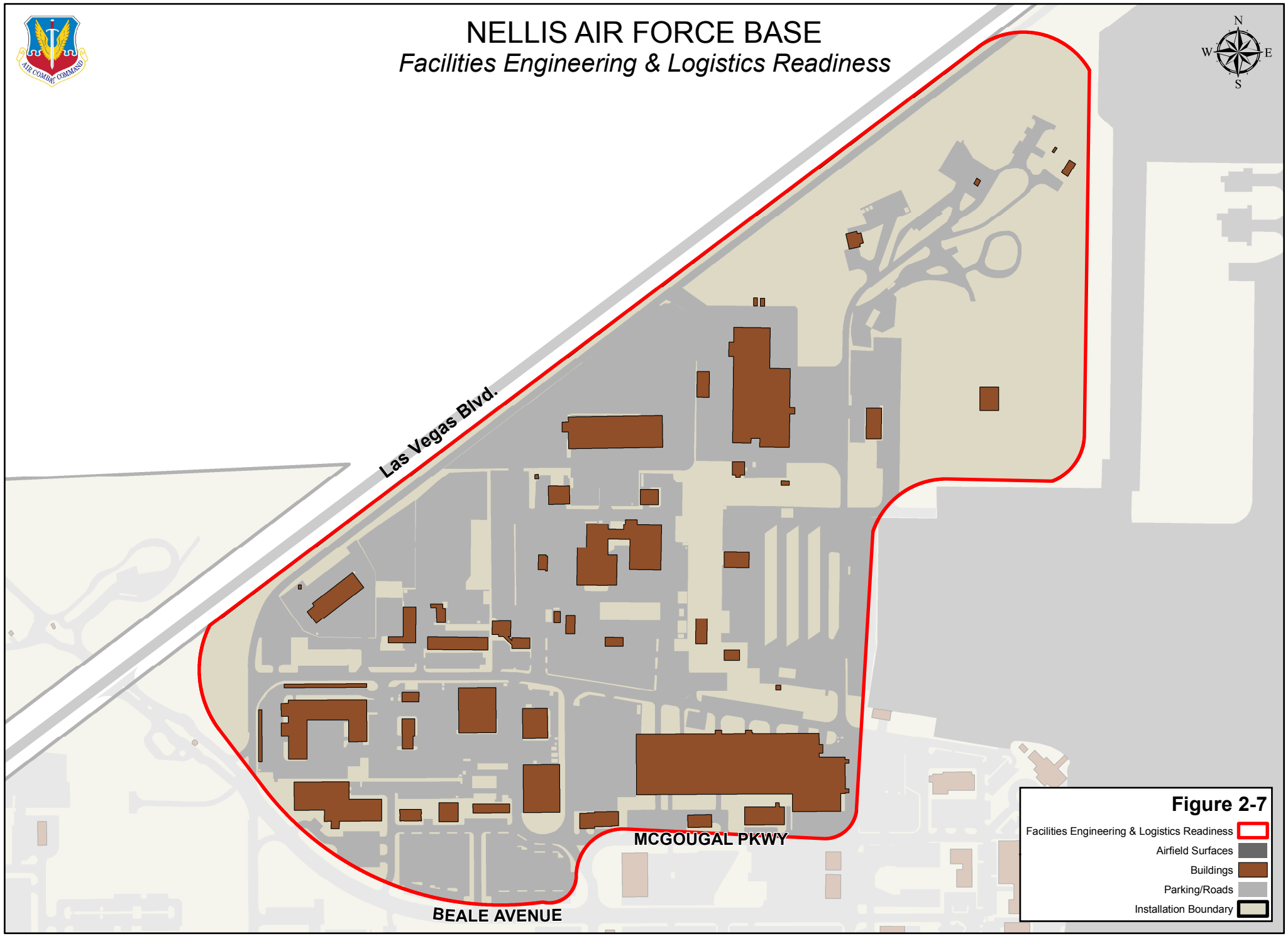
The open recreational area contains playing fields for softball, baseball, soccer, and football. While this accommodates basic recreational needs, further development is necessary to enhance the general character and expand the functional utility of the district.

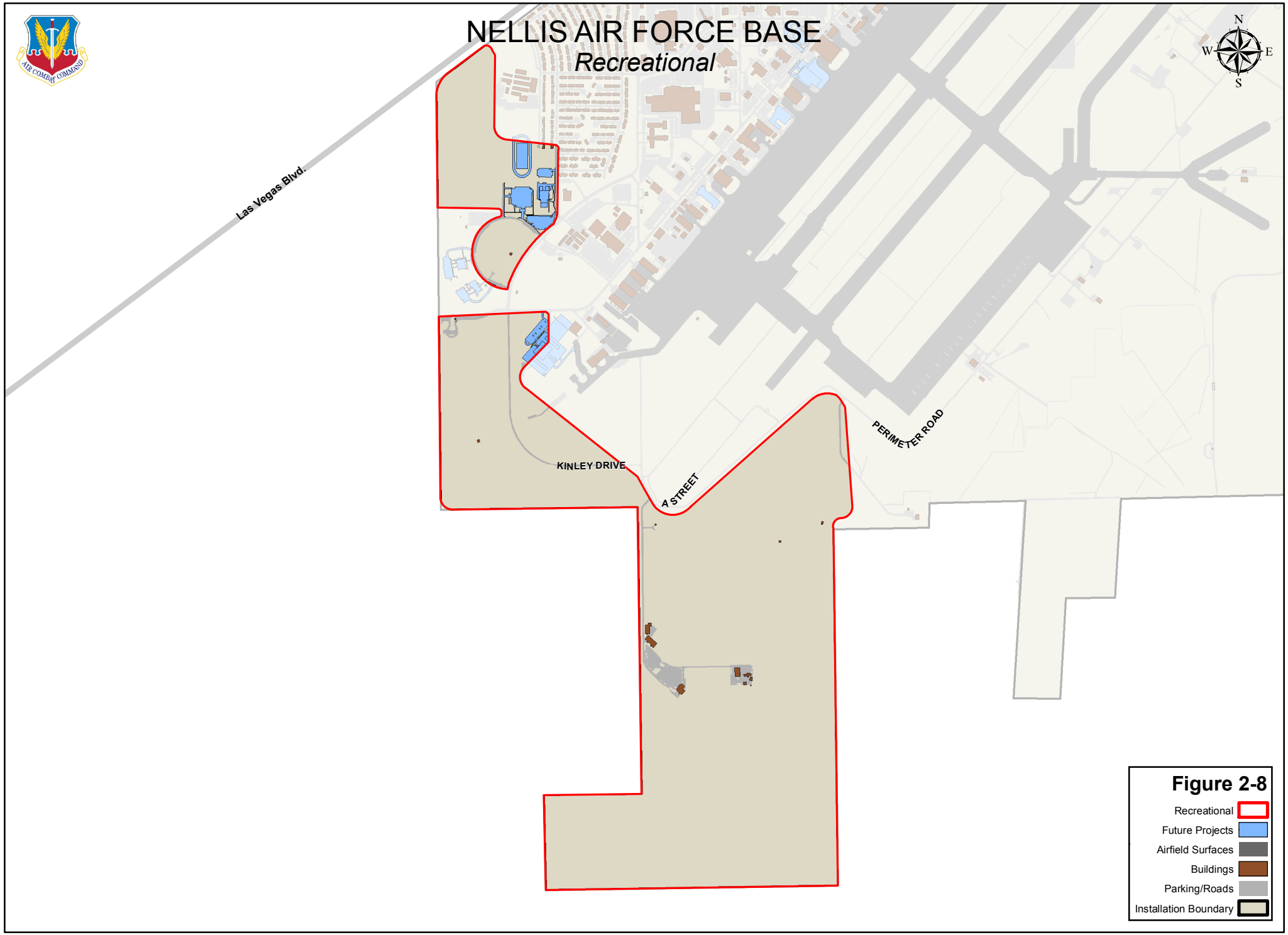
The recently-constructed golf course clubhouse.

The area also has a minimum of supportive landscaping along the street edge, jogging trail, and picnic areas. Such landscaping, if implemented correctly, need not increase water usage or maintenance. In general, reorienting these priorities, reducing unnecessary turf while adding needed shade trees, will assist in maximizing the potential of the Recreational Area District.

NELLIS AIR FORCE BASE

Facilities Engineering & Logistics Readiness




NELLIS AIR FORCE BASE
Recreational
N
W
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S
Las Vegas Blvd.
KINLEY DRIVE
A STREET
PERIMETER ROAD
Figure 2-8
Recreational
Future Projects
Airfield Surfaces
Buildings
Parking/Roads
Installation Boundary

Aside from the adjacency of the recreational areas to residential neighborhoods, no base-wide system of open space has been developed.

The linkage of the individual park elements together in a coordinated fashion should be planned for the future. A unique feature of the recreational spaces, which may begin to provide this linkage, is establishment of appropriate building materials and plant palette for all recreation areas.

Static displays of aircraft can be viewed as sculptural pieces and landmarks within the recreational areas that provide unique elements for the enjoyment of both children and adults.

2.4.5.5 Area II (RED HORSE)

The buildings in the Area II (RED HORSE) District shown in Figure 2-9 vary greatly in many respects; but still constitute a fairly coherent and well-orchestrated campus-like complex. This area consists primarily of a one-story office building for the RED HORSE Squadron, numerous large one-story storage buildings, and a campus of multi-story buildings. Another tenant utilizing facilities in this district is the 58th Rescue Squadron.

The RED HORSE statue is one of the most distinct landmarks on the installation.

Architecturally, the buildings in the area have exterior walls of either concrete masonry units or stucco, with roofs of either standing seam metal or low-sloped asphaltic built-up roofing. Most of the concrete block is smooth-face painted units. While the paint color helps unify the area, it is a maintenance item that should not be duplicated in newer facilities. The red roof color is a distinctive element of this district. Doors and windows are a “punched out” type of fenestration, appropriate for both the interior functions of the buildings and harsh external environment in which they are located.

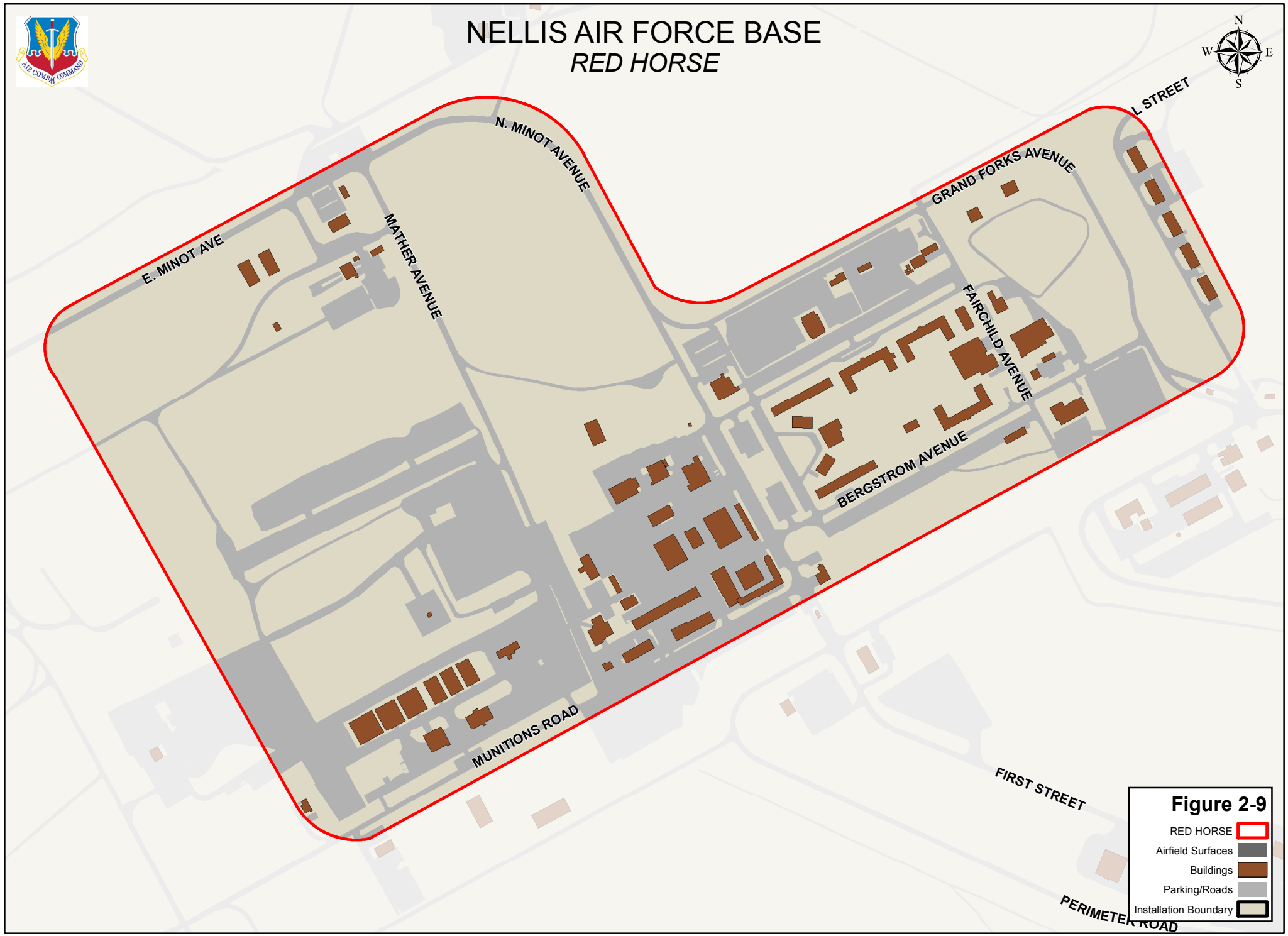
Some of the landscaping within the area is appropriate for the desert climate, but too sparsely applied to function effectively as a unifying element, and there are still areas with turf instead of gravel. While more recent landscaping has a desert theme with drought tolerant plants, extending this policy is critical to enhancing the area.

2.4.5.6 Area III

Existing structures in Area III (see Figure 2-10) represent a variety of building types and functions. This area, which is located west of Las Vegas Boulevard includes family housing, child development center, a shoppette, the installation family camping area (FAMCAMP), tenant facilities and industrial facilities such as the solar array and fuel tanks. Moving forward Area III should follow Mixed Use Central Core Guidelines for public buildings and Engineering and Logistics Readiness District guidelines for utilitarian buildings.

Building 2967 reflects the residential scale of the west portion of Area III.

The solar array is a dominant feature in Area III.


NELLIS AIR FORCE BASE
RED HORSE
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L STREET
GRAND FORKS AVENUE
N. MINOT AVENUE
E. MINOT AVE
MATHER AVENUE
FAIRCHILD AVENUE
BERGSTROM AVENUE
MUNITIONS ROAD
FIRST STREET
PERIMETER ROAD
Figure 2-9
RED HORSE
Airfield Surfaces
Buildings
Parking/Roads
Installation Boundary

NELLIS AIR FORCE BASE

Area III District

2.4.5.7 Creech AFB

Creech AFB (see Figure 2-11) is an independent airfield under Nellis AFB's Command and is located 43 miles northwest of Nellis AFB at Indian Springs, Nevada. In the past, Creech AFB consisted of a relatively modest flightline, supported by offices and maintenance facilities. The buildings were primarily one-story structures with low-sloping roofs. These older buildings included roofs that were typically asphalt shingles or standing seam metal and wall surfaces varied to include wood frame, metal panels, and concrete masonry units. In recent years, the installation has undergone a dramatic redevelopment to accommodate the new and evolving missions. In the end, Creech AFB will be transformed into a "new" installation with very few buildings more than a decade old.

The newer, northeast portion of the base is almost exclusively concrete masonry units and metal wall panels. New roofs are off-white standing seam metal and windows are small and "punched-out." The outstanding features of the base are the control tower and new facilities supporting the remotely piloted Predator mission.

Both new and older buildings are generally shades of brown with tone-on-tone accent trim.

Turf is no longer the primary landscape material at Creech AFB. As the installation redevelops, desert theme landscaping is being installed and maintained. Over time turf will be eliminated at this installation.

Typical structure in the northeast portion of Creech AFB.

The existing road system is a simple grid within the developed areas on Main Base and the Mission Operations area to the northeast. The primary road on the installation is Perimeter Road. This road links the Main Base with the northeast area. All other roads are secondary and tertiary roads that direct traffic toward Perimeter Road.

The Main Base road system reflects utilitarian design and construction from another era when the pedestrian was not given a high priority; however, the installation pedestrian system is being improved during redevelopment of the main base and construction of the Mission Operations area. Sidewalks are being constructed in the main base and operations area to minimize the need for Airmen to walk in streets. As redevelopment occurs in the main base area, the pedestrian realm should be enhanced to reduce the reliance on automobiles.

The older road system on the main base has limited, or no pedestrian amenities, and numerous on-street parking lots.

Recent construction on the main base has resulted in improvements to the pedestrian realm.

If possible, new road construction should be oriented to maximize solar orientation for buildings throughout Creech AFB.

CREECH AIR FORCE BASE

Districts/Image Elements

A strong pedestrian system is being implemented in the Flightline and Operations area to the north.

With the exception of the installation perimeter fence, there are few areas that have distinct edges. Edges are limited to security fencing for the flightline and secure facilities in the Mission Operations area. Most fencing is "transparent" chain link to aid in maintaining visible security.

In general, the overall organization of Creech AFB is good. The installation is developing clearly-delineated zones for Mission Operations and the Main Base. The clarity of this structure should be maintained in future development. Individual developments should take a look at creating "people spaces" such as enclosed/ shaded courtyards, shaded walkways, and windbreaks. The architectural treatments shall conform with split-faced block or metal panels, light- colored standing seam metal roofs, deep set windows, protected entries, trellis shading, and small courtyards. Building siting, design and scale should reflect its location. An example is the Wing HQ, which has been sited to reflect its hierarchy and is a landmark facility. Another landmark at the installation is the control tower.

Wing HQ is sited at the entrance to the mission operations area of the installation and is a prominent landmark facility.

Note: The variety of building types at Creech AFB is directly comparable to the variety and type of buildings at Nellis AFB. The Design Guidelines that are applicable to Nellis AFB are applicable to the corresponding areas of Creech AFB.

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3 Development Considerations

Installation development and sustainability can work hand in hand and, to a degree, have over the decades. The installation has been reusing buildings for many years and continues to do so. However, the age of some structures, changing requirements for work space and the requirement to reduce the amount of square feet of facilities is making building reuse more problematic. Large-scale building reuse is not a likely scenario in the short-term; however, there are many opportunities for consolidation into existing facilities as well as some development of new facilities on vacant parcels at Nellis AFB.

Infill development allows the development of modern facilities that more effectively meet the needs of the Air Force to maintain its mission capabilities, reduce energy consumption, and enhance the working conditions of personnel and the overall quality of life. Infill development should be prioritized to fill in vacant parcels to create a dense, compact development pattern. Redevelopment of previously developed sites should also be a high priority. The lower priority development areas are previously undeveloped areas farther removed from the center of the installation.

Figures for Nellis and Creech AFBs that should be used to help define development considerations can be found in Appendix A.

3.1 Reuse Opportunities

Some structures will be demolished to meet the Air Force requirement to reduce the total square feet of facilities, as well as to eliminate old, non-functional facilities. Reuse opportunities are primarily focused on backfilling and consolidation as the installation redevelops based on new and expanding missions.

Reuse of existing facilities must be funded by the unit desiring relocation to a particular facility and the request must meet reasonable facility and master planning principles for Nellis AFB. Building 340, which used to be the BX, has been renovated and reused for medical functions. There is no single large-scale building currently under consideration for reuse.

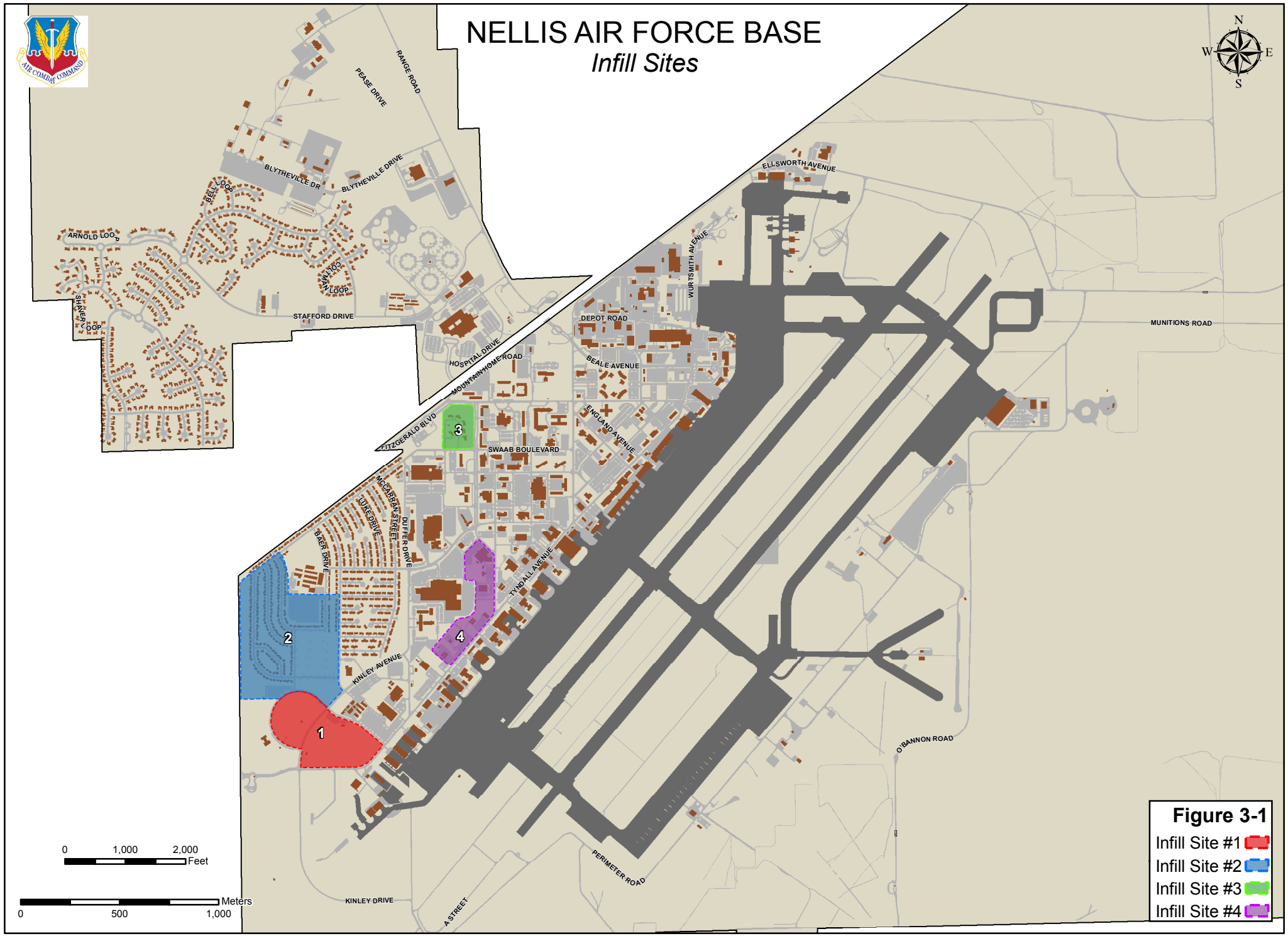
3.2 Infill Opportunities

The installation has prepared a General Plan and Area Development Plans (ADP); however, the frenetic pace of facility development in the past few years has resulted in case-by-case changes to the recommendations in the General Plan and ADPs. This is to be expected at any military installation that undergoes a high demand for facilities. Because the General Plan and ADPs have been overcome by events (OBE), they do not provide a strong framework of identification of infill sites; however, they were still considered in the evaluation of infill sites on Nellis AFB.

Infill sites shown in Figure 3-1 were identified through discussions with 99 CES personnel and incorporation of approved siting and facility footprints for new construction. These sites are located in a variety of areas including recreation areas, the Mixed Use Central Core and the Flightline and Operations areas. Development of infill sites is intended to increase development density but still adhere to AT/FP and fire safety requirements. A more compact site development pattern will enhance the pedestrian environment through landscaping and centralized shared-use parking lots.

To the extent feasible, increased development density should promote multi-story construction and consolidation of functions. Mixed-use (consolidation of functions) opportunities in multi-story buildings can reduce the distance personnel would need to walk and promote less reliance on vehicle use.

Building 340 is an example of typical building reuse. It is the former BX, which has been reused as a one-stop location for medical functions.


NELLIS AIR FORCE BASE
Infill Sites
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PEASE DRIVE
RANGE ROAD
BLYTHEVILLE DR
BLYTHEVILLE DRIVE
BELL LOOP
ARNOLD LOOP
SHINER LOOP
WILFORD LOOP
STAFFORD DRIVE
HOSPITAL DRIVE
MOUNTAINHOME ROAD
FITZGERALD BLVD
ELLSWORTH AVENUE
WURTSMITH AVENUE
DEPOT ROAD
BEALE AVENUE
ENGLAND AVENUE
MUNITIONS ROAD
SWAAB BOULEVARD
BAER DRIVE
LUKE DRIVE
MCCARRAN STREET
DUFFER DRIVE
TYNDALL AVENUE
KINLEY AVENUE
O'BANNON ROAD
PERIMETER ROAD
KINLEY DRIVE
A STREET
1
2
3
4
0 1,000 2,000 Feet
0 500 1,000 Meters
Figure 3-1
Infill Site #1
Infill Site #2
Infill Site #3
Infill Site #4

3.2.1 Infill Site #1

Infill Site #1 is in the Flightline and Operations District. It is currently occupied by the installation jogging/walking path on the east side of Kinley Avenue and ball fields and static displays to the west.

With the relocation of the loop jogging/walking trail (Runner's World) and ball fields to Infill Site #2, this site provides an opportunity to continue expansion of mission-critical functions. Future facility development could be of varying sizes and heights oriented to maximize solar orientation. Pedestrian connections should be provided between the mission oriented facilities of this infill site and the recreation areas in Infill Site #2. A safe pedestrian crossing would be required at the intersection of Kinley Avenue and Access Street.

The intersection of Tyndall Avenue and Kinley Avenue is an appropriate location for a series of landmarks because it is just inside the Tyndall Gate and would be an impressive image to visitors. The landmarks at this intersection would provide a strong entry feature that could be integrated into Freedom Park and static aircraft displays that line Kinley Avenue.

The running track currently at Infill Site #1 would be relocated to accommodate redevelopment of operations facilities.

3.2.2 Infill Site #2

Infill Site #2 is an expansion of the recreation area into the southern portion of the former family housing area. This recreational area will be in proximity to the new fitness center to be constructed on Freedom Circle and the installation elementary school. The recreational facilities will provide a buffer between the installation perimeter fence and the school and family housing.

The recreational area could include a jogging/walking trail (Runner's World), tennis courts, basketball courts, sand volleyball courts, and softball fields. The competition running track and multi-purpose field could be located directly north of the fitness center. Shelters and playgrounds would provide additional opportunities for outdoor gatherings.

The recreational area should include a multi-purpose trail that extends from the recreation area, north to the Nellis Inn and dormitories. The trail would also connect with the inline skate park and follow Duffer Drive to the north. Connection of the trail to unaccompanied housing could be provided by F Street/Swaab Boulevard.

3.2.3 Infill Site #3

Infill Site #3 is currently the housing area for installation leadership. These homes are in close proximity to the installation perimeter fence and the main gate, which is a poor site for security and privacy. Following relocation of the residents of this housing area, this site could be incorporated into the Main Base Town Center. Any new facilities could be oriented to maximize solar gain and would have to meet the security requirements associated with the site's proximity to the main gate and installation perimeter. This infill site is not illustrated in this report, but is identified as a prime redevelopment parcel for the future.

3.2.4 Infill Site #4

Infill Site #4 is primarily in the Flightline and Operations District, but a portion extends into the Main Base Town Center. The facilities in this area include the current fitness center and outdoor adventure center, as well as small industrial and operations buildings. The fitness center will be relocated to a new facility in the recreation area (Infill Site # 2). The swimming pool will be demolished and relocated along with the fitness center. The adventure center should be moved to another location, such as the Facilities Engineering and Logistics Readiness District.

Due to road configuration and existing buildings in Infill Site #4, there is limited opportunity for large-scale facility development. However, the use of smaller buildings provides an opportunity to increase development density, while still meeting AT/FP setback requirements. Solar orientation should be attained for new construction. Although the current road configuration limits facility development, it does provide an opportunity to establish a significant landmark at the end of Washington Avenue.

Because this site is in a transition area between the installation Town Center and mission operations, a variety of compatible functions should be developed that would provide increased pedestrian access between places of employment and dining/shopping establishments. Ideally, mission-oriented infill development would occur closer to Tyndall Avenue. The existing parking lots along Tyndall Avenue could be expanded to create larger shared use lots for the high density of flightline facilities.

After the Fitness Center relocates, the Outdoor Adventure Center will be within an area dominated by operations facilities. This facility should be relocated.

3.3 Circulation

3.3.1 Vehicle Circulation

The installation circulation pattern, which is shown in Figure 3-2, extends from the intersection of Washington Avenue and Fitzgerald Boulevard. These are the two primary roads leading traffic into Nellis AFB from the Main Gate. Other primary roads are: Tyndall Avenue, Beale Avenue, Rickenbacker Road, Ellsworth Avenue, and Duffer Drive/Kinley Avenue. The North Gate and the Tyndall Gate provide secondary access for many of the automobiles entering and exiting the installation. The primary roads account for the highest volume of traffic on the installation. Secondary and tertiary roads serve the balance of the installation and funnel traffic from individual facilities.

Some of the secondary and tertiary roads in the Flightline and Operations District have confusing intersections and some roads may no longer be necessary. A simplified road system could result in an increase to development density in the Flightline and Operations District.

Washington Avenue Sidewalk: Ideally, pedestrian paths should be set back from heavily trafficked roadways.

Most proposed infill areas should not require road construction; however, they could result in improvements to road geometry in certain locations. Road geometry and parking should be evaluated in an installation Transportation Plan or Traffic Study.

3.3.2 Pedestrian Circulation

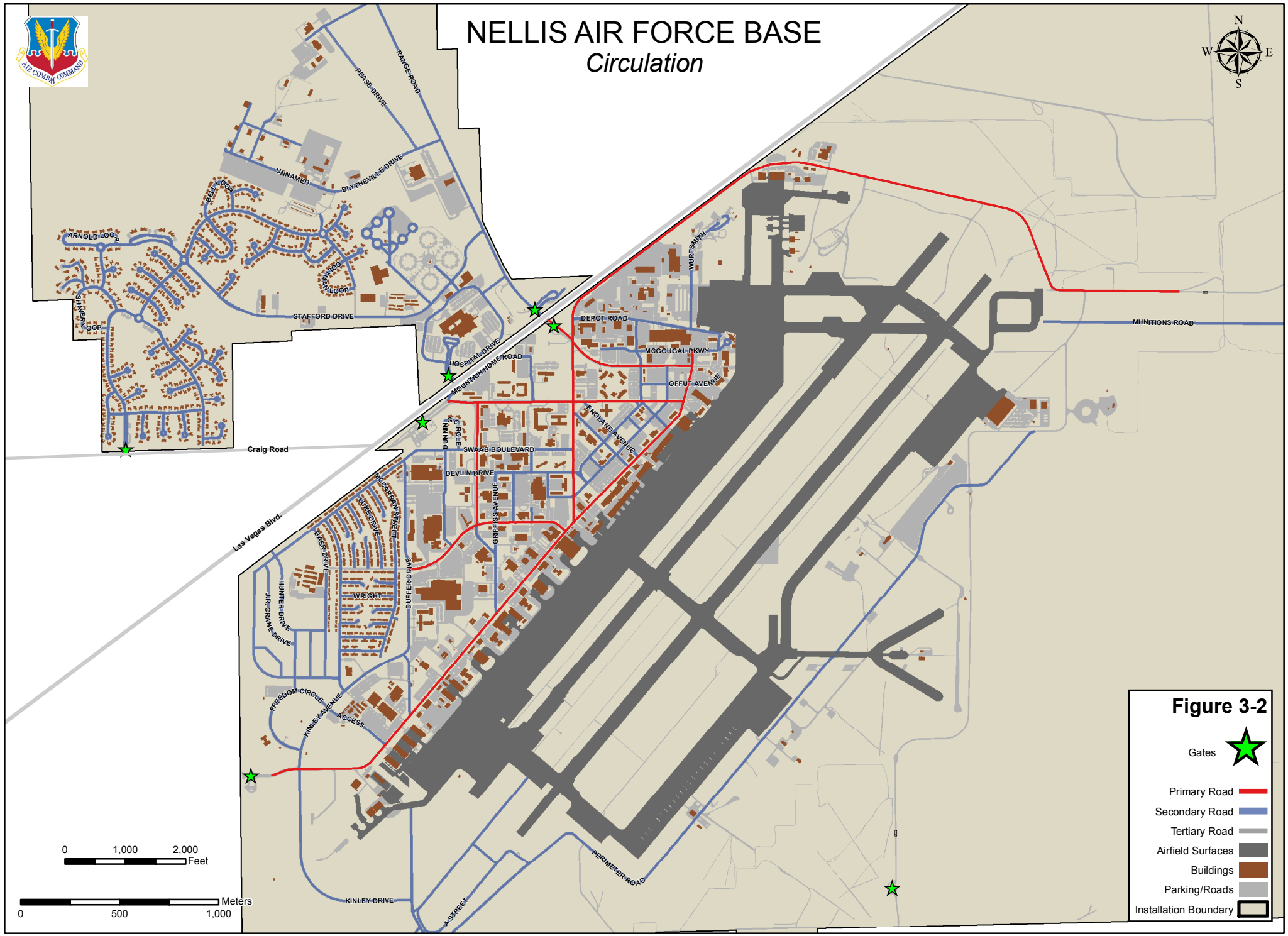
Installation-wide pedestrian circulation is limited to sidewalks and these pedestrian connections are very strong throughout the installation. Although there is a strong system of sidewalks, there is no base-wide walking/biking trail. The only jogging/walking trail is the loop trail (Runner's World) in the Recreation District at the south end of Tyndall Avenue. Another running track on the south side of the flightline is used for physical fitness training and testing for Airmen. Bike traffic is limited to installation streets.

Strong pedestrian path and main entry at 64th Aggressor Squadron.

A multi-purpose trail/route should be established to provide access from the main base area to the transient housing and dormitories A trail, or bicycle route would connect the outdoor recreation area with the inline skate park and follow Duffer Drive to the north. The connection to housing could be provided by F Street/Swaab Boulevard. This trail would provide access to family housing, the Warrior Inn, Nellis Inn, other transient housing facilities, and most importantly, the dormitories at the north end of the main base.

