**Tribal Renewable Energy - Quarterly Progress Report**

| | |
|---|---|
| **Recipient Organization:** | Native Village of Unalakleet |
| **Project Title:** | |
| **Covering Period:** | October 1, 2012 - December 31, 2012 |
| **Date of Report:** | May 2013 |
| **Award Number:** | **DE-EE0005174** |
| **Technical Contact:** | Victoria Kotongan, Native Village of Unalakleet, PO Box 270, Unalakleet, AK 99684 (tel: 907-624-3622/fax 907-624-3621/email: admin@unkira.org) |
| **Partners:** | Jack Herbert, Judith Grunau, Aaron Cooke, Ilya Benesch, David Shippy, Corey Dirutiliano, Cold Climate Housing Research Center (CCHRC)<br>Matt Wirtanen, Polyseal, a CCHRC cost sharing partner |
| **DOE Project Officer:** | Lizana K. Pierce, (720) 356-1749, lizana.pierce@go.doe.gov |
| **GO Project Monitor:** | Cass Gillham, (720) 356-1340, cass.gillham@go.doe.gov |

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## Executive Summary and Project Overview

The Native Village of Unalakleet was established as a sovereign federally recognized tribe in 1934. All projects undertaken by the Native Village of Unalakleet have four goals: to improve conditions for tribal members, to offer job/training opportunities, to be sustainable, and to be in concert with the Tribe's interest in preserving its environment and subsistence way of life. These four goals are in line with NVU's Mission "To provide assistance to the tribal membership that will strengthen and preserve the social, economic, educational and cultural well-being of the Native people of Unalakleet through self-governance."

The Native Village of Unalakleet project was a feasibility study for a retrofit of a "tribally owned" three story, 14 apartment complex located in Unalakleet, Alaska. The program objective and overall goal was to create a plan for retrofitting to include current appraised value and comparable costs of new construction to determine genuine feasibility as low-income multi-family housing for tribal members.

The planning process for this project involved a kick off meeting between NVU and the subcontractor Cold Climate Housing Research Center. A physical inspection was necessary to assess the building's physical condition and its viability in terms of a deep energy retrofit. There is a serious need for safe, affordable, warm housing in Unalakleet. This project focused on if retrofitting the 14-plex was a viable option to meet that need.

Unalakleet, Alaska

## Project Objectives

1. A plan for total retrofitting to include current appraised value and comparable costs of new construction to determine genuine feasibility as love-income multi-family housing

2. A plan for job training in energy efficiency applications for implementation of this project (if it's a go) and other work in Unalakleet and the sub-region

3. Recommendations to develop greater sustainable energy efficiencies with the use of new technology

4. Recommendations as to how this project might be used as a pilot/demonstration project for replication or/what parts of it might be replicated

5. Recommendations as to how the project could be used to teach energy efficiencies to high school students and interested parties

## Description of Activities Performed

The Native Village of Unalakleet and the Cold Climate Housing Research Center (CCHRC) had a kick-off/planning meeting in January 2012. A contract was drafted and signed with CCHRC providing the following services:

- Review of energy usage based on records reported by the client and coordinate the building assessment trip and energy audit
- Building energy experts and a structural engineer will conduct a site visit in Unalakleet to perform and energy audit and review current conditions of the 14-plex
- Create an AkWarm energy model of the existing building to analyze the energy loads of the building and compare it to possible upgrades in the feasibility study
- Issue a report that summarizes the current state of the building and contains an itemized list of potential upgrades that could be made to the building and the theoretical impact that each would have on future energy usage
- Meet with the stakeholders to discuss the report and recommend further action.

The Cold Climate Housing Research Center visited Unalakleet in the beginning of May 2012. NVU contracted with MacSwain Associates, LLC to appraise the property and to generate a summary appraisal report for the 14-plex property.

# *MacSwain Associates LLC*

*4401 Business Park Boulevard, Suite 22, Anchorage, Alaska 99503*

## SUMMARY APPRAISAL REPORT

14-Plex Apartment Property
Lot 2, Block 2, School Subdivision, Plat No. 91-8
Unalakleet, Alaska

Effective Appraisal Date: May 10, 2012 File No. 12-2372

**Submitted To:**
Margaret Hemnes
Grants/Planning
Native Village of Unalakleet
PO Box 270
Unalakleet, Alaska 99684

**MacSwain Associates LLC**
***4401 Business Park Blvd., Suite 22***
***Anchorage, Alaska 99503***
***Phone: 907-561-1965***
***Fax: 907-561-1955***
***s.macswain@macswain.com***

May 31, 2012

Margaret Hemnes
Grants/Planning
Native Village of Unalakleet
PO Box 270
Unalakleet, Alaska 99684

Re: Appraisal of 14-Unit Apartment Property
Lot 2, Block 2, School Subdivision, Plat No. 91-8
NHN Main Street
Unalakleet, Alaska

Dear Ms. Hemnes:

We have prepared a **Summary** appraisal report of the above-referenced property located in Unalakleet, Alaska. The subject consists of a 14-unit apartment complex consisting of 10,456±square feet, situated on a 13,922± square-foot site. This appraisal estimates replacement cost and market value. Native Village of Unalakleet operates the property under a lease from Unalakleet Native Corporation; however, this lease is month-to-month and either party can terminate upon 30 days notice. Therefore, the property rights appraised is the unencumbered *fee simple interest*. The report is prepared in accordance with the *Uniform Standards of Professional Appraisal Practice* (USPAP).

Based on the data, reasoning, and analysis that follow, we are of the opinion that the replacement cost and market value estimates, as of May 10, 2012, are as follows.

| | |
|---|---|
| **Replacement Cost Estimate** | **$2,650,000** |
| **Market Value Estimate** | **$450,000** |

*An extraordinary assumption of this report is that the uninspected units are in similar condition and repair as the units inspected.*

Your attention is directed to the Assumptions and Limiting Conditions of this report. We hope the appraisal report assists your evaluation of the property. If you have any questions regarding this report, please contact our office.

Respectfully,

Steve MacSwain, MAI
State of Alaska Certificate No. 42

## Appraiser Certification

The undersigned certifies that to the best of their knowledge and belief:

- The statements of fact contained in this report are true and correct.
- The reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are our personal, impartial, and unbiased professional analyses, opinions, and conclusions.
- We have no present or prospective interest in the property that is the subject of this report, and no personal interest with respect to the parties involved.
- We have no bias with respect to the property that is the subject of this report or to the parties involved with this assignment.
- Our engagement in this assignment was not contingent upon developing or reporting predetermined results.
- Our compensation for completing this assignment is not contingent upon the development or reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value opinion, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of this appraisal.
- The reported analyses, opinions, and conclusions were developed, and this report has been prepared, in conformity with the requirements of the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute.
- The reported analyses, opinion, and conclusions were developed, and this report has been prepared, in conformity with the *Uniform Standards of Professional Appraisal Practice* (USPAP).
- The use of this report is subject to the requirements of the Appraisal Institute relating to review by its duly authorized representatives.
- Jim Dahl inspected the appraised property on May 10, 2012. Steve MacSwain, MAI has inspected the property on previous assignments.
- Jim Dahl provided significant real property appraisal assistance to the persons signing this certification.
- As of the date of this report, Steve MacSwain, MAI, has completed the continuing education program of the Appraisal Institute. Steve MacSwain, No. 42 is a certified General Real Estate Appraisers in the State of Alaska.
- MacSwain Associates LLC has not performed services, as an appraiser or in any other capacity, regarding the property that is the subject of this report, within the three-year period immediately preceding acceptance of this assignment.

3/31/12

Steve MacSwain, MAI
State of Alaska Certificate No. 42

Date

## Assumptions and Limiting Conditions

This appraisal is subject to the following **extraordinary assumption**.

- An extraordinary assumption of this report is that the uninspected units are in similar condition and repair as the units inspected.

This appraisal is subject to the following **general assumptions and limiting conditions**.

- No responsibility is assumed for the legal description provided or for matters pertaining to legal or title considerations. Title to the property is assumed to be marketable unless otherwise stated.
- The property is appraised free and clear of all liens or encumbrances unless otherwise stated.
- The information furnished by others is believed to be reliable, but no warranty is given for its accuracy.
- All maps, plot plans, and other illustrative material are believed to be accurate, but are included only to help the reader visualize the property.
- It is assumed that there are no hidden or unapparent conditions of the property, subsoil, or structures that render it more or less valuable. No responsibility is assumed for such conditions or for obtaining the engineering studies that may be required to discover them.
- It is assumed the property is in full compliance with all applicable federal, state, and local environmental regulations and laws unless the lack of compliance is stated, described, and considered in the appraisal report.
- It is assumed the property conforms to all applicable zoning, land use regulations, and platting restrictions unless the nonconformity is identified, described, and considered in the appraisal report.
- Possession of this report, or a copy thereof, does not carry with it the right of publication.
- The appraiser, by reason of this appraisal, is not required to give consultation or testimony or to be in attendance in court with reference to the property in question unless arrangements have been previously made.
- Neither all nor any part of the contents of this report shall be disseminated to the public through advertising, public relations, news, sales, or other media without the prior written consent and approval of the appraiser.
- The appraiser did not observe any hazardous materials or other type of environmental contamination on the appraised property. Furthermore, the appraiser does not have any knowledge that such substances exist. However, the presence of these substances may affect the property value.

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Unalakleet Community Information Summary
Appraiser Qualifications

## Appraisal Overview

This **Summary** appraisal report is prepared to comply with the *Uniform Standards of Professional Appraisal Practice* (USPAP). The appraisal report is a summary of the appraisers' data, analyses, and conclusions with supporting documentation retained on file.

**Client:** Margaret Hemnes
Grants/Planning
Native Village of Unalakleet
PO Box 270
Unalakleet, Alaska 99684

**Appraiser:** Steve MacSwain, MAI (State of Alaska Certificate No. 42)

**Intended Use of Report:** Assist the client with determining feasibility of rehabilitation versus replacement

**Intended Users**: Native Village of Unalakleet (NVU) and U.S. Department of Energy

**Property Inspection Date:** May 10, 2012

**Effective Appraisal Date:** May 10, 2012

**Date of Report:** May 31, 2012

**Type of Value:** The type of value estimated is *market value*, which is defined as follows.

*The most probable price which a property should bring in a competitive and open market under all conditions requisite to a fair sale, the buyer and seller each acting prudently and knowledgeably, and assuming the price is not affected by undue stimulus. Implicit in this definition is the consummation of a sale as of a specified date and the passing of title from seller to buyer under conditions whereby:*

*a. buyer and seller are typically motivated;*

*b. both parties are well informed or well advised, and acting in what they consider their own best interests;*

*c. a reasonable time is allowed for exposure in the open market;*

*d. payment is made in terms of cash in United States dollars or in terms of financial arrangements comparable thereto; and*

*e. the price represents the normal consideration for the property sold unaffected by special or creative financing or sales concessions granted by anyone associated with the sale.*[1]

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[1] *Appraisal of Real Estate*, Thirteenth Edition (2008), by the Appraisal Institute, pp. 24 & 25.

**Property Rights Appraised:** Fee simple interest

**Property Owner:** We were not provided a title report. Public records indicate ownership in the property is vested in Unalakleet Native Corporation.

**Property Type / Use:** Multi-family (14-plex apartment)

**Property Location and Identification:** The appraised property is located on the east side of Main Street, just north of Beach Road East in Unalakleet; the physical address is NHN Main Street, Unalakleet, Alaska.

