

### 100% Package #3 – Architectural Design Analysis

#### **General Parameters:**

##### **1. Purpose, Function and Capabilities**

This project is intended to provide new, quality housing for families at Eielson Air Force Base, (AFB) Alaska. There will be a total of 100 housing units at the Galaxy Heights neighborhood and 29 housing units at the Ravenswood neighborhood. The housing units are grouped together as townhomes in combinations of three or four units each. There are a total of 5 different unit variations, ranging in size and number of bedrooms designated for either JNCO or CGO occupancies. In addition, there is a variation of the four-bedroom unit types that has been designed to be capable of converting to fully accessible units.

This housing project has been designed to achieve a rating of LEED Silver per the U.S. Green Building Council's "LEED for Homes" criteria.

#### **Design Objectives and Provisions:**

##### **1. Buildings - Composition of Masses and Spaces; Architectural Details**

All of the unit plans share a similar layout based on the necessity of design and constructability. The Eielson AFB Architectural Compatibility Plan (ACP) has been utilized in the development of our designs. Our design provides for interior spaces that in all cases exceed the Benchmark areas defined in the AFFHG.

We have attempted to design a sense of ownership and pride at each home. Clear and pleasant entries are provided at each unit, and by designing buildings with no more than four units per building, and articulating each building facade with staggered residential units we allow for each home to have a clearly marked individual entry.

Each set of four town homes is grouped into pairs that are offset to reduce the visual impact of multiple units repeating on the streetscape. We have used architectural treatments such as gable roofs, and floor offsets to create variation and undulation in the façade of these buildings. At all elevations, there are bump outs for rooms, garages, porches, etc. This will create a multitude of shadow lines and visual interest.

##### **2. Entries**

Clearly identifiable, welcoming entries that are a minimum of four feet deep highlight each unit. We understand that residents enjoy personalizing and adding individual touches to their homes. By having an entry porch, we allow for the opportunity to place welcoming items and personal elements such as plants, chairs or the American flag while keeping the overall appearances of the street clean, pleasant and inviting.

Because of the unique conditions of the Alaska environment, each home is provided with an Arctic Entry. This room allows for not only energy conservation by reducing the heat loss in the home when entering/exiting, but it's a welcoming threshold to residents and their guests with ample space to kick off shoes and hang wet/snow covered jackets or throw down a back pack when kids come home from school. By not tracking dirt and water into the house it is making the home much easier to maintain.

### **3. Interior Design and Layout**

Once one passes through the Arctic Entry, it is clear that the common areas of the home are straight ahead on the first floor. Living spaces, including the main Living, Family and Dining areas or Great Room incorporate an open plan concept, where the feeling is generous and family friendly and also take advantage of natural light.

A hallway leads to the large open living areas of either the Great Room or Living, Family and Dining Rooms. A common bathroom is provided near the entry at the bottom of the stairs and meets the requirements of not having a visual line of sight from the living areas of the home.

If the residents are entering the home from the garage, which is very likely after parking the car, the plan is organized such that they enter through a Mud Room and can readily remove wet/dirty shoes and jackets, the same as at the Arctic Entry. Conveniently, they will be able to immediately set down groceries or other heavy loads in the kitchen upon arrival home.

Kitchens possess a unique magnetism that draw people to them as the focal point for entertaining guests and family functions. Our kitchens are designed and located such that they can function as the center of the home; spatially and socially serving the Dining Room while also providing snacks or pizza into the Great Room during the big game or movie night. The work triangle has been carefully designed for practical use. Generous countertop space is provided adjacent to the refrigerator to unload groceries bags or to retrieve ingredients for the evening meal. The dishwasher is located right next to the sink so that dirty dishes can be loaded directly into the dish washer without tracking drips across the floor. Lazy-Suzan type corner cabinets help make the kitchen complete along with a raised breakfast counter for informal dining or a quick breakfast before the kids need to catch the bus. Additional storage is provided by way of a closet type pantry that opens directly into the kitchen for quick and convenient access.

Upstairs, on the second floor, are the private areas of the home. This includes the bedrooms, bathroom(s), and Arctic Room and Laundry Room. The bedrooms are all designed to meet or exceed the benchmark requirements for room and closet size. All rooms are organized to have windows either to the front or rear of the house for good natural daylight. Where there is a Master Bathroom or a shared single upstairs bathroom, it has been provided with a double vanity to avoid hectic mornings with parents and kids competing for sink space. In the CGO-2 bedroom unit where the bathroom upstairs is shared by parent and children, access is granted directly from both the Master Bedroom and from the hallway. A door between the sinks and the toilet/shower area is added to allow for increased usability and personal privacy.