3.4 Land Use

The existing land use layout of Nellis AFB generally has been logical and followed basic Air Force planning guidance to support the mission. In general, future land use delineations identified in the eGP are similar to the existing land use found on the base; however, the frequency of new construction in recent years has resulted in some facility development that does not adhere to the future land use recommendations in the 2002 eGP.


NELLIS AIR FORCE BASE
Circulation
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RANGE ROAD
PEASE DRIVE
UNNAMED
BLYTHEVILLE DRIVE
BELL LOOP
ARNOLD LOOP
SHINER LOOP
WILFORD LOOP
STAFFORD DRIVE
Craig Road
Las Vegas Blvd.
HOSPITAL DRIVE
MOUNTAIN HOME ROAD
G CIRCLE
SWAAB BOULEVARD
DEVLIN DRIVE
DEPOT ROAD
MCGOUGAL PKWY
OFFUT AVENUE
ENGLAND AVENUE
WURTSMITH
MUNITIONS ROAD
GRIFFISS AVENUE
MCGARRAH STREET
LUKE DRIVE
BAER DRIVE
DUFFER DRIVE
WRIGHT
HUNTER DRIVE
JR CRANE DRIVE
FREEDOM CIRCLE
KINLEY AVENUE
ACCESS
KINLEY DRIVE
A STREET
PERIMETER ROAD
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0 500 1,000 Meters
Figure 3-2
Gates
Primary Road
Secondary Road
Tertiary Road
Airfield Surfaces
Buildings
Parking/Roads
Installation Boundary

The eGP should be updated and both existing and future land use text and maps should be modified to reflect the land use changes implemented in recent years.

3.5 Sustainability Initiatives

Over the years, Nellis AFB has undertaken a number of initiatives to reduce its consumption of natural resources and its impact on the environment. Future actions planned for the base should enhance and improve upon past actions.

3.5.1 Natural Area Preservation

Nellis AFB actively protects the undisturbed habitat of the Desert Tortoise, located at the south end of the installation as well as some undeveloped areas in base Area II. Nellis AFB also makes a concerted effort to evaluate the habitat of the burrowing owls that may be affected by base construction. The owls' habitat is found along drainage channels.

Nellis has set aside land north of the housing area in Area III as habitat for Las Vegas Bear Poppy as part of an agreement with the State Fish and Wildlife agency. Bear Poppy is a perennial forb that only grows in gypsum-rich soils.

3.5.2 Energy Conservation Initiatives

Nellis AFB has taken a number of steps to reduce energy consumption. One of the most significant initiatives has been working with Solar Star, a third party energy provider, to construct a 14-megawatt solar array at the northwest corner of the base. Under the lease agreement, Solar Star constructed the solar array and provides ongoing maintenance. In turn Nellis AFB purchases all power that is generated by the array. This was seen as a good way to manage up front construction and ongoing maintenance costs while lowering the base's dependence on outside energy sources.

3.5.2.1 Energy Studies

- An ACC-funded renewable energy feasibility study is slated to be undertaken by Pacific Northwest Laboratories. The goal of this study is to determine the feasibility of developing renewable energy generation facilities on base.

- A geothermal feasibility study for Creech AFB was taken to 35 percent design, but was not completed because it was determined not to be economically viable. The Nellis AFB Resource Energy Manager (REM) has indicated that they are planning to take the design to 100 percent in FY 2012, if funding is available, to reconsider the economic feasibility.

- The base is working on environmental documentation for the addition of a second solar array near the south end of the installation. This array will generate an additional 13 to 15 megawatts of power. Combined, the two arrays will provide almost 100 percent of the daytime peak energy demand for the base, which is 34 megawatts.

- Induction lighting will be used in several of the new hangars proposed for construction. This is being done on a trial basis to determine if induction lighting improves the overall lighting conditions while reducing building energy costs.

- The base REM recognizes the need for more energy efficient exterior lighting systems on base. With proper timing controls and fixture upgrades the base's overall usage could decrease. The REM is trying to obtain funding to conduct a lighting study.

3.5.2.2 Reduction in Energy Consumption

- The base REM is actively developing an energy reduction work plan that includes a diverse list of planned or potential projects to implement/change energy management policies, perform audits and energy management plans, and expand upon the current solar-based renewable electrical energy generation program.

- Compact T8 lighting fixtures have been retrofitted in many places on base and fluorescents are the most prevalent lighting on base. T5 fixtures are planned for the future.

- The base has been operating an Energy Monitoring Control Systems (EMCS) using Direct Digital Control (DDC) to control HVAC equipment in some buildings and would like to expand the EMCS coverage. Newly installed and renovated HVAC systems on the base are tied together as part of this energy management system. As new buildings are constructed, their systems are also tied into this EMCS. Older systems are being added to the EMCS by converting pneumatics to DDCs.

3.5.2.3 Submetering

- Standard analog meters exist on many reimbursable facilities for invoicing.

- An advanced electrical metering program has been implemented with 66 advanced metering systems installed in facilities over 35,000 square feet.

- An advanced gas metering program has been funded for 24 facilities, meeting the Air Force's previous policy on metering. The implementation of the program is ongoing.

3.5.3 Water Conservation Initiatives

- The base has significantly reduced water consumption by an aggressive program to replace turf areas with xeriscaping.

- There is a plan to use effluent water for irrigating the golf course. The effluent will come from the city of North Las Vegas' sewage treatment plant constructed adjacent to the base. This will result in a significant reduction in the amount of water needed from irrigation wells in the area.

3.5.4 Waste Reduction Initiatives

- Nellis AFB has an extensive recycling program that includes paper products, cardboard, plastic bottles, scrap metals, and spent brass from ranges, as well as metals from aircraft and weapons systems that are discarded as part of normal use and maintenance.

  The base also recovers or recycles as much hazardous material as possible. The hazardous material recycling program includes antifreeze, waste oil, jet fuel, and continued use solvent; lead acid and lithium ion batteries, oil and fuel absorbents; and mixed scrap metal and brass cartridges from the range.

3.6 Constraints

Figure 3-3 illustrates composite constraints at Nellis AFB. Generally, there are few on-base constraints that will significantly affect development at the installation; however, Las Vegas Boulevard does pose AT/FP constraints to development and opportunities for growth for Main Base and Area III.

This drainage facility at the south end of the installation accommodates large volumes of runoff.

Floodplains associated with the storm water drainage are a very minor limitation to development. There are surface water drainage channels that direct rain water to the south, where significant storm water drainage facilities have recently been constructed. Most new construction in the Main Base area would not be affected by natural resource constraints; however, facility construction in open space would have to ensure that special status species were not affected.

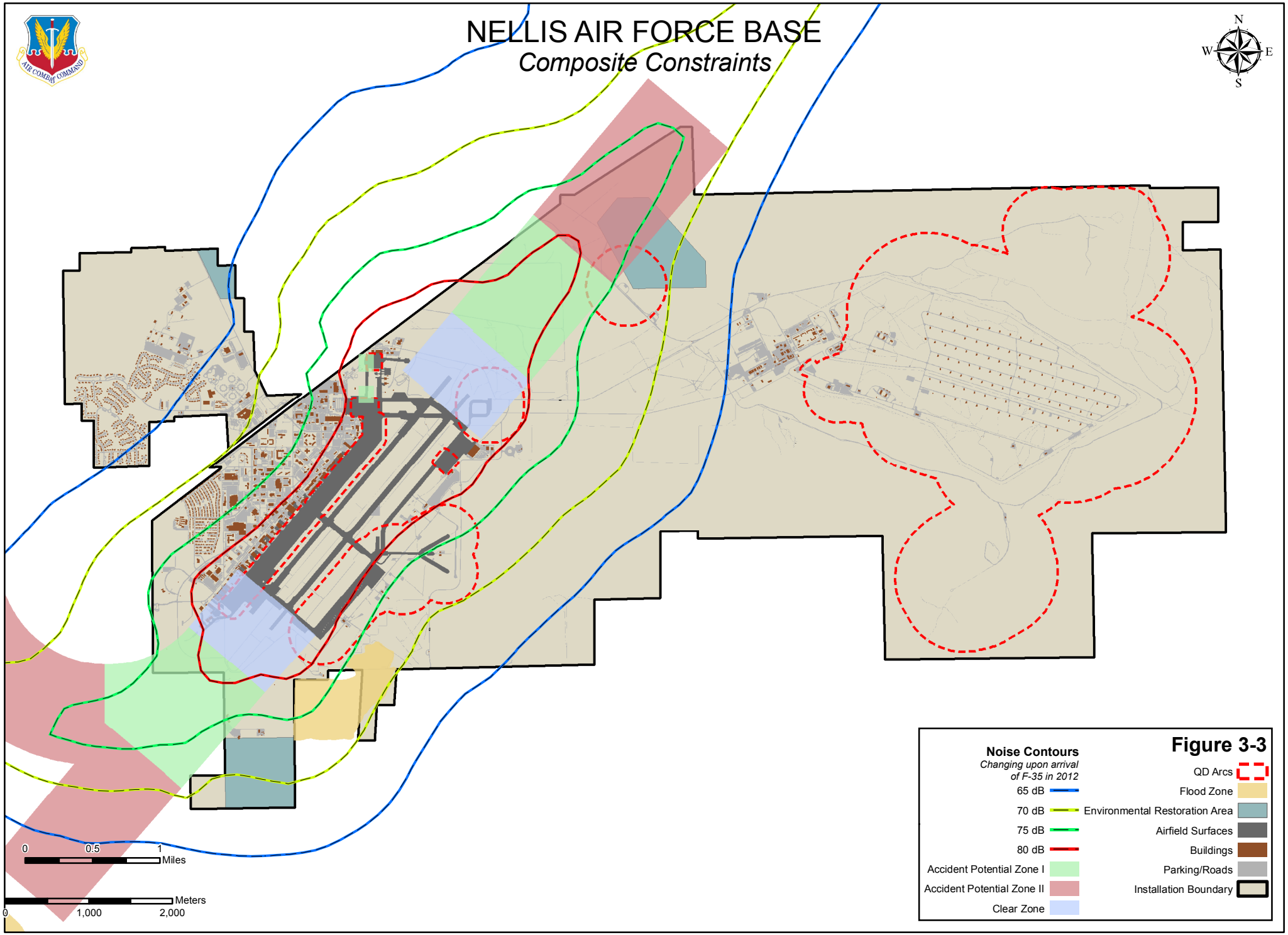
There are relatively few Environmental Restoration Program (ERP) sites on the installation. Because most of the sites are quite small and have been closed to further action, there would be limited development constraints associated with ERP sites.

Another constraint to development is noise associated with aircraft operations. Noise is a quality-of-life issue and can directly affect human health if not attenuated through appropriate construction. The entire main base area—with the exception of some of the family housing area—is within the 70+ Day-Night Average Sound Level (DNL) contours so facility construction will require noise attenuation. Building heights and sites also need to accommodate airfield criteria

Safety and security of Air Force assets, personnel, and families drive AT/FP setbacks for construction of facilities. The AT/FP setbacks limit opportunities to create truly compact development patterns on the installation. They also limit the ability to site a building that addresses the road and sidewalk in a "new urbanist" style. However, buildings may share the standoff distance created between them, which will help in creating a denser development pattern.

NELLIS AIR FORCE BASE

Composite Constraints



4 Illustrative Plan

The purpose of the illustrative plan shown in Figure 4-1 is to graphically illustrate the desired, future state of Nellis AFB by:

- Incorporating the sustainable planning and design principles found in this document.
- Using the infill opportunity areas that were discussed in Chapter 3.
- Integrating Nellis AFB's demolition plan and future development projects.

Implementation of sustainable planning and design principles should result in development density increases to enhance the base as a place to work, live and play, while at the same time providing development opportunities for mission expansion. Increasing the compact nature of the base will help reduce the reliance on automobiles and encourage pedestrian circulation throughout much of the installation. In addition to potential reductions in fuel consumption and emissions from personal vehicle use, increased development density should ultimately reduce costs for infrastructure. Public health benefits should also be realized with the establishment of a centralized outdoor recreation/fitness area that is tied to a multi-purpose trail that has direct access to installation housing areas on the main base.

Overall, development infill occurs in areas where existing buildings are scheduled for demolition; facilities are programmed for relocation; and in areas where there is available vacant land.

In Figure 4-1 the design concepts and components embodying infill development for the base are labeled as follows:

1. This infill site is currently the most prominent redevelopment site on the installation because it is in proximity to the flightline (Figure 4-2). The site's current facilities are a jogging track and ball fields. Because of its current use and proximity to the flightline, the site is slightly "underutilized" and can provide much higher value to the mission following redevelopment with training/administrative or operational facilities that sustain and expand the mission. This location is further enhanced by incorporating strong landmarks that support the importance of the installation and highlight the history of military aviation.

2. A portion of the family housing area on the main base has been demolished and is an excellent location for an installation outdoor recreation park at Infill Site #2 (Figure 4-3). This park includes the new fitness center. This park would be connected to family housing and unaccompanied housing areas with a multi-purpose trail and bike route to encourage pedestrian access and a reduction in personal vehicle use. The creation of this park also helps sustain the installation mission by absorbing outdoor recreation facilities (ball fields and jogging track) currently in Infill Site #1 that are in proximity to the flightline. Once the recreation facilities are relocated, these "underutilized" parcels could be redeveloped for mission training, administrative, or operational facilities, and provide a significantly higher return on investment.

3. This infill site is the former housing area for senior leadership (Figure 4-4). Following relocation of families to the new housing area, this site provides an opportunity to expand the installation town center. Future development is not clear at this time; however, it was determined that identification of this site for future development associated with typical town center functions was important.

4. Infill Site #4 is currently a mix of low density mission operations facilities and community services (Figure 4-5). The fitness center and swimming pool will be relocated to Infill Site #2, and the outdoor adventure center could potentially be relocated in the future. This portion of the infill site could be oriented toward community commercial functions and provide improved pedestrian access to the flightline. Some minor mission-oriented infill development can occur closer to Tyndall Avenue. Facility development along Washington Boulevard should maximize solar orientation and a highly visible landmark could be established at the intersection of Washington Boulevard and one of the entry roads into the BX parking lot. Centralized shared-use parking lots should be constructed to serve flightline facilities.

Much of the gridded roadway pattern and undeveloped parcels on the main base of Nellis AFB allows for solar orientation for new construction and even for some building additions. Although the roadways are not in an east-west grid pattern, new buildings in Infill Site #1 are sited to achieve a solar orientation. The advantage of having buildings sited with good solar orientation is an overall reduction in energy consumption.

Although it is best to face structures directly into the sun, buildings can be oriented up to 30 degrees away from due south and lose only 5 percent of the potential savings.

Although desirable, not every new facility on the installation will be able to maximize solar orientation. But it is important to maintain established setbacks and building orientation in most areas. No matter which building orientation is utilized, the siting of new facilities should result in a compact parking and building relationship that reduces development and infrastructure costs.

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NEILLIS AIR FORCE BASE

Illustrative Site Plan

N
W E
S

3
Future Development
4
2
Multi-Purpose Trail
1

Figure 4-1

Infill Sites 4

Infill Building

Existing Building

Future Building

Air Park/Recreation Area

Multi-Purpose Trail

New Paved Areas

Existing Paved Areas

Landmarks

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NELLIS AIR FORCE BASE

Infill Site #1

Figure 4-2

- Infill Building
- Existing Building
- Future Building
- Air Park/Recreation Area
- Multi-Purpose Trail
- New Paved Areas
- Existing Paved Areas
- Landmarks

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NELLIS AIR FORCE BASE

Infill Site #2

Figure 4-3

- Infill Building
- Existing Building
- Future Building
- Air Park/Recreation Area
- Multi-Purpose Trail
- New Paved Areas
- Existing Paved Areas

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NELLIS AIR FORCE BASE

Infill Site #3

Figure 4-4

Existing Building

Existing Paved Areas

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NELLIS AIR FORCE BASE

Infill Site #4

Figure 4-5

- Infill Building
- Existing Building
- Future Building
- Multi-Purpose Trail
- New Paved Areas
- Existing Paved Areas
- Landmarks

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5 Development and Design Guidelines

5.1 Sustainable Development and High Performance Green Building Design (SD&HPGBD)

ACC has realigned planning, design and construction practices so implementing SD&HPGBD objectives become primary considerations. These changes will allow SD&HPGBD strategy opportunities to influence the building form.

Nellis is also committed to SD&HPGBD to improve the quality of the installation and reduce resource consumption. Initiatives currently in place include focused efforts to reduce energy and water consumption.

Nellis and Creech AFBs use *the ACC SD&HPGBD Scorecard (Scorecard)* as a green building self-assessment metric. The scorecard assembles and consolidates Executive Orders, Public Laws and Federal Agency rulemaking on SD&HPGBD requirements with the LEED Rating System. Using the scorecard is a way to achieve the desired LEED rating and meet critical statutory minimum requirements.

When applied in context, the scorecard can illuminate opportunities for sustainable design, often with low- or no-cost choices. Some choices carry an upfront cost but provide long-term operational cost savings and are value-added building features. Scorecard requirements can guide and inform building projects towards lower lifecycle costs and enhanced sustainability.

This chapter provides guidelines related to site development and infrastructure systems as well as architectural order and elements necessary for achieving SD&HPGBD.

5.1.1 Regional Priority Credits (RPC)

Regional Priority Credits were introduced in the Leadership in Energy and Environmental Design (LEED) 2009 rating systems to provide an incentive to the achievement of credits that address geographically-specific environmental priorities. RPCs are not new LEED credits, but instead are existing credits that United State Green Building Council (USGBC) chapters and regional councils have designated as being particularly important for their areas. The incentive to achieve the credits is in the form of a bonus point. If an RPC is earned, then a bonus point is awarded to the project's total points. The RPC for Nellis and Creech AFBs are the same.

- SSc6.1 Storm Water Design and Quantity Control:
  - **Intent:** Limit disruption of natural hydrology by reducing impervious coverage, increasing on-site infiltration, reducing or eliminating pollution from on-site stormwater runoff and eliminating contaminant.
- SSc7.1 Heat Island Effect–Non-Roof:
  - **Intent:** Reduce heat islands to minimize impacts on microclimates and human and wildlife habitats
- WEc.1 (Option 1, 50 percent)–Water Efficient Landscaping:
  - **Intent:** Limit or eliminate the use of other natural surface or subsurface water resources available on or near the project site for landscaping irrigation
- WEc.3 (Percentage Reduction Required, 40 percent)–Water Use Reduction:
  - **Intent:** Further increase water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.
- EAc.2 (Percentage of Renewable Energy Required, 9 percent)–Onsite Renewable Energy:
  - **Intent:** Encourage and recognize increasing levels of on-site renewable energy self-supply to reduce environmental and economic impacts associated with fossil fuel energy use.
- MRc2 (Construction Waste Management, 50 percent Recycle and/or Salvage):
  - **Intent:** Divert construction and demolition debris from disposal in landfills or incineration facilities. Redirect recyclable recovered resources back to the manufacturing process and reusable materials to appropriate sites.

5.2 Site Development

Site development guidelines focus on building siting and orientation, access, parking/roads, landscape, open space, energy, utilities, and storm water. Each section includes a brief description of existing conditions. The intent of these guidelines is to provide the designer with general background information for the installation and to provide recommendations for site development. The recommendations identified will help foster the base's green infrastructure.

Figure 5-1 *Existing building orientation detail in the main cantonment area.*

5.2.1 Solar Orientation and Building Siting

5.2.1.1 Solar Orientation

The existing buildings at Nellis and Creech AFBs are mostly oriented parallel and perpendicular to the roadway grid. In general, the strength of the existing roadway grids as organizing elements overrides other influences on existing building orientation.

In the main cantonment area, the network of roads is organized as two overlapping grids. Fitzgerald Boulevard aligns with cardinal compass directions, while Tyndall drive runs northeast-southwest. As a result, most of the buildings in the Mixed Use Central Core and Engineering/Logistics Districts are constructed at ideal solar angles (Figures 2-5 and 2-7, respectively).

In some cases, buildings are rotated off of the roadway grid in order to create clusters of landscaping or gathering space. These buildings are not sited to follow an ideal solar orientation, but they create some pleasing open spaces, which add interest and variety to the installation. Figure 5-1 illustrates the two overlapping solar orientation grids that generally follow the street grid and highlights those buildings which are and are not constructed at the proper solar angle.

Design and planning teams should maximize the future solar orientation of buildings through land development planning. Future ADPs in areas without an established road system must be laid out to optimize solar orientation for new buildings. This is generally with the long axis of buildings east-west and solar exposures to the north and south. The layout of new streets in an ADP often dictates the future orientation of buildings toward the street and as such, aligning the street grid according to the sun is critical. Aligning streets and buildings on an east-west axis will serve the dual purpose of also optimizing those buildings to host rooftops solar panels, should the opportunity arise.

For building sites on a road that is not east-west oriented, the designer should strive to maximize the shape and orientation of the building with respect to the sun for passive solar heating, cooling, and daylighting. However, in most cases orientation of buildings parallel to street should take precedence over irregular solar orientation in siting to avoid inefficiencies resulting from an awkward building orientation. Moreover, other measures may be taken in the specific building design to optimize energy efficiency, such as shading devices at window openings, coordination of deciduous tree plantings, overall building envelope massing, and certain types of skylighting.

Overall, a building footprint layout analysis is strongly recommended so that buildings are oriented according to the solar guideline (i.e., 15 degrees to east-west) only when it is clear that this will indeed be effective for the actual building design. If solar orientation will not significantly affect the particular building, then it should be oriented squarely with the street or existing building grid.

Figures 5-2 and 5-3 identify the sites on Creech and Nellis AFBs that need to follow grids for functional and organizational reasons, and those that can follow the grid while also achieving optimum solar orientation. The Flightline District and Area II Red Horse District are the most restrictive. Any buildings sited outside of the highlighted areas can follow the optimum passive solar orientation.

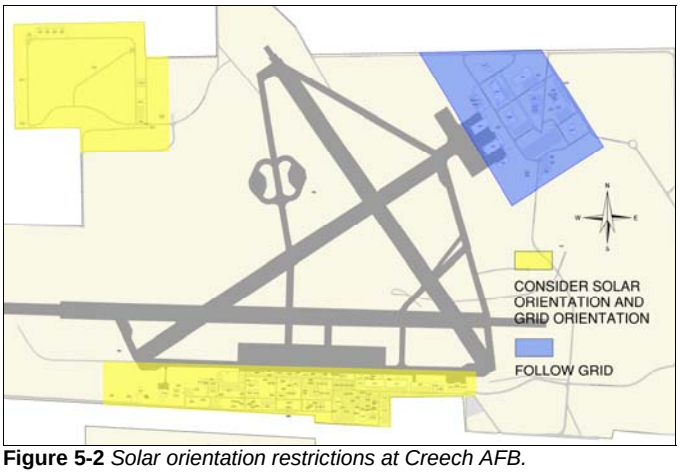


Figure 5-2 *Solar orientation restrictions at Creech AFB.*

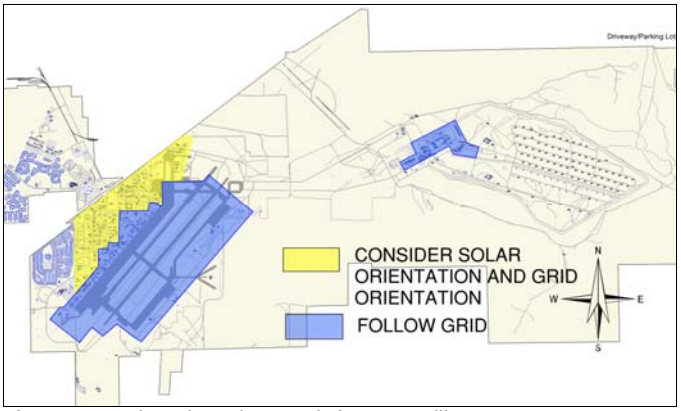


Figure 5-3 *Solar orientation restrictions at Nellis AFB.*

5.2.1.2 Building Siting

Numerous factors need to be considered when siting new facilities. Some of these factors include the following:

- Existing and future land use
- Functional relationships between activities
- Opportunities for LEED credits through orientation and location
- Anti-terrorism/Force Protection (AT/FP)
- Building function and size, including consideration of the minimum size and footprint necessary to serve the function
- Parcel shape and size
- Operational and natural constraints
- Infill opportunity
- Vehicular and pedestrian access
- Proximity to utility corridors
- Natural features

In general, designers should seek to place new buildings in close proximity to existing buildings of similar type and usage, in order to reinforce the character of each individual district. Future retail and civic buildings should be sited in the Downtown Subzone of the Mixed Use Central Core. Future dormitories should seek to reinforce and expand the existing clusters rather than create additional zones of development. Future ancillary facilities that are directly supportive of the base flying mission along the flightline should be situated along Tyndall Avenue. This will serve to link new facilities both to the existing squadron buildings and to the flightline. In recreational areas, congregate recreational structures (bandstands, gazebos, picnic shelters) together to generate coordinated areas of activity within the larger overall areas. New buildings should work with the existing natural features. Conserve, maintain, and enhance natural site elements such as topography, vegetation, and views.

5.2.2 Access

Roads within the installation have benefitted from a strong program incorporating sidewalks and landscaping. Sidewalk placement generally reinforces the road network and connects major activity centers. Adequate development of crosswalks and curb ramps let pedestrians move safely. Palm tree plantings line Washington Avenue, giving prominence to “Downtown” Nellis. The concept is continued down Kinley Avenue, connecting the main cantonment area with the south portion of the base.

Palm-tree-lined Kinley Avenue includes sidewalks and xeriscaping.

The ability of pedestrians to move easily and safely across the base aids sustainability goals by reducing vehicle emissions and reducing the amount of asphalt pavement contributing to heat island effect. With the pedestrian network currently in place at Nellis, the installation is well on its way to embracing the Complete Streets concept, an idea championed by proponents of sustainable design.

According to the National Complete Streets Coalition, complete streets are ones “…*designed and operated to enable safe access for all users. Pedestrians, bicyclists and motorists of all ages and abilities must be able to safely move along and across a safe street*.” Complete streets typically include bike lanes, sidewalks on both sides of the street, frequent street crossings and median islands. The streetscape should include pedestrian amenities, such as benches and landscaping.

Nellis could improve its current program by more thoroughly incorporating bicycle traffic, adding pedestrian amenities, and making landscaping choices that address responsible water usage. Shade and ornamental trees create a more pleasant local microclimate, contribute to the unique character of this installation, and offset vehicle emissions pollution. However, their benefits must be weighed against the scarcity of water in the desert environment for most of the year.

A number of sidewalks abut culverts, designed to hold stormwater during the brief spring rainy season when flash flooding is possible. The incorporation of decorative railings and/or landscaping between the culverts and the sidewalks would improve the pedestrian network by adding a sense of security.

Well developed streetscape at Nellis Hospital entry.

The application of streetscape (or the complete street concept) improvements is seen as one of the ways to enhance pedestrian connectivity. As a result, it is recommended that:

- Streetscape improvements in the Flightline and Facilities Engineering Districts should not require the same amenities as "Complete Streets," because these areas are not envisioned as social/gathering areas, but appropriate pedestrian circulation paths are necessary to minimize pedestrian and vehicle conflicts. Sidewalks may abut roadways in these districts.

- Streetscape features in all other districts should be pedestrian oriented and patterned on the "Complete Streets" concept. Sidewalks should be set back from the street to allow a buffer between the pedestrian and vehicular traffic in these districts. Where possible a permeable zone/planting strip should be a minimum of 8 to10 feet wide. This strip should not be less than five feet wide. Utilize drought-tolerant plant species in combination with decorative rocks to minimize irrigation needs in the landscape buffer. Turf grass is prohibited. The landscape buffer protects the pedestrian from traffic and ensures a more comfortable pedestrian environment and visually attractive setting.

It is also recommended that the design team look beyond the development site for pedestrian improvement opportunities that connect new development sites with adjacent services and amenities. These opportunities will provide an alternative to short-trip driving, ideally embodying the LEED concept of "Community Connectivity." Currently, the bus service offered between the Nellis and Creech installations serves as an example of this goal.


Bus Stop Examples

5.2.3 Parking and Roads

The two intersecting grids which define the layout of the main cantonment area of Nellis create some awkward intersections with limited visibility. Because of the unusual street layout, way-finding is not intuitive once vehicles leave the palm-tree-lined boulevard. Also, the volume of traffic can be heavy at times. Some functional recommendations to improve the flow of traffic include the following:

- Re-work existing intersections as needed to eliminate sharp angles.

- Consider the incorporation of traffic circles for the most heavily-travelled intersections.

Appropriate signage and landscaping at Building 556 main entry on Fitzgerald Boulevard.

- Provide directional signage per base standards.
- Site new buildings to reinforce streets that promote positive traffic flow patterns.
- Utilize the architecture of new buildings and the careful placement of landscape elements to delineate roadways and reinforce key destinations and cardinal directions.
- Utilize landscaping to visually establish hierarchy along primary and secondary roads and provide a consistent visual experience.

In general, the amount of parking at the base seems to be adequate to meet the need without being excessive. Most parking lots are small, well-landscaped lots associated with particular buildings. Newer facilities have parking lots that were developed at the appropriate distance from the building to meet AT/FP standards.

- Provide the appropriate amount of parking to meet the need. Larger lots shared between facilities are preferred over small lots that consume more space because of AT/FP requirements. Mitigation measures for the heat-island effect associated with larger lots shall be considered in the design process.

Other development goals should include the following:

- If space and AT/FP requirements permit, locate shared parking toward the interior of each "block", or smaller parking lots to the sides of buildings in order to allow buildings and their associated landscaping such as rocks, boulders, and native and drought tolerant shrubs to help define street edges. Emphasize site entry drives with landscaping while maintaining site triangles.
- In recreational areas, locate parking toward the periphery of the recreational area.
- Use plant material in combination with berming to screen parking lots from streets and adjoining areas.
- Provide clear sight lines at parking lot entrances.
- Include sustainable design features, such as green infrastructure design solutions for storm water management that are appropriate to locate in a new parking lot development. These systems can be as simple as draining storm water to landscaped areas instead of collection systems to promote infiltration and slow down excess runoff.

Plant material screens parking at the golf course lot (Building 1626).

- Consider reductions in new and existing street sections and parking where appropriate to reduce runoff and heating effects.
- Design lots to minimize incidents of off-road parking by incorporating features that discourage motorists from parking on unimproved surfaces.
- Design parking lots to have islands within them for landscaping. Plant trees where possible to provide shade. Select trees that can withstand harsher conditions such as sun, glare, heat and reduced water supply. Avoid trees with low-growing branches. Choose trees and shrubs that require minimum maintenance and will not litter the parking area with branches, fruit, or nuts. Utilize landscape rocks and low shrubs that will not obstruct sightlines when tree-planting is not feasible.
- Continue palm-tree planting along primary arteries.
- Consider sustainable paving materials, such as lighter color pavements and permeable pavers.

Parking area off of Tyndall Avenue in front of Hangar 285.

- Set aside five percent of parking for car/vanpools and five percent for low-emitting vehicles in preferred locations, embodying the LEED concept of limiting environmental impacts from automobile use and encouraging alternative transportation.

5.2.4 Landscape

A properly designed landscape enhances all facilities and helps to create unity by providing a consistent image throughout. With approximately 4 inches of precipitation annually, landscape development at Nellis and Creech AFBs is limited by the desert environment. Long, hot summers with low rainfall quantities make it a challenge for plant material to survive without some form of irrigation. Unless irrigation is deemed unnecessary by the base, all irrigation systems shall be approved by the ACC and the base and shall follow the guidance laid out below and the design standards provided in Section B.4.2.

Currently, Nellis is seeking a base-wide irrigation waiver from the ACC in order to support the planting program previously established on the base. This planting program included extensive use of palm trees and pine trees, and, to a lesser extent, irrigation-dependant deciduous plants and shrubs. Xeriscaping—the application of landscape rocks, boulders, and native and drought tolerant shrubs—has been embraced in areas of newer construction. The shift away from irrigation-dependence toward sustainable landscape principles is critical to future development at Nellis AFB. The newer development on the northeast part of Creech AFB serves as an excellent example of xeriscape-based development. For Creech AFB, base personnel are in the process of preparing landscaping guidelines that emphasize no maintenance landscaping (e.g., no leaf dropping plants) with minimal/no irrigation needs.

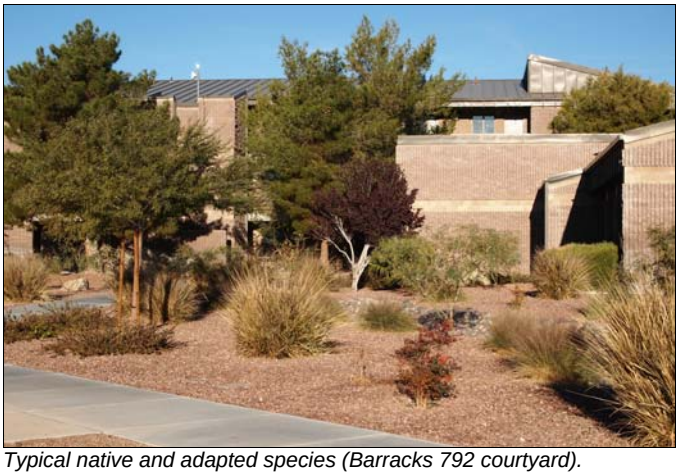
Design principles to follow are listed below.

- Emphasis should be placed on installing draught tolerant and low water use plants and operating the most efficient irrigation systems – drip or underground-available on a seasonal and as-needed basis. Irrigation clocks should be continuously monitored and adjusted as necessary to limit water use and reflect current plant and weather conditions. Plants should only be provided enough water to survive and should not grow excessively.

- Center pivot, lateral sprinklers, and overhead irrigation systems are not permitted.

- The majority of landscape plants used in Nellis and Creech AFB landscape design should be the most drought-tolerant and low-water use type appropriate for the site. Shade trees used in the design should be located to take best advantage of their benefits.

- Provide an automatic irrigation system that should only operate occasionally after the plant establishment period.



Typical native and adapted species (Barracks 792 courtyard).

- In special circumstances, as approved by ACC and the base, higher water use plants such as palm trees and pine trees can be included in landscape design. The drip irrigation system supporting these plants should be zoned separately from an irrigation system that also supports drought-tolerant low-water use plants. In all cases, trees and shrubs with different irrigation requirements shall be in separate zones.

- Where possible, make effluent water available to support irrigation-dependent plantings.