**Location Map**

**Legal Description:** We were not provided a title report. Public records indicate the property is legal defined as *Lot 2, Block 2, School Subdivision, Plat No. 91-8, Records of the Cape Nome Recording District, Second Judicial District, State of Alaska.*

**Three-Year Sale History:** There are no known sales of the subject property in the past three years. However, there is a lease between Unalakleet Native Corporation and NVU, which states that the landlord and tenant are negotiating terms and conditions by which tenant will purchase the property from Landlord. We are unaware of any negotiated terms for a purchase of the property.

**Lease Summary:** There is currently a lease agreement between Unalakleet Native Corporation and NVU. The month-to-month lease commenced June 2009. Stated base rent is $3,500 per month, plus all operating expenses. However, NVU's cost of maintaining the property and curing deferred maintenance was so high that parties amended the lease and Unalakleet Native Corporation relinquished the rent burden if NVU does not generate enough income to support the monthly payment. Therefore, NVU does not pay rent to Unalakleet Native Corporation, but continues to operate the property and pay for all operating costs, including major repairs and maintenance. Additionally, the lease states the property owner and tenant are negotiating terms and conditions by which tenant will purchase the property from property owner. As such, in the event the parties enter an agreement for purchase, any base rent paid by the tenant shall be applied and credited to the purchase price as closing. Either party can terminate this lease upon 30 days written notice.

**Unit Rental Summary:** NVU currently operates the property and leases the unfurnished apartment units. It was indicated that 13 of the 14 apartment units are occupied, with the 14th unit, an efficiency unit, leased on a daily basis. The units are leased on the following terms:

| | NVU Tribal Members Rates | Non-Tribal Member Rates |
|---|---|---|
| **Efficiency Units** | $450.00/Month + 5% =$472.50 | $540.00/Month + 5% =$567.00 |
| | $90.00/Day + 5% =$94.50 | $108.00/Day + 5% =$113.40 |
| **1-Bedroom Units** | $550.00/Month + 5% =$577.50 | $660.00/Month + 5% =$693.00 |
| **2-Bedroom Units** | $700.00/Month + 5% =$735.00 | $840.00/Month + 5% =$882.00 |
| **3-Bedroom Units** | $800.00/Month + 5% =$840.00 | $960.00/Month + 5% =$1,008.00 |

The City of Unalakleet requires the collection of the City of Unalakleet Sales Tax of 5% on all sales within the City limits, including rental housing units. Heating expenses is included in the monthly rent, but electrical and water/sewer services are the responsibility of the tenant.

**Assessed Valuation and Annual Tax Load:** None; the property is not located in a real property taxable area.

**Methodology:** We analyze the primary approaches to value emphasizing the income capitalization approach. While we have analyzed multi-family property sales in remote Alaskan locations, there is insufficient data to develop a reliable indication of value. Typically, market participants do not consider the cost approach meaningful in evaluating this property type. Moreover, the weakness of the cost approach is quantifying all forms of depreciation for an older structure built in phases. Importantly, there is sufficient market data to prepare a reliable income capitalization approach. We also estimate replacement cost of the improvement based on comparable construction costs in rural Alaska and Marshal Valuation

Services manual. The appraisal report is a summary of the appraisers' data, analyses, and conclusions with supporting documentation retained on file.

**Appraisal Scope:** Data collection and confirmation is an important factor in accurately communicating the appraisal process. We rely on data obtained from public agencies, private parties, brokers, appraisers, title company records, and company files to perform our analyses. Confirmation of sale data is with buyers, sellers, brokers, or other knowledgeable third parties. The scope of work specifics includes the following.

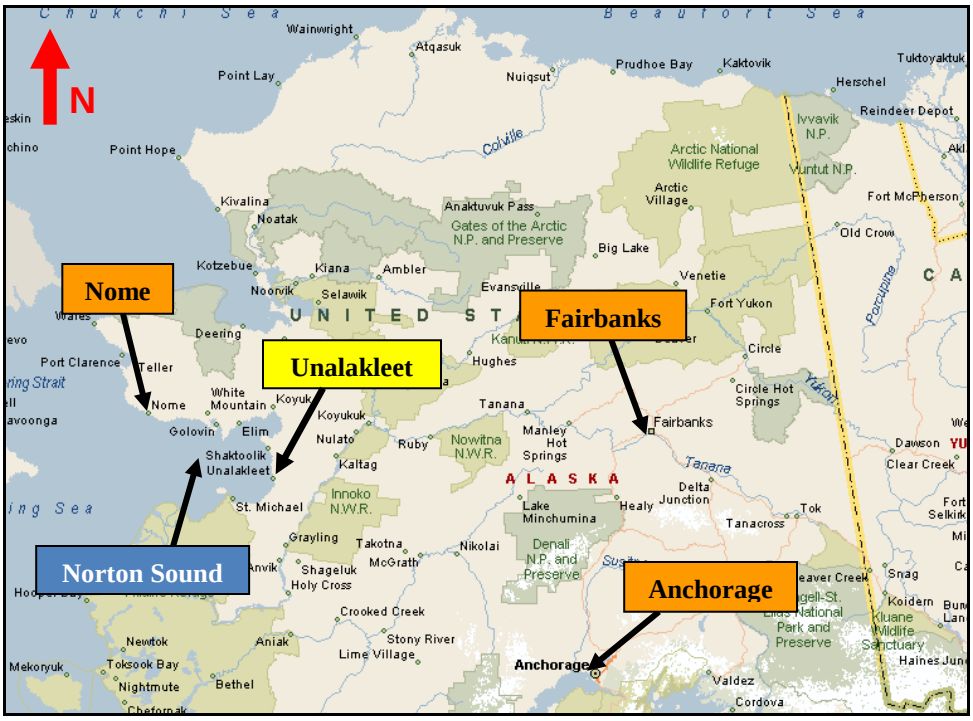
- Inspected the property on May 10, 2012;
- Discussed the property with representatives of NVU;
- Reviewed the Lease between Unalakleet Native Corporation and NVU, dated June 3, 2009;
- Interviewed real estate brokers, agents, private parties, and appraisers regarding comparable building sales and rentals and the market for rural Alaska apartments, and the Unalakleet market;
- Gathered data from the State of Alaska Recorder's Office regarding ownership, and general property information;
- Gathered and confirmed comparable construction costs, land sales, property sales, and rentals;
- Concluded with an estimate of replacement cost for the existing improvement; and
- Developed the income approach for an estimate of market value.

**Statement of Competency:** MacSwain Associates LLC has completed numerous appraisals of apartment properties in rural Alaska. A summary of the appraiser's experience and professional qualifications are located in the addenda. Steve MacSwain, MAI has the knowledge and experience required by the competency provision of USPAP to complete this appraisal assignment credibly.

## Neighborhood Description

**Overview:** The neighborhood is Unalakleet, a community on the east shore of Norton Sound. The community is located at the mouth of the Unalakleet River, which empties into Norton Sound, approximately 150 miles southeast of Nome and 400 miles northwest of Anchorage. Due to client knowledge, we provide a brief summary of the area and neighborhood, and include in the addenda a Community Information Summary prepared by the State of Alaska.

**Location Map**



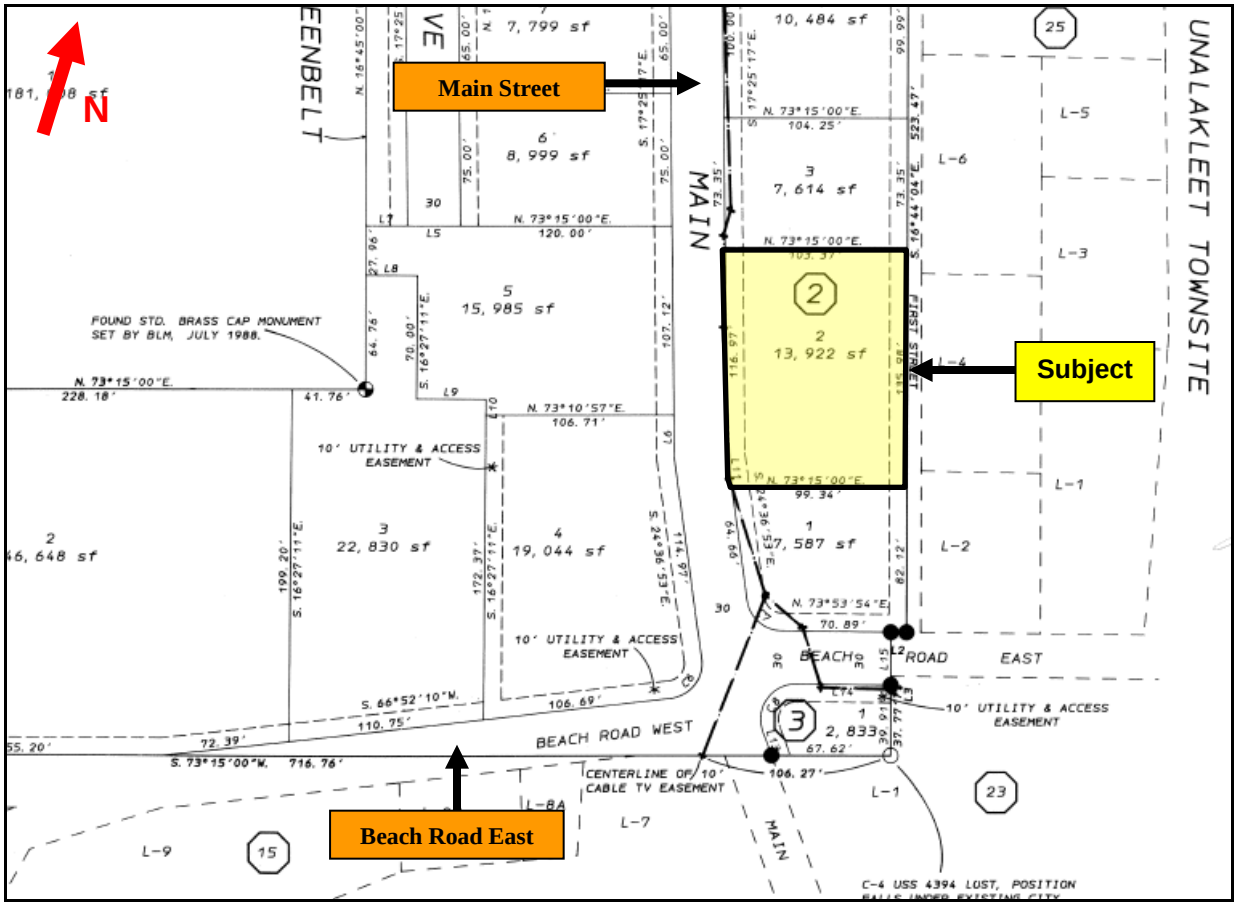

Neighborhood: The neighborhood is Unalakleet, with a population of about 692 residents (2011 Alaska Department of Labor Estimate). Unalakleet has historically been a major trade center for the nearby villages and terminus for the Kaltag people, an important winter travel route connecting to the Yukon River. In comparison to other Norton Sound communities, Unalakleet's local economy is one of the more active and includes a traditional subsistence lifestyle. Both commercial fishing and subsistence activities are major components of Unalakleet's economy. About 101 residents held commercial fishing permits in 2010. Norton Sound Economic Development council operates a fish processing plant. Government and school positions are relatively numerous. Commercial tourism is relatively minimal and has yet to be fully developed. The Unalakleet River Lodge, owned by the local Native Corporation is the only sport-fishing lodge located on the Unalakleet River. Other community infrastructure includes a school serving about 220 students, and staffed by 18 teachers. The main arterials of the townsite were recently paved. Unalakleet has a State-owned 6,200-foot gravel runway, which recently received major improvements. There are daily scheduled flights to/from Anchorage. Cargo is chartered from Nome to Unalakleet, which increases building costs. Local overland travel is mainly by ATV's, snow machines, and dogsleds in winter.