The large Arctic Room can be used as the family desires for a kids play room, a quiet retreat for the parents, an entertainment/game room, an office, or any other number of uses the family may desire.

The Laundry Room is on the second floor so that it is convenient to the bedrooms, avoiding the need to carry loads of laundry up and down the stairs through the more common areas of the home.

### **4. Storage**

Generous exterior bulk storage has been provided within the garage in addition to a work bench and space for a chest freezer. Exterior bulk storage is also provided at the rear of the building adjacent to the patio for convenient storage of a mower, yard toys and patio furniture.

### **5. Accessibility for Handicapped**

This project includes two separate JNCO-4 and CGO-4 floor plans with the necessary design elements to be adapted for full accessibility if necessary. This includes blocking for grab bars,

removable base cabinets, stair climber, etc. In addition, our design for these units includes enlarged spaces for wheelchair access and circulation space.

## **6. Color Schemes**

**Exterior:** Each building offers an opportunity to present a variety of color schemes that will help define the homes. At the same time, in order to emphasize a common neighborhood feel, a shared architectural language of the porches and unifying white trim for windows, eaves and fascias gives an assemblage of buildings that belong together as a neighborhood. By varying the application of the colors on each building, it will help break up the scale of the townhomes and provide visual variety and interest. In addition, the use of varying textures is used to manipulate the scale of each façade.

We have conceived of four different color schemes that will be used to provide each unit of each building its own color design. All four color schemes would therefore be applied to each building. The order in which the schemes are applied would vary however in order to create an array of different patterns for each building.

**Interiors:** The interior materials have been chosen for durability and ease of maintenance, but also are overall pleasing to the eye. The feeling of “home” is carried through each unit through the use of materials and colors.

The first floor will have the rich look of hardwood and stone floors, while the second floor, where the bedrooms are located, will have the warm texture of plush carpet. The sensation of granite and marble counter tops in the kitchens and baths will add to the impression of dignity and distinction. Most of all, we have designed everything to have warm colors on the walls and ceilings to surround you and make you feel comfortable in your home.

## **7. Sustainability/LEED**

Having evaluated the requirements of the USGBC LEED for Homes criteria, our design and intended construction practices will meet the points necessary for LEED Silver. Refer to the LEED for Homes Checklist Exhibit at the end of this section. Examples of potential LEED points include:

- Building locations avoid sensitive areas
- Housing density of 7 units/acre or more
- Minimize disturbing mature trees and other similar areas of the site
- Windows that meet the insulation values and provide adequate natural daylight
- Durable materials
- Meet or exceed insulation requirements
- Energy efficient appliances
- High efficiency plumbing fixtures
- Efficient HVAC systems, including sealed ducts and air filtration/HRV systems
- Energy efficient lighting
- Storm water managed by natural absorption

## **Types of Construction Materials, Architectural Systems and Finishes**

Every effort has been taken to build economical housing that is also attractive and durable. Local building materials and suppliers will be used where possible.

## **1. Wall Construction**

The houses will be of typical wood framed construction, utilizing panelized walls that not only help speed up the construction in the field but reduce construction waste; one of the requirements to achieve a LEED Silver rating.

The walls of these units are designed for optimum durability, sound and insulation control. Proposed construction for wall and floor assemblies complies with minimum FSTC requirements. The structural system has been coordinated to meet the functional requirements of the building, such as accommodating the routing of piping, ductwork and electrical panels.

Careful attention has been given to provide a complete envelope of the interiors with a vapor barrier for vapor migration control. In addition, all attic spaces are well ventilated, including where lower roof section abuts second floor walls and at over framed locations.

See Sheet A1.500 for the exterior wall assemblies and party wall construction. These sections demonstrate the effort to provide proper insulation for thermal and acoustic properties.

## **2. Foundation**

These homes will be built with concrete slab foundations on NFS fill so that there will be minimal settlement requirements.

The foundation design includes an arctic insulated frost protected shallow foundation system with minimum R20 perimeter insulation and R10 underslab insulation which provides improved performance for the hydronic in-slab radiant heating system.

## **3. Roofing Systems**

We have designed the roofing system with the Eielson AFB arctic conditions in mind. Trusses utilize an arctic heel for complete and uniform attic insulation along the eave line has been provided. Roofs slopes are primarily designed at 4:12 with the exception of front shed roof which is at 3-1/2:12 in compliance with AFFHG minimums. Three tab shingles are provided with appropriate flashings and ice and water shield for a complete weather tight roof system. All ridge lines including projecting gables are ventilated with ridge vents. Decorative full or half moon type gable end vents supplement the venting volume in addition to the flow-through venting provided along the eave. Eaves and the rake are concealed by a perforated soffit. The perforated soffit is blanked off directly above any dryer or kitchen exhaust caps. This combination of venting will meet or exceed the 1/150 attic venting area requirements necessary to mitigate conditions which cause ice damming and eave glaciation. Gutters and downspouts have been included for all eaves at the first floor roof.