- Landscape plants shall be those species listed on the Appendix B Plant List. Plants listed on the Southern Nevada Water Authority Water Smart Landscapes Program plant list may also be used with approval from the Base Architect

- Turf is not permitted as a landscape element.

- Strategically placed landscaping should be provided for all new facilities to provide necessary shading for the facilities' solar orientation if the design of the structure does not include shading devices. This should include the use of deciduous trees on the south, east and west sides to shade buildings during the summer but allow sun in the winter months.

- Strategically placed landscaping should be provided for all new facilities to provide necessary wind protection, specifically at Creech AFB, where the wide-open nature of the northeast cantonment area could benefit from landscape walls, shrubs, and evergreen trees as windbreaks.

Appropriately designed large storm water retention basins at Building 204.

- All reasonable measures should be taken to preserve existing trees, especially large specimens over an eight-inch caliper.
- Vary landscaping to denote different areas such as building entrances, entry drives, pedestrian walkways, and intersections.
- Use landscaping to control and frame views.
- Consider the use of landscape boulders for AT/FP. Different-sized boulders should be placed irregularly and be partially buried and incorporated with mounding, if possible. The goal is to use natural landscape features to impede vehicles from driving up to facilities.
- Landscape that also serves as a force protection barrier, including mounds and large boulders, is encouraged and shall be used in lieu of concrete/ concrete masonry unit walls and/or bollards, whenever possible.
- Use informal and natural arrangements of plantings. Due to higher than average loss rate in the desert environment, avoid rectilinear masses of plants and straight lines.
- Landscape designs should include low barrier walls, decorative rocks and paving, in combination with plantings, to maximize impact while minimizing irrigation needs.

Appropriate landscaping and site amenities at Nellis Hospital entry.

- Multi-colored river rock is encouraged to simulate water paths and cover ponding areas.
- Mounds, depressions and contours shall be used to break up/add variations to the landscaped area.
- Screen mechanical equipment, transformers, backflow preventers and other irrigation system components, loading docks, dumpsters, and incompatible uses with a combination of plant material and walls. Install plant materials at sizes and spacing that soften the screen walls.
- Use landscape to enhance building entrances and create focal points.

Established plantings and site wall at Building 20 screen mechanical equipment.

- Use foundation plantings to visually integrate the building with the site.
- Because of water restrictions, consider planting specimen trees and creating focal points rather than a dense group of plantings.
- Landscape plants located within 33 feet of a building exterior wall shall be a type that would not fully conceal from view a 6-inch by 6-inch package. Certain ornamental or less dense type desert shrubs and trees would be acceptable in this zone. Reference AT/FP document UFC 04-010-01 for additional site planning requirements.
- Along Tyndall Avenue, concentrate plantings along the building fronts, northwest of the low barrier wall that separates the flightline. Keep the southeast side of the wall open for loading, storage and other flightline activities. Similar principles apply to Reaper Road at Creech AFB.
- Provide shaded outdoor spaces to provide relief from the heat.
- Utilize desert landscaping to naturalize drainage ways. Reduce the rigidity of linear channels while keeping the functionality intact.
- Minimize the use of natural turf to special situations approved by the base in order to reduce water needs. Consider the use of artificial turf for prominent buildings and recreation fields, such as baseball and soccer fields and open play areas.

Naturalized drainage swale and landscaping at dormitory buildings.

Naturalized drainageway.

Shade structure at outdoor recreation and picnic area.

5.2.5 Open Space

Open space can be defined as active or passive. Passive areas include expanses of native or adapted vegetation, grasslands, floodplains, and canals while the active recreational areas include ballfields, parade grounds, parks, and picnic areas.

Nellis AFB is a relatively developed installation with a compact cantonment area. Visual relief from building and parking lot development is provided by landscaped areas around drainage swales; in clearances required by AT/FP; by consciously applied parking lot buffers; and by streetscape elements. However, relatively few pockets of truly undeveloped space exist in the defined Districts.

Passive open space can be found south/southwest of Access and Freedom Circle to the golf course development. The golf course itself can be considered active open space.

A number of functions have been moved to the opposite side of Las Vegas Boulevard in order to open potential development pockets in the Mixed Use Central Core. The development on the opposite side, Area III, is still natural desert from the west edge of the housing area to the base boundary.

The compact nature of Nellis AFB should be reinforced and encouraged in support of sustainability goals. Reduced development footprint minimizes impact on local microclimates, preserves native plant and animal life, reduces infrastructure needs, and requires less raw materials. To that end, designers should:

- Consider vertical rather than horizontal development wherever possible.
- Seek or create infill opportunities rather than expand development into passive open space.
- Use landscape elements and existing natural features to define outdoor spaces and gathering areas.

The density of development at Nellis AFB makes the preservation of active open space and the careful creation of new active open spaces critical to the base character and function.

The recommended level and frequency of active open space development should vary depending on the needs of the development and its surrounding land uses.

- Large, active open space areas should be preserved to function as gathering/multi-use spaces especially in the Mixed Use Central Core.
- With the possible exception of the flightline, district development should include small-scale gathering nodes. Include provisions for shade and shelter from the wind. Utilize a combination of special pavement such as colored concrete or precast concrete pavers, picnic tables, benches and barbecue grills (where appropriate) to give the space definition and character.

Note that Creech AFB is a less dense installation than Nellis AFB. As a result, the new development on the northeast side of Creech is more subject to strong prevailing winds than existing developed areas at Nellis. When creating successful outdoor gathering spaces, shade and wind protection are key considerations at both installations, but more so at Creech AFB.

- Shade and windbreaks can be achieved through planting of landscape material, construction of site walls, and earth berming. Shade can also be achieved through the use of shade structures that are compatible in color, form, and materials with the adjacent buildings. The adjacent building itself can also be a source of shade and wind protection.

Shade structure and privacy wall at 64th Aggressor Squadron outdoor break area.

5.2.6 Energy and Utilities

Nellis and Creech AFBs have undertaken a number of energy and water efficiency projects to meet higher-level policy goals and directives. Further reduction of the base's resource consumption is a complex problem that will only be solved by approaching energy and water utilities in a holistic way.

Energy saving recommendations presented in this section are taken from the Nellis AFB ISA, 2010. The recommendations build upon sustainability initiatives already in place and are specific to the local conditions and previous, successfully implemented practices. Recommendations should be reviewed by planning and

5.2.6.1 Heating and Cooling

Air conditioning is the primary thermal load at Nellis and Creech. The base has so far mostly used individual air-cooled chiller and boiler units at each building for heating and cooling, while a few buildings use direct-expansion package units.

- Planning of new buildings should consider distributed water heating and cooling systems. Such systems will allow for greater flexibility in the future to connect to centralized cooling systems or solar thermal heating systems.

Increasing density through infill development with centralized utility plants and distribution systems serving multiple buildings within a campus offers a possible order of magnitude improvement in energy savings compared to current development practices.

- Consider construction of an ice storage/central plant in dense areas on the base to create a district cooling system. Larger cooling districts attached to a single, central plant provide more benefits because the distribution system acts as a thermal reservoir (a "flywheel" effect) and the aggregation of equipment is often more efficient and easier to maintain than individual units at each building.

Approximately half of the buildings on base use boiler-based heating systems and half use direct-expansion units.

- Any modification to the type of heating used should favor non-electrical power sources to reduce the Source 2 greenhouse gas emissions caused by the local energy provider's use of coal to generate electricity.

- Consider strategies for incorporating solar thermal energy to supply heating for buildings, including thermal massing techniques appropriate for the desert climate, like rammed earth walls or trombe walls.

- As the existing boilers (and hot water heaters) require replacement, upgrade to 94 percent or higher condensing-type boilers in the event that district heating or other more sustainable systems cannot be used.

- Within individual buildings, consider using variable refrigerant flow systems to capitalize on internal heat gains to minimize heating required for the exterior envelope of buildings as an alternative to water source heat pump systems.

5.2.6.2 Metering and Controls

Advanced metering and control management systems shall be installed on all new buildings, major renovations, and reimbursable tenants per ACC Standards. The Air Force Facility Metering Policy (Appendix C), Memorandum, 10 July 09, provides specifications for use of advanced metering and water metering.

- Ensure advanced metering and control systems are compatible with existing systems to enable the Base Energy Manager to control the energy load of the building–based on current energy demand and varying rates—in the most advantageous manner to minimize energy use and energy costs.

- Consider including real-time energy use displays in each facility that are tied to the advanced meters. This practice makes users aware of energy consumption and often results in significant savings since building occupants can take charge of their own energy habits.

5.2.6.3 Water Utilities

Nellis and Creech AFBs manage water use as appropriate for the local desert climate. Water supply has been abundantly available from multiple on-base and off-base sources and to date has not been a significant enough constraint on the mission of the base to demand an extensive program of water use reduction. However, Nellis AFB is investigating the possibility of redirecting wastewater discharges to a new treatment plant being planned next to the base in exchange for the use of effluent water for irrigation of the base golf course.

- Consider the use of the effluent system to satisfy irrigation needs for each new project. See Section 5.2.4 for the use of effluent water and xeriscaping for water irrigation.

- Consider extending the effluent system or existing raw water pipelines beyond the project limits to eliminate other existing uses of potable water irrigation.

- Consider using effluent water or raw water for toilet flushing and other non-potable water uses in new construction on the base, as acceptable to local plumbing code.

- Continue the use of high-efficiency water fixtures that implement automatic fixture sensors, flow restrictors and flow aerators as well as low-consumption toilets and waterless urinals for each new project. EPA's WaterSense program provides certification for products meeting such standards.

- Contractors should coordinate filling of water trucks with CES/CEAN staff familiar with locations where regular flushing of stagnant water is required to reduce the amount of water consumed by flushing and non-potable uses.

5.2.6.4 Renewable Energy Infrastructure

Local climate conditions at Nellis and Creech make them well suited for use of solar energy for power generation and thermal energy. Nellis AFB has already been able to exploit this opportunity through a private-public partnership development of a 14.2 mW photovoltaic array that supplies energy exclusively to the base.

At the time of the site visit by the ID2 team, ACC was engaging local researchers to complete a detailed study of potential for developing renewable energy supplies at the base.

Solar Energy

Solar energy is currently the most utilized source of renewable energy at Nellis, but primarily in the form of power generation using photovoltaic arrays. The application of solar technology and use should consider the following:

- Evacuated tube technology solar hot water panels. Damaged tubes can be easily replaced without replacing the entire panel. Water does not leak from the panels when they are damaged since the evacuated tubes are exposed and do not contain water, and the panels continue to allow water throughput and heating even when individual tubes are broken.

- Use of small- and large-grid arrays of photovoltaic panels for power generation. Solar PV panel arrays can be developed in conjunction with parking areas to serve a dual purpose of providing shade to reduce urban heat island effects.

Should the use of solar energy systems be deemed impractical for current project budgets, solar-ready construction with the following traits should be considered, at a minimum during building siting and design:

- Orient the building with a south-facing roof that is unshaded from 9 AM to 3 PM with a large, rectangular area free from vent pipes, skylights and other penetrations. Roofs do not need to be exactly south facing, but should be within a southeast to southwest orientation. The roof should have adequate uninterrupted square footage for a useful system of panels. At a minimum, at least 200 square feet is required for any solar array. This provides sufficient room for the array and maintenance access and complies with most fire codes. Ultimately, the size of a solar thermal system should be determined by estimating the buildings' hot water demands. Sizing of a photovoltaic array is usually constrained by available space and budget, as excess electricity can be returned to the grid.

- Include wire and piping in new construction or renovations so that at a later date the building can be easily augmented with solar PV (electric) and/or solar hot water systems.

- Ensure structural capacity to carry future panels and equipment related to solar energy capture, including wind load considerations.

- Provide roof access for installation and maintenance.

Solar-ready construction allows the energy manager to procure PV or solar hot water systems as funding becomes available and/or through power purchaser agreements with the local utility without costly and disruptive facility renovations.

Ground Source and Turbines

According to maps produced by the National Renewable Energy Laboratory, local conditions at Nellis and Creech are favorable for deep enhanced geothermal systems. Designers contemplating geothermal energy should review the geothermal resource map estimates and the recommendations of the forthcoming ACC report on renewable energy sources to determine if geothermal energy is appropriate for the project.

Development of ground source renewable energy may be particularly applicable at Creech AFB as it would not require development of an offsite infrastructure network or extensive trucking to supply a renewable fuel source.

Biomass

According to maps produced by the National Renewable Energy Laboratory, there is relatively high potential for biomass fuels such as mill residues, wood waste, and methane recovery from landfills in the area around Nellis AFB. Biosolids recovered from wastewater treatment may also become a renewable energy resource of significant energy potential and local supply pending the development of a treatment plant adjacent to the base.

Wind Turbines

Wind resource estimates developed by AWS Truewind in conjunction with the National Renewable Energy Laboratories show that local conditions at Nellis and Creech provide poor opportunity for wind power. Designers contemplating wind energy should review the wind resource estimates and determine if wind energy is appropriate for the project.

5.2.7 Storm Water

Nellis AFB currently operates a storm water system that focuses on the collection and conveyance of storm water away from facilities on base for irregular, high intensity storm events that are typical of the local climate. Storm water infrastructure at the base primarily consists of culverts for road crossings, open drainage swales and localized closed storm water systems along the flight line. Storm water is also conveyed to a large Clark County drainage ditch at the south end of the base.

Development plans for the base should acknowledge that these practices are not sustainable and should consider the following, mostly simple, improvements to existing facilities to disconnect the flow of storm water from collection systems to encourage infiltration and reduce the rate of storm water runoff:

- Disconnect downspouts from underground, piped systems and redirect the discharge to splash on-grade blocks.
- Add curb cuts along existing streets to redirect water collected in gutters to landscaped areas.
- Where grades allow, remove the curb and gutter along parking areas to sheet the water off of the parking lot into grass and landscaped areas.

EISA Section 438 requires all new and redeveloped federal facilities over 5,000 SF to "use site planning, design, construction, and maintenance strategies for the property to maintain or restore…the predevelopment hydrology…" To meet this requirement, designers of new projects at Nellis and Creech AFBs should consider the following:

- Significant areas around the southwest, southeast, and northeast sides of the runway at Nellis AFB are mapped as Hydrologic Soil Group B type soils which may be suitable for infiltration of storm water runoff. The majority of the developed area of the base is mapped as HSG D soils which are not as suitable for infiltration practices. Designers should review soils specific to their project site for opportunities to infiltrate storm water runoff. Where opportunities do not exist, designers should consider developing infiltration areas in open land areas that have higher infiltration rates to offset increased runoff from the project.
- Where development will include areas of landscape rock for xeriscaping practices, consider developing depressional storage in areas an appropriate distance away from buildings. For areas where depressional basins are considered not aesthetically pleasing, consider creating basins and filling them with uniformly graded large rock fill that has significant void space to provide storage volume and cover the large rock with decorative stone that matches the surrounding landscape design.
- Designers should be aware that conveyance channels and systems for high flows will still be necessary to accommodate larger, high-intensity storm events.

5.3 Architectural Design

Buildings at Nellis AFB consist of a variety of types and designs. Past emphasis has been on using landscaping, more so than architecture, to create a unified aesthetic throughout the installation. With irrigation limits impacting landscape design, architecture needs to play a more significant role in defining the character of the base. One goal of this section is to convey which architectural elements are encouraged to be maintained in order to preserve this installation's unique image.

Although the buildings at Nellis and Creech AFBs convey some general uniformity, visual cues are also used to indicate various districts throughout the installation. These districts are defined in *Chapter 2 Installation Image*. Each district, while containing various elements and materials from other districts, has a few components that separate it visually from other areas of the installation.

The purpose of this portion of the document is to provide architectural guidance that will:

- Uphold some of the existing architectural consistency of the installation, thus resulting in a degree of visual order;
- Allow designers to seek creative solutions that respond to the unique challenges associated with the contextual setting of the base, each individual site and each building; and
- Guide the designer in maintaining positive elements of each district.

5.3.1 Architectural Order

Architectural order requires a holistic planning approach that considers solutions appropriate to the building site, fully implements SD&HPGBD objectives, and is sensitive to the built context, reflective of the program needs and scale, and responsive to the hierarchical importance.

5.3.1.1 Plan Complexity and Geometry

A significant portion of the existing buildings' plans tend to be simple due to the straightforward function of the building. The most obvious examples of this simplicity are hangars and maintenance or storage buildings,

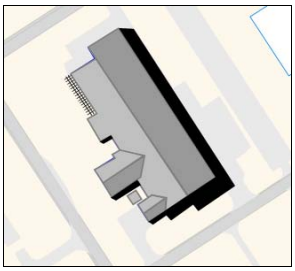
which are more predominant in the industrial areas and flightline areas. In other areas of the installation, simple rectangular plans also are prevalent in retail structures, barracks, and administration buildings.

In some cases, complex plan geometry is the result of multiple building additions over time, rather than an intentional design approach. In other cases, simple rectangular plans are grouped together to create courtyard gathering spaces or to conceal parking and loading conditions.

For future development, plan complexity and geometry should be derived primarily from the building's type or function. Less complex programs will still likely result in straightforward plan geometries. However, more complex programs and uses should be seen as an opportunity to provide more interesting buildings, which can better respond to site constraints or better support sustainable design goals, such as enhanced daylighting and views.

Complex geometry is evident on the building exterior (above) and in the plan view (below).

A good example of the use of complex plan geometry is shown here. It is evident that multiple internal functions inform the plan geometry of this building at Creech AFB. The complex form provides a more visually interesting building than that of a simple rectangular plan.

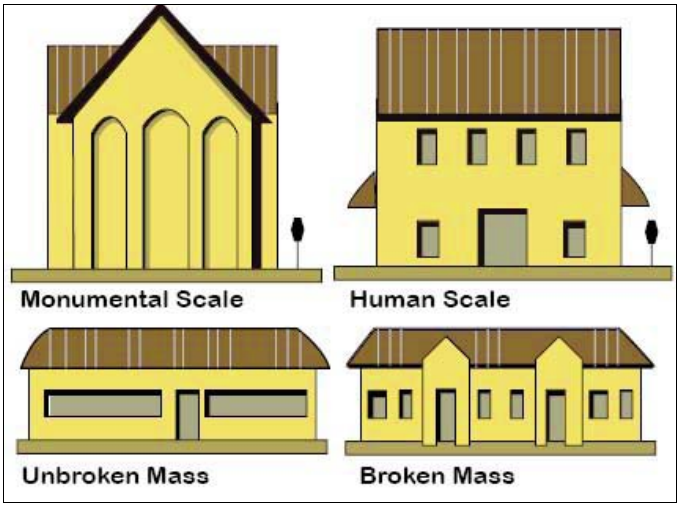


5.3.1.2 Building Scale and Proportion

Scale refers to the size of building elements in relation to people and surrounding buildings. Buildings of monumental scale feature predominantly vertical facades that dwarf a person and surrounding buildings. Buildings of human scale have more horizontal facades designed to relate to the size of a person. Additionally, the sizes of roof forms, windows, ornament, and landscaping all affect a building's scale. In general, larger windows, plants, and taller roofs relate less to the human scale than do smaller elements. The scale of most existing buildings on Nellis and Creech AFBs is human rather than monumental scale. Obvious exceptions to this would be hangars and other large flightline or industrial facilities.

Appropriately articulated Building 332 commercial facility in Nellis Central Core.

Unless necessary due to building function, monumental architectural design should be reserved for more ceremonial buildings, such as worship centers and headquarters complexes. These buildings often make use of large, glazed areas at entrances and oversized fenestration elements to draw users to the building entry and to create a scale appropriate to the building's use.



Scale and mass diagrams

For new developments, building scale and proportion should vary by building type, which in turn will usually vary by district. In general, buildings should be of a scale appropriate for their use or importance.

Child Development Center has appropriate scale and exterior articulation.

Appropriate use of monumental scale at the USAF Weapons School.

If a building has functions that require large scale building masses, but is not of particular importance or a ceremonial use, effort should be taken to humanize the building scale. One way to achieve this is to surround large-scale functions with smaller-scale functions, thus making a more human scale at the points where people see or approach the facility. The building shown below is an excellent example of thoughtful arrangement of spaces and features within a single building.

Nellis Golf Course Clubhouse has appropriate scale and proportion to its location and function.

Where internal functions are not conducive to this type of design, external features such as planters and mechanical screens can help to break down large masses.

Broken massing at Building 11 helps to humanize the facade.

A similar effect can be achieved by the siting of buildings in relation to each other, when those buildings vary in the number of stories and the articulation of the facades. Along the southeast side of Tyndall Avenue, single-story support buildings have been carefully placed in front of hangers. The effect is a unique street presence: approachable, yet significant.

Building 297 on Tyndall Avenue does a number of things well. Banding and fenestration provide articulation. Broken massing helps to humanize the façade and camouflage the hanger beyond.

Another good practice for buildings with large uninterrupted masses is to use horizontal banding to minimize the impact of these forms by giving them some visual interest. Banding can be in the form of a contrasting material or recesses in the main building veneer.

Subtle banding of the mountains is reflected in the façade of Building 204.

Water tables, or wainscot, may be used to create more of a human-scale for buildings. Water tables should be made of a durable material such as brick or stone. At pedestrian-accessed buildings, the height of the water table should be about one-third the height of the total wall. At larger structures, such as hangars, the proportion should be closer to one-fifth. At buildings that have only one veneer material, the appearance of a water table can be created using banding, or varying wall projections and colors.

Typical wainscot/water table at Creech AFB.

Efforts should be made to modulate vertical elements of the façade, as well. Windows along long stretches of walls could be arranged into groups of two or three and patterned along the wall. Long, straight walls can also receive vertical treatment to break up monotonous horizontal planes. This can be achieved by the use of pilasters and downspouts or varying the protrusion of the wall itself. Successful use of these techniques can be seen on existing Buildings 202 and 625.

Appropriate vertical façade modulation through pilasters and downspouts at Building 202.

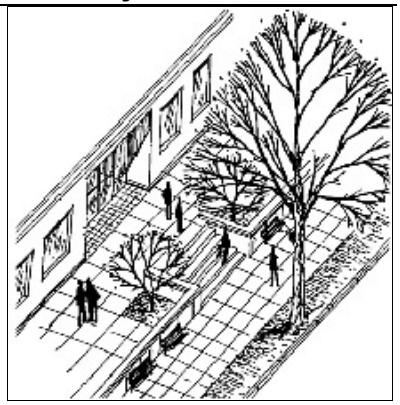
Appropriate exterior surface articulation for windowless Building 282.

Building scale should not be confused with building size. Most buildings at Nellis and Creech Air Force Bases are one or two stories in height. Exceptions include some three-story dormitories and office buildings. Moving forward, designers should weigh the building's importance, function, and surrounding context against sustainable goals when deciding on the number of stories.

In the Mixed Use Central Core, as pressure mounts for additional development, taller buildings should be concentrated in the Downtown Subzone. Compact floor plans that extend up, rather than out, reduce land development and utility distribution, thus contributing to sustainable goals. However, the same compact floor plan that reduces land use in the Downtown Subzone may restrict daylight, views, and cross-ventilation opportunities, thus being inappropriate for another location on base. The continued use of single-story mission support buildings to enhance the frontal presence of flight lines and provide screening is encouraged.

5.3.1.3 Symmetry/Hierarchy of Elevations

Major building elements should be sectioned into order of importance. Entrances, walkways, and non-accessible building faces should all have distinct characteristics that give occupants visual signals as to how the building may be accessed.



Entrance is Positive Visual Experience.

Main entrances should be covered for shade and weather and have a vertical appearance that provides a strong indication of pedestrian access. Main entrances should also face the road and be clear of visual obstructions that would block the view of the entrance from the street.

Welcoming main entrance at the Child Development Center.

Secondary entrances should have a low roof covering. The appearance of secondary entrances should be minimal in scale and not compete with the main building entrances.

Walkways or colonnades along the face of a building might have a roof covering. In these instances, the roof should be lower than the roof over the main entrance, in order to provide a visual indication of a secondary hierarchy that leads into the larger, main hierarchy.

Major building facades that do not relate to entering the building should be relatively simple and clear of architectural elements that would deter from the building's entrances. Roofs at these areas should have continuous, straight eaves and ridge lines.

Louvered shade canopy at Building 297 main entry.

Clearly-defined entry at Building 60.

5.3.1.4 Building Open Spaces

Open spaces are most often associated with public buildings such as recreation and dining facilities, which support large populations during non-working hours. At Nellis and Creech, smaller-scale gathering spaces are additionally present outside office buildings, barracks, and some of the more populated maintenance facilities. In any building type which supports working or leisure population for a significant part of the day, efforts should be made to create a strong connection between large interior spaces and outdoor spaces. With the harshness of the summer sun in this climate, the key to making outdoor spaces useable is to provide shade. At Creech AFB and outlying areas of Nellis, windbreaks are also critical. In many cases, the building footprint and orientation can create the necessary wind and sun protection. Low walls, berms, and landscaping can also help block prevailing winds.

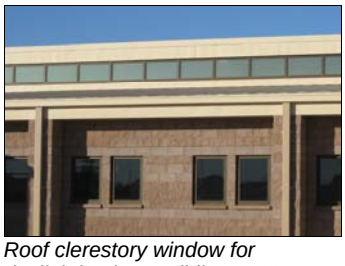
An example of an existing outdoor space that provides basic functional necessities is the Library (Building 312), which offers a covered roof, seating and vending. The outdoor seating area at the Golf Course Clubhouse combines an open weave trellis with fans, outdoor heaters, and spectacular views.


Shaded reading area at the Library (Building 312).


Shade trellis at outdoor seating area at Golf Course Clubhouse.

Daylighting and views to the outside are significant elements that support sustainable design goals and must be incorporated whenever possible. Additional vertical height typically seen in large open spaces, such as vehicle maintenance bays or dining halls, should be leveraged to provide as much natural daylighting as possible. Translucent panels, in the form of clerestories and wall panels, should be used to furnish additional daylighting. Skylights are seen on older hangar buildings but are not preferred for new construction.


Successful daylighting system (Building 252).


Roof clerestory window for daylighting into Building 1730's interior corridor.

Entries and vestibules should have a strong visual connection to outdoor spaces. These areas also provide a transition between indoor and outdoor environments. Any space inside a building that has access to a courtyard, main entrance or other pedestrian-friendly area should have as much glazing as is possible and practical.

5.3.2 Architectural Elements

Along with the items that define architectural order, there are also various architectural elements that define the overall look of Nellis and Creech AFBs. These elements include fenestration, roof elements, and exterior building materials.

5.3.2.1 Fenestration

Existing fenestration at the Nellis and Creech installations varies greatly. A significant number of buildings are windowless. Those that do have windows have a mixture of punched openings, ribbon windows, and large areas of storefront. Larger sections of glazing typically occur on more prominent buildings. Windows on older buildings tend to be flush, a condition which is not recommended for newer construction.

In new construction, preference should be given to punched openings, which are appropriate for this locale due to the harshness of the summer sun.


Punched openings at Building 297.

Large areas of glazing should not be used anywhere on a building unless it is north facing, or can be properly screened from direct summer solar gain. The use of curtain walls or storefronts can be an appropriate feature of main building entrances if designed properly.


Two-story glazed entry with large roof overhang at Creech AFB.

Dormitory 777 with operable windows and recessed shaded patio doors.

Translucent wall panels can be an attractive way to provide natural light for large interior spaces when views are not possible, such as at clerestories or skylights. All new or replacement glazing must be insulated and have a "Low-E" coating to achieve a high level of energy efficiency. The use of light shelves and solar shades already established at the base should be continued.

Solar shade/light shelf at Building 204 entry.

Solar shade above punched openings at Creech AFB.

5.3.2.2 Roof Features and Form

Roof forms and materials vary across the Nellis and Creech installations. Standing seam metal roofs with gabled ends are the most prevalent. Colors include dark brown, tan, sandstone, and red. Flat membrane roofing is most prevalent in the Mixed Use Central Core. Red clay and integrally-colored concrete roof tile occur mostly in the Mixed Use and Engineering and Logistics Districts, in gable or hip roof configurations.

Roof trim thickness varies, with thinner fascia and rake trim expressing a more modern aesthetic on newer buildings. Thicker trim, and in some cases tall standing-seam metal fascias that match the roofing material, are most commonly seen on older buildings, although this is not universally true. Some newer buildings in flightline areas exhibit thicker trim in proportion to the building size and scale.

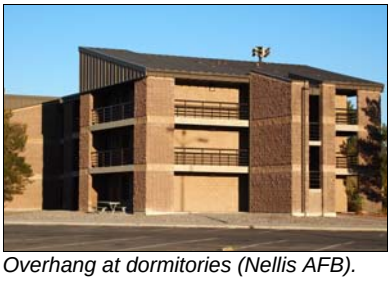
One type of roof design at Creech AFB.

For most buildings, roof shapes should be simple. More complex roof designs can be an effective way to emphasize more important buildings on the installation without making their floor plan overly complicated. Newer buildings in the south portion of Nellis incorporate sharp, single-sloped roof forms reminiscent of wings in flight.

North elevation of Fitness Center has low sloped angular roofs and ample glass for daylighting and views out of the facility.

A typical roof slope for steep-sloped roofs is a minimum of 3:12 for most of the installation. Standing seam metal is preferred, except that concrete tile roofs can be acceptable for community activity facilities, or to relate to surrounding context. Concrete tile roofs are preferred over clay tile roofs. Very large buildings, such as hangars, can have a more minimal slope of 1:12 if an appropriate, structural-type standing seam metal roof is provided. All roofs for new construction should slope unless the building design or other factors do not allow it, however "low-slope" roofs (1/4:12) can be a good solution for larger building masses. If low-slope roofs are used, a white membrane roof with high solar reflectivity should be used in order to help reduce the heat island effect and utility usage. Low-sloped roof design shall be approved by the base. Roofs at major building elements can have a steeper slope in order to create visual interest. Slopes should not exceed 8:12 at these areas.

The recent introduction of lighter-colored roofing material is a positive change recognizing the need to reduce energy consumption. Like new membrane roofs, new standing seam metal roofs at Nellis and Creech should be light in color. Roofs at Nellis should be "Travatan" color and roofs at Creech "Sandstone" color. Where a building addition or other response to context requires dark roofing material with a slope above 2:12, designers should seek products specifically designed to comply with a Solar Reflective Index above 29.



Overhang at dormitories (Nellis AFB).

To further reduce heat gain, roof overhangs should be implemented into new construction where possible. Overhangs can be especially important elements at south-facing glazing to reduce direct solar gain in summer months. Existing barracks buildings with exterior balconies are a consistent example of good use of roof overhangs.

Industrial buildings in Flightline and Engineering and Logistics Districts may have minimal or flush overhangs.

5.3.2.3 Exterior Materials

The existing architecture of the base includes a number of styles and treatments that have evolved over the years. Nellis and Creech both have a significant amount of new construction, which clearly reflects the preferred design direction of the base and incorporates sustainable goals.

Future buildings should consist of integrally-colored CMU or metal panel exterior wall materials. Materials should include recycled content and be provided locally to the greatest extent possible.

Façade design should incorporate a variety of CMU patterns and textures in order to add interest. In general, split-faced, ground-faced, fluted split-face and single-scored smooth-face CMU are the preferred choices. Open voids are another way to add pattern, and are seen in screen walls throughout the base.

Metal panels should be considered for larger and more utilitarian buildings. Providing a CMU "base" on metal panel buildings can aid with durability and help blend the building into adjacent districts.

The base also makes use of stucco on a number of smaller structures. Stucco may be considered for small buildings and facilities in the Recreational District, but should be approved by the base.

See Appendix B for additional material recommendations.

5.3.2.4 Other Building Features

A number of different aesthetics are used to articulate building main entrances. Conventional entrance canopies supported by masonry piers are common on a number of fundamental structures throughout Nellis. These types of canopies simultaneously identify entry, provide shade, and humanize building scale. In other cases, additive vestibules are used. Vestibules can be single or multi-story depending on the monumentality of the structure. All new occupied buildings should incorporate vestibule design, whether protruding or inset, in order to control heat gain and reduce tracking of pollutants into the building.

Two-story vestibules are often combined with shading devices or light shelves. Solar shading devices on the building exterior, typically of bronze-colored metal, should be continued in new construction on south and west-facing elevations and entrances as appropriate.

Along Tyndall Avenue, glass curtain wall elements are used to signify entry at more significant buildings. Limited curtain wall use may be appropriate for new construction and should be approved by the base.

Where the monumental nature of the building discourages canopies or shading devices, glazing selection and orientation become especially critical to energy-efficient design.

Traditional canopy example, Building 812 at Nellis AFB.

Windowless buildings are common at Nellis and Creech, and in some cases intentionally downplay the building entry point. At windowless buildings, the careful arrangement of masonry colors, textures, and patterns becomes especially important. Vertical and/or horizontal articulation, massing, solar shading, and use of plantings play a larger role in the building's identity. Follow techniques described in previous sections of this report for windowless buildings.

Decorative lighting may be used for visual interest at major architectural elements. Light fixtures should have a simple profile and be a "cut-off" type that will not contribute to light trespass.


Exterior Lighting

As discussed in Chapter 2 of this report, Districts have their own subtle differences from each other, which help define their individual character. Some of these unique architectural details include the following:

- Buildings in the northeast area of Creech have tan colored, single-scored, ground-face CMU with dovetail corners where it meets split-face CMU.
- Buildings in the southern portion of Nellis have sharp angled, single-sloped roofs, not traditional hip or gable roofs.
- Buildings in the Nellis Area II District make use of red-colored roofing materials.


Dovetail detail at Creech AFB

The intent is not to copy these features directly. Rather, designers should display their understanding of the built context with interpretive and sensitive solutions.

5.3.3 Additional Architectural and Design Direction

Appendix B provides additional architectural and design direction that is currently in use and in some cases, preferred by the base.