**Unalakleet Location Map**

**Summary:** The subject is located on Main Street, near the center of the Unalakleet townsite. Development in the area includes commercial, residential, industrial, and institutional. Location on the paved, main arterial is a positive attribute.

## Site Description

**Plat Map 91-8**




Location, Size, and Access: Location is on the east side of Main Street, just north of Beach Road East, Unalakleet, Alaska. This location is near the center of the Unalakleet townsite. The nearly rectangular-shaped lot contains 13,922± square feet or 0.32± acres. Access is provided by Main Street, a paved, two-lane arterial; and an access easement from Beach Road East.

Zoning, Easements, and Restrictions: There is no zoning in Unalakleet. A title report was not provided. There is a 10-foot wide telecommunications and electric easement on the east boundary. The plat map indicates there is a 10-foot utility and access easement paralleling the eastern and western boundaries. There are no other known easements.

Utilities, Floodplain, and Environmental Conditions: Public water, sewer, electricity, and telephone. Site is generally level and near grade with surrounding streets and properties. The site is not located within a floodplain or wetland area. No environmental hazards are known and we assume the site is free of environmental contamination.

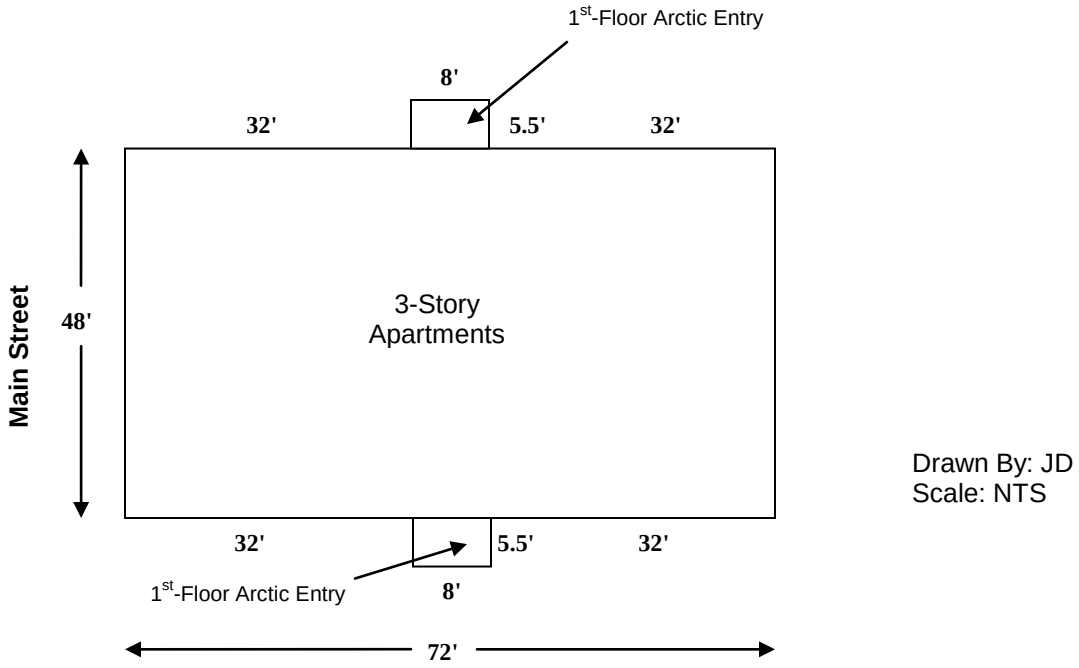
Site Suitability: Location and land area is adequate for several types of potential development. Physical attributes include size, shape, utilities available, and paved access. Overall, the site is well suited for development.

## Improvement Description

14-Plex Apartment: The subject improvements consist of a three-story, wood-frame structure originally built in the late 1970s with the third floor addition in the 1980s. The structure contains a gross building area (GBA) of 10,456± square feet. There are four, efficiency units; two, one-bedroom units; six, two-bedroom units; and two, three-bedroom units. The building foundation is concrete slab.

**Exterior Finish:** Exterior finish is painted wood siding. The gable roof is metal covering wood trusses.

Interior Finish: Interior finishes vary slightly from unit-to-unit as units have been renovated over the years. However, general interior finish consists of painted and textured drywall walls and ceilings. Floor covering includes vinyl and carpet. The common area hallways have painted and textured drywall walls and ceilings and vinyl or laminate floor covering. The kitchens have wood cabinets, stainless steel sinks, and laminate countertops. Windows are wood frame, though some have been replaced with insulated, vinyl windows. Exterior personnel doors are metal; interior unit doors are wood.




Heating, Electrical, **Plumbing:** There are two oil-fired boilers that provide hot water baseboard heat. There is a 500-gallon aboveground fuel oil storage tank. Electrical service is assumed adequate. Interior lighting is overhead incandescent fixtures. Each apartment unit has a three-fixture bathroom. There is no fire protection.

Unit Appliances: Typical of the Unalakleet market, unit appliances include a range, hood, and refrigerator. *These appliances do not represent a significant component of the market value conclusion; therefore, we have not allocated a separate value for these items.*

**Furniture, Fixtures, and Equipment (FF&E):** The units are not furnished; however, there are washing machines in ten units (non-efficiency). There is also one washer and three coin-op driers in common areas. *These appliances do not represent a significant component of the market value conclusion; therefore, we exclude from our valuation any FF&E or personal property.*

Site **Improvements and Parking:** Site improvements include gravel parking area and aboveground fuel storage tank. Parking appears adequate and representative of the Unalakleet market.

**Recent Capital Improvements:** NVU reported several recent capital improvements including new water heaters; some new windows and doors; new attic insulation; new roof ventilation; replacement of some sinks and fixtures; and repairs to ceilings damaged by water. While we were provided a maintenance and repairs expense for 2011, there was no specific allocation made to the cost of these improvements.

**Deferred Maintenance:** Based on discussions with NVU and our appraisal inspection, deferred maintenance includes water damage to ceilings and walls on third floor; plumbing leaks of hot water baseboard heating system; stuck zone valves (open and/or closed); damaged and/or unsealed windows; and damaged exterior paint. Importantly, we classify the deferred maintenance as curable physical deterioration.

**Quality and Condition of Improvement**: The quality of construction of the improvement is rated average for the Unalakleet market. Current condition of the building is rated fair to average.

**Effective Age and Economic Life:** The improvements were constructed in two phases in the late 1970s and 1980s, indicating an actual age of 25 to 35± years. According to age-life tables, life expectancy of similar buildings is 50 years. Effective age is estimated to be near actual age or 30± years with a remaining economic life of 20± years. Importantly, buildings can last beyond expected economic life with regular maintenance and periodic upgrades.

Suitability of **Improvements:** The subject improvement represents an average-quality apartment property constructed in the 1970s and 1980s. While the quality of construction is rated average, the building is in fair to average condition and repair. Though NVU has cured some physical deterioration with recent capital improvements, deferred maintenance is still apparent and efficiency concerns remain. However, a lack of affordable housing in the Unalakleet market keeps the property near capacity. In conclusion, the improvements appear to meet a need for housing in Unalakleet, though curing deferred maintenance would increase operating efficiency and long-term viability of the income stream.

## Property Photographs

Date: May 10, 2012

Taken By: Jim Dahl

Northeast view from Main Street

Southwest view of 14-plex

View of arctic entry and building siding

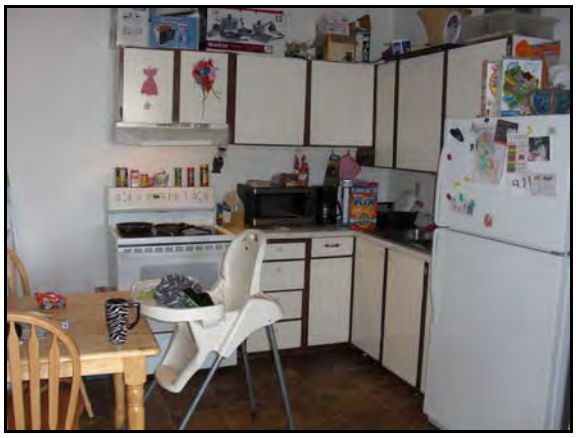
Southerly view of utility & access easement along eastern boundary of the site

Easterly view of access from Main Street and southern boundary of site

Northerly view of Main Street frontage

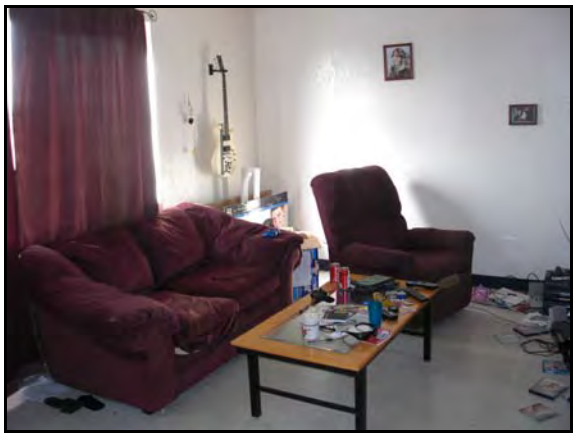
Date: May 10, 2012

Taken By: Jim Dahl

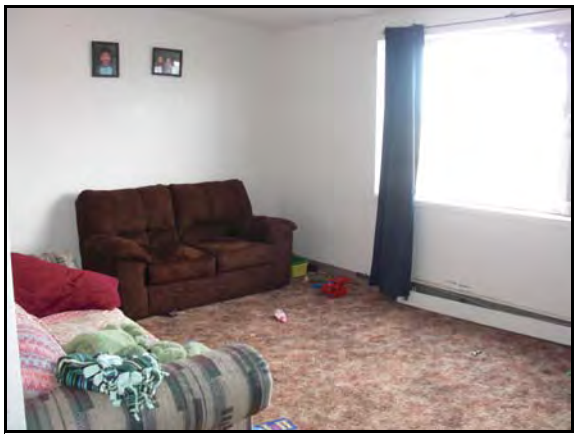


Typical kitchen

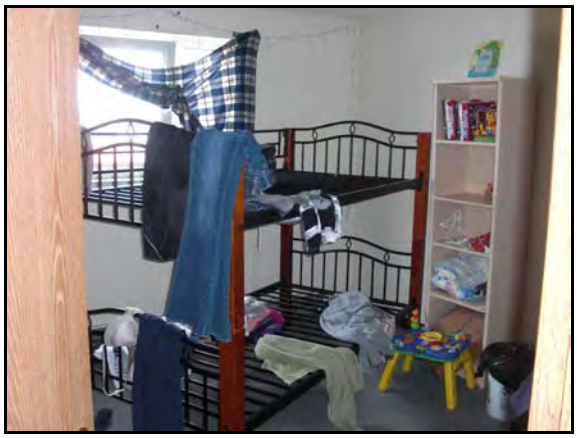
Typical kitchen



Typical living area



Typical living area



Typical bedroom

Typical Bathroom

## Highest and Best Use Analysis

**Highest and Best Use As Though Vacant:** The nearly rectangular-shaped lot contains 13,922± square feet or 32± acres. There is no zoning in Unalakleet, which allows a wide range of commercial and residential development options. There is good frontage and exposure on Main Street, a paved primary arterial. Moreover, location, physical character (size, frontage, and exposure), and land uses in the immediate area encourage commercial or residential development. Few speculative-type development opportunities exist at this time in Unalakleet that are financially feasible. Simply, current rent levels are less then that necessary to justify the cost of new construction on a speculative basis. New commercial development has primarily been build-to-suit or to satisfy an owner-occupied need rather than for investment or speculative purposes. The most probable construction is commercial, but development of this nature must have a built-to-suit tenant or be owner-occupied. A viable financial alternative is to hold the land until market conditions justifies the investment risk. Regardless of the investment alternative selected, commercial development maximizes the return to the land, with residential a secondary option. As vacant, the highest and best use is commercial development.