The roof includes either batt or blown insulation with a minimum assembly of R49. Typical provisions for carefully installed and sealed air and/or vapor retarders are included in the wall, roof and foundation design.

## **4. Sound and Vibration Control**

Sound and vibration control is achieved through sturdy construction and sound batt insulation at key area of the units. A double party wall is used between all townhouse units with 3-1/2" sound batts on both sides and a 2-1/2" air gap. A significant portion of the interior wall of each unit are also provided with sound batt insulation, including the living room, dining room, kitchen, family room, bedrooms bath, mudroom, laundry room utility areas and areas adjacent to the garage. The floor space above the garage will also receive sound insulation.

## 5. Interiors

The interior schemes are durable and easy to maintain. In addition, they were chosen to be warm, comfortable and pleasing to the eye. The comforting feeling of “home” is carried out in the units with plush carpet, wood cabinets, and natural daylight.

Durable materials include vinyl flooring, plastic laminate countertops and hardwood cabinets. Like most vinyl flooring options, our materials selections are easy to maintain, affordable and also stylish. We have also chosen wood cabinet and trim finishes that compliment the flooring selections.

Interior doors will be solid wood stile and rail doors with heavy-duty door hardware and solid wood trim.

## 6. Exterior

Materials feature insulated vinyl siding, vinyl windows and shutters, field finished insulated metal doors, asphalt roofing shingles and pre-finished metal trim and flashings.

## 7. Equipment furniture and furnishings

**Furnished by Contractor, Installed by Contractor:** The contractor will provide each housing unit with heating, ventilation and plumbing equipment as required by the RFP. In addition, each unit will be provided with a refrigerator, dishwasher, electric range and oven, range hood, washer & dryers, microwave and in-sink garbage disposal.

Each unit has its own Utility and Electrical room that is integrated into the building design.

### **100% Package #3 – Structural Design Analysis**

The structural system for the housing units consist of conventional wood-framed construction supported on concrete thickened slab footings. The second floors are framed with engineered wood I-joists and a combination of glulams and engineered wood beams all supported with wood bearing walls and built up columns. The roof is framed with pre-engineered wood trusses supported by wood bearing walls. Lateral wind and seismic forces will be resisted by a wood sheathed 2<sup>nd</sup> floor and roof diaphragm that distributes the lateral loads to wood sheathed shear walls. The shear walls subsequently transfer the loads to the concrete foundation system.

#### Wall System

Exterior stud walls of the housing units will be constructed of 2x8 Douglas Fir or Hem Fir #2 studs at 24" on center, interior walls are 2x4 and 2x6. The exterior walls will be sheathed with 7/16" APA rated plywood or oriented strand board and are anchored to the foundation to transfer lateral shear forces into the foundation and to the ground.

#### Roof Framing System

The roof framing system for the housing units will consist of pre-engineered wood trusses at 24" on center. The roof is to be sheathed with 19/32" APA rated exterior grade plywood.

#### Code Requirements

In accordance with the RFP requirements, the housing units will be designed for the following code criteria:

##### Wind Loads

Wind loads per ASCE 7 as adopted by the 2006 IBC  
Basic wind speed = 90 mph  
Exposure = C  
Importance factor = 1.0

##### Seismic Loads

Seismic loads per ASCE 7 as adopted by the 2006 IBC  
Site class = D  
Seismic design category = D  
Occupancy category = II  
Importance factor = 1.0  
S<sub>s</sub> = 1.062  
S<sub>1</sub> = 0.296  
Seismic dead load includes 20% of the uniform roof snow load

##### Snow Loads

Snow loads per ASCE 7 as adopted by the 2006 IBC  
Minimum uniform roof snow load = 50 psf

Ground snow load = 60 psf  
Drifting and unbalanced snow loading per ASCE 7

Live Loads  
40psf for 2<sup>nd</sup> floor

Dead Loads  
Actual weights

## MECHANICAL DESIGN ANALYSIS

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Demolition & Construction  
Military Family Housing Units  
Eielson A.F.B., Alaska  
FA8903-06-D-8505  
Task Order No. 15

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### **100% Design Package # 3, Eielson Family Housing Mechanical Systems**

#### **General:**

The project consist of the construction of replacement housing units for the Galaxy Heights and Ravens Wood subdivisions on Eielson Air Force Base.