Appendix B includes:

- B.1 Background
- B.2 Architectural Design Elements
- B.3 Site Design
- B.4 Landscape
- B.5 Signage
- B.6 Site Lighting Standards
- B.7 Engineering Standards
- B.8 References

6 List of Acronyms

ABS	Acrylonitrile Butadine Styrene
ACC	Air Combat Command
ACS	Access Control System
ADA	Americans with Disabilities Act
ADAAG	ADA Accessibility Guidelines for Buildings and Facilities
ADP	Area Development Plan
AEW	Air Expeditionary Wing
AFB	Air Force Base
AFH	Air Force Handbook
AFI	Air Force Instructions
AFOSHA	Air Force Occupational Safety and Health Administration
AGE	Aerospace Ground Equipment
AICUZ	Air Installation Compatibility Use Zone
ANSI	American National Standards Institute
APZ	Accident Potential Zone
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
AT/FP	Antiterrorism/Force Protection
AWWA	American Water Works Association
BCE	Base Civil Engineer
BX	Base Exchange
CBM	Certified Ballast Manufacturer
CDC	Child Development Center
cfm	Cubic Feet Per Minute
CMP	Corrugated Metal Pipe
CMU	Concrete Masonry Unit
CPVC	Chlorinated Polyvinyl Chloride
CSP	Corrugated Steel Pipe
D2 Board	Development and Design Review Board
DDC	Direct Digital Control
DeCA	Defense Commisary Agency
DNL	Day-night Average Sound Level
DoD	Department of Defense
DOT	Department of Transportation
eGP	electronic General Plan
EIA/TIA	Electronic Industries Alliance/Telecommunication Industries Association
EISA	Energy and Independence Security Act
EMCS	Energy Monitoring Control Systems
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
ETL	Engineering Technical Letter
EO	Executive Order
F	Fahrenheit
FACP	Fire Alarm Control Panel
fpm	Feet Per Minute
fps	Feet Per Second
HCFC	Hydrochlorofluorocarbon
HP	Horsepower
HQ	Headquarters
HVAC	Heating, Ventilation and Air Conditioning
IBC	International Building Code
ICC	International Code Council
ID2	Installation Design and Development
IDS	Intrusion Detection Systems
IECC	International Energy Conservation Code

IEEE	Institute of Electrical and Electronics Engineers
IMC	International Mechanical Code
INRMP	Integrated Natural Resources Management Plan
IPC	International Plumbing Code
ISA	Installation Sustainability Assessment
LAS	Landscape Architectural Standards
LEED	Leadership in Energy and Environmental Design
LNG	Liquefied Natural Gas
Mbh	thousands of BTUs per hour
MDO	Medium Density Overlay
MUTC	Manual for Uniform Traffic and Control Devices
NACE	National Association for Corrosion Engineers
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NDOT	Nevada Department of Transportation
NFPA	National Fire Protection Association
NTTR	Nevada Test and Training Range
OSHA	Occupational Safety and Health Administration
p.f.	Power Factor
PB	Polybutylene
PP	Polypropylene
PSIG	Pounds per Square Inch Gauge
PVC	Polyvinyl Chloride
RCP	Reinforced Concrete Piping
RPC	Regional Priority Credits
RSP	Rock Slope Protection
RTRP	Reinforced Thermo-setting Resin
SD&HPGBD	Sustainable Development and High Performance Green Building Design
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SNMP	Simple Network Management Protocol
SRI	Solar Reflective Index
UAV	Unmanned Aerial Vehicle
UFAS	Uniform Federal Accessibility Standards
UFC	Unified Facilities Criteria
UMC	Uniform Mechanical Code
USACE	U.S. Army Corps of Engineers
USAF	United States Armed Forces
USGBC	United State Green Building Council
UPC	Uniform Plumbing Code
VAV	Variable Air Volume

A Figures

FIGURES

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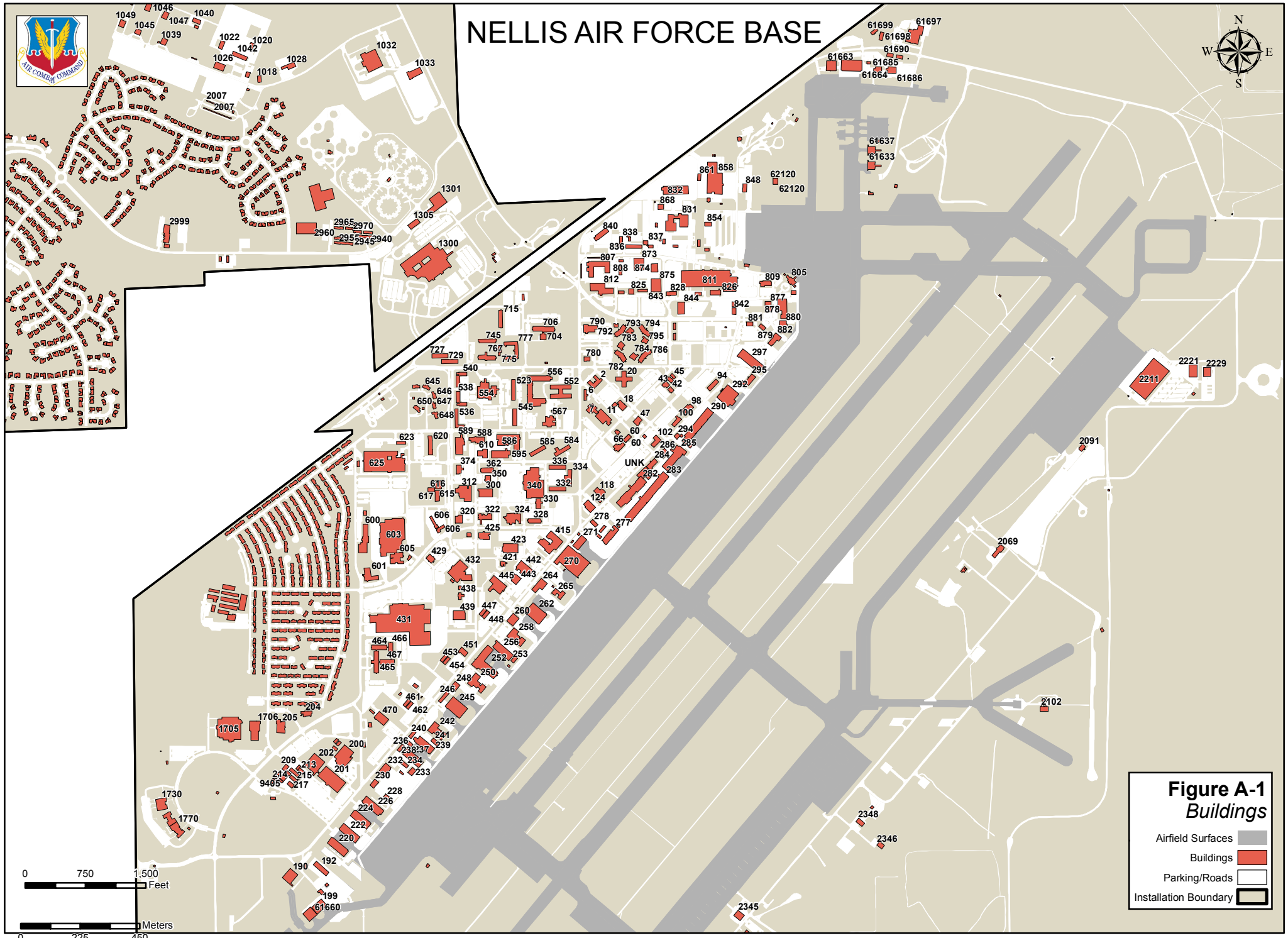

NELLIS AIR FORCE BASE
N
W
E
S
Figure A-1
Buildings
Airfield Surfaces
Buildings
Parking/Roads
Installation Boundary
0 750 1,500
Feet
0 225 450
Meters

NELLIS AIR FORCE BASE

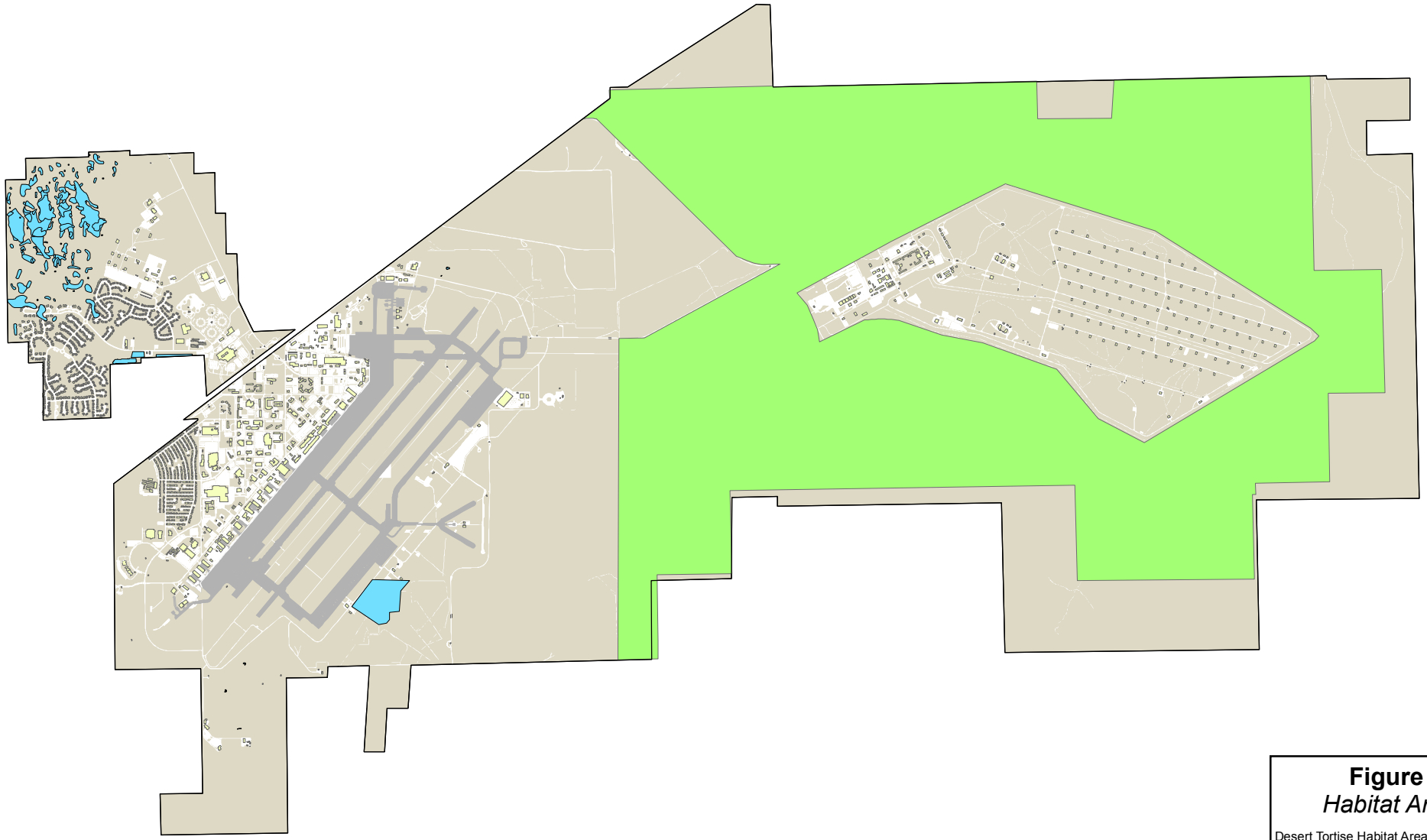
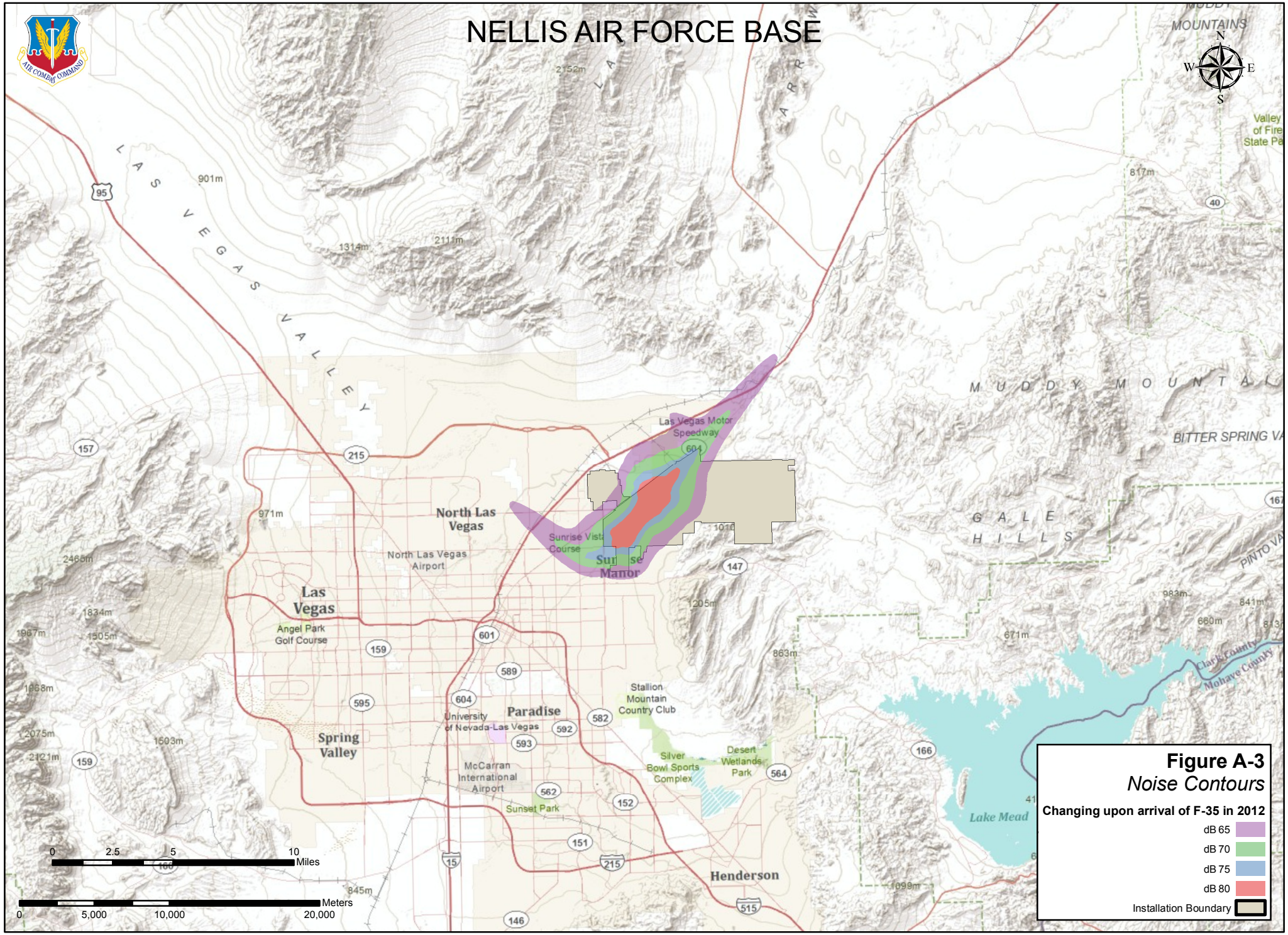
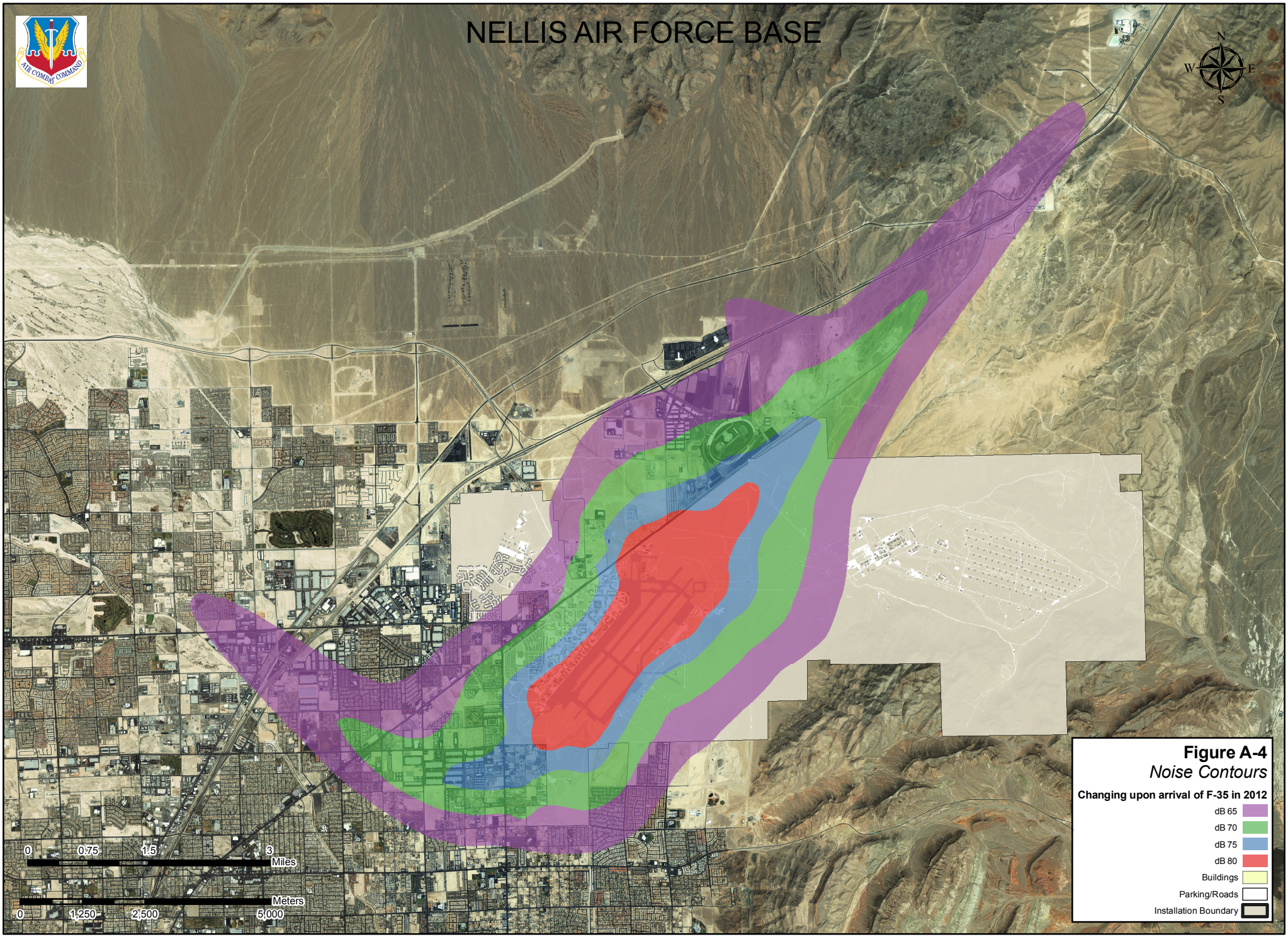


Figure A-2
Habitat Areas

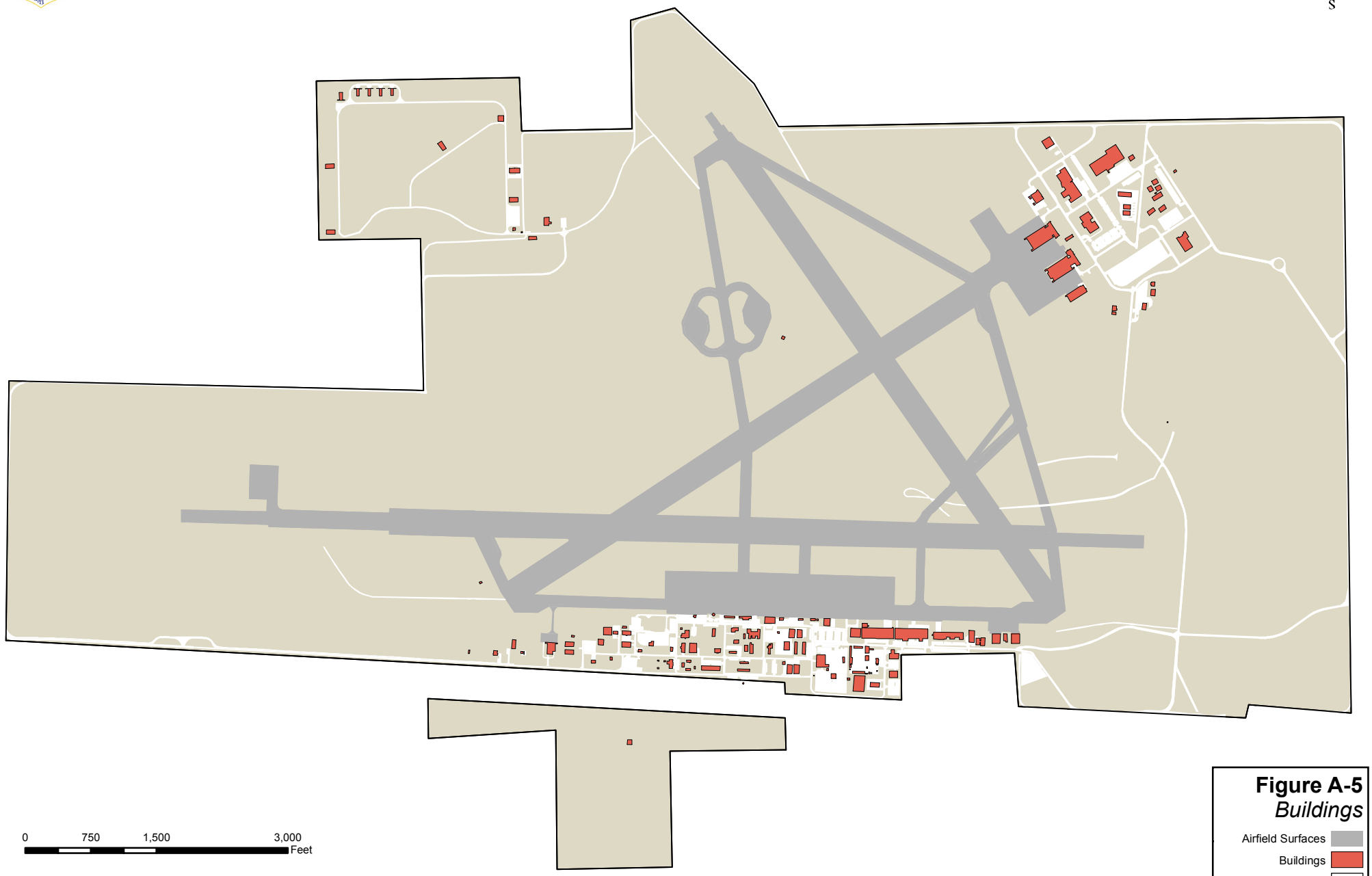
- Desert Tortise Habitat Area
- Flora Habitat Areas
- Airfield Surfaces
- Buildings
- Parking/Roads
- Installation Boundary

NELLIS AIR FORCE BASE




NELLIS AIR FORCE BASE
AIR COMBAT COMMAND
N
W
E
S
0
0.75
1.5
3
Miles
0
1,250
2,500
5,000
Meters
Figure A-4
Noise Contours
Changing upon arrival of F-35 in 2012
dB 65
dB 70
dB 75
dB 80
Buildings
Parking/Roads
Installation Boundary

CREECH AIR FORCE BASE



FIGURES

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B Technical Constraints and Considerations

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B Technical Constraints and Considerations

B.1 Background

B.1.1 General

This section provides installation-centric background information and identification of functional-technical considerations necessary for a fully successful design. It identifies preferred systems and technical components and is intended to describe best practices related to planning, architecture, and engineering. It identifies materials, systems, practices, approaches and finishes historically used and having proven success over time. It is not intended to serve as a comprehensive list of all applicable building codes, regulations, directives, and references or to identify facility-centric or unique user requirements. Functional-Technical Constraints and Considerations need to be specifically addressed in the Basis of Design analysis written during the concept development phase and the design development phase. Understanding the driving forces behind these constraints and considerations will greatly contribute to a successful project outcome.

B.1.2 Brand Name References

References to equipment, materials, articles or patented processes by trade name, make or catalog number shall be regarded as establishing a standard of quality and not construed as limiting competition.

B.1.3 Design Criteria for Additions

- When additions are less than 25 percent of the existing building's floor area, it is usually more appropriate to design additions to match the original construction. However, opportunities to meet the current standards of the ID2 should be investigated.
- When additions exceed 25 percent of the original building area, investigate upgrading the existing facility to comply with current standards of the ID2.
- Whether large or small, additions should not appear as obvious add-ons. Match form, massing, and scale to make the addition and the original structures appear as parts of a new, unified whole.
- Where a high maintenance existing finish such as paint occurs on an existing building, the addition should provide a low maintenance complimentary material.

B.1.4 Codes and Standards

All projects at Nellis and Creech AFBs shall be constructed in accordance with this ID2 document; ACC Command-level Instruction, ID2 (publication forthcoming); the International Building Code; the Americans with Disabilities Act; the Uniform Federal Accessibility Standards and UFC 4-010-01; and DoD Minimum Antiterrorism Standards for Buildings.

For security engineering guidelines reference Army Technical Manuals 5-835-1, 5-835-2, and 5-835-3 or Air Force Manuals 32-1071V1, 32-1071V2, and 32-1071-V3. For facility site design guidelines reference UFC 4-010-02, DoD Minimum Standoff Distances for Buildings. Reference Air Force Handbook 32-1084, Facility Requirements, for programming information.

B.1.5 Secured Facilities

Sensitive Compartmented Information Facilities shall meet requirements of Intelligence Community Standard 705-1 and 705-2 and the Intelligence Community Technical Specification for ICD/ICS 705. Special Access Program Facilities shall meet requirements of JAFAN 6/9. Facility perimeter construction, door assemblies, mechanical, electrical, communication, security, fire protection, and mass notification systems shall meet all specified requirements.

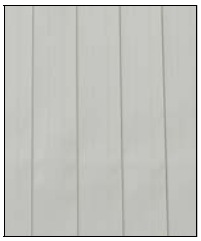
B.2 Architectural Design Elements

B.2.1 Roofs and Gutters/Downspouts

B.2.1.1 Roof Materials

Typical roof materials (Figure B-1) being used at the bases:

- Factory Finish Standing Seam Metal Roofs:
  - **Nellis AFB Color:** Match Frazee Paint #213 "Travatan"
  - **Creech AFB Color:** Match Englert Metals "Sandstone"
- Painted Surfaces:
  - **Manufacturer:** Frazee
  - **Color:** #213 "Travatan"
  - **Color:** #212 "Spanish Brown"



Creech Sandstone

Nellis Travatan

Figure B-1
Roof Materials

- Concrete Roofing Tiles:
  - **Manufacturer:** MonierLifetile
  - **Color:** "California Mission Blend" or "Desert Sage"
  - Provide tile bird stops at eaves
- Other Materials:
  - Soffits shall be metal panel or stucco.
  - Metal fascias, soffits, trim, coping, flashing, gutters, and downspouts shall be factory finish and match metal roof color.
  - Soffits shall be metal panel or stucco unless otherwise approved by the base.
  - Provide ventilation for all roof systems. Continuous soffit strips and ridge vents are preferred.
  - All roofs must withstand 90 MPH wind loads.
  - EPDM Roofs:
    - Minimum 20 year warranty
    - 60 mil minimum
    - Fiber reinforced
    - Mechanically fastened
  - Standing Seam Metal Roofs:
    - Minimum 25 year warranty
    - 22 gauge minimum
  - TPO Roofs:
    - Minimum 20 year warranty
    - 0.08 thickness minimum
  - Concrete Tile Roofs:
    - Minimum 30 year warranty
  - Shingle Roofs:
    - Minimum 20 year warranty
    - Heavier asphalt or metal
  - Built-up roofs not allowed.

B.2.1.2 Rooftop Equipment

- Nellis and Creech AFBs prefer that all vent piping, flues, exhaust fans, etc., penetrating roofs not be visible from the view of the building front/main entrance. These penetrations are considered trim material and should be painted/manufactured for consistency/compatibility with the facility.
- Roof mounted equipment and roof penetrations shall be kept to a minimum. All roof equipment shall be screened from view.
- Facilities that have photovoltaic panels shall have panels installed on the roof unless otherwise directed. Roof curbs that support PV panels shall be part of roof manufacturer's system and have same warranty. Permanent stairs to roof shall be provided to access and maintain PV panels.

B.2.1.3 Gutters and Downspouts

- Roof overhangs are encouraged. Buildings with overhanging sloped roofs may eliminate gutter and downspout systems except over entrances.
- Rain diverters, gutters and downspouts, or some other type of diversion device, must be provided over building entrances.
- Buildings with minimal or no overhangs shall have gutters, either concealed or exposed. Exposed gutters and downspouts should be factory-finished to be compatible with adjacent wall or metal roof and trim color.
- Scuppers, where approved for low sloped roofs, should be of clay tile or concrete or as otherwise approved by the Base Architect. Interior roof drains are discouraged and require approval from the Base Architect.

B.2.2 Exterior Walls

B.2.2.1 Materials

- Preferred material for occupied buildings is integrally-colored split-face or ground-face CMU.
- Manufacture CMU and mortar with additives to discourage efflorescence.
- Wall construction for occupied buildings shall meet or exceed the requirements of applicable energy codes.
- Metal wall panels shall be factory-prefinished aluminum or galvanized steel with a 20-year guarantee against fading.
- Exterior materials shall be very low maintenance and field painting shall be avoided, except for hollow metal doors/frames and small miscellaneous building and site items.
- Colors (Figure B-2) currently in use at Nellis and Creech AFBs are as follows:
  - CMU:
    - **Manufacturer:** CEMEX USA.

- **Texture:** Split Face, Ground Face, Fluted Split-Face, Single-scored Smooth Face, Single-scored Ground Face
- **Colors:** Sandstone, Brown, and Tan

Split-Face Sandstone

- Metal Wall Panels:
  - **Nellis AFB Factory-Finish Color:** Match Frazee Paint #213 "Travatan"
  - **Creech AFB Factory-Finish Color:** Match Englert Metals "Sandstone"

Split-Face Brown

- Painted Surfaces and Stucco (Paint):
  - **Manufacturer:** Frazee Paint
  - **Colors:** #213 "Travatan" with #212 "Spanish Brown" trim

Ground-Face Tan

Travatan Metal Wall Panels, Ground-Face Brown CMU, Split-Face Brown CMU, Spanish Brown Metal Door, and Dark Bronze Light Fixture

Figure B-2 *Exterior Materials*

B.2.3 Windows and Doors

B.2.3.1 Design

- Design building fenestration for user comfort and energy efficiency. Reduction of cooling loads is critical during Nellis' hot summer months. The base recommendation is no more than 15 percent glazed area on a building exterior.
- Recessed punched openings are encouraged to reduce solar gain. Glazed units should be set back from the face of the exterior wall surface a minimum of two inches. Limited window groupings, glazed entry doors with sidelights and other variations are acceptable. However, large curtain wall applications are not appropriate in the desert climate.
- Use north facing clerestory windows and other natural lighting methods to reduce lighting demand and associated cooling loads.
- The use of skylights is discouraged.
- Sunshade devices (Figure B-3), overhangs, porches, colonnades, and other strategies to block direct summer solar gain are strongly encouraged.
- Windows and doors shall meet requirements stated in UFC 4-010-01.

Figure B-3 shows a section through two typical aluminum window unit sunshade devices. For most efficient shading, integral louver device should occur at top window mullion and at all intermediate horizontal mullions. Coordinate sunshade type and cantilever length with window glazing unit height.

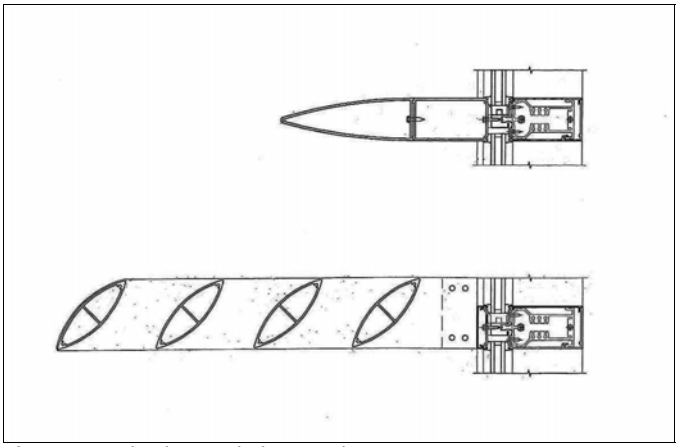


Figure B-3 *Aluminum Window Section*

B.2.3.2 Materials

- Main entry doors should be of a glazed storefront type in thermally-broken aluminum-anodized frames, unless otherwise approved. Medium or dark bronze is the primary color currently used.
- Secondary entrances, exit doors, and frames should be factory-primed, insulated, hollow metal.
- Windows shall be set in thermally-broken bronze-anodized frames. Medium or dark bronze is the primary color currently used.
- Use of clear/natural color aluminum frames for windows and storefront doors in lieu of medium/dark bronze color aluminum frames may be appropriate for some facilities, upon approval of the Base Architect.
- Glass must be tempered (where required by applicable codes), insulated, minimum dual-pane with ½" argon gas pocket. Energy efficient glazing is mandatory and Low-E coating is recommended. Existing windows are bronze-tinted.
- Solar shading film shall not be used as a solar control option.
- Triple-glazing is encouraged where high noise levels are evident. Refer to the Air Installation Compatible Use Zone Noise Contours in Appendix A.

Opening colors and materials currently in use at Nellis and Creech AFBs include the following (see previous sections for color swatches):

- Aluminum Window Units and Storefront Doors:
  - **Frame Color:** Medium Bronze Anodized
  - **Glazing:** Bronze Tinted with Low-E coating
- Painted Exterior Steel Doors/Windows/Trim:
  - **Manufacturer:** Frazee Paint
  - **Color:** #212 Spanish Brown or Medium Bronze
- Hangar Doors:
  - **Color:** #212 Spanish Brown

B.2.3.3 Hardware

Door hardware should be selected and sized on a case-by-case basis for its specific function. In order to unify the quality and appearance of hardware base-wide, the following recommendations are a guide to the finish and quality level expected of hardware that may not be specifically listed. All door hardware must comply with the requirements of ADA and UFAS. Builders Hardware Manufacturers Association (BHMA) is listed as a reference for standard finishes.

- **Door Hinges:** Exterior door hinges shall be heavyweight ball bearing. Interior door hinges shall be ball bearing or plain bearing. All hinges shall be Satin Medium Bronze unless otherwise approved by the Base Architect.
- **Door Closers:** Door closers shall be Grade 1, surface mounted, regular or parallel arm mount. Finish shall be BMHA689, Sprayed Medium Bronze unless otherwise approved by the Base Architect.
- **Exit Devices:** Single doors shall have Type 1, rim exit device. Double doors shall have Type 2 vertical rod device. Finish of all exit devices shall be Satin Medium Bronze unless otherwise approved by the Base Architect.
- **Locksets:** Exterior and interior locksets shall be BMHA series 4000m Grade 1, lever trim, removable core function as required (see BMHA ANSI function F75-F93). Lever handles shall be provided at all locations. Finish of levers and all miscellaneous visible parts shall be Satin Medium Bronze unless otherwise approved by the Base Architect. Provide “Best” or locks compatible with “Best” for all work unless directed otherwise. The cylinder and cores must be interchangeable and have six or seven pin tumblers and be fully compatible with products from Best Lock Co.
- **Miscellaneous Hardware:** Stops, kick plates, etc. shall be Satin Medium Bronze unless otherwise approved by the Base Architect.
- **Thresholds:** Shall be Medium Bronze-Anodized extruded aluminum. Exposed rubber stops on holders, stops and bumpers shall be gray unless otherwise approved by the Base Architect.
- **Creech AFB**: Additional requirements include the following: All lockset cylinders shall be 7-pin G keyway and key systems shall be ANSI/BHMA A156.5 Grade 1 Certified. Stainless steel clip shall be used and not a riveted key stop. Locksets and latch sets shall conform to ANSI A156.2, Series 4000, Grade 1, and be UL listed. Locksets shall have anti-rotational studs that are thru-bolted and keyed lever shall not have exposed keeper hold.