**Highest and Best Use as Improved:** The site is improved with a 14-unit apartment complex consisting of 10,456±square feet, an allowable and permitted use. While deferred maintenance exists, it is curable physical deterioration. Construction costs and market rental rates do not support new apartment development; therefore, economic obsolescence exists. However, apartment market conditions are characterized by a limited supply of “market rent” apartment properties and low overall vacancy rates. As management practice, the units are currently subsidized slightly below market for NVU tribal members. However, considering current supply and demand for residential rental units, conversion of tenants to market-based rentals would not affect the subject’s occupancy or market dynamics. Importantly, we determined the total value of the property as improved is greater that the value of the site as vacant. Moreover, there is no economic justification in the Unalakleet market for removal or rehabilitation of the existing improvements for an alternative use. In conclusion, the highest and best use, as improved, is an apartment property (current use).

## Replacement Cost Estimate

**Overview:** As instructed, we estimate the replacement cost of the subject apartment building. Replacement cost is the estimated cost to construct, at current prices as of the effective appraisal date, a substitute for the building being appraised using modern materials and current standards, design, and layout.[2] We utilize the Marshall Valuation Service (MVS) Cost Manual and comparable construction costs as our basis for determining the replacement cost.

**MVS Cost Manual:** The MVS is a national cost manual containing indexes of replacement costs for various building types. Replacement cost includes typical direct costs, contractor overhead, and profit and is estimated as follows.

| MVS Replacement Cost Estimate | |
|---|---|
| **Building Type** | Multiple Residence |
| MVS Reference | Sec. 12, Pg. 16 |
| Cost Date | August 2010 |
| Class/Type | Good / S |
| Base SF Cost | $83.67 |
| Less: Heat/Cool Adjustment | - $1.32 |
| **Adjusted Base SF Cost** | **$82.35** |
| Current Multiplier | × 1.07 |
| Location Multiplier (Anchorage) | × 1.26 |
| Location Multiplier (Unalakleet) | × 1.75[3] |
| MVS Replacement Cost | $194 (R) |

The principal weakness of the MVS is classification of improvement type and an accurate adjustment of base costs for remote Unalakleet location. Typically, we have found that MVS greatly underestimates the cost of construction in remote Alaska locations.

**Comparable Construction Costs:** We have analyzed costs of comparable apartment properties in Unalakleet and other rural Alaska locations. The following is a summary of our analysis.

> **Bering Strait School District Housing (Unalakleet):** Bering Strait School District (BSSD) had three, 4-plex buildings constructed in 2008-2009 in Unalakleet. The buildings consist of four, two-bedroom units totaling 4,000± square feet each. BSSD reported that the cost was approximately $1,000,000 for each building, or $250 per square foot. The cost included all hard and soft costs including overhead and profit.

[2] *Appraisal of Real Estate*, Thirteenth Edition (2008), by the Appraisal Institute, p. 385.

[3] There is no Marshall Valuation Service location multiplier for Kotzebue. The Kotzebue location multiplier is based on the Alaska Housing and Finance Corporation (AHFC) Market Basket Construction Cost Survey and comparison between Anchorage and Barrow, Nome, and Bethel.

**Proposed 20-Plex Apartment Building (Nome):** We have reviewed a construction budget for proposed construction of a 20-plex apartment building in Nome, which is scheduled for construction in 2012. The building consists of seven, one-bedroom; 11, two-bedroom; and two, three-bedroom units. Total gross building area is 20,900± square feet. The contractor's proposed cost is approximately $3,290,000, or $157 per square foot. We note this cost does not include contractor overhead and profit.

**Proposed 50-Unit Apartment Building (Nome):** We discussed with Bering Straits Development Company a proposed project of a 50-unit apartment building in Nome, which was scheduled for construction in 2012. The project is currently on hold due to title problems, but we analyze the estimate as a current indicator of costs. The proposed building consists of a mix of two- and three-bedroom units. Total gross building area is 60,000± square feet. The proposed cost is approximately $16,500,000, or $267 per square foot. The cost included all hard and soft costs including overhead and profit.

The comparable construction costs analyzed indicated a range of cost from $157 to $267 per square foot. The cost of $157 per square foot for the proposed 20-plex in Nome did not include overhead and profit; therefore, an upward adjustment is necessary. The proposed 50-unit apartment building in Nome is currently on hold due to title problems; therefore, we weigh this comparable cautiously. However, we expect a cost less than $267 per square foot for the subject improvement. We consider the BSSD project in Unalakleet the best indicator of cost for the subject building. While an upward adjustment is necessary for increasing construction costs, a downward is required for larger size. Overall, the net adjustment to the Unalakleet cost comparable is slightly upward, indicating a unit value greater than $250 per square foot. In conclusion, the comparable costs indicate a unit cost greater $250 per square foot, but less than $267 per square foot, for the subject 14-plex building.

**Reconciliation:** We give most weight to the comparable cost estimate in Unalakleet in our reconciliation, and factor it upward slightly as indicated. After making the necessary adjustments, we estimate a unit cost greater than $250 per square foot, but less than $260 per square foot. This develops the following range of replacement cost.

| | |
|---|---|
| 10,456 SF × $250/SF = | $2,614,000 |
| 10,456 SF × $260/SF = | $2,718,560 |

Based on the preceding analysis, the replacement cost of the subject improvement is reconciled in the middle of the indicated range at $2,650,000.

| | |
|---|---|
| **Replacement Cost Estimate** | **$2,650,000** |

## Market Value Estimate – Income Capitalization Approach

**Overview:** We analyze the primary approaches to value emphasizing the income capitalization approach. While we have analyzed multi-family property sales in remote Alaskan locations, there is insufficient data to develop a reliable indication of value. Typically, market participants do not consider the cost approach meaningful in evaluating this property type. Moreover, the weakness of the cost approach is quantifying all forms of depreciation for an older structure built in phases. Importantly, there is sufficient market data to prepare a reliable income capitalization approach.

Anticipation of future benefits is the basic economic premise of the income approach. Value is measured by estimating the present worth of all rights to these future benefits. Converting future benefits into a value conclusion requires a capitalization process. We employ direct capitalization to convert property income into a market value estimate.

**Rental Summary:** NVU currently operates the property and leases the unfurnished apartment units. It was indicated that 13 of the 14 apartment units are occupied, with the 14th unit, an efficiency unit, leased on a daily basis. The units are leased on the following terms, with subsidized rates for NVU tribal members.

| | NVU Tribal Members Rates | Non-Tribal Member Rates |
|---|---|---|
| **Efficiency Units** | $450.00/Month + 5% =$472.50 | $540.00/Month + 5% =$567.00 |
| | $90.00/Day + 5% =$94.50 | $108.00/Day + 5% =$113.40 |
| **1-Bedroom Units** | $550.00/Month + 5% =$577.50 | $660.00/Month + 5% =$693.00 |
| **2-Bedroom Units** | $700.00/Month + 5% =$735.00 | $840.00/Month + 5% =$882.00 |
| **3-Bedroom Units** | $800.00/Month + 5% =$840.00 | $960.00/Month + 5% =$1,008.00 |

The City of Unalakleet requires the collection of the City of Unalakleet Sales Tax of 5% on all sales within the City limits, including rental housing units. Heating expenses is included in the monthly rent, but electrical and water/sewer services are the responsibility of the tenant.

**Comparable Property Rentals:** Four comparable apartment rentals, and the subject rental rates, are relied upon to facilitate comparative analysis, and the rental rates include a 5% local sales tax (same as the subject). A tabular summary of the comparable rentals is on the following page. Additional details of these rentals are retained on file.

## Comparable Rentals

| No. | Name / Location | Building Type | Unit Type | Rental Rate | Year Built | Tenant Expense |
|---|---|---|---|---|---|---|
| 1 | ***Melin Apartments***<br>River Road | 4-plex | 1-bedroom:<br>2-bedroom:<br><br>3-bedroom: | $500<br>$800<br>$900<br>$1,200 | N/A | Electric & water |
| 2 | ***UNC 8-Plex***<br>Main Street | 8-plex | Efficiency:<br>3-bedroom: | $650<br>$1,500 | 2005 | Electric & water |
| 3 | ***BSSD 4-Plexes***<br>Airport Road | 4-plexes | 2-bedroom: | $1,000 | 2008/ 2009 | None |
| 4 | ***City 4-Plex***<br>Tank road | 4-plex | 2-bedroom:<br>3-bedroom: | $787<br>$866 | N/A | Electric & water |
| 5 | ***NVU 14-Plex***<br>Main Street **(Subject)** | **14-Plex** | **Efficiency:**<br>**1-bedroom:**<br>**2-bedroom:**<br>**3-bedroom:** | **$567**<br>**$693**<br>**$882**<br>**$1,008** | **1970s / 1980s** | **Electric & water** |

## Comparable Rentals Map

**Rental 1**

**Rental 2**

**Rental 3**

**Rental 4**

**Comparable Rental Analysis:** The primary elements of comparison that affect rental rates for apartments in Unalakleet are age/condition and economic character (tenant expenses).

**Rental 1:** The Melin Apartments is a 4-plex building located on the west side of River Road. While the one-bedroom unit indicates $500 per month, the property owner indicated the rate would increase at the termination of the current lease. Additionally, the two-bedroom units are $800 and $900 per month, based on unit size. The three-bedroom unit rents for $1,200 per month. The tenant is responsible for electricity and water expenses. Overall, Rental 1 is rated similar to the subject, indicating market rental rates approximating the rental rates these units for the subject units.

**Rental 2:** The Unalakleet Native Corporation 8-Plex is located on the corner of Main Street and Airport Road. The building was constructed in 2005 to help support the Norton Sound Health Corporation's healthcare workers. The efficiency units rent for $650 per month, while the three-bedroom units rent for $1,500 per month. The tenant is responsible for electricity and water expenses. Overall, Rental 2 is rated superior to the subject in terms of age/condition, indicating market rental rates less than the rental rates these units for the subject units.