#### **Utilities:**

The project served by high pressure steam as a heating medium. 85 psig steam is delivered to a central mechanical building at Galaxy Heights and to smaller mechanical rooms at Ravens Wood, where it is reduced to 15 psig and used to generate a 180 deg. F. heating solution of 50/50 propylene glycol. This glycol solution is then distributed to each unit and provides heat and domestic hot water.

#### *Steam Line Sizing:*

The criteria for sizing the steam line was to provide sufficient steam to the mechanical room at a maximum of velocity of 12,000 feet per minute and a minimum pressure drop of 2 psi per 100 feet. A gross heat loss calculation was done for each type of unit then a spread sheet was developed to summarize the heating and domestic hot water load for each block. A heat exchanger was selected to provide this heat and the steam load was determined based on the requirements of the heat exchanger. Attached is the heat loss calculations (by unit type), a block summary of heating loads, a cut sheet for the heat exchanger selected and a sizing chart that show the required line size.

#### *Pumped Condensate Sizing:*

The criteria for sizing the pumped condensate return line was a maximum pressure drop of 2.5 feet per 100 feet and a gpm of three times the total demand. Attached is the calculations used to size the condensate return line.

#### *Heating Glycol Loop Sizing:*

The heating glycol loop was sized to provide the required heat to the units while limiting the temperature drop of the medium to 20 deg. F. Attached is the calculations used to size the glycol loop piping.

#### *Service Water Calculations:*

Each unit has a demand of 20 gpm and is served by a one inch line. Each building is then server by a 1-1/2" line.

### **Plumbing Systems:**

The plumbing systems were designed per the requirements of the Uniform Plumbing Code (UPC) and other requirements in the RFP.

The domestic water was sized per the requirements of the plumbing code and was based on "Fixture Units". Calculations show that each unit needed 26.5 Fixture Units (FU) (See calculations). 26.5 FU's is equivalent to just under 18 gpm. The water branch piping to each unit was sized based on a maximum velocity of 8 ft./sec. and a maximum pressure drop of 5 psi/100 ft. The size was determined to be 1".

Domestic hot water was sized per the recommendations in ASHRAE. The recommended size of water heater for a 2.5 bath / 3 & 4 bedroom unit is 75 gallons per hour with a 100 deg.F. rise. The unit selected is rated for continuous flow of 139 gph at a 70 deg.F. rise. This is equivalent to 97.3 gph at a 100 degree rise.

Sanitary sewer for the units was sized based on the plumbing code. Code requires that if you have three water closets on a line that it must be a minimum of 4". The waste main was therefore sized at 4"

### **Heating System:**

Each unit has a utility room that is the central location of the heating system. Glycol lines are brought to the building where it is distributed through the unit to provide heat and also used to produce domestic hot water via an indirect fired water heater.

The heating system for the units is a combination of, "Radiant Floor" on the first level and "Baseboard" on the second.

### **Ventilation System:**

The units are provided with a Heat Recovery Ventilation (HRV). The air quantities listed in the RFP were used to layout the system. This included 50 cfm exhaust from each bathroom, 25 cfm exhaust from the kitchen and 25 cfm exhaust from the laundry room for a total of 200 cfm. The make up air was returned to the space and divided equally between the bedrooms, kitchen and laundry room.

The utility room was provided with a thermostatically controlled fan and relief hood. The ventilation rate for the utility room was established at 200 cfm.

### **100% Package #3 –Electrical Design Analysis**

#### **1.1. Codes and Standards**

The electrical system is designed in accordance with 2008 NFPA 70 (NEC).

#### **1.2. Power Service & Distribution**

Each residential multi-unit housing building will be served by a 240/120V, 1 phase, 3 wire underground power service. The power service feeds a multi-unit meter center located on the back of each residential building. 3-Plex buildings utilize 400A rated meter centers, and 4-Plex buildings utilize 600A rated meter centers. Each power feed from the meter center has its own service meter and disconnect circuit breaker. This arrangement conforms to standard multi-dwelling unit construction methods and the NEC's six disconnect rule. The meter center feeds power to each dwelling unit panel and house load panel. All service feeds from the meter center are 125A with the exception of ADA dwelling units which are 150A.

Service feeds are XHHW copper and routed underground in HDPE conduit to each panel location. Each service feed shall include a dedicated equipment grounding conductor.

A 125A or 150A 42-Space dwelling unit panel is provided in each dwelling unit garage. The dwelling unit panel utilizes 1-pole and 2-pole circuit breakers to feed all dwelling unit branch circuits.