B.3 Site Design

B.3.1 Parking

- Follow all Antiterrorism/Force Protection (AT/FP) guidance in determining the location and standoffs for all parking lot development at Nellis.
- All construction shall be in accordance with DoD Force Protection Requirements and shall adhere to AFI 10-245, DoD Std. 28, and AFH 10-222, Vol. 3.
- It is preferred that parking spaces be 90º to parking lot aisles. Aisles shall be 26 feet wide and standard parking spaces 9 feet wide by 18 feet deep unless otherwise approved by the Base Architect.
- Parking areas shall have standard stalls and stalls for people with disabilities. Stalls for the disabled shall comply with The Americans with Disabilities Act (ADA) Guidelines and other applicable codes and standards.
- All parking areas are to be striped and signed per Nellis/Creech standards.
- It is recommended that approximately15 percent of the net areas of internal parking bays be developed as islands. Islands should be used to promote lot shading and storm water runoff management.
- Where parking lots are visible from any street, the minimum height of the screening plants at installation shall be 30 inches (Figures B-4 and B-5).

Figure B-4 *Typical screened parking lot.*

Figure B-5 *Typical screened parking lot.*

- All service driveways that provide direct access to buildings shall have manually-retractable bollards placed at or outside of the 33-foot or 82-foot stand-off AT-FP protective zone around the building. Manually-retractable bollards shall be 4'-0" on center to prohibit driving on service driveways when raised. Bollards shall be Barrier Security Products, Model BR900 or approved equal. Wide pedestrian sidewalks with ramps that provide direct access to buildings shall have permanent architectural concrete bollards installed as required, to prevent vehicle access.

B.3.2 Sidewalks

- Sidewalks shall be held back a minimum of 5 feet from the back of the curb for pedestrian comfort and landscaping.

- All walkways shall be accessible by people with disabilities. Requirements of the ADA and Uniform Federal Accessibility Standards must be met when designing walkways, ramps, and other pedestrian access facilities. Where site or development conditions make full accessibility unfeasible, an alternative route shall be provided.

- It is preferred that walkways not exceed continuous grades over three percent. Walkways with sustained grades in excess of five percent are considered ramps and shall have level areas a minimum of 5 feet in length every 30 feet.

- Where possible, walkways should have a continuous common surface, not interrupted by steps or abrupt changes in level exceeding ½-inch. The walk surface shall be relatively smooth and have a non-slip surface such as a medium broom finish. These standards apply wherever walkways cross other walkways, driveways, or parking lots.

- Surface cross slopes shall not exceed ¼-inch per foot (two percent).

B.3.3 Fences and Site Walls

B.3.3.1 Design

- Use screening around mechanical equipment (Figure B-6), storage and loading areas, trash dumpsters, and other visually objectionable items.

Figure B-6 *Mechanical Enclosure*

- Equipment screens must allow required clearance for equipment maintenance, removal, and airflow. Provide easy vehicle access to dumpsters and mechanical equipment areas where necessary.

- Site walls functioning as mechanical equipment screens shall be 1-foot higher than the equipment.

- Loading docks and dumpsters shall be screened with an 8-foot-high site wall.

- Dumpsters (Figure B-7) shall not open toward a street nor be accessed from a street.

- Retaining walls, where required to accommodate changes in elevation, shall not exceed 4 feet in height. Grade changes that require retaining walls exceeding 4 feet must be terraced with a minimum 3 feet clear separation between each wall.

Figure B-7 *Dumpster Enclosure*

- All mechanical yard enclosures and equipment enclosures shall meet antiterrorism requirements stated in UFC 4-010-01.

B.3.3.2 Materials

- Materials for outbuildings, garden walls, and fences should visually match either the adjacent building exterior or a material integral to the landscape.
- Decorative top courses should be used to provide accents to walls that are highly visible.

B.3.4 Shade Structures

B.3.4.1 Design

- Orient shelters and courtyards to take advantage of climatic conditions, such as seasonal sun, shade, and breezes. Consider the effects of blowing dust and debris when building shelters to minimize the trapping and settling of trash and weeds.
- Provide site furnishings, lighting, and landscaping as appropriate.

B.3.4.2 Materials

- Shade structures used for break areas or picnic areas should match the architectural style of adjacent facilities.
- Columns should be integrally colored split-face or ground-face concrete masonry units or steel columns enclosed by CMU.
- Roof structures should be steel framing with standing seam metal roofing or concrete tile roof unless otherwise approved by the Base Architect.
- Shade structures at child development centers can have a steel tube structure with tan fabric covering.
- Utilitarian shade structures used to shade aircraft and vehicles can have a steel structure with tan fabric covering.

B.3.5 Site Furnishings

Color, style, and placement of site furnishings can contribute to an overall unified image. Some existing site furnishings do not conform to the recommended style and therefore may have to be removed and replaced. Consistent site furnishing also provides ease of maintenance.

As noted on page B-1, references to equipment, materials, articles or patented processes by trade name, make or catalog number shall be regarded as establishing a standard of quality and not construed as limiting competition.

B.3.5.1 Design

- Develop a coordinated approach to site furnishings.
- Furniture shall be comfortable, durable, vandal-resistant, and easily maintained.
- Site furnishings must be accessible to the physically disabled.

B.3.5.2 Recommended Furnishings

All preferred site furnishing should be constructed of concrete. Concrete site furnishings, including benches, tables and trash receptacles are currently being used at the installation and are better suited for the hot climate. Plastic coated metal benches are also considered suitable. Metal bike racks are appropriate for use at the installation.

- Benches should be located at prominent building entrances, within plazas and courtyards, and parks. Benches should be integrated into the pedestrian circulation to provide places for resting and relaxation.
- Tables should be located at prominent gathering places including courtyards, plaza, and recreation facilities.
- Trash receptacles should be uniform in design and appearance so they are easily recognizable but also unobtrusive. Locate adjacent to walkways, building entries, and recreation areas.
- With approval by the Base Architect other site furnishing may be considered for use.

B.4 Landscape

B.4.1 Landscape Materials

The following non-vegetative landscape materials are to be used throughout the base.

- Rock Mulch:
  - **Minimum ¾-Inch Granite:** Rebel Red color, 3 inches deep minimum.
  - **Minimum 1½-Inch Granite:** Rebel Red color, 3 inches deep minimum.
  - **Minimum 3- to 12-Inch River Rock:** Red/tan/gray color, 4 inches deep minimum, naturally smooth, stream bed river run stone.
- **Boulders:** Small (2 ft. diameter), medium (3 ft. diameter), and large (4 ft. diameter) sized decorative rock boulders shall be placed in a natural looking manner and be 1/3 buried. Color shall be red and/or tan and sandstone shall not be used.

B.4.2 Irrigation

Use irrigation systems in accordance with the guidance laid out in Section 5.2.4. For irrigation systems the design following standards shall apply.

- Generally, each plant should have a minimum of 2 drip emitters and no spray-type emitters. Reduced pressure backflow preventers are required. Place backflow preventers in low visibility locations or screen with plants. Another alternative is to use an insulating hard cover that resembles a boulder to hide the backflow preventers.
- Landscape design shall include the total estimated annual water usage (in gallons) used by the irrigation system, after the initial plant establishment period.
- Irrigation runoff should not flow into any street. Drip or underground irrigation shall be installed for all plant material. Appropriate filtration and pressure regulating devices shall be installed. No fixed risers are allowed. Drip zones shall be designed so that additional emitters to trees can be installed as the tree matures.
- An electric, solid state controller is required and shall be equipped with a master valve terminal and at least two fully independent programs. The irrigation system controller shall be placed inside the building. All irrigated areas shall utilize remote electric control valves installed in valve boxes. No manual valves are allowed.
- A “master” electric control valve shall be installed immediately downstream of each backflow preventer if a foundation structure is present within the irrigated area. The valve must be capable of fully opening under the lowest design flows (drip). Quick coupling valves shall be installed at a minimum of 100-foot spacing and at dead end of all mainline runs to facilitate hand watering of plant material.

B.4.3 Landscaping Plants Allowed on Nellis AFB

The Approved Landscape Plants (Table B-1) list includes regional natives and fully naturalized plant species that are low maintenance. There is a wide variety of plants available in all size/functionality categories, so there shall be no substitutions of other plants not on this list with the exception of plants listed on the Southern Nevada Water Authority Water Smart Landscapes Program. Plants listed under this program may also be used with approval from the Base Architect.

In Table B-1, common and scientific/botanical names are provided to ensure selection of proper species. Select specific plant species from the plant list with the appropriate character and height for the specific function and aesthetic outcome desired. If further information on a species, whether on this list or not listed, is required, or if ideas for companion plantings or substitution recommendations for more traditionally-recognized landscaping plants are desired, please contact the Base Architect.

Generally, minimum tree container size should be 24" x 24" and shrub/groundcover container size should be 5 gallons.

Table B-1 *Approved Landscape Plants*

Common Name/*Botanical Name*	Description
Trees	
Whitethorn Acacia, Viscid Acacia, Catclaw Acacia (Acacia greggii), Wilow Acacia (Acacia salicina), Sweet Acacia (Acacia smallii) Guajillo, Acacia *Acacia constricta, A. neovernicosa, A. greggii, A. berlandieri, Acacia* sp.	Small tree to large shrub. Varies in height from 10 feet to 40 feet. Most have small ball-shaped flowers in spring or summer. Drought tolerant. Select species are cold hardy.
Littleleaf Palo Verde Cercidium microphyllum Sweet acacia *Acacia farnesiana*	Deciduous. Single/multi-stem. 20-foot height by 20-foot spread. Bright yellow flowers. Yellow green bark and leaves.
Dwarf Purple Desert Willow *Chilopsis linearis "Lucretia Hamilton"*	Deciduous. Single/multi-stem. 30-foot height by 30-foot spread. Flower color varies. Shaggy bark and twisting trunk.
Pink Dawn Chitalpa *Chitalpa tashkentensis "Pink Dawn"*	Deciduous. 25-foot height by 25-foot spread. Pale lavender to pink flowers. Bright green leaves.
Eucalyptus (Forman's) *Eucalyptus formanii*	Small evergreen tree. 15- to 25-foot height by 10- to 15-foot spread.
Native Ash *Fraxinus velutina coriacea*	Deciduous. 30-foot height by 20-foot spread. Leathery leaves that turn yellow in fall. Resists heat and drought.
Fan-Teby Ash *Fraxinus velutina "Rio Grande"*	Deciduous. 25-foot height by 25-foot spread. Large dark green leaves turn golden yellow in late fall.
Jacaranda *Jacaranda mimosifolia*	Deciduous. Clusters of fragrant, purple blooms. Excellent shade or street tree. 50-foot height and up to 60-foot spread. Drought tolerant.
Grecian Laurel *Laurus Nobilis*	Evergreen. Single/multi-stem. 20-foot height by 20-foot spread. Aromatic leathery leaves. Clusters of small yellow flowers.
Swan Hill Fruitless Olive *Olea europa "Swan Hill"*	Evergreen. 25-foot height by 35-foot spread. Fruitless, stiff, leathery gray-green leaves.
Pheonix Date Palm *Phoenix dactylifera*	20- to 60-foot height with 2- to 3-foot diameter trunk. Imposing, long, blue-green linear leaves.
Mondel Pine *Pinus eldarica*	Evergreen. 60-foot height by 40-foot spread. Tolerates desert conditions.
Aleppo Pine *Pinus halepensis*	Evergreen. 70-foot height by 20-foot spread. Thrives in desert heat, drought, and wind.
Chinese Pistache *Pistacia Cinensis*	Deciduous. 50-foot height by 40-foot spread. Scarlet, crimson, and orange fall colors.
Arizona Sycamore *Platanus wrightii*	Deciduous. 40-foot height by 40-foot spread. Prickly fruit balls. Blue-white bark. Glossy green leaves.
Fremont Cottonwood *Populus fremontii*	Deciduous. 50-foot height by 20-foot spread. Bright green foliage turning gold in fall. Rough gray bark.
Chilean Mesquite *Prosopis chilensis*	Semi-deciduous. 30-foot height by 30-foot spread. Thornless with yellow flower. Used as wind break.
Purple-Leaf Plum *Prunus ceraifera "Atropurpurea"*	Deciduous. Single/multi-stem. 10-foot height by 12-foot spread. Graceful branching.
California Pepper *Schinus molle*	Evergreen. 20- to 30-foot height by 15-foot spread. Drought-tolerant; suitable for xeriscaping.
Chaste Tree *Vitex agnus-castus*	Deciduous. 20-foot height by 25-foot spread. Aromatic lilac flowers. Gray-green narrow leaves.
California Fan Palm *Washingtonia filifera*	20- to 60-foot height with 2- to 3-foot diameter trunk. Fan-shaped leaves spread from around top of tree..
Joshua Tree *Yucca Brevifolia*	Evergreen. 15-foot height by 10-foot spread. Sharp leaves surround trunk and branches. Greenish-white flowers in summer.
Shrubs and Groundcover	
Sand Sage *Artemisia filifolia*	Evergreen shrub. 3- to 6-foot height by 4- to 6-foot spread. Leaves are gray-green with a pleasant fragrance.
Red Yucca *Hesperaloe parviflora*	Evergreen. 2-foot height by 3-foot spread. Stiff gray-green leaves radiating around central base with 4-foot flower stalks.
Desert Broom *Baccharis sarothroides*	Evergreen shrub. 3- to 9-foot height. Female shrubs have showy fruits, fall through winter, with a smoky appearance.
Mexican Bird-of-Paradise *Caesalpinia mexicana*	Small- to medium-sized evergreen shrub. 10-foot height by 6-foot wide. Yellow flowers, spring through fall. Can be trimmed to keep compact.
Red Bird-of-Paradise *Caesalpinia pulcherrima*	Small- to medium-sized shrub. 6-foot height by 6-foot spread, with many bright red and yellow flowers in summer to fall. Plant will likely freeze in winter, so best to cut back to ground-level in late fall (November).
Fairy Duster *Calliandra eriophylla*	Semi-evergreen shrub. 3-foot high by 4-foot wide. Red to purplish feathery flowers.
Fernbush *Chamaebatiaria millefolium*	Deciduous shrub. 4- to 6-foot in height and 5-foot wide. Olive-green fern-like foliage with showy white blooms in mid-summer.
Desert Willow *Chilopsis linearis*	Deciduous shrub. 25-foot height by 15-foot spread., Can be trimmed up to tree shape. Lavender, pink or white flowers, April through September.

Table B-1 *Approved Landscape Plants (Continued)*

Common Name/*Botanical Name*	Description
Shrubs and Groundcover (Continued)	
New Mexico Privet *Forestiera neomexicana*	Deciduous shrub 6 to 8 feet tall and 8 feet wide. Fast growing and low maintenance once established.
Creosote Bush *Larrea tridentata*	Spindly evergreen shrub. 8 feet tall by 6 feet wide. Small yellow flowers spring through fall. Pleasant scent, especially after rainfall.
Chihuahuan Sage *Leucophyllum laevigatum*	Evergreen shrub. 6 feet tall and 5 feet wide. Covered with ½-1" purple flowers summer through fall.
Texas Sage, Texas Ranger, Silver Cloud, Green Cloud *Leucophyllum* sp.	Evergreen shrub. 4 to 6 feet tall and 5 feet wide. Foliage green to gray-green. Showy magenta, blue, or purple flowers all summer and fall.
Feathery Cassia *Cassia Artemisioides*	Evergreen. 6-foot height by 6-foot spread. Gray-green needle-like foliage. Yellow flowers in the spring.
Red Clusterberry Cotoneaster *Cotoneaster lactues*	Evergreen. 6-foot height by 7-foot spread. Gray-green leaves. Stiff, angled, arching branches. Red berries in the fall.
Desert Sage *Salvia dorrii var. dorrii*	Perennial shrub. 3 feet tall and 3 feet wide. Flowers purple, nice contrast with foliage.
Bush Purple Dalea *Dalea pulchra*	Evergreen. 4-foot height by 5-foot spread. Rose-purple flowers. Gray green leaves on spikes.
Brittlebush *Encelia farinosa*	Deciduous. 5-foot height by 5-foot spread. Yellow flowers. Gray-green foliage.
Ballerina Indian Hawthorn *Raphiolepis Indica "Ballerina"*	Evergreen. 3-foot height by 4-foot spread. Dense mounding with rosy-pink flowers.
Chaste Tree *Vitex agnus-castus*	Large shrub or small tree to 15 feet tall with similar spread. Lilac or white flowered varieties available.
Upright Rosemary *Rosmarinus officinalis*	Evergreen. 4-foot height by 4-foot spread. Dark gray-green needle-like leaves. Dense upright massing.
Dwarf Heavenly Bamboo *Nandina domestica "Compacta"*	Evergreen. 4-foot height by 2-foot spread. Lacy-look with bamboo-like stalks. Oriental effect.
Trailing Indigo Bush *Dolca Greggii*	Groundcover. 3-foot height by 4-foot spread. Small gray leaves with profuse purple flowers.
Lantana Species "New Gold" *New Gold Lantana*	Groundcover. 2-foot height by 4-foot spread. Rough, dark green foliage with gold flowers.
Bush Morning Glory *Convolvulus cneorum*	Ground cover. 3-foot height by 3-foot spread. Silvery-gray leaves with funnel-form white flowers.
Baccharis "Centennial" *Cebtebbuak/baccgarus*	Ground cover. 3-foot height by 5-foot spread. Dark green, low mounding with tan capsules.
Deer Grass *Muhlenbergia rigens*	Perennial bunchgrass, to 3' high and 4' wide. Has showy, 1-foot long, flowering spikes from July to October. Cut at ground level to rejuvenate clumps.
Pyracantha species *Firethorn*	Evergreen. 7-foot height by 7-foot spread. Dark green leaves with white flowers and orange berries.
Arizona Rosewood *Vauquelinia californica*	Evergreen. 8-foot height by 8-foot spread. Dark green leather-toothed foliage with flower clusters.
Euphorbia "Firesticks" *Euphorbia tirucalli 'Rosea'*	Deciduous shrub. 4-foot height by 4-foot spread. Red flowers. Drought tolerant. suitable for xeriscaping
Desert Spoon *Dasylirion wheeleri*	Evergreen. 5-foot height by 6-foot spread. Long, erect, gray-green rigid leaves.
"Centennial" Desert Broom *Baccharis pilularis x. sarothroides*	Low growing gray-green shrub. 3 feet high to 5 feet wide. Evergreen.
Regal Mist Deer Grass *Muhlenbergia capillaries "Regal Mist"*	Ornamental grass with deep green leaves with wispy white seed spikes
Ruby Fountain Grass *Pennisetum setaceum "Rubrum"*	Ornamental grass with narrow leaves with rosy-colored fuzzy seed plumes.
Bear Grass *Nolina microcarpa*	Ornamental grass with green cascade of long leaves.
Weeping Yucca *Yucca recurvifolia*	Evergreen. 4-foot height by 4-foot spread. 3-foot stalks of waxy-white lily-like blossoms.
Ocotillo *Fouquieria splendens*	Ornamental tube-like clusters of flowers in orange to red with small green leaves.
Pampass Grass *Cortaderia selloana*	Tall dense grass that can reach a height of 9 feet. Leaves are usually bluish-green, but can be silvery gray.

B.5 Signage

B.5.1 Exterior Signs

B.5.1.1 General

- The signage standards are governed by Air Force Sign Standard UFC 3-120-01 and ACC Instruction 32-1054.
- All road and traffic signs shall have a reflective material finish per Air Force standards.
- All facilities shall have a minimum of two building number signs. Wall-mounted signs should be 8" by 16" and be installed approximately 8 feet above ground. See Figure B-8.

Figure B-8 *Building Numbers*

- The lettering style for all exterior building signs and temporary signs shall be Helvetica. Helvetica Medium shall be used for primary information and Helvetica Regular shall be used for secondary information.
- Individual lettering attached to building structures, monuments and entryway glass shall be metallic, beige, or white. All other types of signs shall have white lettering on a brown background, except signs pertaining to safety which are governed by national standards.
- Major signs, such as those at base entrances, can be designed to be more decorative and can vary from the general recommendations. Specialty signs with message boards shall be as approved by the Base Architect.
- Materials for signs shall be aluminum, galvanized steel, and non-ferrous materials. Wood posts shall not be used. Internally lighted signs are limited to special commercial applications and must be approved by the Base Architect. If lighting is required for other signs, use external flood or spot.
- Signage shall be created from recycled content materials, as much as possible.

B.5.1.2 Identification Signs

- Identification signs may be one- or two-sided. Two-sided signs shall be installed perpendicular to the roadway.
- Base Identification Signs: These are located at Base entry points to identify the facility. Three types of base identification signs are to be used: 1. The Main Entrance Sign 2. The Secondary Entrance Sign; and 3. The Entry Gate Sign. These signs are all one-sided since they are viewed from one direction only.
- Military Identification Signs: Military identification signs are strictly prohibited.
- Community Identification Signs: These identify facilities and activities used for non-military purposes. These signs have the same character as military signs but consist of a different background color, lack military emblems, and building numbers.
- The use of community and commercial related symbols is permitted.

B.5.1.3 Direction Signs (Figure B-9)

- Direction Signs are used to direct vehicular traffic to specific locations.
- All signs shall be faced with brown reflective sheeting for the background and white reflective materials for the graphics.

Figure B-9 *Directional Signage*

B.5.1.4 Regulatory Signs

- Regulatory signs are used to direct vehicular traffic to specific locations. Highway Standards, Base Warning Signs, and Parking Regulation Signs are considered Regulatory Signs.
- Traffic control signs are governed by the Manual of Uniform Traffic Control Devices and signs are governed by OSHA. Examples include regulatory and traffic control signs (speed limit signs, stop signs, yield signs) and hazard/danger signs required by OSHA. Such special signs mandated by National Standards must be of the required colors and design. All signs on Base will adhere to standards set forth in ACCI 32-1054, Exterior Signs, (except that color shall be white letters on brown backgrounds and posts shall be brown), AFPAM 32-1097, Sign Standards Pamphlet, and MUTCD.
- New traffic signs will not be painted on back.

B.5.1.5 Motivational Signs

- These signs serve to increase morale.
- Motivational signs should be used to identify principal organizations, support safety campaigns, fund-raising drives, special events, display emblems and to express unit pride.
- Electronic messaging can be used for this sign type.

B.5.1.6 Information Signs

- These signs provide educational information and directional guidance for visitors.

B.5.1.7 Products/Treatments

Wall mounted signs (Figure B-10) shall be limited to the following applications:

Figure B-10 *Unit Patch and Building Lettering*

- Exterior lettering is limited to the main facility function title or unit identification. If two main functions share a facility, both titles will be displayed. All lettering will be constructed of anodized aluminum with three-dimensional uppercase Helvetica medium style and letter size proportional to signage location and facility size. Letters on facilities with metal walls will also be constructed from anodized aluminum. Under specific circumstances, plastic lettering can be used. Styrofoam letters should not be used.
- Medium Bronze color will be used for letters and metal background will match building wall color. All other exterior walls will receive Medium Bronze Anodized aluminum letters. Installation shall be permanent and appropriate for building finish (*i.e.,* split-face CMU, stucco, metal, etc.).
- Installation of unit patches is limited to the Unit Headquarters facility and only one patch per facility is allowed. Patch should be located near the main entrance and near the unit/building name signage. Size should be appropriate to the size and scale of the facility but vertical dimension shall not be greater than 3 feet, 6 inches. The professionally manufactured patch shall be factory-painted on a silhouetted aluminum panel. The panel shall have an appropriate gauge thickness and be mounted approximately 1-inch from the wall surface to separate it from the plane of the wall and create a shadow. The following unit patches are exempt from limits on size and number: USAF Thunderbirds, RED FLAG, USAF Weapons School, and Joint Air Ground Operations School.

B.5.1.8 Temporary Signs

Temporary signs will not be permitted except as described below.

- All temporary signs shall be fabricated to follow the style and guidelines as specified and illustrated.
- Temporary construction signs shall be permitted during the construction of a facility and shall be removed no later than one week after issuance of the certificate of occupancy. One project sign shall be permitted and shall be parallel to the street with locations subject to approval of the Base Architect. The sign should include only the following information:
  - Building name
  - Major tenant(s)
  - Architect
  - Consulting engineers(s)
  - Landscape architect
  - Developer (when applicable)
  - General contractor

  Subcontractor signs shall not be permitted. The temporary construction sign outlined above shall be located within a minimum of 5 feet of the property line and adjacent to the construction trailer. Construction signs will not be permitted off-site except as needed to direct construction traffic.
- All temporary signs shall be free-standing, ground-mounted. Signs of this nature shall not be affixed to any building.
- Clark County Dust Permit signs.

B.6 Lighting Standards

B.6.1 General

All interior and exterior lighting shall meet the efficiency levels established in *Command-level requirements, described in ACC Instruction ID2 (publication forthcoming). In the interim, use ACC Energy and Facility Management Policy)* as well as the specifications found in:

- Engineering Technical Letter (ETL) 10-18: Light-Emitting Diode (LED) Fixture Design and Installation Criteria for Interior and Exterior Lighting Applications, 13 December 2010, (latest version) and

- UFC 3-530-01, Design: Interior, Exterior Lighting and Controls, Chapter 8, 10 December 2010, (latest version)

Other lighting standards:

- Parking lot fixtures shall be a maximum height of 20 feet and shall be absolute cut-off type fixtures as manufactured with the quality of Kim Lighting (818) 968-5666. Style shall be "EKG series model 401." Color shall be bronze unless otherwise approved by the Base Architect.

- Roadway light fixtures shall be a maximum height of 35 feet and shall be absolute cut-off type fixtures as manufactured with the quality of Kim Lighting (818) 968-5666. Style shall be "EKG series model 401." Color shall be bronze unless otherwise approved by the Base Architect.

- Poles for roadway and parking lot lighting shall be square steel non-tapered. Color shall be bronze unless otherwise approved by the Base Architect.

- Low bollard fixtures or landscape lighting for walks and building entries shall be of the quality as manufactured by Kim Lighting (818) 968-5666. Style shall be vandal-resistant model VRB1. Unless otherwise approved by the Base Architect:
  - The metal color of the light fixture shall be bronze.
  - The diameter of the bollards shall not exceed 6 inches.
  - The height shall not exceed 42 inches.

- Building mounted lights (Figures B-11 and B-12) shall be absolute cut-off type fixtures and shall be recessed and of the quality as manufactured by Kim Lighting (818) 968-5666. Unless otherwise approved by the Base Architect:
  - Style shall be "Wall Director."
  - Color shall be bronze.

Figure B-11 *Building-Mounted Light*

- Wall mounted lights for lighting stairs and sidewalks shall be of the quality as manufactured by Kim Lighting (818) 968-5666. Unless otherwise approved by the Base Architect the color shall be bronze.

Figure B-12 *Building-Mounted Light*

- Building and sign flood lighting (Figure B-13) shall be of the quality as manufactured by Kim Lighting (818) 968-5666. Style shall be "Architectural Flood Light." Unless otherwise approved by the Base Architect the color shall be bronze.

Figure B-13 *Building/Sign Flood Light*

- Landscape accent lighting shall be of the quality as manufactured by Kim Lighting (818) 968-5666. Style shall be Model CL-4. Unless otherwise approved by the Base Architect the color shall be bronze.

- Jogging trail and walkway lighting shall be a maximum height of 15 feet and shall be absolute cut-off type fixtures. The lighting shall match existing standards currently in use on the base.

- Interior Lighting:
  - Provide wire guards for all open fluorescent lamps. Provide seismic protection for all fixtures, especially ceiling grid mounted fluorescent fixtures. Provide Certified Ballast Manufacturer (CBM) listed ballasts. Fixtures shall be 2-foot by 4-foot with recessed parabolic lens.
  - Restroom and conference room lights shall be controlled by motion detectors. Consider having all facility lights controlled by motion detectors.

B.7 Engineering Standards

B.7.1 Civil

B.7.1.1 General

All civil work should indicate all calculation and design analysis and show design criteria on drawings and shall conform to the latest editions of the following:

- State of Nevada Department of Transportation (NDOT) Standard Specifications
- The NDOT Standard Details
- The Clark County Public Works standard drawings for civil work
- The International Building Code (IBC)
- UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings
- The International Plumbing Code (IPC)
- American Water Works Association (AWWA)
- Uniform Plumbing Code (UPC) standards.

All civil work shall conform to the requirements of:

- The Uniform Federal Accessibility Standards (UFAS)
- The Americans with Disabilities Act (ADA)

The most stringent requirements shall apply.

B.7.1.2 Site Plans

- General base plans and some more specific as-built plans for the existing buildings and utilities are available on request; however, they may be incomplete and inaccurate.
- Existing conditions will need to be surveyed and verified by the A/E.
- A new site plan shall be developed showing all existing utilities, irrigation, facilities, trees, ponds, and other features at a scale appropriate to show the information (typically 1"=40'-0" or 1"=20'-0"). Use computer software as directed by the Base.
- One-foot contours shall be accurately shown, with bold 5-foot contours.
- Key spot elevations shall also be shown accurate to 1/10-inch for land features and accurate to 1/100-inch for structures, pavements, and slabs.
- Finish drawings must include horizontal and vertical control references to actual survey data control points.
- Benchmarks and key work/control points must be shown on site plans with coordinates (State plane). Copies shall be furnished to the Government upon completion of the project in the format requested. (Historically, these have been AutoCAD disk/CD copies.) Typical civil design drawing format is AutoCAD files provided on a CD.

B.7.1.3 Gas Service

- The design agent should expect to coordinate and arrange new facility connection to the natural gas lines.
- Contract plans should clearly identify connections necessary and the party responsible for the work.
- Gas lines shall have maximum working pressure 60 pounds per square inch gauge (PSIG).
- Underground gas piping shall be non-metallic.
- Refer to Mechanical/Plumbing Section for additional information.

B.7.1.4 Sanitary Sewer Service

- The minimum service lateral size for a facility shall be 4 inches. Size shall be increased to 6 inches or 8 inches as required per total number of plumbing fixtures serviced. Sewer line shall be designed and constructed to serve facility from the closet manhole that can be reached via gravity flow.
- The A/E shall study the most economical gravity sewer design option.
- The A/E shall verify capacities of the existing sewer to handle additional flows, once they are determined.
- Sewer lines shall be installed according to manufacturer's recommendations with not less than a 2.5 feet per second (fps) hydraulic velocity flow.
- Sewer manholes shall be precast reinforced concrete manhole sections with two exterior coats of heavy duty bituminous. Manholes shall conform to ASTM C478-72. Locate manholes at every 45 degree and 90 degree turn and locate them 400 feet apart or less.

B.7.1.5 Manholes/Cleanouts

- Use standard precast manholes with a nominal 25-inch diameter cast iron cover.
- A new manhole or cleanout shall be required if there is a significant change in direction for the new line.
- Minimum wastewater flow velocity is 2 fps.

B.7.1.6 Water Supply

- Verify that existing water mains are adequate to handle fresh water demands of the project, including fire protection and irrigation.
- Wet barrel fire hydrants shall be supplied to the building site off existing water mains, in accordance with the National Fire Protection Association (NFPA). Fire hydrants shall be Kennedy or Muller only. Fire hydrants shall be provided with Hydroshield hose connection couplers.
- A water demand analysis shall be made to determine flow and capacity requirements, line sizes, routing, as well as which line or lines are best to tie into.
- Cathodic protection is required on any metallic piping.
- Use Polyvinyl Chloride (PVC) type C-900 for underground service, and galvanized steel for aboveground (outside).
- Install a water meter at each new facility.

- Disinfect the plumbing lines in accordance with the American Water Works Association (AWWA) and the Uniform Plumbing Code (UPC) standards. Provide for bacteriological and pressure testing of the water after the building is complete.

- Water piping shall be designed for a maximum velocity of 3 fps, or manufacturer's recommendation, whichever is less. Plastic piping shall be pressure pipe capable of withstanding 165 psi. Trenching, backfilling, and pipe installation shall be done according to manufacturer's recommendations. Pipe shall have a minimum cover of 3 feet.

- No pressure piping shall be allowed under slabs unless it is in a crawl space or pipe chase, except for the service entrance. The service entrance shall be perpendicular to the slab edge and not extend more than 5 feet under the slab.

- Provide reduced pressure backflow preventers at the service entrance. The mechanical make-up water system shall have a separate air gap type (10-gallon tank and float with pressure-actuated, gear-driven pumps) backflow prevention device.

B.7.1.7 Storm Drainage

- The building site shall be designed such that the 100-year flood plain shall be at least one foot below finish floor elevation.

- Surveys should be required in accordance with county standards in order to meet design standards for the 100-year flood requirement

- All facilities should be 18" above the highest point of surrounding streets in accordance with the county standard.

- Culverts, storm drains, and catch basins shall be sized to handle a 25-year storm.

- EISA Section 438 requires all new and redeveloped federal facilities over 5,000 SF to "use site planning, design, construction, and maintenance strategies for the property to maintain or restore…the predevelopment hydrology

B.7.1.8 Site Drainage

- Drainage shall generally be surface drainage away from the building with paved areas sloping a minimum of one percent; earth areas a minimum of two percent; and pipes, gutters and swales a minimum of a half percent.

- RCP shall be used for culverts. No CSP is allowed.

- Use precast concrete catch basins with cast iron grates.

- Provide concrete splash blocks at outlets of downspouts.

- Where slope exceeds 20 percent, a system of erosion control should be provided.

B.7.1.9 Soil and Foundation Conditions

- Site-specific soil borings are required to determine soil bearing, pH, and resistivity characteristics.

B.7.1.10 Pavement/Parking Materials

- Asphalt road pavements: For parking lots and secondary roads, the minimum requirement is 3-inch thick asphalt concrete on 6-inch class 2 aggregate base. For asphalt roads, pavement shall be a minimum of 4 inches thick with a 6-inch aggregate base course (also for areas used by large trucks and tractor trailers).