**Rental 3:** This comparable is the three BSSD 4-plex buildings located on the south side of Airport Road. The buildings were constructed in 2008/2009 for housing BSSD employees. The two-bedroom units rent for $1,000 per month, with all utilities included. A BSSD representative indicated the rental rate is based on market alternatives, but the utilities are subsidized. Overall, Rental 2 is rated superior to the subject in terms of age/condition, but inferior in terms of economic character. In conclusion, the net adjustment is downward, indicating a market rental rate less than $1,000 per month for the subject unit.

**Rental 4:** This comparable is the City of Unalakleet 4-Plex located on the west side of Tank Road, between O Street and 8th Street. The two-bedroom units rent for $787 per month, while the three-bedroom units rent for $866 per month. The tenant is responsible for electricity and water expenses. Overall, Rental 4 is rated inferior to the subject in terms of condition, indicating market rental rates less than the rental rates these units for the subject units.

**Rental 5 (Subject):** This comparable is the subject 14-Plex located on the east side of Main Street, just north of Beach Road East. The efficiency units rent for $567 per month, one-bedroom units rent for $693 per month, two-bedroom units rent for $882 per month, and the three-bedroom units rent for $1,008 per month. The tenant is responsible for electricity and water expenses. These rental rates are subsidized for NVU tribal members. Overall, the subject rental rates appear to be supported by the comparables, and given primary reliance in our market projections.

**Reconciliation of Comparative Analysis:** The comparable rentals indicate a narrow unadjusted range of $567 to $650 per month for efficiency units, $500 to $693 per month for one-bedroom units, $787 to $1,000 per month for two-bedroom units, and $866 to $1,500 per month for the three-bedroom units. Based on the preceding analysis, and giving most weight to the subject rental rates, which area supported by the comparables, we estimate market rental rates for the subject property as follows.

| Market Rent | |
|---|---|
| **Efficiency Unit** | **$575** |
| **One-Bedroom Unit** | **$700** |
| **Two-Bedroom Unit** | **$880** |
| **Three-Bedroom Unit** | **$1,000** |

**Potential Gross Income:** Based on market rental rates, potential gross income is estimated as follows.

| Unit Type | Units | Market Rent | Monthly Total | Annual Total |
|---|---|---|---|---|
| Eff. | 4 | $575 | $2,300 | $27,600 |
| 1-Bed | 2 | $700 | $1,400 | $16,800 |
| 2-Bed | 6 | $880 | $5,280 | $63,360 |
| 3-Bed | 2 | $1,000 | $2,000 | $24,000 |
| **Potential Gross Income** | | | | **$131,760** |

**Effective Gross Income:** Our market investigation revealed few vacant apartment properties in Unalakleet. Additionally, excepting an efficiency unit leased on a daily basis, the property is at full occupancy. Considering the preceding, and including an allocation for collection loss, a 5% vacancy rate is projected over the investment-holding period. Effective gross income is calculated as follows.

| | |
|---|---|
| Potential Gross Income | $131,760 |
| Less: Vacancy and Collection Loss (5%) | - $6,588 |
| Effective Gross Income | $125,172 |

**Operating Expenses:** We rely upon both historic and comparable property operating expenses. NVU provided us with operating expenses for 2011. The property owner is responsible for City Sales Tax, insurance, management, utilities (except for unit electric and water expenses), building maintenance and repair, miscellaneous, and a replacement allowance. Property owner expenses are estimated below.

**City Sales Tax:** The City of Unalakleet requires the collection of the City of Unalakleet Sales Tax of 5% on all sales within the City limits, including rental housing units. Therefore, we project a City Sales Tax expense of 5% of effective gross income, or $6,300.

**Insurance:** An actual insurance expense was not provided to the appraisers. Comparable insurance expenses range from $322 to $720 per unit. Based on the preceding, we estimate an insurance expense in the middle of the indicated range. In conclusion, we estimate an insurance expense of $500 per unit or $7,000.

**Management:** NVU acts as property manager. Moreover, property owners in Unalakleet do not retain professional management services. Discussions with various professional management companies in Anchorage indicate a range in management fees from 3% to 4% of collected income. By recognizing rural location and increased costs, we estimate a management expense at the upper range or 4% of effective gross income. An annual management expense of $5,000 is projected.

**Utilities:** Actual utility expenses (common area electricity and heating fuel) were reported at $43,459. The trend of utility expenses is increasing with fuel oil costs. Considering the upward trend, an annual utility expense of or $45,000 is projected.

**Building Maintenance and Repair:** NVU provides building maintenance and repair services and the 2011 expense was reported at $122,160. However, this expense included extensive costs to cure deferred maintenance and replace short-lived items, or items typically covered in the reserve allowance. Generally speaking, this expense varies from property-to-property and year-to-year due to maintenance requirements, building age, management practice, and accounting. Comparable building maintenance and repair expenses range from $748 to $1,247 per unit. Considering the subject's age and condition, we project a higher-range annual building maintenance expense of $1,000 per unit or $14,000. Note this expense includes ground maintenance costs.

**Miscellaneous:** The property owner did not provide historical miscellaneous expenses. Comparable miscellaneous expenses from similar properties range from $33 to $92 per unit. We project a mid range expense of $70 per unit or $1,000 for miscellaneous expenses.

**Replacement Allowance:** This expense is an allocation for the periodic replacement of short-lived building components such as roof covering, boilers, carpeting, flooring, appliances, and other costs incurred to repair building items that wear out despite regular maintenance. A property owner seldom set-aside income for future replacement,

but an estimate for reserves is an appropriate deduction from operating income. Investor responses in the PwC Real Estate's Investor Survey Q1 2012 for replacement reserves in the Pacific Region Apartment Market indicate an annual expense expectation from $150 to $350 per unit. Recognizing age/condition, additional requirements in Unalakleet, an annual replacement allowance of $350 per unit or $4,900 is projected.

**Projected Operating Statement:** The projected operating statement is as follows.

| | | |
|---|---|---|
| **Potential Gross Income** | | $131,760 |
| Less: Vacancy and Collection Loss (3%) | | - $6,588 |
| **Effective Gross Income** | | $125,172 |
| Less: Property Owner Expenses | | |
| City Taxes | $6,300 | |
| Insurance | $7,000 | |
| Management | $6,300 | |
| Utilities | $45,000 | |
| Building Maintenance and Repairs | $16,800 | |
| Miscellaneous | $1,000 | |
| Reserves for Replacement | $4,900 | |
| **Total Operating Expenses (66%)** | | - $83,200 |
| Net Operating Income (NOI) | | $41,972 |

**Direct Capitalization:** Direct capitalization is the method used to convert projected net income into a value estimate. This market-based process analyzes improved property sales to determine the market range of overall capitalization rates ($R_o$) and the rate of return necessary to attract investment capital. A summary of our direct capitalization analysis follows.

**$R_o$ Derived from Comparable Apartment Sales:** There have been no sales of similar apartment properties in Unalakleet to derive overall capitalization rates. Alternatively, capitalization rates extracted from recent apartment sales in Anchorage and Kodiak are summarized as follows.

| **Anchorage Apartment Sales** | |
|---|---|
| Overall Rate ($R_o$) | 7.9% to 10.5% |

| **Kodiak Apartment Sales** | |
|---|---|
| Overall Rate ($R_o$) | 7.5% to 9.1% |

**$R_o$ Derived from Comparable Commercial Sales:** Capitalization rates extracted from recent commercial sales in Nome and Kotzebue are summarized on the following page.

| Nome Commercial Sales | |
|---|---|
| Overall Rate ($R_o$) | 9.4% to 11.5% |

| Kotzebue Commercial Sales | |
|---|---|
| Overall Rate ($R_o$) | 11.8% to 14.2% |

Generally speaking, multi-family properties typically command capitalization rates near the low end of the range, relative to other commercial and industrial properties. However, property sales in remote Alaska locations typically generate higher capitalization rates than those in larger cities. Based on analysis of comparable property sales, and the subject's physical (age and condition) and economic characteristics, a capitalization rate in the middle of the indicated range is considered appropriate. In final analysis, we conclude with an overall capitalization rate between 8.5 and 9.0%, which is considered a realistic projection for the subject property. The subject's value range via directed capitalization is developed below.

| Projected NOI capitalized at 9.0% | |
|---|---|
| $41,972 divided by 9.0% = | $466,356 |

| Projected NOI capitalized at 8.5% | |
|---|---|
| $41,972 divided by 8.5% = | $493,788 |

**Value Indication by Direct Capitalization:** Direct capitalization indicates a value range from $466,000 to $494,000 (rounded).

**Rent Loss:** We utilize market rental rates in our income projection because the property is occupied by NVU tribal members, with subsidized rental rates. Therefore, we must consider the income loss over time necessary to convert below market rent to market levels. By considering current Unalakleet apartment market conditions that include low vacancy rates and a shortage of supply, a reasonable conversion period to market rates is three months. However, because the current (subsidized) rental rates are only slightly below market and the short time necessary for conversion to market rates, the expected rent loss is nominal in relation to the overall property value. Therefore, we do not make a deduction, but consider the rent loss in our reconciliation.

**Deferred Maintenance Deduction:** As previously indicated in our improvements description, the property suffers from some deferred maintenance. We determined the improvements appear to meet a need for housing in Unalakleet, though curing deferred maintenance would increase operating efficiency and long-term viability of the income stream. Additionally, we classify the deferred maintenance as curable physical deterioration.

We do not have an engineer report detailing deferred maintenance. Based on our appraisal inspection and discussions with NVU representatives, deferred maintenance includes water damage to ceilings and walls on third floor; plumbing leaks of hot water baseboard heating system; stuck zone valves (open and/or closed); damaged and/or unsealed windows; and damaged exterior paint. We also base our cost estimate for curing deferred maintenance on our appraisal inspection, appraiser judgment based on experience in remote Alaska, and discussions with NVU representatives.

We note that with past maintenance and repairs (new water heaters; some new windows and doors; new attic insulation; new roof ventilation; replacement of some sinks and fixtures; and repairs to ceilings damaged by water), deferred maintenance has declined over the previous two years. However, the cost to cure remaining maintenance issues could be anywhere from $15,000 to $50,000. In conclusion, we estimate a cost of $25,000 to cure outstanding deferred maintenance, and increase operating efficiency and long-term viability of the income stream. This develops the following market value range.

| | | |
|---|---|---|
| Value Indicated By Direct Capitalization | $466,000 | $494,000 |
| Less: Cost to Cure Deferred Maintenance | - $25,000 | - $25,000 |
| **Indicated Value by Income Approach** | **$441,000** | **$469,000** |

**Market Value Conclusion:** After deducting a cost estimate to cure deferred maintenance, the value range indicated by the income capitalization approach is $441,000 to $469,000. In conclusion, we reconcile in the middle of the indicate range, and the market value of the appraised property, as of May 10, 2012, is estimated as follows.

| | |
|---|---|
| **Market Value Estimate** | **$450,000** |

*An extraordinary assumption of this report is that the uninspected units are in similar condition and repair as the units inspected.*

**Exposure Time:** 12 months

# Unalakleet

For Photos of Unalakleet click here.
For Maps of Unalakleet click here

## General Overview

| | |
|---|---|
| **Current Population:** | 692 (2011 DCCED Commissioner Certified Estimate, June 15, 2012) |
| **Pronunciation/Other Names:** | (YOO-nuh-luh-kleet) |
| **Incorporation Type:** | 2nd Class City |
| **Located In:** | Nome Census Area |
| **School District:** | Bering Strait School District |
| **Regional Native Corporation:** | Bering Straits Native Corporation |

## Location:

Unalakleet is located on Norton Sound at the mouth of the Unalakleet River, 148 miles southeast of Nome and 395 miles northwest of Anchorage. It lies at approximately 63.873060 North Latitude and -160.788060 West Longitude. (Sec. 03, T019S, R011W, Kateel River Meridian.) Unalakleet is located in the Cape Nome Recording District. The area encompasses 2.9 sq. miles of land and 2.3 sq. miles of water.