A 125A 42-Space house panel is provided in main mechanical rooms type 'A' and 'A1'. The house panel utilizes 1-pole and 2-pole circuit breakers to feed all mechanical room and heating system loads located in type 'A', 'A1', 'B', and 'C' mechanical rooms.

All service equipment and branch circuit panels are rated for 10,000 AIC minimum. Each panel is provided with a transient voltage surge suppression (TVSS) device.

Service grounding shall conform to NEC and consist of connections to building foundation steel, concrete encased electrodes, main water pipe, main steam pipe, telecommunications grounding bus bar, and exterior driven ground rods. The neutral and ground bus shall be bonded at the service meter center, but at no other point in the system.

#### **1.3. Power Branch Circuiting**

Residential dwelling units shall have general use receptacles and branch circuits as required by NEC. Additional receptacles and branch circuits are provided for specific equipment noted on plans. Exterior, garage, kitchen, laundry, and bathroom receptacles shall have ground-fault circuit interrupter (GFCI) protection. All other 120V 15A and 20A branch circuits shall have arc-fault circuit interrupter (AFCI) protected circuit breakers as required by NEC 210.12.

The building house panel is located in main mechanical rooms type 'A' and 'A1' and feeds branch circuits located in that room and adjacent unit mechanical rooms type 'B' and 'C'. Mechanical rooms type 'B' and 'C' branch circuits are fed from the house panel via an underground routed HDPE conduit with multi-circuit branch wiring. This conduit stubs up to a junction box in each type 'B' and

'C' mechanical room from which branch circuits are distributed. Motor loads shall be provided with necessary disconnect switches, starters, and thermal overloads as required by NEC.

All branch circuit wiring to be type NM cable with integral equipment grounding conductors.

#### **1.4. Lighting Systems**

Dwelling units are provided with residential grade luminaires. Fluorescent luminaires are provided in the garage, kitchen, laundry, storage, and mechanical rooms. Downlights are provided for secondary dining, bathrooms, and the arctic room. Variable speed ceiling fans with light kits are provided for the great room, den, and all bedrooms. Interior located incandescent luminaires will be provided with retro fit medium base compact fluorescent lamps for energy efficiency.

3-way and 4-way light switching is provided in hallways, great room, arctic entry, mud room, etc, where necessary for control convenience.

Master bedrooms are provided with (2) split wired duplex receptacles with wall switch control at bed location for plug in lamp control.

Master bedrooms, dining, and kitchens are provided with dimmer switch light control. Luminaires with dimmer control shall have compact fluorescent lamps rated for dimming capability. Kitchen luminaires utilize a dimmable fluorescent ballast.

Exterior luminaires are provided with photocell control and local wall switch override. A photocell receptacle is also provided under the front porch eave for connection to holiday lighting.

Lighting levels are based on the Illuminating Engineering Society of North America (IESNA) design standards for residential dwelling units. Each dwelling unit is designed to meet or exceed IESNA recommended lighting levels.

#### **1.5. Telecommunication Systems**

Each residential multi-unit housing building telecomm service is fed underground. The telecomm service conduits stub up to a telecommunication termination backboard (TTB) located in the building main mechanical room type 'A' and 'A1'. The TTB consists of a fire retardant painted plywood backboard with telephone service network interface device, termination blocks, cable TV connection block, ground bus bar, and dedicated quad receptacle. The TTB grounding bus bar is connected to the building service ground, metallic conduits, and telecomm/television service devices.

The TTB feeds each dwelling unit multi-media panel via an underground HDPE conduit. An additional conduit shall be provided from the TTB to a junction box located under the eave of the back of the building for a future satellite dish connection. Dwelling unit backbone cabling shall consist of CAT 5E telecomm cabling and RG-11 television cabling.

A multi-media panel is provided in each dwelling unit garage. The multi-media panel provides termination blocks and cable television splitters for feeding unit telecom and television outlets. Horizontal cabling shall consist of CAT 5E telecomm cabling and RG-6 television cabling.

Telecomm outlets are provided in the great room, kitchen/dining, den, arctic room, and all bedrooms.

**1.6. Fire Detection Systems**

Smoke detectors are provided in each dwelling unit per NFPA requirements. Carbon monoxide detectors are provided at each dwelling unit level and outside the bedrooms. Detectors shall have battery backup and be hard wired to a dedicated 120V circuit. Detectors shall be interconnected in each dwelling unit so that all detectors sound alarm in that unit in the event of detection from any one of the detector devices. ADA dwelling units shall utilize detectors with strobe/sound bases for audible and visual notification.

Detectors shall be spaced from ceiling fans per NFPA requirements.