- In most cases, concrete curb is required along driveways, around parking areas and around landscape islands in the parking lot. (Tack-on curbs are not allowed unless it interferes with low impact development solution for runoff.

- Lane delineation shall be ceramic traffic buttons and reflectors.

- All joints between precast concrete and asphalt pavements shall be routed out and sealed.

- Control joints shall be provided in concrete pavement to minimize random cracks.

- Boring shall be used when possible to eliminate road cuts. All pavement less than 5 years old shall be bored under to eliminate road cuts.

- Cuts in asphalt pavement shall be backfilled with a slurry cement backfill to prevent settlement. Pavement patches must be at least 10 foot wider on both sides of actual trench width at a minimum. Smaller patches may be approved by base personnel if road is scheduled for repair.

- Sidewalks shall be a minimum of 5 feet wide.

- Design the parking lot such that the total number of spaces is equal to the expected building population plus 10 percent. For buildings that have public gatherings or assemblies, parking calculations shall include increased capacity, as required, for the assembly location.

- Parking spaces for people with disabilities shall be provided in accordance with the requirements of the American with Disabilities Act (ADA) and the Uniform Federal Accessibility Standards (UFAS).
- Site design should provide adequate separation between pedestrian and automobile traffic through sidewalks, curbs, landscaping, or other buffering elements.
- Separate specialized vehicles, such as delivery trucks, from other vehicles where possible.

B.7.1.11 Construction Considerations

- Detailed construction phasing and an order of work schedule shall be "submitted by the contractor for approval" on all major projects to reduce negative impact on nearby facilities and traffic..
- Asbestos and lead paint shall be tested for prior to any demolition. Determine the presence of asbestos and lead paint (and any other toxic substances) prior to any demolition. If present, include required degree of remediation in the project. Coordinate testing and abatement with 99 CES/CEO and 99 CES CEANQ prior to commencing work. Clark County asbestos abatement permit is required.
- Supply Piping shall be non-metallic, such as Polybutylene (PB) or Chlorinated Polyvinyl Chloride (CPVC).
- Waste, vent and drainage piping shall be non-metallic, such as Acrylonitrile-Butadiene-Styrene (ABS), Polyvinyl Chloride (PVC), Polypropylene (PP) or Filament-wound Reinforced Thermo-setting Resin (RTRP).
- Provide remote monitoring, including advance meters, HVAC, generators, etc.
- Provide advance meters for all renovated and new facilities.

B.7.2 Structural

B.7.2.1 Structural General

- The structural system and materials shall be suitable for permanent type facilities, capable of carrying the required loads, and compatible with fire protection requirements and architectural and functional concepts.
- Materials not already defined in these standards shall be selected for economy, general availability, desirability, resistance to fire, and low maintenance costs over the design life of the facility.
- In selecting the type of structural system, the total cost of the facility shall be considered in conjunction with utilities, HVAC, lighting, finish materials and other architectural features.
- In choosing miscellaneous structural materials for projects, consideration shall be given to the site environment, climate, subsurface conditions, accessibility, wind velocity, seismic ratings, skill and experience of prospective contractors, the design life of the facility and maintenance cost over this period, availability of labor and materials, and the feasibility of preassembling or precasting major structural elements.
- A preconstruction meeting is required prior to any asbestos or lead-based paint work.
- Soil treatment for termites shall be specified for any new building with wood framing.

B.7.2.2 Design Loads

- Comply with the latest edition of the International Building Code and UFC 1-200-01, Design: General Building Requirements.
- Consideration should be given to the use of bearing walls since past designs indicate their economic advantages.
- Any design using a column and beam system must be analyzed to determine the most economical system.
- Floor, ceiling, and roof structures should be investigated to determine the most economical system consistent with the desired acoustical attenuation.
- Walls and partitions should be held to a minimum thickness to obtain maximum useable areas within the gross area limitation.
- The selection of walls and partition systems must take into consideration acoustical separation, fire protection, maintenance, structural requirements, recycled content of material, and utility systems.
- Facilities that will have solar panels installed on the roof shall have a structural system designed and constructed to accommodate the panels.

B.7.2.3 Design Notes

- Include general structural notes on drawings such as roof, floor, wind and seismic loads; material types and design stresses; unusual members sections

properties; survey references; and other pertinent notes relating to conformance to codes or construction practices.

B.7.2.4 Compatibility with Finishes

- Structural systems that require the use of cast in place concrete in conjunction with concrete masonry units should be carefully designed and detailed to present an attractive and acceptable appearance allowing for expansion/contraction and not allowing any leakage.

B.7.3 Plumbing/Mechanical

B.7.3.1 General Requirements

- The design of mechanical systems must take into consideration all factors that will ensure a quiet, comfortable, and convenient environment for the occupants.
- All mechanical equipment and systems must be selected on the basis of acoustical impact on the building occupants.

B.7.3.2 Reference Standards

- International Code Council (ICC)
- International Mechanical Code (IMC)
- International Plumbing Code (IPC)
- National Fire Protection Association (NFPA) Codes
- Occupational Safety and Health Administration (OSHA) and Air Force OSHA (AFOSHA) regulations
- Americans with Disabilities Act (ADA)
- Uniform Federal Accessibility Standards
- UFC 3-600-01 Fire Protection Engineering for Facilities
- ASHRAE standards
- Department of Defense Unified Facilities Criteria (UFC)
- DoD Minimum Antiterrorism Standards for Buildings, UFC 4-010-01
- Design: Energy Conservation, UFC 3-400-01
- Design: Engineering Weather Data, UFC 3-400-02
- Design: Heating, Ventilating, and Air Conditioning, UFC 3-410-01FA
- Design: Heating, Ventilating and Air Conditioning Control Systems, UFC 3-410-02A
- Design: Plumbing, UFC 3-420-01FA
- Military Handbook Facility Planning and Design Guide, Mil-HDBK-1190
- Engineering and Design Sustainable Design for Military Facilities, ETL 1110-3-491
- Nellis AFB Specification Section 27 10 00, Building Telecommunications Cabling System (Cooling Requirements)

B.7.3.3 Special System Criteria

- Provide air conditioning and ventilation for proper operation of computers, machinery, etc.
- Provide for the ventilation of mechanical rooms where refrigerant may be present.
- Reference TRANE application engineering manual “Refrigeration Equipment Room Design” (REF-AM-2, Aug 1992).

B.7.3.4 Maintenance Consideration

- Each piece of equipment must be installed so it can be properly maintained.
- Clearances must be provided around all equipment to allow it to be serviced, removed, and replaced as required.
- Plans and specifications should be examined to minimize large maintenance costs in the future.
- Provide convenient access to all utilities, cleanouts, HVAC equipment and systems, and gas fittings, in the mechanical room, underground and in the building.
- Additionally, any work performed in the overhead space must be done with the least disruptions to personnel utilizing the facility.
- Provide direct vehicular access to mechanical rooms, if possible.
- Ensure adequate means of removing interior equipment.
- Construction contract shall include training period for base maintenance personnel.
- Training period shall range from four hours of on-site instruction for simple systems up to two days for complex systems.
- DVD of training sessions shall be included.

B.7.3.5 Energy Conservation Measures

- All new facilities shall comply with the 2009 International Energy Conservation Code
- Executive Order (EO) 13123 (1999)—federal agencies to reduce energy intensity by 30 percent before 2005, based on a 1985 baseline
- Energy Policy Act of 2005

- Guiding Principles Federal Leadership in High Performance and Sustainable Buildings MOU, Updated in 2008
- EO 13423 (January 2007)
- Energy Independence and Security Act of 2007
- EO 13514 (October 2009)
- Reference the following Engineering Technical Letter (ETL) for current design guidance: "U" values, ETL 83-9; Energy Budget Figures, ETL 87-4; Meters, ETL 87-5 (Draft rev. 93-XX); Equipment Efficiency, ETL 82-2; HVAC control, ETL 83-1.
- A computer energy system analysis, under ETL 84-2 (Draft rev. 93-XX) shall be required.
- Use a present value (discounting) technique using 10 percent mid-year values.
- Equipment economic life shall be equal to the building projected occupancy, but not more than a 25-year cost period.
- Designer shall conform to the Energy Budget Figures set forth in ETL 87-4 (Draft ref. 93-XX).
- Submit proposed Energy Budget Figures corresponding to the different facility operating hours.
- Advanced meters shall be installed on all utility system renovation projects exceeding $200K, Military Construction projects, Energy Conservation Investment Program Projects, and Energy Savings Performance Contract projects. See Air Force Metering Policy (Appendix C). All meters shall be JCI Metasys-compatible and connect to base Energy Monitoring Control Systems (EMCS).

B.7.3.6 Corrosion Control/ Cathodic Protection

- Apply cathodic protection on all buried or submerged ferrous piping, tanks, and related facilities.
- Under no circumstances will underground facilities be installed without cathodic protection.
- This requirement includes ferrous materials such as cast iron.
- All buried or submerged cast iron pipe joints will be bonded with number 2 AWG insulated wire.
- Thermit wire connections must be coated.
- All cathodic protection design must be performed by an engineer accredited by the National Association for Corrosion Engineers (NACE).
- All cathodic protection design must be based upon specific field tests made at the construction site. Tests will include soil resistivity and water conductivity.
- Cathodic protection systems shall be sacrificial anode or impressed current and shall comply with corrosion protection criteria outlined in NACE Standard RP-01-69-9 (revised), ETL 87-3, AFM 88-45, AFI-105 and UFC 3-570-06 O&M.
- All dissimilar metals shall be separated by dielectric union.

B.7.3.7 Potable Water Source

- Coordinate with the Engineering and Site Development Sections at Nellis AFB for location of water mains and the operating pressure ranges in the area of connection. Contractor or designer shall verify existing flows and pressures.

B.7.3.8 Piping Materials and Special Outlets System–Material

- **Water (Underground):** PVC type C-900
- **Water (Aboveground, Outside):** Galvanized steel
- **Water (Aboveground, Inside):** Hard copper Type l
- **Sanitary Drain, Waste (Building, Three Stories and Less):** ABS or PVC–vent sanitary sewer
- **Sanitary Drain, Waste (Buildings Taller than Three Stories):** Cast iron
- **Storm Drain:** RCP only
- **Chilled Water PVC:** Schedule 80 or Hard Copper, Type L
- **Heating Hot Water:** Schedule 40 black steel or hard copper, Type L
- **Natural Gas (Underground):** Polyethylene with tracer wire
- **Natural Gas (Aboveground):** Black iron
- Provide dielectric union when connecting dissimilar metals.
- Provide lead-free plumbing components.

- Provide identification labels for pipes in the Mechanical Rooms.
- Label all flow directions.

B.7.3.9 Piping System

- Provide valves to isolate portions of building to avoid shutdown of entire building.
- Drain, waste, and vent piping as required by IPC for sanitary sewer system from each new facility.
- Fire protection systems are required for each facility per UFC 3-600-01, Fire Protection Engineering for Facilities.
- Energy conservation washerless fixtures shall be all metal construction, no chrome-plated plastic. All techniques shall be considered, including 1 gpm or lower-flow restrictors for faucets, 0.5 to 2 gpm low-flow shower heads, single control mixing type faucets, low-volume flush water closets, and self-closing faucet valves. Low-flow fixtures should meet the standards of EPA Water Sense. Showers shall have valves with pressure balance feature. Utilize freezeless wall hydrant. Provide interior wall access (self-draining) with hose attached. Wall mounted drinking fountains are preferred.
- In buildings that will be normally occupied by more than 15 persons, provide separate toilet rooms for each sex; position them together and use a common wall for plumbing chase. In buildings occupied by 1-15 persons, a single toilet to serve both sexes may be provided. Furnish one water closet, one lavatory, and a room door that can be locked from the inside.
- All applications of plumbing fixtures shall be considered for usage by people with disabilities, as directed by Air Force Guidelines.
- Consider the inclusion of showering facilities for LEED credit, where applicable, as well as for physical conditioning programs.
- Plumbing fixture types: Note the IPC and UPC define maximum flow rates and consumption for all types of plumbing fixtures. These standards or the EPA WaterSense Standards, when they become available, should be used for reducing water consumption.
    - **Water Closets (Institutional):** Flushometer valve, siphon-jet, elongated bowl, top supply spud, floor or wall mounted, minimum 1.5 gpm/flush. Seat: plastic, elongated, open front.
    - **Water Closets (ADA-Compliant, Institutional):** Top rim of bowl shall be 18-inches above the floor. (All others same as #1).
    - **Lavatories (Institutional):** Enameled cast iron or vitreous china, counter top. Facet: as required.
    - **Urinal (Institutional):** Wall hung. Siphon-jet or washout. Minimum 1 gpm/flush Waterless type urinals should be installed where proper maintenance of the units can be provided.
    - **Kitchen Sinks (Institutional):** Single or double bowl. Ledge back with holes for faucet and spout. Enameled cast iron, porcelain enameled steel or stainless steel. Faucet: As required.
    - **Service Sinks (Institutional):** Enameled cast iron. Trap standard, wall or floor mounted. Faucet: As required.
    - **Food Service Sinks (Institutional):** Stainless steel with drain board. Faucet: As required.
    - **Water Coolers (Institutional):** Self contained. Exposed surfaces shall be stainless steel. Wall mounted surface. Wall mounted semi-recessed. Wall mounted recessed. ADA-compliant; free standing.
    - **Showers (Institutional):** Wall mounted for stall or bathtub. Valves as required.

B.7.3.10 HVAC

- Preferred air conditioning units shall be Carrier. York or Trane can also be considered, but are not preferred. The units shall be designed for an ambient temperature of 115°F. Mcquay will not be accepted.
- Provide Variable Air Volume (VAV) systems in all new projects and during major renovations where entire mechanical system is being removed.
- Provide Energy Management Control System for units greater than 10 tons and connect to Local Area Network (LAN).
- Provide water cooled chillers for units greater than 40 tons.
- Roof-mounted mechanical equipment requires approval by the Base Architect. Fresh air intake shall be at least 10 feet aboveground level.
- Provide gas heating where gas is available. This needs to be confirmed for each project. Do not use heat pumps if gas is available.

- Provide screw type compressors for chillers greater than 40 tons up to 450 tons. Provide centrifugal chillers at higher efficiencies for chillers larger than 400 tons.
- Provide economizer when appropriate.
- Provide water treatment for all water systems, heating or cooling. These systems shall be maintenance free systems. Large systems should have loops installed as part of the system.
- Provide washable pleated air filters.
- Provide phase protection for all HVAC equipment (*i.e.,* pumps, chillers, air handling units).
- Refrigerant shall be hydrochlorofluorocarbon (HCFC) type only.
- Provide recommended manufacturing clearance around boilers, chillers, and air handlers for maintenance purposes.
- Provide external ductwork insulation where possible, not fiberglass duct liner inside of duct.
- If LNG or propane tank is provided for a facility it shall be located at least 50 feet from facility and enclosed by CMU screen walls.
- Provide fan speed controls (2-speed or variable speed) for cooling tower fans.
- Consider variable flow and/or variable speed chillers to minimize pumping and compressor power requirements.

B.7.3.11 Controls

- Provide Direct Digital Controls (DDC) that are manufactured by Johnson Controls and part of the Metasys System or an approved equal that is fully compatible with the base EMCS. DDC shall have direct communication with base EMCS.
- Existing base EMCS is Johnson Controls Metasys System, which is a microprocessor-based network installed on the base LAN and designed for maintenance management, trouble-shooting, and energy management. The system is comprised of a network of stand-alone units, each capable of DDC and supervisory control with direct LAN connection accessible by any desktop computer with appropriate software installed. The system allows for the base to perform manual operation, coordinate systems for energy reduction, view facility status in real time and generate run-time reports on equipment.
- Provide a fully labeled control schematic that details all set points, throttling ranges, actions, spaces, proportional bands, and any other adjustment.
- Provide a fully labeled elementary diagram (ladder diagram).
- Provide a sequence of control on the drawings cross-referenced to the control schematic and elementary diagram.
- Provide a generic, functional description of each control component shown on the drawings.
- Provide for remote monitoring, including advance meters, HVAC, generators, etc. Use remote sensors so that controllers can be centrally located in the mechanical room.
- Provide logical grouping of controllers, adapters, relays, and power supplies in an easily accessible controls cabinet mounted away from vibrating machinery.
- Provide electronic system terminal strips cross-referenced to the control schematic to facilitate troubleshooting and calibration. Maximize “self-help” software as well.
- Provide control schematic, elementary diagram, control sequence, description of components, control panel details, legends and schedules in the design.
- All possible “clog” points shall have differential pressure checks on them.
- Connect all HVAC controls to JCI Metasys System. Building Systems shall be fully functional on their own in case connection to main EMCS is lost.
- Drawings shall identify all confined spaces.

B.7.3.12 Heating

- Designer will research and choose most appropriate heating system for the facility.
- Use ASHRAE Standards for calculating heating loads.
- The use of cast iron boilers is discouraged. Provide boiler water testing sample points on all hot water systems. Provide chemical feeding systems on all hot water heating systems. Provide automatic, pilotless, ignition systems on all gas-fired equipment. Install thermostats on heating supply and return lines. Install pressure gauges with valves on suction and discharge lines to all pumps. Install gas pressure gauges with valves on all gas trains on boilers.

- Consideration should be given to electric boilers due to the problem with permitting gas powered boilers
- Access to equipment for servicing is an extremely important consideration when designing new systems. Consider servicing and removal of coils, filters, valves, pumps, and tubes during design.
- Sloped roofs shall not have any equipment located on them unless otherwise approved by the Base Architect. All equipment located closer than 10 feet from the edge of a flat roof shall have a safety railing.
- Equipment located on the ground shall be hidden from view.
- Where humidification is required, steam humidifiers shall be used.
- The fuels available for use are gas for furnaces and boilers, and electric for heat pumps.
- The equipment selection should be based on the system selected to provide the most energy efficient combination.
- Equipment types to be used:
  - **Type-1:** HVAC boilers smaller than 3,000 mbh shall be steel tube condensing type with a minimum 90 percent efficiency at worst-case design conditions. Domestic hot water boiler shall be copper tube.
  - **Type-2:** Heat exchanges shall be shell and tube type or plate type.
  - **Type-3:** Heat pumps shall be air-to-air or water-to-air.
  - **Type-4:** Circulating pumps shall be centrifugal base mounted, inline horizontal or vertical.
  - **Type-5:** Unit heaters shall be horizontal or vertical.
  - **Type-6:** Air handling units shall be blow through or draw through packaged type.
  - **Type-7:** Fan coil units shall be horizontal, vertical, or through-the-wall type.
  - **Type-8:** Radiant heaters shall be gas-fired combination.
- Distribution piping and ducting shall be in accordance with (IAW) the Uniform Mechanical Code (UMC), Sheet Metal and Air Conditioning Contractors National Association (SMACNA), and applicable ASHRAE design criteria. Flexible duct runs should be limited to 6 feet lengths.
- All piping installed to serve the building and within the building shall be thermally insulated IAW the latest edition of ASHRAE 90.1 Energy Conservation (section 6.4.4 in the 2009 version).
- No asbestos-containing materials will be used for insulation.
- For heating plant and systems, water softeners and water treatment equipment, make sure water softeners are properly sized to allow soft water to be introduced into the plant at all times, including emergency shutdown. Provide soft/conditioned water for all large boiler systems. Install adequate water treatment equipment on boilers/plant.

B 7.3.13 Ventilation/Air Conditioning/ Refrigeration System

- Evaporative coolers shall be installed at the 2-foot to 3-foot level, not on the roof. Select air-cooled condensers based on 115°F ambient temperature. A central mechanical system shall normally be provided unless specific engineering cost analysis indicates sub systems to be more economical. Locate equipment designed to operate outside behind architectural screening. Avoid locating outside equipment near the main entry of buildings.
- A life cycle cost analysis shall be done for air-cooled and/or water-cooled chillers. Larger air conditioning units work more efficiently with cooling towers. Use of a screw type compressor chiller may be more efficient for chiller sizes of 40 to 450 tons. Centrifugal chillers are long lasting. Based on the above, a life cycle cost analysis shall be done to compare initial costs, long-term costs, and energy efficiency.
- Access to equipment for servicing is an extremely important consideration when designing new systems. Removal or servicing of coils, filters, valves, pumps, and tubes is to be considered when designing mechanical systems.
- Sloped roofs shall not have any equipment located on them.
- Equipment located on the ground shall be hidden from view (see B.3 “Site Design”).
- **Fuel:** Mechanical refrigeration shall be fueled by electricity.
- **Equipment:** Shall be suitable for the application.

- **Type-1:** Chillers shall be packaged air-cooled type or water-cooled screw or centrifugal type.
- **Type-2:** Evaporative coolers shall be up-blast, or vertical-discharge closed-circuit type, or cellulose material impregnated with anti-rot salt and rigidifying saturants. Media efficiency shall be 76 percent at 600 FPM face velocity with no entrainment of pad water. Open evaporative coolers shall be designed to provide an indoor temperature of 80°F.
- **Type-3:** Heat pumps shall be air-to-air, water-to-air, or geothermal closed loop.
- **Type-4:** Circulating pumps shall be centrifugal base mounted, inline horizontal, or vertical.
- **Type-5:** Air handling units shall be flow through or draw through packaged type.
- **Type-6:** Fan coil units shall be horizontal, vertical, or through-the-wall type.

- Office areas, dining rooms, and personnel living spaces shall have air conditioning.
- Air conditioning system shall be chosen on the basis of economy, efficiency, and ease of maintenance.
- When calculating cooling loads, use ASHRAE standards.
- The peak or maximum cooling load for selecting the room side cooling equipment will consist of the following:
  - Exterior heat gain through building construction;
  - Personnel occupancy;
  - Electrical lighting not to exceed one watt per square foot for rooms and 1½ watts per square foot for office and shop space;
  - Design occupancy ventilation air total heat (outside air design minimum room design condition);
  - 10 percent safety factor.
- Window shading devices on the exterior and interior will be investigated in an effort to reduce the room solar heat gain.
- Minimum room supply air rate or fan-coil capacity will be 0.80 cfm/sq. ft.
- The building peak or block cooling load for central refrigeration capacity will be determined on the identical parameters outlined above with the following exceptions:
  - Personnel occupancy will be 40 percent total occupancy;
  - No interior electrical lighting;
  - 10 percent minimum safety factor to include motor horsepower and heat gain to coolant distribution system.
- The chilled water supply temperature will normally vary between 40 and 50°F, which shall be determined from the designer's analysis of the optimum balance for the cooling unit, water distribution, and water chiller.
- Normal air infiltration should be evaluated in an effort to meet the requirement for range hood exhaust.
- The building peak heat gain analysis will include the personnel ventilation rate or continuous toilet exhaust where the air flows through the occupied space.
- Provision will be made for removal of equipment for maintenance. Tube bundles will have provision of easy removal for maintenance (*i.e.,* A-frame or monorails structurally adequate to support the loads and provide proper distance between system components and walls to ensure ability to clean, repair, or replace tube bundles).
- Install bypasses on all strainers so that they may be cleaned without plant shutdown.
- Distribution piping and/or ducting specification shall be the same as for heating.
- Design conditions shall be chosen from ASHRAE.
  - Ventilation shall be supplied in accordance with ASHRAE.
- Pipelines/Utilities:
  - Sufficient clearance shall be provided for any conceivable service equipment that may be installed or temporarily operated in the future facility.
  - All crossings must be made by boring or jacking unless a road cut is expressly approved.
  - On approved road cuts, provide spare pipe sleeve for future use.
- **Separation Requirements:** Design shall meet IAW the International Plumbing Code.
- Maximum/Minimum Depths of Cover:
  - 18-inches minimum for all services at the 5' building line.
  - 30-inch average depth is acceptable on piped utilities.

- Proper engineering design may allow less depth.

B 7.3.14 Fire Protection

Plans shall include engineered stamped drawings, calculations, and certification for fire protection system.

- Design Development:
  - Provide description of fire alarm/suppression system to be utilized, fire water flow rates, connection point, and catalog cuts for proposed equipment.
  - Provide preliminary design, water flow pipe calculations (if sprinkler system is proposed), cost estimates and specifications with hydraulic calculations.
  - Provide the Base Civil Engineer, Electrical Shop (alarm maintenance section), with training for all Fire Alarm Control Panel (FACP) systems (addressable or non-addressable). Required training includes demonstrations of how to program the FACP and each type of addressable device installed within the new facility, such as pull stations, smoke detectors, heat detectors, duct detectors, and control modules used for auto-shutdown of HVAC system.
  - Provide at least two copies of installation, programming, and user guides for the FACP and all devices or control modules installed.
  - Provide certification (the contactor shall) training for a minimum of two individuals for any system base personnel are not certified in.
  - Provide all required proprietary software with license (MS Windows compatible), all interface cables, and accessory programming equipment or adapters to be able to program all devices installed in new fire alarm system.
  - Meet requirements of UFC 3-600-01, Design: Fire Protection Engineering for Facilities.
- **Response Distance/Time (Mobile Fire Apparatus):** Information regarding the base water distribution is available from the Base Civil Engineer (BCE).
- Existing Fire Protection System:
  - Provide a radio fire alarm transceiver compatible with base fire alarm system, which is a D-21 reporting system.
  - Research pressure and flow rate for hydrants in the building area to determine if sufficient capacity exists.
- Compliance with Life Safety Code (NFPA Standard 101):
  - Design for structural, fire protection and occupancy features, including means of egress, roof ventilation, emergency lighting, and illumination, and building service (heating, ventilation, and air conditioning systems) shall be IAW the latest edition of NFPA 101.
  - Provide calculations and diagrams showing compliance.
  - Ceiling light in corridors to be used as emergency lighting units with battery backup lights to be near each exit. Exit lights shall have a battery backup.
- Fire Detection System Requirements:
  - Manual pull stations shall be provided throughout the facility, typically including one pull station at every personnel exit door.
  - Actuation of a pull station shall sound local alarms and transmit an alarm to the Base Fire Department via the building central control panel.
  - Actuation of a pull station of fire detection system shall indicate both audible and visual signals.
  - This system shall be designed IAW NFPA Standard 72.
  - Smoke/Heat Detectors: Install 135°F fixed-temp heat detectors or photoelectric smoke detectors in all areas except dormitory sleeping areas. In dormitory and sleeping areas, install combination smoke/heat detectors.
  - Only the heat detectors component shall be connected to the fire detection systems, which transmit a coded signal to a central alarm location.
  - Smoke detectors in sleeping areas shall only activate an audible room alarm. Battery-operated units are not permitted.
  - Areas protected by automatic fire detection systems will include occupied and unoccupied spaces and attics.
  - Mechanical rooms, laundry room, and attic must be 190°F waterproof where exposed to moisture.

- Design shall comply with applicable NFPA Standards.
- Systems should contain a fan shutdown to turn off all air handlers, exhaust fans, and ventilation motors upon activation. Follow UNC and NFPA requirements.
- Past fire alarm panel have been Monaco M-2 (RF) unit, but other panels may be acceptable such as the Hoshiki Fire Alarm Control Panel. However, Monaco transmitter must be used.

- **Fire Sprinkler Requirements:** Provide a fire sprinkler system IAW NFPA 13 for Automatic Systems.
- **Special Extinguishing Systems Requirements:** Provide recessed or semi-recessed cabinets for portable fire extinguisher. Distribution shall be IAW NFPA Standard 10.
- **Provisions:** Fire protection provisions shall be summarized and submitted as a separate analysis.
- **Testing:** Contracts and specifications shall include requirements for all testing and initial charging of systems as part of the construction in accordance with NFPA 13 to produce a complete and usable system.
- Cooking Area Requirements:
  - Hood and dust systems for cooking equipment that produces smoke or grease-laden vapors shall comply with NFPA 96, "Installation of Equipment for Removal of Smoke and Grease-laden Vapors from Commercial Cooking Equipment."
  - Activation of the hood and duct fire suppression systems shall automatically de-energize the unit.
  - Activation of the hood and duct fire suppression systems shall sound a general building alarm and transmit a signal to the fire department.
- **ADA-Compliant Requirements:** Designs shall comply with the Americans with Disabilities Act (ADA) and the Uniform Federal Accessibility Standards (UFAS). The most stringent requirements shall apply.

B.7.4 Electrical

B.7.4.1 General

- The design of underground distribution systems shall be based on the calculated demand with sufficient electrical capacity for expansion if allowed or if within the budget.
- The materials as indicated above shall be plastic conduit encased in concrete allowable plastic conduits including PVC, fiberglass, or similar nonmetallic electrical duct.
- Meet requirements of ANSI C2, National Electric Safety Code and UFC 3-550-01, Exterior Electrical Power Distribution.

B.7.4.2 High Voltage

- Pad-Mounted Transformers:
  - No dry type transformers on high voltage.
  - Oil-filled transformers shall be newly manufactured equipment. Rebuilt transformers are not allowed.
  - Specify copper windings OA/FA, 55/65 Deg C rise, 95KV BIL, with surge arrestors. Aluminum is not allowed.
- Pad-Mounted Switches:
  - Specify "RTE" RVAC's for inline switching. Joslyns will not be allowed.
  - Specify "RTE" MOST Oil switches for taps.
  - All taps off of a high voltage line shall be fused and have a dead front switch.
- Fused Cutouts:
  - Specify A-B Chance or S and C. All fused cutouts will be porcelain. Fiber types are not allowed.
  - Always require an Aluma-Form or equal aluminum bracket installation for risers and fused cutouts.
- **Connections:** Connections shall be made in aboveground cabinets whenever possible rather than underground manholes.
- **Surge Arrestors:** Specify General Electric or Ohio Brass non-porcelain type, 9KV.
- **Underground Cable:** Specify copper, 15KV insulation, 95 KV, 133 percent BIL, XLP or EPR insulation.
- **Concentric Neutral:** Neutral to be stranded, not banded.
- **Terminations:** Specify 3M-5601 shrink on Quick Term or equal.

- **Services:** By regulation, all building services will be metered.

B.7.4.3 Low Voltage

- **Panelboards:** Specify breakers, no fuses. Square D or GE are preferable.
- **Contactors:** Specify magnetic contactors, not manual for a load over ½ hp. Lighting contactor with photocell, locate photocell as high as possible. Motor Starters: Always specify thermal protection. Specify with a hand-off-auto switch so the shops can bypass if necessary.
- **Wire:** All wire larger than #10 shall be stranded copper. For indoor and general wiring, specify THHN insulation. For outdoor underground wire, specify either XHHW or XLP.
- **Dry Type Transformers:** Specify copper windings, 115 Deg C rise over a 40 Deg C ambient.
- All communication connections will be in panel boxes. Do not use plywood on the walls. There shall be no exposed wires.

B.7.4.4 Wiring Devices

- Provide new devices and plates whenever an area is renovated. All devices shall be recessed except in mechanical rooms and utility areas. Provide devices rated at 20 amps where heavy use or electrical load dictates the need for 20 amp devices. All wiring shall be copper. No aluminum is allowed.
- **Climatic Controllers:** Provide battery backup for lawn sprinkler system controllers and automatic setback thermostats.
- **Over-Current Protective Devices:** The minimum sized over-current device for branch circuits is 20 amps. Ensure proper coordination and withstand ratings for all over-current protection devices. Demonstrate coordination with first upstream existing protective device. Replace old circuit breakers with new when remodeling facilities. If replacement breakers are unavailable, consider replacement of entire panelboard. Main fusing is acceptable for limiting short circuit currents; however, place a box with one full set of spare fuses adjacent to main panel.
- Provide plastic panelboard and disconnect labels. Labels shall be laminated (black with white core), engraved with ¼"high letters. Attach to front exterior of enclosures. Labels shall match plan designations. Provide non-ferrous phase and circuit identification labels in all enclosures for feeder circuit conductors. Provide underground marker tapes for all underground conductors. If underground conductors are not in metallic conduit, provide marker tape with foiled backing to facilitate detection.
- Add PF capacitors to induction motors (100 HP or larger) to correct PF to 0.90 (+ .05, - .00). Switch PF capacitors in with the motor. Size capacitor IAW Institute of Electrical and Electronics Engineers (IEEE) 141, National Electrical Manufacturers Association (NEMA) MG2 and motor manufacturer recommendations.
- Power requirements for building shall be 208/120 unless building function specifically requires 480/277.
- Balance loads on phases within 10 percent at all panelboards. Conduit fault calculations to ensure proper withstand ratings for all protective devices. Ensure coordination for all protection devices, conductors, enclosures, and equipment.
- Conduit run in concrete shall be PVC unless steel conduit is needed for a specific reason, *i.e.,* to limit fault currents. Minimum conduit size shall be 4" and greater if required by code. Underground primary voltage feeders shall be in concrete encased conduit. All penetrations of fire -resistance rated walls shall be fire stopped IAW National Electric Code (NEC) Article 300-21. Highlight compliance with NEC Articles 300-5 (g) and 300-7 (1) regarding moisture seals. All wire shall be copper.
- All new utility lines shall be run in underground conduit, provide spare conduits form transformer to building.
- Meters shall be generally located in rear of building or near service entrance.
- Provide lightning protection system (LPS) as required. Reference Annex L of NFPA 780 (Lighting Protection Code) and complete risk assessment for project. If LPS is required, design and install per NFPA 780 and AFM 88-9, Chapter 3. Mission critical facilities and facilities with extensive electrical and communications equipment shall have LPS.

B.7.4.5 Security Systems

- Provide all electrical service, conduits, and junction boxes for Access Control System (ACS) and Intrusion Detection System (IDS) for all secured facilities or special access areas. ACS and IDS will be installed as equipment by the building tenant unless otherwise stated. Design, layout, and construction shall be coordinated with building tenant and their security representative. Provide dedicated electrical service to ACS and IDS panel(s), and to other system devices

and door security hardware as required. Existing base security system is Advantor Systems.

B.7.4.6 Telecommunications

- Facility construction projects shall meet telecommunications requirements stated in the following documents: Section 271000 Building Telecommunications Cabling System; 38 EIG Handbook 33-01 Communications and Information FIRST FOUR HUNDRED FEET; Engineering Technical Letter (ETL) 02-12: Communications and Information System Criteria for Air Force Facilities; UFC 3-580-01 Telecommunications Building Cabling Systems Planning and Design; Comm Room Wiring Plan. All communication work shall be performed by and all equipment shall be furnished and installed by a Building Industry Consulting Service International (BICSI) certified telecommunications contractor.

- Provide dedicated communications (comm.) room per EIA/TIA standards. Dedicate HVAC system for comm. room/thermostat.

- Facility communication rooms shall have HVAC, lighting, dedicated power to racks, cable ladders, data/voice outlets, and 110 VAC outlet for maintenance. Communication room doors shall have cipher locks. Equipment racks shall be lockable. Multistory facilities shall have a minimum of one comm. room per floor. Communication rooms should be accessible from building exterior wherever possible.