## History:

Archaeologists have dated house remnants along the beach ridge from 200 B.C. to 300 A.D. The name Unalakleet means "from the southern side." Unalakleet has long been a major trade center as the terminus for the Kaltag Portage, an important winter travel route connecting to the Yukon River. Indians on the upper river were considered "professional" traders with a monopoly on the Indian-Eskimo trade across the Kaltag Portage. The Russian-American Company built a post here in the 1830s. In 1898, reindeer herders from Lapland were brought to Unalakleet to establish sound herding practices. In 1901, the Army Signal Corps built over 605 miles of telegraph line from St. Michael to Unalakleet, over the portage to Kaltag and Fort Gibbon. The city was incorporated in 1974.

## Culture:

Unalakleet has a history of diverse cultures and trade activity. The local economy is the most active in Norton Sound, along with a traditional Unaligmiut Eskimo subsistence lifestyle. Fish, seal, caribou, moose, and bear are utilized. The sale of alcohol is prohibited in the community, although importation and possession is allowed.

## Economy:

Both commercial fishing for herring and herring roe and subsistence activities are major components of Unalakleet's economy. In 2010, 101 residents held commercial fishing permits. Norton Sound Econonomic Development Council operates a fish processing plant. Government and school positions are relatively numerous. Tourism is becoming increasingly important; there is world-class silver fishing in the area.

The 2006-2010 American Community Survey (ACS) estimated 247[1] residents as employed. The public sector employed 33.6%[1] of all workers. The local unemployment rate was 9.5%[1]. The percentage of workers not in labor force was 43.4%[1]. The ACS surveys established that average median household income (in 2010 inflation-adjusted dollars) was $47,222 (MOE +/-$8,433)[1]. The per capita income (in 2010 inflation-adjusted dollars) was $20,575 (MOE +/-$3,927)[1]. About 14.5%[1] of all residents had incomes below the poverty level.

[1] All ACS statistics are published with their repective margin of error (MOE). Some of the statistics here are calculated from the original ACS data. The MOE was unable to be carried through the calculations.

**For additional ACS information please click** here.

**For current Local Labor Market Information please click** here

## Facilities:

Water is derived from an infiltration gallery on Powers Creek and is treated and stored in a million-gallon steel tank. The water source is not sufficient during extremely cold weather. One-hundred-ninety (190) households are connected to the piped water and sewer system and have complete plumbing. Only two households haul water and honeybuckets. Residents haul refuse to the baler facility for transportation to the landfill. Refuse collection is available for commercial customers. Matanuska Electric Association owns and operates the electrical system in Unalakleet, through the Unalakleet Valley Electric Cooperative.

## Transportation:

Unalakleet has a state-owned 5,900' long by 150' wide gravel runway and a gravel strip that is 1,900' long and 75' wide. There are regular flights to Anchorage. Cargo is lightered from Nome; there is a dock. Local overland travel is mainly by ATVs, snowmachines, and dogsleds in winter.

## Climate:

Unalakleet has a subarctic climate with considerable maritime influences when Norton Sound is ice-free, usually from May to October. Winters are cold and dry. Average summer temperatures range 47 to 62 °F; winter temperatures average -4 to 11 ° F. Extremes have been measured from -50 to 87 °F. Precipitation averages 14 inches annually, with 41 inches of snow.

Webmaster

# *MacSwain Associates LLC*

*4401 Business Park Boulevard, Suite 22, Anchorage, Alaska 99503*

**Appraiser:** Steve MacSwain, MAI

Member of Appraisal Institute - No. 5700

State of Alaska, Certified General Real Estate Appraiser - No. 42

**Professional Experience:** 1986 to Present - MacSwain Associates LLC

1976 to 1986 - Appraisal Company of Alaska - President

1970 to 1975 - Real Estate Services Corporation – Appraiser

1969 to 1970 - State of Alaska Department of Highways - Right of Way Agent

Real estate appraiser and consultant of all property types throughout Alaska including commercial, industrial, subdivisions and special-purpose properties. Appraisals have been performed for financing, leasing, insurance, condemnation, taxation, property damages, investment analysis, and buy-sell decisions. Appraisals include valuation of both real property and business enterprises. Professional experience totals 40 years.

**Education:** Bachelor of Business Administration, Finance (1969), University of Alaska Fairbanks

**Appraisal Education:** The following is a list of completed appraisal courses and seminars.

*2012 – Uniform Standards of Professional Appraisal Practice – Update* by the Appraisal Institute

*2011 – Uniform Standards of Professional Appraisal Practice – Update* by the Appraisal Institute

*2010 – Reviewing Appraisals in Eminent Domain* by the International Right of Way Association

*2010 – Commercial Appraisal Engagement and Review Seminar for Bankers and Appraisers by the Appraisal Institute*

*2009 – Uniform Standards of Professional Appraisal Practice – Update* by the Appraisal Institute

2009 – *The Appraiser as an Expert Witness: Preparation and Testimony* by the Appraisal Institute

*2009 – Attacking and Defending an Appraisal in Litigation* by Whitmer Education

*2009 – Uniform Appraisal Standards for Federal Land Acquisitions (Yellow Book)* by the Appraisal Institute

*2008 – Uniform Standards of Professional Appraisal Practice* by the Appraisal Institute

*2007 – Business Practices and Ethics* by the Appraisal Institute

*2007 – Eminent Domain Law for Right of Way Professionals* by the International Right of Way Association

*2007 – Appraisal Review for Federal Aid Programs* by the International Right of Way Association

*2007 – Analyzing Operating Expenses* by the Appraisal Institute

*2007 – Forecasting Revenue* by the Appraisal Institute

*2007 – Case Studies in Highest and Best Use* by the Appraisal Institute

*2005 – Uniform Standards of Professional Appraisal Practice* by the Appraisal Institute

*2002 – Uniform Standards for Federal Land Acquisitions: Practical Applications for Fee Appraisers* by the Appraisal Institute

*2002 – Legal Aspects of Easements* by the International Right of Way Association

*2001 – Partial Interest Valuation Undivided* by the Appraisal Institute

*2001 – Special Purpose Properties Divided* by the Appraisal Institute

*1969-2000: Numerous appraisal classes pertaining to principles, income capitalization, cost analysis, sale comparison approach, and highest and best use analysis by the Appraisal Institute, Society of Real Estate Appraisers, International Right-of-Way Association, International Association of Assessing Officers, and Marshall Valuation Service*

**Membership and Organizations:** Member of Appraisal Institute – No. 5700
Member of International Right of Way Association
Member of Building Owners and Managers Association (BOMA), Anchorage

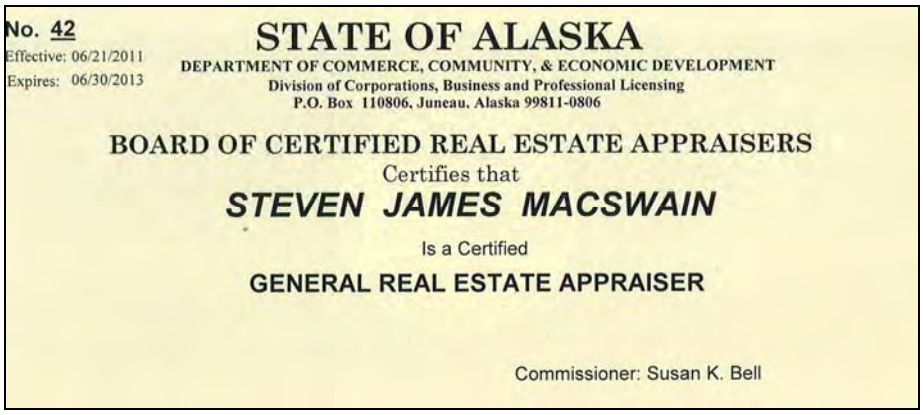
**Public Service:** Past Chairman of the State Board of Certified Appraisers
Past member of Board of Equalization, Municipality of Anchorage
Past member of National Experience Review Committee of the Appraisal Institute
Past member of Regional Ethics and Counseling Panel of the Appraisal Institute
Past president of Alaska Chapter 57 of the Appraisal Institute

**Significant Assignments:**

- Appraised Calais Company, Inc., a real estate holding company consisting of 39 commercial parcels in Anchorage.
- Principal real estate consultant and expert witness for all lands affected by the *Exxon Valdez* oil spill. Project involved over 2,000,000 acres of remote land and nearly 2,000 private property owners.
- Appointed as a representative of a three-member panel that analyzed and valued over 1,000,000 acres and 8,000 parcels for the Mental Health Lands Settlement.
- Contract assessor for the North Slope Borough, Kodiak Island Borough, City of Nome, and the City of Valdez.
- Represented Seibu Alaska, Inc. (Alyeska Resort and Alyeska Prince Hotel) in preparing of their property tax appeal with the Municipality of Anchorage that resulted in a $65 million reduction in assessed value.
- Appraised submerged tideland parcels and wetlands parcels located in Womens Bay on Kodiak Island for the purpose of an exchange between Koniag, Inc. and U.S. Fish and Wildlife Service
- Appraised Common Carrier Pipeline right-of-ways leased and operated by BP Transportation Alaska and ConocoPhillips Alaska.
- Appraised 3,600 acres consisting of the former Adak Naval Air Station and Submarine Base conveyed to the City of Adak and the State of Alaska.
- Appraised and/or provided consulting services on properties throughout Alaska including numerous financial institutions, Native corporation lands, and real estate holding companies both public and private.

**Expert Witness Experience:** Steve MacSwain is qualified as an expert witness in both the United States Federal Court and the State of Alaska Superior Court. Steve has testified as an expert witness in State and Federal courts. In addition, Steve has testified as expert witness in numerous Alaskan municipal tax courts, public hearings, and depositions on matters related to real property.

**Arbitrator Experience:** Appointed a Master by the Superior Court of Alaska and Municipality of Anchorage to serve as an arbitrator in determining just compensation.


No. 42
Effective: 06/21/2011
Expires: 06/30/2013

STATE OF ALASKA
DEPARTMENT OF COMMERCE, COMMUNITY, & ECONOMIC DEVELOPMENT
Division of Corporations, Business and Professional Licensing
P.O. Box 110806, Juneau, Alaska 99811-0806

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Cold Climate Housing Research Center

CCHRC

# UNALAKLEET
## Feasibility Study for the NVU
# 14-PLEX

**Prepared for:**
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And

The Department of Energy,
Tribal Energy Program


**March 25, 2013**


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COLD CLIMATE HOUSING RESEARCH CENTER

CCHRC

March 25, 2013

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Dear NVU IRA Council,

The Cold Climate Housing Research Center (CCHRC) is pleased to have been invited by the Native Village of Unalakleet (NVU) to participate in the U. S. Department of Energy-funded feasibility study on its 14-plex housing unit. Unalakleet is a rural Alaska community of about 700 residents located on the Bering Sea. The NVU is not connected to a road system or other infrastructure found in less isolated regions. Access to the community is limited to air or seasonally by water. Transportation and energy costs are extremely high and the local cash economy is limited to seasonal employment cycles with few year-round jobs. However, there is a healthy subsistence economy that provides a source of traditional food and activities. Local historians and archeologists believe that people have lived sustainably for over two thousand years in this location. Remains of house sites confirm that the history of the people is at least that long.

The 14-plex is home to approximately fifty individuals, both adults and children. This constitutes a significant number of village residents and is an important resource in a community with scarce housing options. The 14-plex exhibits many of the issues that buildings of this construction period have, most notably high energy use and thus high costs. These costs have reportedly been about $65,000 dollars annually. The cost of energy is close to exceeding the rental revenue and is certainly not a sustainable pattern. CCHRC was tasked with determining if the building was structurally sound enough to consider renovation and an extensive energy efficiency retrofit. What could the costs of this course of action be? Should demolition and new construction be considered? The following report examines these options in more detail. In conclusion, it was evident that there were many economic advantages to an extensive energy retrofit.

Some of the benefits to this approach are difficult to quantify—in particular, the health benefit of improved indoor air quality and comfort. A whole building ventilation system has been well-documented to contribute to better overall occupant health. The cost of serious upper respiratory episodes in elders and children is extremely high in rural Alaska. Emergency transportation to facilities to treat these episodes alone can exceed tens of thousands of dollars per occurrence. Decreasing these incidents not only has major benefits to the afflicted but also avoids considerable costs to the state, community and family.

There are other benefits of a retrofit approach that are covered in the report. It is quite possible to plan the weatherization work to allow for securing financing in stages. Well coordinated renovation activities can reduce the disruption to resident life if planned carefully. It also may be possible for residents to remain in their units during much of the construction period. Displacing and finding temporary housing for this many residents will be difficult if the building were to be torn down for replacement. Of course, a less than $1 million dollar retrofit compared to an estimated $4 million for a new multifamily unit is appealing.

It is the Cold Climate Housing Research Center's hope that the 14-plex project in Unalakleet can be an example to the state of a practical approach to dramatically improve the performance and longevity of a building in rural Alaska. Decreasing financial resources and escalating energy and construction costs will require creative approaches to a daunting challenge. We wish the people of Unalakleet and their region the best in carrying the 14-plex project to completion. CCHRC has been fortunate to be part of this important and very worthwhile effort.

Jack Hebert
President/CEO
Cold Climate Housing Research Center

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# THE 14-PLEX STRUCTURE

## Project Description

In 2011 the Cold Climate Housing Research Center (CCHRC) was approached by The Native Village of Unalakleet to investigate an existing structure within the village. In May 2012 the team carried out an energy audit and review of current conditions for the 14-unit building, with intentions to help determine potential futures for the structure. This report will address the following:

**[1] BUILDING ANALYSIS; Existing Conditions of the 14-PLEX**
This includes a site visit and analysis of the structure, investigation of indoor air quality and mold potential, inspection of the existing building systems, and an energy audit based on collected data.

**[2] ENERGY MODELS; Potential Futures**
Following the initial analysis, CCHRC staff modeled the current conditions of the 14-PLEX and posited two possible courses of action:

> **New Construction, Commercial BEES**
> If the structure were to be compromised beyond a salvageable state, what would new construction entail for an equivalent sized building? What are the design parameters in doing so, and what costs need to be considered?
>
> **CCHRC Recommended Retrofit**
> If the building is structurally sound, and the decision is made to preserve (and potentially upgrade) what measures would be required? What would be the resultant energy savings and estimated costs?

**[3] Comparison and Steps forward**
This section compares the paths forward, highlighting strengths and weaknesses of each scheme. Considering the situation holistically, the analysis team ultimately recommends the most viable option.

**[4] Appendix**
Pertinent supplementary information for this analysis is located here.

CCHRC enlisted two consultants to join in the building analysis team to assist with the survey and testing; an energy rater from Solutions for Healthy Breathing, and a structural engineer from USKH.

**The Team:**

Jack Hebert (CCHRC, President and Founder)
Ilya Benesch (CCHRC, Building Science Specialist)
Corey DiRutigliano (CCHRC, Project Manager)
Frank Thompson (USKH, Structural Engineer)
Karl Hough (Solutions for Healthy Breathing, Energy Rater)

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(This project has been funded by a generous grant from the Department of Energy (DOE) under the Tribal Energy Program)

# Feasibility Study for the NVU 14-PLEX BUILDING ANALYSIS

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# OBSERVED CONDITIONS

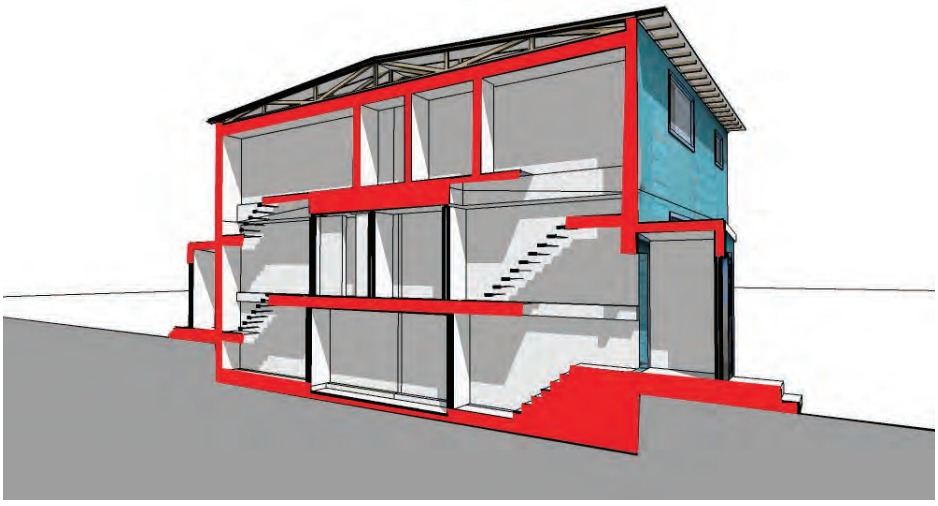
## Building Description

The 11,229 square foot Unalakleet 14-PLEX was constructed in 1978, with a normal occupancy of 50 people. The number of hours of operation for this building average 16 hours per day, considering all seven days of the week. Units are accessed from interior shared hallways, connecting the North and South sides of the building; these public spaces house mechanical equipment and shared amenities. Two open stairwells connect levels vertically, providing access and egress.

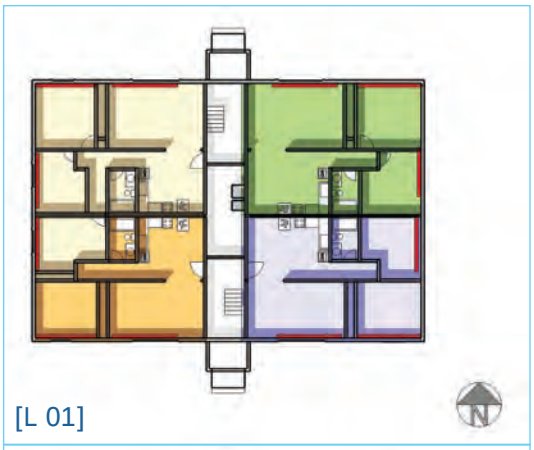
The original 1978 structure was a split-level two story with approximately eight units (four on each level). In 1985 an additional floor was added to the building, enclosing the roof trusses in between the now second and third stories. Current levels consist of: four units on the first and second floors, and six units on the third floor for a total of 14 units.

The **first** level is a daylight basement, partially below grade, at approximately -3'-0" (+0'-0" being grade); the **second** level at +5'-9" (above grade), and the **third** at +15'-9".

[May 2012; Southwest corner street side photo]



[Digital model section showing split levels]



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# STRUCTURAL REPORT

## May 2012 Conditions

USKH, an architectural and engineering firm located in Fairbanks Alaska, was subcontracted by CCHRC to travel to Unalakleet in order to complete a structural analysis of the existing 14-PLEX building. Frank Thomas, a Structural Engineer, accompanied the team analyzing the structure, and assisting with other areas of inquiry. The following report, created by USKH, identifies concerns as well as potential solutions.

Questions regarding the following structural report pages, can be best directed towards USKH.

# UNALAKLEET HOUSING ANALYSIS

# FINAL REPORT

February 2013

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# SUMMARY

USKH, Inc. Structural Engineer, Frank Thompson, conducted a site visit to Unalakleet, Alaska to perform a structural investigation of the Unalakleet 14-plex with the Cold Climate Housing Research Center (CCHRC). The structural investigation involved interviews with users and structural observation with minimal impact to the building. The investigation was performed to as built the existing structure and provides recommendations for upgrades to the structure.

The original housing structure was a two story structure with a daylight basement as the first floor, constructed in the late 1970's. Sometime in the 1980's a third story was added over the existing roof structure. The wood structure is built on a concrete thickened edge foundation, with a wood foundation wall at the daylight basement. The structure is in located in the middle of Unalakleet, a village that is found on a sand spit between the Unalakleet River and the Norton Sound. A geotechnical report was not provided, but it was indicated that the foundation material was alluvial gravel and that the probability of permafrost was unlikely.

From a structural perspective, the 14-plex appears to be in good condition. Two structural issues observed during the investigation included: deflection of the basement wall adjacent to many of the daylight basement windows and a possible lack of structural sheathing at exterior wall locations. Recommendations for dealing with these issues are provided below.

## Structural Observations

### Foundation

The foundation of the 14-plex building appears to be a 3" slab on grade with a perimeter thickened slab. It is unknown if the slab was thickened at interior bearing locations. At the perimeter of the building a treated 2x8 was keyed into the thickened slab, and a 2x6 all-weather wood foundation wall was constructed above it. The grade around the perimeter of the building comes up to the sill of the window at many locations, approximately 30" above basement floor, particularly on the north and south faces of the building. At the window locations there was noticeable deflection at the windows, where the wall appeared to be bowing in due to surcharge from the exterior grade. Frost heaving on the basement wall due to poor drainage and heat loss at the windows may exacerbate the problem. The construction of the all-weather wood foundation wall was not exposed, but it is assumed that the wall was constructed from treated 2x6's spanning from the concrete foundation to the first floor, with a layer of treated sheathing up to grade. The deflection observed at the window sills may be due to an under designed sill and king stud adjacent to the windows.

### Recommendations

Existing grade around the perimeter of the building should ensure that snowmelt and precipitation drains freely away from the foundation of the structure. Providing positive drainage away from the building will alleviate frost heave loading associated with water freezing adjacent to foundation wall. A more extensive method would be to remove the existing material around the perimeter to the concrete foundation level, inspect the condition of the foundation wall sheathing and replace as necessary. Adding rigid insulation on the existing foundation wall

and a distance horizontally away from the building at this time would be beneficial in reducing the heat loss to the exterior perimeter grade. The backfill material around the perimeter of the building would then be non-frost susceptible material to ensure that water drains freely adjacent to the foundation wall. Another item that could be included would be the installation of egress wells at daylight basement window locations to keep surrounding grade and snow build up adjacent to windows to a minimum.