- New facility wiring shall be Category 6 or higher as approved by the base. All communications outlets shall be quad outlets. A quad comm. outlet is required for every 100 square feet.

- When facilities have multiple communications rooms, the backbone data uplinks shall be multimode fiber. Where a comm. room requires redundant links to another facility, a hybrid single mode and multimode fiber optic cable may be installed. Backbone cable plant shall consist of 62.5/125 or 50/125 12 strand multimode graded-index fiber optic cables.

- Voice outlets shall be terminated to Cat 6 or higher patch panels and collocated with their respective data ports.

- Patch cords and cross connect jumpers shall be rated at same performance category as the cabling it connects.

- All new fiber optic patch panels shall be SC type connectors and mounted in 19-inch racks. Equipment racks shall be equipped with wire management panels.

- Label all communications infrastructure and equipment components IAW approved Labeling Scheme.

- For new construction, communications rooms shall be designed to ANSI/TIA/EIA 569A. For repair projects, comm. rooms shall conform as closely as possible to ANSI/TIA/EIA 569A.

- All abandoned communications cables, voice and data, shall be removed. Reference NEC sections 800.2, 800.52 (B), 800.53 (A), and 800.532 (B) (1). Cable records databases shall be updated as necessary.

- Provide drawing package that accurately depicts network configuration and cable plant.

- Network hardware installations shall support at a minimum 10/100 Mbps to the desktop and be SNMP compliant.

B.7.4.7 Mass Notification

- Facilities shall have a Mass Notification System meeting the requirements of UFC 4-021-01, Design and O&M: Mass Notification Systems. MNS panel shall be Monaco BT-XM unit, or an approved equal, which is a communicator/fire alarm subpanel that allows two-way control from facility to 9-1-1 Dispatch or from the Command Center/9-1-1 to the facility. The Monaco BT-XM shall be located adjacent to the fire alarm panel.

- The Autonomous Control Unit Communicator and connected Autonomous Control Unit shall be a complete, supervised system that is compatible with the Monaco D-21 Mass Notification, Fire Management, and Force Protection receiving and reporting systems. The Autonomous control Unit Communicator and the Reporting and Receiving System shall employ two-way radio communication as the primary method. The Reporting and Receiving System shall be capable of receiving live-voice input from the Fire Department (and other agencies as deemed necessary) and pass this live-voice input to the Autonomous Control Unit Communicator. The Autonomous Control Unit shall be capable of receiving this live-voice input for announcement on connected speakers.

- MNS and fire alarm indicators that are in a Sensitive Compartmented Information Facility (SCIF) portion of a building shall have a high gain buffer amplifier (or an approved type of electronic isolation) at the point where the system cable penetrates the SCIF secure perimeter. Same shall be required for Special Access Program Facilities.

B.8 References

This section contains a list of required or recommended references. Contractors shall refer to, but not limit their references to, the latest edition of the listed publications.

- A Manual of Recommended Practice, latest edition, American Conference of Governmental industrial Hygienists
- ADAAG, Americans with Disabilities Act Architectural Guidelines
- AFH 32-1084 Facility Requirements Handbook
- AFI 31-101, Volume I, Air Force Physical Security Program
- AFI 31-209 Air Force Resource Protection Program (Chapters, 3, 4, 5)
- AFI 31-209 USAF Resources Protection Program
- AFI 31-210 Air Force Antiterrorism Program
- AFI 32-1010, Land Use Planning, 1 November 1998
- AFI 32-7062, Air Force Comprehensive Planning, 1 October 1997
- AFMAN 32-1071, Vol. 1 force protection requirements for glazing
- AFOSH 9166, General Industrial Operations
- AFPM 32-1097, Sign Standards Pamphlet, 1 November 1997
- Air Force Regulation 91-38
- Americans with Disabilities Act (ADA)
- Americans with Disabilities Act Accessibility Guidelines (ADAAG)
- ANSI/TIA/EIA-568-B and All Addenda, Commercial Building Telecommunications Cabling Standard, 2001 (includes System Testing Requirements)
- ANSI/TIA/EIA-569-A, Commercial Building Standard for Telecommunications Pathways and Spaces
- ANSI/TIA/EIA-598-A, Optical Fiber Cable Color Coding
- ANSI/TIA/EIA-606, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications
- ASTM—American Society for Testing and Materials—E648—Naval Publications and Forms Center, 5801 Tabor Ave, Philadelphia, PA 19120
- Department of Energy Standards Part 435, Energy Conservation Voluntary Performance Standards for New Buildings
- Development and Maintenance of Traffic Control Device Inventories for DOD Installations
- DoE 435 (Energy conservation performance standard)
- Emerald Book for Equipment Grounding, NFPA-70/NEC, National Electric Code
- Engineering Technical Letter (ETL) 93-1, Construction Signs, 11 March 93
- ETL 93-1, Construction Signs, 11 March 1993
- ETL 94-3, Air Force Carpet Standards
- ETLs 86-8, 86-9, 90-6, 90-9, 91-1, 91-4, 91-5, 93-4, 96-1, 99-12, 00-7, and 01-2
- ETL 10-18: Light-Emitting Diode (LED
- Factory Mutual Global (FM) (http://www.fmglobal.com)
- HQ AFCEE Carpet Selection Handbook
- International Conference of Building Officials
- International Conference of Building Officials, publishers of the Uniform Building Code (UBC), (http//:www.icbo.org)
- International Organization for Standardization (ISO)
- International Plumbing Code, latest edition
- Manual on Uniform Traffic Control Devices (MUTCD by Federal Highway Administration)
- MIL-HDBK-1008B Fire Protection for Facilities, Engineering, Design, and Construction
- Military Traffic Management Command, Traffic Engineering 7 Highway Safety Bulletin, Traffic Engineering for Better Gates; August 2001
- National Fire Protection Association (NFPA) (http://www.nfpa.org)
- NFPA 101 The Life Safety Code
- NFPA 13 Sprinkler Systems
- NFPA 1500 Standard for Fire Department Occupational Safety and Health Program
- NFPA 17A Standard for Wet Chemical Extinguishing Systems
- NFPA 403 Standard for Aircraft Rescue and Fire Fighting Services at Airports
- NFPA 409 Aircraft Hangars
- NFPA 410 Aircraft Maintenance
- NFPA 70 National Electrical Code
- NFPA 72 Standard for Fire Protection Signaling Systems
- NFPA 72E Automatic Fire Detectors
- NFPA 80 Fire Doors and Windows
- NFPA 96 Standard for Installation of Equipment for the Removal of Smoke and Grease Laden Vapors
- National Institute of Building Sciences (NIBS), producers of the “Construction Criteria Base” (CCB). (http://www.nibs.org): (http://www.ccb.org/html/home.html)
- Occupational Safety and Health Administration (OSHA) (http://www.osha.gov/comp-links.hlml)
- Plant Installation Safety Guide, NESC (ANSI/IEEEC-2), National Electric Safety Code
- Society of Fire Protection Engineers, Inc. (SFPE) (http://www.sfpe.org)
- The general Plan Guide and Template, HQ Air Force Center for Environmental Excellence (AFCEE)
- UFAS, Uniform Federal Accessibility Standards
- UFC (Unified Facilities criteria) 4-010-01, DoD Minimum Antiterrorism Standards for Buildings, latest edition
- UFC 3-120-01 Air Force Sign Standard, 6 February 2003

- UFC 4-010-02, DoD Minimum Antiterrorism Standoff Distances for Buildings, Latest version
- UFC 3-530-01, Design: Interior, Exterior Lighting and Controls
- Underwriters Laboratories, Inc. (UL) (http://www.ul.com/welcome.html)

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C Air Force Metering Policy

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON DC

06 MAY 2010

MEMORANDUM FOR ALMAJCOM/A7

FROM: HQ USAF/A7C
1260 Air Force Pentagon
Washington, DC 20330-1260

SUBJECT: Air Force Facility Metering Policy (S/S AF/A7C Memo, 10 Jul 09)

A vital component of the Air Force's energy program is measuring utility usage by installing meters (electric, natural gas, steam, and water) where appropriate, thus allowing for informed decisions and improved energy efficiency.

Meters are required at all existing facilities when feasibility criteria are met (see attachment for criteria). Advanced meters shall be installed on all utility system renovations exceeding $200K, new MILCON, major renovation, Energy Conservation Investment Program projects (ECIP), and Energy Savings Performance Contract (ESPC) projects.

Water meters shall be located at all installation potable water entry/service points, on base well water facilities and at any location where the annual usage exceeds 2M gallons. Where it is not cost-effective to install stand-alone water meters, bases shall determine water consumption and leak detection by using a temporary meter to collect at least 30 days worth of information. Steam shall be metered at central steam plants in accordance with AFI 32-1068, "Heating Systems and Unfired Pressure Vessels" (1 Oct 98).

For electric and gas meters, installations shall conduct and document, with MAJCOM verification, capability of existing meters installed on facilities, and upgrade of meters or communication where appropriate. Installations shall ensure facilities meet DODI and AF criteria and conduct meter feasibility evaluations to determine if advanced meters are required (see attachment for criteria). This supersedes a previous criterion which was based solely on a square foot threshold.

MAJCOMs shall ensure Advanced Meter Reading (AMR) project installations are in compliance with ETL 09-11, *Civil Engineering Industrial Control System (ICS) Information Assurance (IA) Compliance*. All AMR ICSs shall comply with interim IA security requirements contained within ETL 9-11 by 31 Dec 10 or be turned off (stop transmitting over unapproved systems) by 1 Jan 11. AF Network Integration Center (AFNIC) has approved a standard wireless Platform IT (PIT) for CE AMR.

Forward requests for exceptions to this policy to AFCESA/CENE, DSN 523-6222.

PAUL A. PARKER, SES
The Deputy Civil Engineer
DCS/Logistics, Installations & Mission Support

Attachment:
AF Meter Feasibility Criteria

AF METER FEASIBILITY CRITERIA

All installation Civil Engineers shall implement the AF Facility Metering policy based on the following directives and Unified Facilities Guide Specifications:

- Public Law 109-58 - Energy Policy Act (EPAct) 2005, 8 Aug 05
- Energy Independence and Security Act (EISA) of 2007, 19 Dec 07
- DoDI Instruction 4170.11, *Installation Energy Management*, 11 Dec 09
- AFPD 23-3, *Energy Management*, 7 Sept 93
- Air Force Energy Program Policy Memorandum 10-1, 19 Dec 08
- UFGS 26 27 13.10 30, October 2007, Electric Meters
- UFGS 33-12-33.00 30, August 2008, Water Meters
- UFGS 31 53 33, Natural Gas Meters
- UFC 3-400-01 Energy Conservation (para 2.5) NOT Applicable

The following inequality must be 'true' in order to assert/verify meter cost effectiveness:

$$[(\text{Inst Cost})_1 + (\$3000)_2] < [(2\%)_3 \times (\text{Ann Util Cost})_4 \times (10\ \text{yrs})_5] + \text{Other Savings}_6$$

1. Initial installation cost of metering to include meter, software, and communications
2. $300/yr maintenance cost over 10 yr meter life cycle.
3. Minimum energy savings due to increased awareness and improved operations
4. Estimated annual cost of energy expected to flow through the meter
5. Life cycle period of 10 yrs
6. Other documentable savings (reduced cost of operation and maintenance, increased potential for energy management/savings, and energy efficiency improvement)

- Costs associated with "existing" communication hardware or software used to connect advanced meters should not be included in the cost-effectiveness evaluation.
- The Federal Energy Management Program (FEMP) *"Guidance for Electric Meters on Federal Building"*, 6 Feb 2006, provides additional information on cost effectiveness determinations (http://www1eere.energy.gov/femp/pdfs/adv_metering.pdf).

Advanced meters shall have the ability to communicate information to a standardized data collection system and conform to Unified Facilities Guide Specifications for electric, gas, and water.

Installations may install advanced meters meeting minimum requirements of UFGS and not include the communication infrastructure until an approved communication system, with software is determined by A7C. Meters are recommended for facilities that do not meet the above criteria when accurate billing data is needed for reimbursable customers, per AFI 32-1061.

D Air Force Sustainable Design and Development Policy

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, DC

2 JUN 2011

MEMORANDUM FOR SEE DISTRIBUTION

FROM: HQ USAF/A7C
1260 Air Force Pentagon
Washington, DC 20330-1260

SUBJECT: Air Force Sustainable Design and Development (SDD) Implementing Guidance

This memorandum reinforces the Air Force commitment to incorporate sustainable concepts in the planning, programming, design, construction, and operation of facilities and infrastructure. Beginning with FY12 and *regardless of funding source*, all permanent construction activity on Air Force installations in the United States (including Alaska and Hawaii) and its territories on permanent Active Air Force installations, resulting in Air Force Real Property Assets, shall comply with the requirements of this memorandum. This policy shall apply to overseas construction activities to the extent practical, considering mission objectives, and Host Nation agreements. The requirements of the following directives are incorporated into this memorandum:

- Executive Order (EO) 13327, Federal Real Property Asset Management, 6 Feb 04
- Public Law 109-58, Energy Policy Act (EPAct) 2005, 8 Aug 05
- Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding and Guiding Principles, 24 Jan 06
- EO 13423, Strengthening Federal Environmental, Energy, and Transportation Management, 26 Jan 07
- Public Law 110-140, Energy Independence and Security Act (EISA) of 2007, 19 Dec 07
- EO 13514, Federal Leadership in Environmental, Energy, and Economic Performance, 8 Oct 09
- Deputy Under Secretary of Defense (Installations and Environment) Memorandum, 19 Jan 10, Subject: DoD Implementation of Storm Water Requirements under Section 438 of the Energy Independence and Security Act (EISA)
- Deputy Under Secretary of Defense (Installations and Environment) Memorandum, 25 Oct 10, Subject: Department of Defense Sustainable Buildings Policy
- 10 CFR Part 433, Energy Efficiency Standard for the Design and Construction of New Federal Commercial and Multi-Family High Rise Residential Buildings
- 10 CFR Part 436, Subpart A – Methodology and Procedures for Life Cycle Cost Analyses
- FY12 Defense Planning and Programming Guidance

The following sustainability requirements apply to the Air Force Construction program:

a. All new vertical construction, and major renovations[1] (Restoration & Modernization), **meeting the USGBC LEED 2009 Minimum Program Requirements (MPRs)** (see attachments 1 and 2) – All facilities in this category shall fully incorporate Federal

[1] For the purposes of this memorandum, a major renovation project is defined as changes to a building that provide significant opportunity for substantial improvement in the sustainable design elements of the building, including energy efficiency, as determined by the signatory of the DD Form 1391. For major renovation projects seeking formal LEED certification, criteria established in the MPRs and the LEED Reference Guide must also be met.

requirements for High Performance and Sustainable Buildings (HPSB) (see attachment 3); shall be registered in USGBC LEED-Online; *shall be formally certified and achieve at a minimum LEED Silver certification* (or meet a comparable level of achievement with an overseas third-party green building rating system); and shall achieve not less than 20 points (40 percent of the Silver point threshold) dedicated toward energy efficiency and water conservation.

b. All new vertical construction, and major renovations (R&M), **not meeting the USGBC LEED 2009 MPRs**, shall fully incorporate the Federal requirements for HPSBs and shall pursue LEED credits (or credits in an equivalent overseas third-party green building rating system), relevant to the scope of the project, to the maximum extent practicable (see attachment 3). For horizontal, utility, and industrial projects, attachments 4, 5, and 6 have been provided as guidance to indicate appropriate thresholds of compliance with this memorandum. The project types are defined in ETL 08-13, *Incorporating Sustainable Design and Development (SDD) and Facility Energy Attributes in the Air Force Construction Program* as:

- Vertical – Includes typical building construction for which LEED-NC was developed as a metric
- Horizontal – Includes site development, heavy earthwork, construct and repair roads, runways, taxiways, aircraft aprons, containment, sidewalks, parking lots, revetments, curbs, and gutters
- Utility - Includes electric, gas, water, steam, and wastewater, including substations, lift stations, oil/water separators, storage tanks, petroleum, oil, lubricants (POL) lines, and transformers
- Industrial – Includes all enclosed facilities for which mechanical cooling/heating is provided for less than 50 percent of the building square footage

The following paragraphs apply to all projects subject to the requirements of paragraphs a and b above, and other construction activities noted herein.

Apply life cycle cost criteria as specified in 10 CFR 436 Subpart A - Methodology and Procedures for Life Cycle Cost Analyses; EO 13327, Federal Real Property Asset Management; AFI 32-1021, Planning and Programming Military Construction (MILCON) Projects; and AFI 32-1032, Planning and Programming Appropriated Funded Maintenance Repair and Construction Projects, as appropriate.

As a continuation of the Air Force commitment to low impact development, implement the DUSD (I&E), DoD Implementation of Storm Water Requirements under Section 438 of Energy Independence and Security Act (EISA) policy for FY11 O&M and MILCON projects (see attachment 7 for implementing guidance). In exceptional circumstances where project considerations may affect the practicability of implementing the DoD guidance in FY11 O&M projects and FY11 or FY12 MILCON projects, low impact development design strategies will continue to be consistent with existing applicable Air Force design guidance.

The requirements of this memorandum are not optional. Sustainable elements necessary to comply with this memorandum cannot be eliminated to save scope or cut cost. The DD Form 1391 shall include the scope and the cost estimate to achieve the requirements of this memorandum. A separate line item entitled "SDD, EPAct05, EO 13423, EISA 438, and EO 13514" shall list the scope and estimated cost. In lieu of a cost estimate, an allowance, not exceeding 2 percent of the total construction cost, may be identified on the DD Form in the "SDD, EPAct05, EO 13423, EISA 438, and EO 13514" line item.

For MILCON projects, a Federal government employee of the design/construction agent (as the Owner's Agent) and the BCE, or his/her designee (as the Owner) shall sign the LEED Project Registration Agreement and the LEED Certification Agreement as appropriate.

The Air Force MILCON Sustainability Requirements Reporting Scoresheet (attachment 3) shall be used for reporting Air Force compliance with the Federal HPSB requirements and LEED status, of all MILCON project types listed in paragraphs a and b of this memorandum. AFCEE MILCON Project Managers shall send the Air Force MILCON Sustainability Requirements Reporting Scoresheet to AFCEE.TDB.MILCONrptg@us.af.mil, at: 1) the initial design charrette; 2) the RFP/35 percent design; 3) design complete; and 4) construction complete phases of all MILCON projects addressed by this memorandum. Any decisions based on cost constraints leading to deletion of sustainable concepts, or certification of the project, shall be included in the documentation. At the completion of the project provide HPSB status information to the installation Civil Engineering office for the purpose of updating the ACES-RP, RPA Sustainability Code field.

Specific roles and responsibilities in support of this memorandum are:

ORGANIZATION	ROLES AND RESPONSIBILITIES
HQ USAF/A7C	Development and dissemination of sustainable development policy. POC: Gene Gallogly, AF/A7CA, thomas.gallogly@us.af.mil Development and dissemination of MILCON program policy. POC: Robert Gill, AF/A7CP, robert.gill@us.af.mil
AFCEE	Provide guidance documents and technical support, to include planning, design criteria, the delivery process, and general guidance on sustainability and LEED certification. POC: Paula Shaw, AFCEE/TDBS, paula.shaw@us.af.mil
AFCESA	Provide guidance documents and technical support to include engineering criteria, construction standards, life cycle and sustainable costs, and operations and maintenance issues. POC: Clifford Fetter, AFCESA/CEOA, clifford.fetter@us.af.mil
	Provide guidance documents and technical support to include energy and water conservation, and renewable energy technologies. POC: Ken Walters, AFCESA/CEN, kenneth.walters.1@us.af.mil

As new LEED rating systems are introduced by USGBC, AFCEE and AFCESA will evaluate the potential for incorporation into the Air Force Construction Program and will forward recommendations to HQ USAF/A7C for guidance update consideration.

TIMOTHY A. BYERS, Maj Gen, USAF
The Civil Engineer
DCS/Logistics, Installations & Mission Support

7 Attachments:
1. LEED 2009 Minimum Program Requirements (MPR)
2. LEED 2009 MPR Supplemental Guidance
3. Air Force MILCON Sustainability Requirements Reporting Scoresheet, LEED 2009
4. Guidance on Applying LEED Principles to Air Force Horizontal Construction Projects
5. Guidance on Applying LEED Principles to Air Force Utility Construction Projects
6. Guidance on Applying LEED Principles to Air Force Industrial Construction Projects
7. Implementing Guidance to Meet EISA 2007 Section 438 Requirements

DISTRIBUTION:
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AFCESA/CC/CEN/CEO
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ALMAJCOM/A7
11 WG/CE
USAFA/CE
AFIT/CE
HQ AAFES-CF
HQ DECA-CIF
HQ USACE/CEMP-ZA
HQ NAVFAC/(00)

ATTACHMENT 3

Air Force MILCON Sustainability Requirements Scoresheet

version LEED® 2009

General Information		
		Project ID (e.g. ABCD12345)
		Building Name
		Project Type
		Installation
		City
		State
		MAJCOM
		PM Name
		PA ($k)
		Building Size (SF)
		Program Year (FY####)
		Project Phase
		Design Started (FY####)
		BOD (MM/DD/YY)
		Pursuing formal LEED® Certification
		Date Project Registered with USGBC (MM/DD/YY)
	LEED® 2009	LEED® Rating System
	0	LEED® Credits Achievable
	Prerequisites Not Achieved	LEED® Certification Level Achievable (per AF SDD Policy (July 2007))
		LEED® Credits Awarded by GBCI (e.g. 42)
		LEED® Certification Level Awarded by GBCI
		LEED® Energy and Water Credits Achievable
		Date Project Certified by GBCI (MM/DD/YY)
		Registration Fees ($)
		Certification Fees ($)
	0%	HPSB Compliant
	0%	Water Conservation Achieved (% below EPAct 1992)
	0%	Energy Efficiency Achieved (% below ANSI/ASHRAE/IESNA Standard 90.1-2007)
		Cost to Implement EISA 438 (Pre-Development Hydrology)
		Comments

Color Coding: See Instructions Tab for more detail		
Drop-Down Box	Drop-Down Box Stoplight	Custom Subquestions
No Entry	Yes - Credit Achieved	Not Required
Custom General Information	Maybe - Credit Maybe	
LEED Prerequisite	No - Credit not Achieved	

Air Force MILCON Sustainability Requirements Scoresheet

version LEED® 2009

Federal Requirements for High Performance Sustainable Buildings (HPSB)

HPSB I: Employ Integrated Design Principles				
Achievable Points	0		Possible Points	2
	HPSB I.1	**Integrated Design**		1
	HPSB I.2	**Commissioning**		1
HPSB II: Optimize Energy Performance				
Achievable Points	0		Possible Points	5
	HPSB II.1	**Energy Efficiency, Achieve Option 1 or 2 and insert design percentage**		1
	1		Reduce energy use 30% Below ANSI/ASHRAE/IESNA Standard 90.1-2007, OR	
	2	2	If not at least 30% below ANSI/ASHRAE/IESNA Standard 90.1- 2007, will the design achieve the maximum level of energy efficiency that is life-cycle cost-effective?	
			Insert percentage below ANSI/ASHRAE/IESNA Standard 90.1-2007 in terms of energy use (e.g. 32)	
			Insert building energy intensity (Btu/SF) calculated with the energy model per 10 CFR 433	
			Roof Attributes (Recommended)	
			Cool roof (LEED SS cr 7.2 or Energy Star)	
			Green roof	
			Solar electric	
			Solar thermal	
			Solar passive	
			Achieve "Designed to Earn the Energy Star" rating - Benchmark from first year of operation (Recommended)	
	HPSB II.2	**Preferential use of ENERGY STAR or FEMP-designated equipment, when lifecycle cost effective**		1
	HPSB II.3	**On-site Renewable Energy - Solar Hot Water Heater System**		1
			Lifecycle cost assessment found solar hot water heater system not effective	
			When lifecycle cost effective, solar hot water system installed - min 30% demand	
			Insert percentage achieved	
	HPSB II.4	**On-site Renewable Energy**		1
			Lifecycle cost assessment found renewable energy generation projects not effective	
			When lifecycle cost effective, renewable energy generation projects installed	
			Renewable energy type	
			Insert first renewable energy type, if applicable	
			Insert second renewable energy type, if applicable	
			Insert generation capacity (kW)	
			Insert percentage of total building	
	HPSB II.5	**Measurement and Verification - Advanced Metering**		1
			Water Metering: Select N/A if not used	
			Electric Metering: Select N/A if not used	
			Natural Gas Metering: Select N/A if not used	
			Steam Metering: Select N/A if not used	
	HPSB II.6	**Project Case Study Entered in High Performance Federal Buildings Database (Recommended)**		
	EISA 2007 II.7	**Reduction in fossil fuel-generated energy consumption (Recommended)**		
	EISA 2007 II.8	**Data Center Energy Consumption (Recommended)**		
HPSB III: Protect and Conserve Water				
Achievable Points	0		Possible Points	7
	HPSB III.1	**Indoor Water - 20% Reduction**		1
			Insert percentage achieved	
	HPSB III.2	**Outdoor Water - Reduce Potable Water Use by 50%**		1
	HPSB III.3	**Outdoor Water - Stormwater runoff**		1
	HPSB III.4	**Outdoor Water - Achieve Pre-Development Hydrology when technically feasible, when disturbance > 5,000 GSF**		1
			Insert cost to implement	
	HPSB III.5	**Process water potable water use**		1
			Energy efficiency measures using water were considered and the cost was included in lifecycle cost assessment	
			Energy efficiency measures using water were not considered for the design	
	HPSB III.6	**Water-Efficient Products**		1
	HPSB III.7	**Water Efficient Products - Irrigation Contractors**		1

Air Force MILCON Sustainability Requirements Scoresheet

version LEED® 2009

HPSB IV: Enhance Indoor Environmental Quality				
Achievable Points	**0**		Possible Points	9
	HPSB IV.1	**Thermal Comfort, ASHRAE 55-2004**		1
	HPSB IV.2	**Ventilation: ASHRAE 62.1-2007**		1
	HPSB IV.3	**Moisture Control**		1
	HPSB IV.4	**Daylighting - 75% of Spaces**		1
	HPSB IV.5	**Daylighting - Controllability of Systems**		1
	HPSB IV.6	**Low Emitting Materials**		1
	HPSB IV.7	**Protect Indoor Air Quality during Construction**		1
	HPSB IV.8	**Protect Indoor Air Quality after Construction**		1
	HPSB IV.9	**Environmental Tobacco Smoke (ETS) Control**		1
HPSB V: Reduce Environmental Impact of Materials				
Achievable Points	**0**		Possible Points	6
	HPSB V.1	**Recycled Content**		1
	HPSB V.2	**Biobased Content**		1
	HPSB V.3	**Environmentally Preferable Products**		1
	HPSB V.4	**Waste and Materials Management - Recycling**		1
	HPSB V.5	**Waste and Materials Management - Divert 50% from Disposal**		1
	HPSB V.6	**Ozone Depleting Compounds**		1
HPSB Totals			Possible Points	**29**
0	**Federal Requirements Achieved (29 line items)**			
0	**Federal Requirements Maybe Achieved**			
0	**Federal Requirements Not Achieved**			
0%	**Percentage of Federal Requirements Achieved**			

Air Force MILCON Sustainability Requirements Scoresheet

version LEED® 2009

LEED® 2009 Checklist

LEED® Credits and/or Prerequisites that meet HPSB Requirements

LEED® Credits and/or Prerequisites that align closely with HPSB Requirements

LEED® Credits that meet USAF Energy & Water Criteria (may depend on technologies & strategies)

Sustainable Sites			
Achievable Points	0	Sustainable Sites	Possible Points 26
	Prereq 1	Construction Activity Pollution Prevention (HPSB GP3)	Required
	Credit 1	**Site Selection**	1
	Credit 2	**Development Density & Community Connectivity**	5
	Credit 3	**Brownfield Redevelopment**	1
	Credit 4.1	**Alternative Transportation -** Public Transportation Access	6
	Credit 4.2	**Alternative Transportation -** Bicycle Storage & Changing Rooms	1
	Credit 4.3	**Alternative Transportation -** Low-Emitting & Fuel Efficient Vehicles	3
	Credit 4.4	**Alternative Transportation -** Parking Capacity	2
	Credit 5.1	**Site Development,** Protect or Restore Habitat	1
	Credit 5.2	**Site Development,** Maximize Open Space	1
	Credit 6.1	Stormwater Design, Quantity Control (HPSB GP3)	1
	Credit 6.2	Stormwater Design, Quality Control (HPSB GP3)	1
	Credit 7.1	**Heat Island Effect -** Non-Roof	1
	Credit 7.2	**Heat Island Effect -** Roof	1
	Credit 8	**Light Pollution Reduction**	1
		Select which LEED® Interior Lighting Option was used	

Water Efficiency			
Achievable Points	0		Possible Points 10
	Prereq 1	Water Use Reduction - 20% Reduction (HPSB GP3)	Required
	Credit 1	Water Efficient Landscaping (HPSB GP3)	2 to 4
	2	Reduce Potable Water Use by 50% (HPSB GP3)	2
	4	No Potable Use or Irrigation (HPSB GP3)	2
	Credit 2	**Innovative Wastewater Technologies**	2
	Credit 3	Water Use Reduction (HPSB GP3)	2 to 4
	2	30% Reduction (HPSB GP3)	2
	3	35% Reduction (HPSB GP3)	1
	4	40% Reduction (HPSB GP3)	1

Energy & Atmosphere			
Achievable Points	0		Possible Points 35
	Prereq 1	Fundamental Commissioning of the Building Energy Systems (HPSB GP1)	Required
	Prereq 2	Minimum Energy Performance (HPSB GP2)	Required
	Prereq 3	Fundamental Refrigerant Management (HPSB GP5)	Required
	Credit 1	Optimize Energy Performance (HPSB GP2)	1 to 19
	1	12% for New Buildings/8% for Existing Building Renovations	1
	2	14% for New Buildings/10% for Existing Building Renovations	1
	3	16% for New Buildings/12% for Existing Building Renovations	1
	4	18% for New Buildings/14% for Existing Building Renovations	1
	5	20% for New Buildings/16% for Existing Building Renovations	1
	6	22% for New Buildings/18% for Existing Building Renovations	1
	7	24% for New Buildings/20% for Existing Building Renovations	1
	8	26% for New Buildings/22% for Existing Building Renovations	1
	9	28% for New Buildings/24% for Existing Building Renovations	1
	10	30% for New Buildings/26% for Existing Building Renovations	1
	11	32% for New Buildings/28% for Existing Building Renovations	1
	12	34% for New Buildings/30% for Existing Building Renovations	1
	13	36% for New Buildings/32% for Existing Building Renovations	1
	14	38% for New Buildings/34% for Existing Building Renovations	1
	15	40% for New Buildings/36% for Existing Building Renovations	1
	16	42% for New Buildings/38% for Existing Building Renovations	1
	17	44% for New Buildings/40% for Existing Building Renovations	1
	18	46% for New Buildings/42% for Existing Building Renovations	1
	19	48%+ for New Buildings/44%+ for Existing Building Renovations	1
	Credit 2	On-Site Renewable Energy (HPSB GP2)	1 to 7
	1	On-site 1%	1
	2	On-site 3%	1
	3	On-site 5%	1
	4	On-site 7%	1
	5	On-site 9%	1
	6	On-site 11%	1
	7	On-site 13%	1
	Credit 3	Enhanced Commissioning (HPSB GP1)	2
	Credit 4	Enhanced Refrigerant Management (HPSB GP5)	2
	Credit 5	Measurement & Verification (HPSB GP2)	3
	Credit 6	**Green Power**	2

Air Force MILCON Sustainability Requirements Scoresheet

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Materials & Resources				
Achievable Points	0		Possible Points	14
	Prereq 1	Storage & Collection of Recyclables (HPSB GP5)		Required
	Credit 1.1	**Building Reuse,** Maintain Existing Walls, Floors & Roof		1 to 3
		1	Maintain 55% of Existing Walls, Floors & Roof	1
		2	Maintain 75% of Existing Walls, Floors & Roof	1
		3	Maintain 95% of Existing Walls, Floors & Roof	1
	Credit 1.2	**Building Reuse,** Maintain 50% of Interior Non-Structural Elements		1
	Credit 2	Construction Waste Management (HPSB GP5)		1 to 2
		1	50% Recycled or Salvaged	1
		2	75% Recycled or Salvaged	1
	Credit 3	**Materials Reuse**		1 to 2
		1	5%	1
		2	10%	1
	Credit 4	Recycled Content (HPSB GP5)		1 to 2
		1	10%	1
		2	20%	1
	Credit 5	**Regional Materials**		1 to 2
		1	10% Extracted, Processed & Manufactured	1
		2	20% Extracted, Processed & Manufactured	1
	Credit 6	Rapidly Renewable Materials (HPSB GP5)		1
	Credit 7	Certified Wood (HPSB GP5)		1
Indoor Environmental Quality				
Achievable Points	0		Possible Points	15
	Prereq 1	Minimum IAQ Performance (HPSB GP4)		Required
	Prereq 2	Environmental Tobacco Smoke (ETS) Control (HPSB GP4)		Required
	Credit 1	**Outside Air Delivery Monitoring**		1
	Credit 2	**Increased Ventilation**		1
	Credit 3.1	Construction IAQ Management Plan, During Construction (HPSB GP4)		1
	Credit 3.2	Construction IAQ Management Plan, Before Occupancy (HPSB GP4)		1
	Credit 4.1	Low Emitting Materials, Adhesives & Sealants (HPSB GP4)		1
	Credit 4.2	Low Emitting Materials, Paints & Coatings (HPSB GP4)		1
	Credit 4.3	Low Emitting Materials, Flooring Systems (HPSB GP4)		1
	Credit 4.4	Low Emitting Materials, Composite Wood & Agrifiber Products (HPSB GP4)		1
	Credit 5	**Indoor Chemical & Pollutant Source Control**		1
	Credit 6.1	Controllability of Systems, Lighting (HPSB GP4)		1
	Credit 6.2	**Controllability of Systems,** Thermal Comfort		1
	Credit 7.1	Thermal Comfort, Design (HPSB GP4)		1
	Credit 7.2	**Thermal Comfort,** Verification		1
	Credit 8.1	Daylight & Views - Daylight 75% of Spaces (HPSB GP4)		1
	Credit 8.2	**Daylight & Views** - Views for 90% of Spaces		1
Innovation & Design Process				
Achievable Points	0		Possible Points	6
	Credit 1.1	**Innovation in Design 1.1**		1
			Select if ID 1.1 was for energy and/or water	
	Credit 1.2	**Innovation in Design 1.2**		1
			Select if ID 1.2 was for energy and/or water	
	Credit 1.3	**Innovation in Design 1.3**		1
			Select if ID 1.3 was for energy and/or water	
	Credit 1.4	**Innovation in Design 1.4**		1
			Select if ID 1.4 was for energy and/or water	
	Credit 1.5	**Innovation in Design 1.5**		1
			Select if ID 1.5 was for energy and/or water	
	Credit 2	**LEED® Accredited Professional**		1
Regional Priority Credits				
Achievable Points	0		Possible Points	4
	Credit 1.1	**Regional Priority 1.1**		1
			Select if RP 1.1 was for energy and/or water	
	Credit 1.2	**Regional Priority 1.2**		1
			Select if RP 1.2 was for energy and/or water	
	Credit 1.3	**Regional Priority 1.3**		1
			Select if RP 1.3 was for energy and/or water	
	Credit 1.4	**Regional Priority 1.4**		1
			Select if RP 1.4 was for energy and/or water	

LEED Project Totals (pre-certification estimates)		Possible Points 110
0	LEED® Credits Achievable	
0	LEED® Credits Maybe Achievable	
0	LEED® Credits Not Achievable	
	LEED® Energy and Water Credits Achievable (when pursuing LEED® Certification)	
Prerequisites Not Achieved	**LEED® Certification Level Achievable**	
N/A	**LEED® Horizontal Benchmark Level**	
N/A	**LEED® Utility Benchmark Level**	
N/A	**LEED® Industrial Benchmark Level**	

Air Force MILCON Sustainability Requirements Scoresheet

version LEED® 2009

Certified: 40-49 points, **Silver:** 50-59 points, **Gold:** 60-79 points, **Platinum:** 80-110

MILCON Sustainable Building Requirements Scoresheet Instructions	
Color Coding	
Green text	**LEED® Credits and/or Prerequisites that align closely with Federal High Performance Sustainable Buildings (HPSB) Requirements** These credits and/or prerequisites align closely with the associated HPSB Guiding Principle. They could be either more or less stringent or have different measurement metrics. In the case where one is more stringent than the other, achieving the more stringent one does not imply the less stringent is achieved.
Blue Text	**LEED® Credits and/or Prerequisites that meet Federal High Performance Sustainable Buildings (HPSB) Requirements** These credits and/or prerequisites have the same requirements as the associated HPSB Guiding Principle. This does not guarantee achieving the LEED Credit, as some documentation methods may vary.
Gray Text	**Recommended (Federal Requirement not fully defined at this time)**
Purple Text	**Summary Calculations fo LEED and HPSB Scores**
Light Orange Cell	Cell uses a drop down box for set values. User should select using the drop-down box.
Light Gray Cell	Cell is populated by other cells. User is not required to enter values.
White Cell	Cell is for custom entry of General Building Information. Boxes that appear when cell is selected give further instruction on entering data. Some cells restrict values that can be entered - which is explained if incorrectly entered
Light Blue Cell (When used, conditional formatting changes text to Green, Yellow, or Red depending on entry)	Cell uses a drop down box for LEED Prerequisites and allows for "Yes", "Maybe" and "No"
	Cell uses a drop down box and user is designating "Yes"
	Cell uses a drop down box and user is designating "Maybe"
	Cell uses a drop down box and user is designating "No"
Light Green Cell (When used, conditional formatting changes cell to Green, Yellow, or Red depending on entry)	Cell provides a drop-down box for the user to select which LEED Credits and HPSB Requirements that the project is attempting. When a "Yes", "Maybe", or "No" is selected the cell follows the stoplight convention to visually represent progress. The stoplight convention is also used for "Yes", "Maybe" or "No" totals. Some light green boxes also have an option for "N/A" when used for subquestions
	Cell uses a drop down box and user is designating "Yes" or "N/A" when applicable
	Cell uses a drop down box and user is designating "Maybe"
	Cell uses a drop down box and user is designating "No"
Dark Blue Cell, White Text	**LEED® Credits that meet USAF Energy & Water Criteria (may depend on technologies & strategies). The DoD Sustainable Buildings Policy and AF Sustainable Design and Development Memorandum require a minimum of 20 energy and water credits for all projects seeking LEED certification. SS Credits 7.1-7.2, WE Credits 1.1 - 3, EA Credits 1-3 and Credits 5-6, IEQ Credit 1 and Credit 8.1 are always energy and water projects according to AF policy. SS Credit 8 is an energy and water credit if the project uses Option 1 for Indoor Lighting. Innovation and Design and Regional Priority Credits must be specified as energy and water projects for inclusion.**
Light Yellow Cell	Cell is for custom entry on how the project is pursuing LEED Credits and HPSB requirements. These are subquestions.
Dark Gray Cell	Cell is for selections that does not count towards achieving HPSB status

High Performance Sustainable Building Requirements and LEED® 2009 References		Links
	The High Performance Sustainable Building Requirements (Dec 08) described below are also found on the FedCenter website:	High Performance Sustainable Building Guidance (Dec 08)
	For more information on LEED® Credits that meet or align closely with federal requirements as well as other credits a building can pursue towards the Silver certification level, review the LEED® New Construction and Major Renovations 2009 Rating System:	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
Color Code	**LEED® Credits and/or Prerequisites that align closely with Federal High Performance Sustainable Buildings (HPSB) Requirements** These credits and/or prerequisites align closely with the associated HPSB Guiding Principle. They could be either more or less stringent or have different measurement metrics. In the case where one is more stringent than the other, achieving the more stringent one does not imply the less stringent is achieved.	Air Force Sustainable Design and Development Policy Memorandum (July 2007)
	LEED® Credits and/or Prerequisites that meet Federal High Performance Sustainable Buildings (HPSB) Requirements These credits and/or prerequisites have the same requirements as the associated HPSB Guiding Principle. This does not guarantee achieving the LEED Credit, as some documentation methods may vary.	
	Recommended (Federal Requirement not fully defined at this time)	
	LEED® Credits that meet USAF Energy & Water Criteria (may depend on technologies & strategies). The DoD Sustainable Buildings Policy and AF Sustainable Design and Development Memorandum require a minimum of 20 energy and water credits for all projects seeking LEED certification. SS Credits 7.1-7.2, WE Credits 1.1 - 3, EA Credits 1-3 and Credits 5-6, IEQ Credit 1 and Credit 8.1 are always energy and water projects according to AF policy. SS Credit 8 is an energy and water credit if the project uses Option 1 for Indoor Lighting. Innovation and Design and Regional Priority Credits must be specified as energy and water projects for inclusion.	
	HPSB I: Employ Integrated Design Principles	
HPSB I.1: Integrated Design	Use a collaborative, integrated planning and design process that • Initiates and maintains an integrated project team as described on the Whole Building Design Guide in all stages of a project's planning and delivery, http://www.wbdg.org/design/engage_process.php • Integrates the use of OMB's A-11, Section 7, Exhibit 300: Capital Asset Plan and Business Case Summary • Establishes performance goals for siting, energy, water, materials, and indoor environmental quality along with other comprehensive design goals and ensures incorporation of these goals throughout the design and lifecycle of the building • Considers all stages of the building's lifecycle, including deconstruction.	HPSB Guidance
Requirement Source Document(s)	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	None	
HPSB I.2: Commissioning	Employ commissioning practices tailored to the size and complexity of the building and its system components in order to verify performance of building components and systems and help ensure that design requirements are met. This should include an experienced commissioning provider, inclusion of commissioning requirements in construction documents, a commissioning plan, verification of the installation and performance of systems to be commissioned, and a commissioning report.	HPSB Guidance
Requirement Source Document(s)	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	LEED EA Prerequisite 1: Fundamental Commissioning of Building Energy Systems LEED EA Credit 3: Enhanced Commissioning	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
LEED Credit(s) meet HPSB:	None	

High Performance Sustainable Building Requirements and LEED® 2009 References		Links
	HPSB II: Optimize Energy Performance	
HPSB II.1: Energy Efficiency.	For new construction, reduce the energy use by 30 percent compared to the baseline building performance rating per the American National Standards Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., (ASHRAE)/Illuminating Engineering Society of North America (IESNA) Standard 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential, except for the performance rating formula in G1.2, which should be used as follows (from 10 CFR 433.5): Percentage improvement = 100 x (Baseline building consumption—Proposed building consumption) ÷(Baseline building consumption—Receptacle and process loads). This differs from the LEED calculation. For major renovations, reduce the energy use by 20 percent below pre-renovations 2003 baseline. Laboratory spaces may use the Labs21 Laboratory Modeling Guidelines. ENERGY STAR qualified low-slope roofs (2:12 inches or less) have an intial solar reflectance greater than or equal to 0.65 and is greater than or equal to 0.50 three years after installation. Steep slope roofs (greater than 2:12 inches) have an intial sola	HPSB Guidance
Requirement Source Document(s)	10 CFR 433.5, Federal Leadership in High Performance and Sustainable Buildings MOU	GPO Access: 10 CFR 433.5
LEED Credit(s) aligns closely with HPSB:	LEED EA Prerequisite 2: Minimum Energy Performance LEED EA Credit 1: Optimize Energy Performance	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
LEED Credit(s) meet HPSB:	None	
HPSB II.2: Preferential use of ENERGY STAR or FEMP-designated equipment, when lifecycle cost effective	Use ENERGY STAR® and FEMP-designated Energy Efficient Products, where available.	HPSB Guidance
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	None	
HPSB II.3: On-site Renewable Energy - Solar Hot Water Heater System	Per the Energy Independence and Security Act (EISA) Section 523, meet at least 30% of the hot water demand through the installation of solar hot water heaters, when lifecycle cost effective.	HPSB Guidance
Requirement Source Document(s):	EISA Sec. 523, Federal Leadership in High Performance and Sustainable Buildings MOU	Energy Independence and Security Act of 2007
LEED Credit(s) aligns closely with HPSB:	LEED EA Credit 2: On-Site Renewable Energy	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
LEED Credit(s) meet HPSB:	None	
HPSB II.4: On-site Renewable Energy	Per Executive Order 13423, implement renewable energy generation projects on agency property for agency use, when lifecycle cost effective. Renewable energy types include: Geothermal, GSHP, Solar PV, Solar CP, Solar Thermal, Wind, Hydro, Daylighting, Waste to Energy.	HPSB Guidance
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	LEED EA Credit 2: On-Site Renewable Energy	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
LEED Credit(s) meet HPSB:	None	
HPSB II.5: Measurement and Verification - Advanced Metering	Per the Energy Policy Act of 2005 (EPAct) Section 103, install building level electricity meters in new major construction and renovation projects to track and continuously optimize performance. Per EISA Section 434, include equivalent meters for natural gas and steam, where natural gas and steam are used. Per A7C Memorandum, *DoD Facilities Metering Installation Initiative* (27 April 2006), all new construction should install potable water meters.	HPSB Guidance
Requirement Source Document(s):	EPAct 2005 Section 103, EISA 2007 Section 434, Federal Leadership in High Performance and Sustainable Buildings MOU	Energy Policy Act of 2005
LEED Credit(s) aligns closely with HPSB:	LEED EA Credit 5: Measurement and Verification	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
LEED Credit(s) meet HPSB:	None	

High Performance Sustainable Building Requirements and LEED® 2009 References		Links
HPSB II.6: Project Case Study Entered in High Performance Federal Buildings Database	As a recommendation, enter data and lessons learned from sustainable buildings into the High Performance Buildings Database.	HPSB MOU
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	http://femp.buildinggreen.com/
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	None	
EISA 2007 II.7: Reduction in fossil fuel-generated energy consumption	For new Federal buildings and Federal buildings undergoing major renovations…(I) The buildings shall be designed so that the fossil fuel generated energy consumption of the buildings is reduced, as compared with such energy consumption by a similar building in fiscal year 2003 (CBECS or RECS data from EIA), by the percentage specified...FY2010 (55%), 2015 (65%), 2020 (80%), 2025 (90%), and 2030 (100%). *The DOE Rulemaking is not yet complete*	Energy Independence and Security Act of 2007
Requirement Source Document(s):	EISA 2007, Sec. 433, (a)(D)(i)	
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	None	
EISA 2007 II.8: Data Center Energy Consumption	EISA 2007 Section 453 directs DOE and EPA to initiate a voluntary national information program for widely used data centers and data center equipment for which there is significant potential for energy savings. *The DOE/EPA guidance is not yet issued.*	Energy Independence and Security Act of 2007
Requirement Source Document(s):	EISA 2007, Sec. 453	
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	None	
	HPSB III: Protect and Conserve Water	
HPSB III.1: Indoor Water - 20% Reduction	Employ strategies that in aggregate use a minimum of 20 percent less potable water than the indoor water use baseline calculated for the building, after meeting the EPAct 1992, Uniform Plumbing Codes 2006, and the International Plumbing Codes 2006 fixture performance requirements. The installation of water meters is encouraged to allow for the management of water use during occupancy. The use of harvested rainwater, treated wastewater, and air conditioner condensate should also be considered and used where feasible for nonpotable use and potable use where allowed.	HPSB Guidance
Requirement Source Document(s):	EPAct 1992, Federal Leadership in High Performance and Sustainable Buildings MOU	THOMAS EPAct 1992
LEED Credit(s) aligns closely with HPSB:	LEED WE Credit 3: Water Use Reduction - Reduce by 30% (3.1), 35% (3.2), 40% (3.3)	
LEED Credit(s) meet HPSB:	LEED WE Prerequisite 1: Water Use Reduction - 20% Reduction	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
HPSB III.2: Outdoor Water - Reduce Potable Water Use by 50%	Use water efficient landscape and irrigation strategies, such as water reuse, recycling, and the use of harvested rainwater, to reduce outdoor potable water consumption by a minimum of 50 percent over that consumed by conventional means (plant species and plant densities). The installation of water meters for locations with significant outdoor water use is encouraged.	HPSB Guidance
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	LEED WE Credit 1.2: Water Efficient Landscaping - No Potable Water Use or Irrigation	
LEED Credit(s) meet HPSB:	LEED WE Credit 1.1: Water Efficient Landscaping - Reduce by 50%	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
HPSB III.3: Outdoor Water - Stormwater runoff	Employ design and construction strategies that reduce storm water runoff and discharges of polluted water offsite.	HPSB Guidance
Requirement Source Document(s):	AF ETL 03-1, Federal Leadership in High Performance and Sustainable Buildings MOU	Engineering Technical Letter (ETL) 03-1 - Stormwater Construction Standards
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	LEED SS Prerequisite 1: Construction Activity Pollution Prevention	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008

High Performance Sustainable Building Requirements and LEED® 2009 References		Links
HPSB III.4: Outdoor Water - Achieve Pre-Development Hydrology when technically feasible, when disturbance > 5,000 GSF	Per EISA Section 438, to the maximum extent technically feasible, maintain or restore the predevelopment hydrology of the site with regard to temperature, rate, volume, and duration of flow using site planning, design, construction, and maintenance strategies.	HPSB Guidance
Requirement Source Document(s):	OUSD Memo 19 Jan 2010, EISA 2007 Sec 438, Federal Leadership in High Performance and Sustainable Buildings MOU	OUSD Memo EISA Section 438
LEED Credit(s) aligns closely with HPSB:	LEED SS Credit 6.1: Stormwater Design - Quantity Control LEED SS Credit 6.2: Stormwater Design - Quality Control	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
LEED Credit(s) meet HPSB:		
HPSB III.5: Process water - potable water use	Per the Energy Policy Act of 2005 Section 109, when potable water is used to improve a building's energy efficiency, deploy lifecycle cost effective water conservation measures.	HPSB Guidance
Requirement Source Document(s):	EPAct 2005, Sec. 109, Federal Leadership in High Performance and Sustainable Buildings MOU	Energy Policy Act of 2005
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	None	
HPSB III.6: Water-Efficient Products	Specify EPA's WaterSense-labeled products or other water conserving products, where available.	HPSB Guidance
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	None	
HPSB III.7: Water Efficient Products - Irrigation Contractors	Choose irrigation contractors who are certified through a WaterSense labeled program.	HPSB Guidance
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	None	
	HPSB IV: Enhance Indoor Environmental Quality	
HPSB IV.1: Thermal Comfort, ASHRAE 55-2004	Meet ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy, including continuous humidity control within established ranges per climate zone.	HPSB Guidance
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	LEED EQ Credit 7: Thermal Comfort - Design	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
HPSB IV.2: Ventilation: ASHRAE 62.1-2007	Meet ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality.	HPSB Guidance
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	LEED EQ Prerequisite 1: Minimum Indoor Air Quality Performance	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
HPSB IV.3: Moisture Control	Establish and implement a moisture control strategy for controlling moisture flows and condensation to prevent building damage, minimize mold contamination, and reduce health risks related to moisture.	HPSB Guidance
Requirement Source Document(s):	ETL 04-3: Design Criteria for Prevention of Mold in Air Force Facilities (Achieves HPSB GP4, Moisture Control), Federal Leadership in High Performance and Sustainable Buildings MOU	AF ETL 04-3
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	None	
HPSB IV.4: Daylighting - 75% of Spaces	Achieve a minimum daylight factor of 2 percent (excluding all direct sunlight penetration) in 75 percent of all space occupied for critical visual tasks.	HPSB Guidance
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	LEED EQ Credit 8.1: Daylight and Views - Daylight	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
LEED Credit(s) meet HPSB:	None	

High Performance Sustainable Building Requirements and LEED® 2009 References		Links
HPSB IV.5: Daylighting - Controllability of Systems	Provide automatic dimming controls or accessible manual lighting controls, and appropriate glare control.	HPSB Guidance
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	LEED EQ Credit 6.1: Controllability of Systems - Lighting	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
LEED Credit(s) meet HPSB:	None	
HPSB IV.6: Low Emitting Materials	Specify materials and products with low pollutant emissions, including composite wood products, adhesives, sealants, interior paints and finishes, carpet systems, and furnishings.	HPSB Guidance
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	LEED EQ Credits 4.1-4.4: Low-Emitting Materials - Adhesives and Sealants (4.1), Paints and Coatings (4.2), Flooring Systems (4.3), and Composite Wood and Agrifiber Products (4.4)	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
LEED Credit(s) meet HPSB:	None	
HPSB IV.7: Protect Indoor Air Quality during Construction	Follow the recommended approach of the Sheet Metal and Air Conditioning Contractor's National Association Indoor Air Quality Guidelines for Occupied Buildings under Construction, 2007.	HPSB Guidance
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	LEED EQ Credit 3.1: Construction Indoor Air Quality Management Plan - During Occupancy	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
LEED Credit(s) meet HPSB:	None	
HPSB IV.8: Protect Indoor Air Quality after Construction	After construction and prior to occupancy, conduct a minimum 72-hour flush-out with maximum outdoor air consistent with achieving relative humidity no greater than 60 percent. After occupancy, continue flush-out as necessary to minimize exposure to contaminants from new building materials.	HPSB Guidance
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	LEED EQ Credit 3.2: Construction Indoor Air Quality Management Plan - Before Occupancy	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
LEED Credit(s) meet HPSB:	None	
HPSB IV.9: Environmental Tobacco Smoke (ETS) Control	Implement a policy and post signage indicating that smoking is prohibited within the building and within 25 feet of all building entrances, operable windows, and building ventilation intakes during building occupancy.	HPSB Guidance
Requirement Source Document(s):	GSA Federal Register: December 22, 2008 (Volume 73, Number 246), Federal Leadership in High Performance and Sustainable Buildings MOU	Federal Register - Protecting Federal Employees from Environmental Tobacco Smoke
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	LEED EQ Prerequisite 2: Environmental Tobacco Smoke (ETS) Control	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
	HPSB V: Reduce Environmental Impact of Materials	
HPSB V.1: Recycled Content	Per Section 6002 of the Resource Conservation and Recovery Act (RCRA), for EPA-designated products, specify products meeting or exceeding EPA's recycled content recommendations. For other products, specify materials with recycled content when practicable. If EPA-designated products meet performance requirements and are available at a reasonable cost, a preference for purchasing them shall be included in all solicitations relevant to construction, operation, maintenance of or use in the building.	EPA's Comprehensive Procurement Guideline Website
Requirement Source Document(s):	RCRA 2002, Sec 6002, Federal Leadership in High Performance and Sustainable Buildings MOU	RCRA 2002
LEED Credit(s) aligns closely with HPSB:	LEED MR Credit 4.1-4.2: Recycled Content - 10% of Content (4.1), 20% of Content (4.2)	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
LEED Credit(s) meet HPSB:	None	

High Performance Sustainable Building Requirements and LEED® 2009 References		Links
HPSB V.2: Biobased Content	Per Section 9002 of the Farm Security and Rural Investment Act (FSRIA), for USDA-designated products, specify products with the highest content level per USDA's biobased content recommendations. For other products, specify biobased products made from rapidly renewable resources and certified sustainable wood products. If these designated products meet performance requirements and are available at a reasonable cost, a preference for purchasing them shall be included in all solicitations relevant to construction, operation, maintenance of or use in the building.	USDA's Biopreferred Website
Requirement Source Document(s):	FSRIA 2002 Section 9002, Federal Leadership in High Performance and Sustainable Buildings MOU	FSRIA 2002
LEED Credit(s) aligns closely with HPSB:	LEED MR Credit 6: Rapidly Renewable Materials LEED MR Credit 7: Certified Wood	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
LEED Credit(s) meet HPSB:	None	
HPSB V.3: Environmentally Preferable Products	Use products that have a lesser or reduced effect on human health and the environment over their lifecycle when compared with competing products or services that serve the same purpose. A number of standards and ecolabels are available in the marketplace to assist specifiers in making environmentally preferable decisions.	WBDG Federal Green Construction Guide
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	None	
HPSB V.4: Waste and Materials Management - Recycling	Incorporate adequate space, equipment, and transport accommodations for recycling in the building design.	HPSB Guidance
Requirement Source Document(s):	EO 13423, Sec 2(e), Federal Leadership in High Performance and Sustainable Buildings MOU	Executive Order 13423
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	LEED MR Prerequisite 1: Storage and Collection of Recyclables	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
HPSB V.5: Waste and Materials Management, Divert 50% from Disposal	During a project's planning stage, identify local recycling and salvage operations that could process site-related construction and demolition materials. Provide salvage, reuse and recycling services for waste generated from major renovations, where markets or onsite recycling opportunities exist. During construction, recycle or salvage at least 50 percent of the non-hazardous construction, demolition and land clearing materials, excluding soil, where markets or onsite recycling opportunities exist.	HPSB Guidance
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	None	
LEED Credit(s) meet HPSB:	LEED MR Credit 2.1: Construction Waste Management	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
HPSB V.6: Ozone Depleting Compounds	Eliminate the use of ozone depleting compounds during and after construction where alternative environmentally preferable products are available, consistent with either the Montreal Protocol and Title VI of the Clean Air Act Amendments of 1990, or equivalent overall air quality benefits that take into account lifecycle impacts.	HPSB Guidance
Requirement Source Document(s):	Federal Leadership in High Performance and Sustainable Buildings MOU	
LEED Credit(s) aligns closely with HPSB:	LEED EA Credit 4: Enhanced Refrigerant Management	LEED(R) for New Construction & Major Renovations 2009 - Nov 2008
LEED Credit(s) meet HPSB:	LEED EA Prerequisite 3: Fundamental Refrigerant Management	

ATTACHMENT 4

APPLYING LEED™ 2009, NC PRINCIPLES TO AIR FORCE HORIZONTAL CONSTRUCTION*

Project Checklist

Sustainable Sites		6 Possible Points
Prereq 1	Construction Activity Pollution Prevention	Required
Credit 1	Site Selection	1
Credit 3	Brownfield Redevelopment	1
Credit 5.1	Site Development - Protect or Restore Habitat	1
Credit 6.1	Stormwater Design - Quantity Control	1
Credit 6.2	Stormwater Design - Quality Control	1
Credit 8	Light Pollution Reduction	1
Water Efficiency		4 Possible Points
Credit 1	Water Efficient Landscaping	2-4
Materials & Resources		8 Possible Points
Credit 2	Construction Waste Management	1-2
Credit 3	Materials Reuse	1-2
Credit 4	Recycled Content	1-2
Credit 5	Regional Materials	1-2
Innovation & Design Process		6 Possible Points
Credit 1.1	Innovation in Design	1
Credit 1.2	Innovation in Design	1
Credit 1.3	Innovation in Design	1
Credit 1.4	Innovation in Design	1
Credit 1.5	Innovation in Design	1
Credit 2	LEED Accredited Professional	1
Regional Priority		4 Possible Points
Credit 1.1	Regional Priority	1
Credit 1.2	Regional Priority	1
Credit 1.3	Regional Priority	1
Credit 1.4	Regional Priority	1
Project Totals		28 Possible Points

* Projects may pursue other LEED 2009, NC credits, not listed, towards meeting benchmark.

APPLYING LEED™ 2009, NC PRINCIPLES TO AIR FORCE HORIZONTAL CONSTRUCTION

MET BENCHMARK LEVELS

Certified	7 - 8 points
Silver	9 - 10 points
Gold	11 - 13 points
Platinum	14 - 28 points

ATTACHMENT 5

APPLYING LEED™ 2009, NC PRINCIPLES TO AIR FORCE UTILITY CONSTRUCTION*

Project Checklist

Sustainable Sites		7 Possible Points
Prereq 1	Construction Activity Pollution Prevention	Required
Credit 1	Site Selection	1
Credit 3	Brownfield Redevelopment	1
Credit 5.1	Site Development - Protect or Restore Habitat	1
Credit 5.2	Site Development - Maximize Open Space	1
Credit 6.1	Stormwater Design - Quantity Control	1
Credit 6.2	Stormwater Design - Quality Control	1
Credit 8	Light Pollution Reduction	1
Water Efficiency		4 Possible Points
Credit 1	Water Efficient Landscaping	2-4
Materials & Resources		2 Possible Points
Credit 2	Construction Waste Management	1-2
Innovation & Design Process		6 Possible Points
Credit 1.1	Innovation in Design	1
Credit 1.2	Innovation in Design	1
Credit 1.3	Innovation in Design	1
Credit 1.4	Innovation in Design	1
Credit 1.5	Innovation in Design	1
Credit 2	LEED Accredited Professional	1
Regional Priority		4 Possible Points
Credit 1.1	Regional Priority	1
Credit 1.2	Regional Priority	1
Credit 1.3	Regional Priority	1
Credit 1.4	Regional Priority	1
Project Totals		23 Possible Points

* Projects may pursue other LEED 2009, NC credits, not listed, towards meeting benchmark.

APPLYING LEED™ 2009, NC PRINCIPLES TO AIR FORCE UTILITY CONSTRUCTION

MET BENCHMARK LEVELS

Certified	5 – 6 points
Silver	7 – 8 points
Gold	9 – 10 points
Platinum	11 – 23 points

ATTACHMENT 6

APPLYING LEED™ 2009, NC PRINCIPLES TO AIR FORCE INDUSTRIAL FACILITIES*

Project Checklist

Sustainable Sites		15 Possible Points
Prereq 1	Construction Activity Pollution Prevention	Required
Credit 1	Site Selection	1
Credit 3	Brownfield Redevelopment	1
Credit 4.2	Alternative Transportation - Bicycle Storage & Changing Rm	1
Credit 4.3	Alternative Transportation - Low Emitting & Fuel Efficient Vehicles	3
Credit 4.4	Alternative Transportation - Parking Capacity	2
Credit 5.1	Site Development - Protect or Restore Habitat	1
Credit 5.2	Site Development: Maximize Open Space	1
Credit 6.1	Stormwater Design - Quantity Control	1
Credit 6.2	Stormwater Design - Quality Control	1
Credit 7.1	Heat Island Effect - Non-Roof	1
Credit 7.2	Heat Island Effect - Roof	1
Credit 8	Light Pollution Reduction	1

Water Efficiency		10 Possible Points
Prereq	Water Use Reduction – 20% Reduction	Required
Credit 1	Water Efficient Landscaping	2-4
Credit 2	Innovative Wastewater Technologies	2
Credit 3	Water Use Reduction	2-4

Energy and Atmosphere		26 Possible Points
Prereq 1	Fundamental Commissioning of Building Energy Systems	Required
Prereq 2	Minimum Energy Performance	Required
Prereq 3	Fundamental Refrigerant Management	Required
Credit 1	Optimize Energy Performance	1-10
Credit 2	On-Site Renewable Energy	1-7
Credit 3	Enhanced Commissioning	2
Credit 4	Enhanced Refrigerant Management	2
Credit 5	Measurement & Verification	3
Credit 6	Green power	2

Materials & Resources		14 Possible Points
Prereq 1	Storage & Collection of Recyclables	Required
Credit 1.1	Building Reuse - Maintain Existing Walls, Floor & Roof	1-3
Credit 1.2	Building Reuse - Maintain 50% Interior Non-Structural	

	Elements	1
Credit 2	Construction Waste Management	1-2
Credit 3	Materials Reuse	1-2
Credit 4	Recycled Content	1-2
Credit 5	Regional Materials	1-2
Credit 6	Rapidly Renewable Materials	1
Credit 7	Certified Wood	1

Indoor Environmental Quality		10 Possible Points
Prereq 1	Minimum IAQ Performance	Required
Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
Credit 1	Outdoor Air Delivery Monitoring	1
Credit 2	Increased Ventilation	1
Credit 3.1	Construction IAQ Management Plan - During Occupancy	1
Credit 3.2	Construction IAQ Management Plan - Before Occupancy	1
Credit 4.1	Low-Emitting Materials - Adhesives & Sealants	1
Credit 4.2	Low-Emitting Materials - Paints & Coatings	1
Credit 4.3	Low-Emitting Materials - Carpet Systems	1
Credit 4.4	Low-Emitting Materials - Composite Wood & Agrifiber Products	1
Credit 5	Indoor Chemical & Pollutant Source Control	1
Credit 8.1	Daylight & Views – Daylight	1

Innovation & Design Process		6 Possible Points
Credit 1.1	Innovation in Design	1
Credit 1.2	Innovation in Design	1
Credit 1.3	Innovation in Design	1
Credit 1.4	Innovation in Design	1
Credit 1.5	Innovation in Design	1
Credit 2	LEED Accredited Professional	1

Regional Priority		4 Possible Points
Credit 1.1	Regional Priority	1
Credit 1.2	Regional Priority	1
Credit 1.3	Regional Priority	1
Credit 1.4	Regional Priority	1

Project Totals	85 Possible Points

* Projects may pursue other LEED2009, NC credits, not listed, towards meeting benchmark.

APPLYING LEED™ 2009, NC PRINCIPLES TO AIR FORCE INDUSTRIAL FACILITIES

MET BENCHMARK LEVELS

Certified	30 - 37 points
Silver	38 - 44 points
Gold	45 - 59 points
Platinum	60 - 85 points

Attachment 7 - Implementing Guidance to Meet EISA 2007 Section 438 Requirements

Applicability. This guidance applies to projects that construct facilities with a footprint greater than 5,000 gross square feet, or expand the footprint of existing facilities by more than 5,000 gross square feet (See DoD policy memorandum, 19 Jan 2010, Subject: DoD Implementation of Storm Water requirements under Section 438 of the Energy Independence and Security Act (EISA) for details). If any DoD or other federal agency has an applicable construction project on Air Force installations, they will comply with this guidance. Air Force overseas installations and activities will strive to achieve Low Impact Development (LID) approaches consistent with applicable host nation requirements and in accordance with the host nation Final Governing Standards (FGS), Overseas Environmental Baseline Guidance Document (OEBGD) or applicable international agreements, e.g., Staus of Force Agreements.

Estimating pre- and post-development hydrologic parameters. Air Force planners and designers and Construction Agents use standard engineering practices to estimate development hydrologic parameters. Unified Facilities Criteria 3-230-01 1 Aug 2006, Surface Drainage Design reviews three methods appropriate to the scope of EISA 2007 Section 438 compliance. These are: 1) the rational method, 2) National Resource Conservation Service (formerly Soil Conservation Service) technical release 55 (TR-55) method, and 3) the U.S. Geological Survey (USGS) regression equations. Planners and designers should choose a method that is practical and appropriate to the scope of the project. For example, watershed continuous models like EPA's BASINS and HSPF would not typically be appropriate.

Maximum Extent Technically Feasible (METF). Restoring predevelopment hydrology can be difficult to achieve and Congress recognized this potential difficulty by including the METF language in the statute. For projects where technical infeasibility exists, document and quantify that storm water strategies, such as infiltration, evapotranspiration, and harvesting were employed to the METF. If the design objective cannot be met within in the project footprint, LID measures may be applied at nearby locations on DoD property (e.g., downstream from the project) within available resources. The land surrounding the project site is available to implement the appropriate Green Infrastructure (GI)/LID practices where optimal. Although the performance requirements of EISA Section 438 apply only to the project footprint, the flexibility exists to utilize the entire federal property in implementing the storm water strategies for the project.

Documentation: All site-specific technical constraints that limit the full attainment of the design objective shall be documented and retained in the project record. Documentation of technical infeasibility should include, but may not be limited to, engineering calculations, geologic reports, hydrologic analyses, and site maps. The installation construction project engineer validates the designer has met METF.

Retention / Detention Ponds. Any construction of permanent retention or detention ponds is strongly discouraged. If retention/ detention option is selected, written documentation for options considered and justification for the choice should be included in the design analysis, Additionally Bird Aircraft Strike Hazard (BASH) as well as other storm water management, maintenance and real property issues should be addressed. Where cost effective and allowed, LID measures should consider on site reuse of storm water for landscape/irrigation purpose to meet the water conservation requirements of EO 13514.

Post-construction analysis: Installations verify the effectiveness of as-built storm water features by periodic site visits to document the storm water LID systems and practices are functioning as intended.

INSTRUCTIONS FOR ACES-PM INPUTS FOR EISA 2007 SECTION 438

In the unique field of an applicable project input the words “EISA 438.” In the Value field input one of the following:

Unique Field Value Input	Definition
YES	This project is a federal project with a footprint greater than 5,000 SF and **can** demonstrate with documentation the project maintains or restores, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow. Alternatively the installation may report project compliance with this metric by reporting completion of an installation-wide stormwater management hydrology evaluation that defines the installation pre-development condition and demonstrates through established hydrology methods and tools the post-development parameters of temperature, rate, volume and duration of storm water flow do not exceed pre-development parameters at the federal property boundary to the maximum extent technically feasible.
NO	This project is a federal project with a footprint greater than 5,000 SF and **cannot** demonstrate with documentation that storm water design objectives were met through practices that infiltrate, evapotranspire and/or harvest and use the rainfall to the maximum extent technically feasible.

If a project is not applicable to EISA 2007 Section 438 no Unique Field data inputs are required.