Superstructure

Gravity

The 14-plex structure has bearing lines at the quarter points of the building at 12' on center along the 48' length of the building. Interior corridor walls also appear to be bearing walls supporting the corridor. The exterior walls are of 2x6 construction, and interior bearing walls of 2x construction. The first floor construction appears to be ¾" floor sheathing on 2x8's at 16" on center spanning 12', which are very close to capacity for residential construction. The second floor construction consists of ¾" floor sheathing on manufactured joists, which previously served as the roof structure; the joists are 24" deep parallel chord manufactured trusses at 16" on center. The roof structure consists of 5/8" roof sheathing on manufactured roof trusses at 24" o.c. The roof trusses appeared to span from the exterior walls to the interior center bearing line and had a roof slope of approximately 1.5/12.

Recommendations

From a gravity standpoint the 14-plex appears to be in sound condition. The first floor joists are close to maximum capacity for residential construction, using a live load of 40 pounds per square foot, and assuming a dead load of 15 pounds per square foot. Any modification to the structure shall be careful to take into account the location of bearing walls.

Lateral

The 14-plex lateral system to resist wind and seismic loading would most likely consist of plywood sheathing on the 2x walls. Wind loading controls in this region, with minimal amount of expected seismic activity expected. With a design wind load of 130 miles per hour, exposure D, the design wind pressure is in the range of 35 to 45 pounds per square foot. Observation of the exterior of the building found that the exterior sheathing may be deficient. The exterior sheathing/siding appeared to be a combination of T 1-11 siding and wood clap boards. The exterior siding was not removed to check for a layer of structural sheathing below the siding material. Interviews with residents and locals found that with a strong gust of wind, the structure would exhibit levels of movement that made them uncomfortable.

Recommendations

It is not confirmed that the structure lacks a main force wind resisting system, but it should be checked for structural adequacy due to the high wind loads in the region. The exterior siding of the structure shall be removed to identify if structural wall sheathing was used during

construction. T1-11 siding may be used for sheathing against lateral forces if it is rated, and typically 5/8" thick. With the high winds in the region, structural sheathing should be provided to stiffen the building and resist the lateral loading.

**Figure 1: Interior concrete slab**

**Figure 2: 2X8 Sill on perimeter thickened edge**

**Figure 3: Exposed foundation wall sill plate**

**Figure 4: Exterior view of daylight basement window**

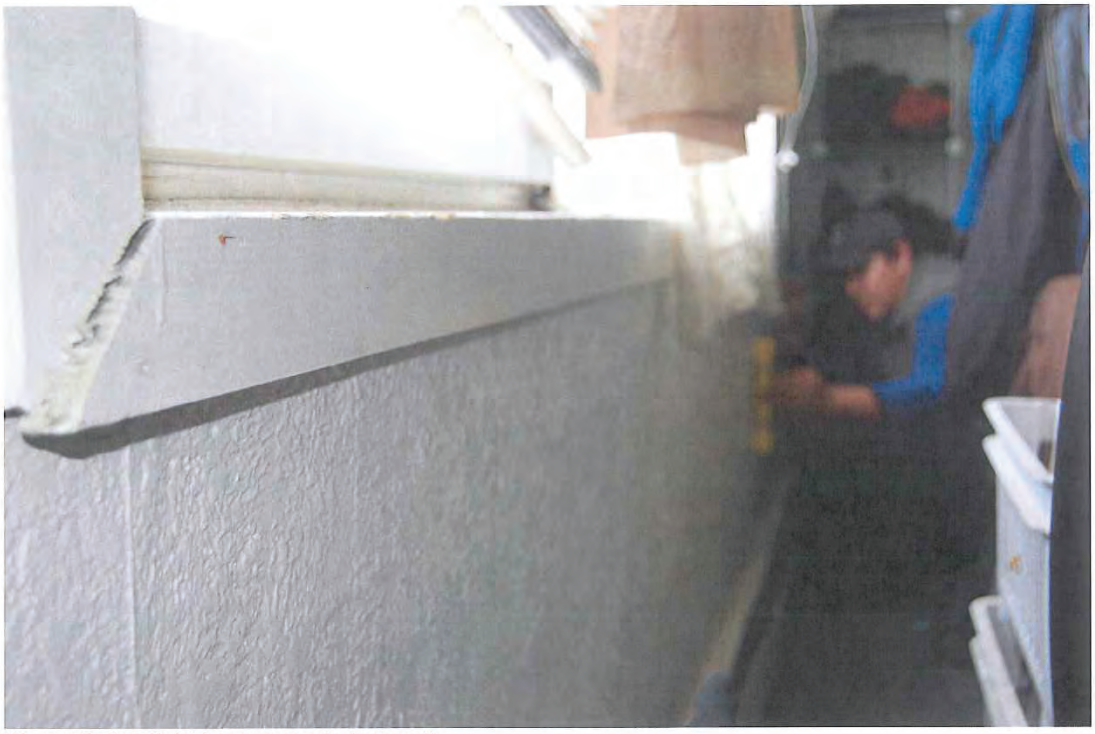


**Figure 5: Daylight basement window wall**

**Figure 6: Manufactured floor trusses**

**Figure 7: Manufactured roof trusses**

**Figure 8: North elevation, T1-11 siding**

**Figure 9: South elevation, T1-11 siding and clapboard**

**Figure 10: West Elevation**

**Figure 11: East elevation**

# BUILDING COMPONENTS

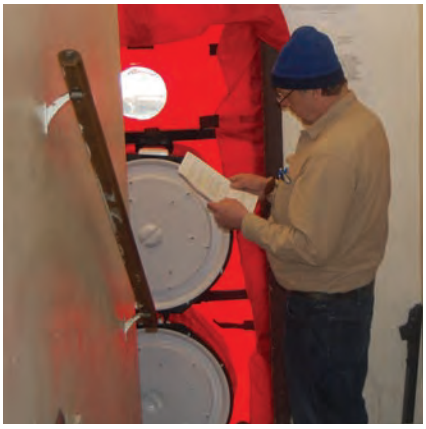
## Current State

The project team thoroughly examined the envelope, from both beyond and within. Prior to arrival, through contact with Margaret Hemnes-Woods and Waylon Koutchak, CCHRC was made aware of existing concerns. This included drafty windows, periodic water damage, draftiness, and 'excessive' amounts of fuel consumption required during heating seasons. The team prepared for a number of tests and investigations prior to arrival, the outcomes of which are described on the following pages.

## Blower Door Test

A blower door test is a standardized air leakage test that uses one or more calibrated exhaust fans to depressurize a structure under controlled conditions. The air leakage rate determined under these test conditions provides an assessment of a building's air tightness level. Once an air leakage rate has been established, it then becomes possible to calculate the energy cost associated with that leakage. When used in combination with infrared cameras and/or smoke-generating devices, blower door testing can also help locate the air leakage points within a building envelope.

Measuring the air leakage rate of the Unalakleet 14plex proved challenging. The high occupant load of the 14 units made air leakage testing on the structure difficult since exterior openings such as windows and doors continued to be used in spite of the test. Consequently, multiple tests were run to establish a consistent estimate of the air leakage rate. A double blower door configuration was used to perform the depressurization test due to the volume of the structure and the amount of air leakage. The multiple tests averaged the leakage rate at 9100 cubic feet per minute at 50 pascals of pressure.



[Individual Blower Door Test Unit (with double fans) installed and running]

From a statistical standpoint, this amount of air leakage falls within the current regional average for commercial structures of this size and type. In contrast to leakage rates for other structures of this type built in the 1970s in this region–when air sealing practices and available materials were minimal –the tested leakage is considered relatively low. During the physical inspection, it appeared that over the years various efforts had been made to improve the building's air tightness around traditional weak spots in the building envelope—including air sealing around penetrations into the attic and other exterior openings such as windows and doors. Using the test data in combination with observations made during the physical inspection, it can be reasonably assumed that various air sealing efforts have improved the building's air tightness. Even so, there remains significant room for improvement as the current amount of air leakage still accounts for over 50% of all energy loss in the list of building shell components

# Foundation and Floors

Floor construction is lumber framing with a plywood sub floor. No noticeable damage or issues were noted in the areas inspected. It was initially assumed that the foundation of the structure was poured concrete but further examination showed that it was treated All-Weather Wood (AWW). This construction method is made up of a 2x6 wall with 2x8 sill/foundation plate, placed onto concrete and keyed. Elements appeared to be dry and sound. (Reference preceding Structural Report)

Surface drainage on the exterior around the foundation appeared to be potentially problematic. The lack of a sloping grade away from the building perimeter (further exacerbated by the absence of a guttering system on the roofs) allows water to pool near the foundation. This could be entering basement living areas. On a walk-though of the building no water damage or reports of any recent water intrusion was reported or seen. It was concluded that surface drainage is likely very good through the Non-Frost Susceptible (NFS) gravels that constitute the general soils in the community. Heat escaping from the (suspected) uninsulated poured concrete slab is allowing thawed ground to be present immediately adjacent to the AWW foundation wall - a precarious situation that could eventually lead to frost heaving complications.

[Floor construction on levels 2 and 3]

[Absence of positive grade drainage]

[Ice as evidence of water pooling at foundation walls ]

[Snow sitting against foundation walls ]

# Insulation and Wall Construction

The Exterior walls 2x6 wood framing is clad in T1-11 siding and has an assumed insulation value of R-19. From the exterior the building appears straight and true with no apparent subsidence or major structural issues (see Structural Analysis for further information).

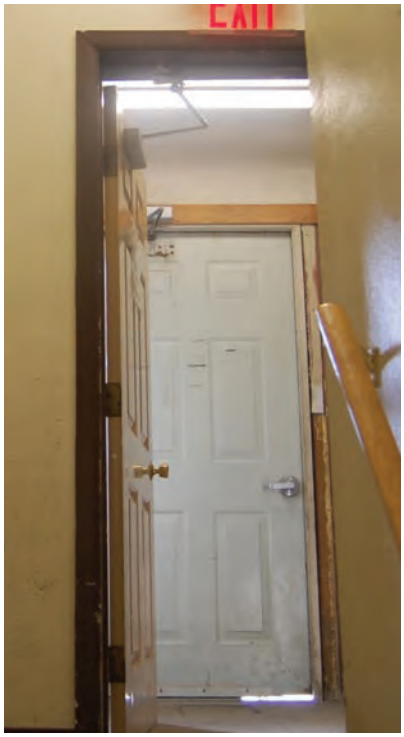
[Exterior wall showing T1-11 siding and other cladding material]

# Windows and Doors

Typical windows throughout the building are double-glazed vinyl casement windows. Many windows, if not most, leaked, did not operate well, and had broken panes. Condensing and water damage to the sills and walls beneath the windows was apparent, though visual mold was not visible in most cases.

The two exit doors, one located on the North side and the other on the South, are hollow core steel with sidelights. These doors exhibited surface damage and failing gaskets around the thresholds, but otherwise appeared to be structurally sound.

[Compromised operable window unit ]




[Exterior Doors - gap visible at bottom threshold]

# Roof

The 14-PLEX has a Cold Roof. It is structurally supported by a prefabricated and modular truss system. An examination of the roof truss cavity showed what appeared to be sound structural members. No apparent rot or discoloration of the members from exterior water intrusion was visible. Seven to five inches of recently applied cellulose had been applied in the roof cavity. Sheldon and Albert reported that the NVU had removed the fiberglass insulation that was saturated from moisture introduced from bath fans directly venting in to the roof cavity. NVU had repaired this problem, ducting the exhaust to the exterior, and correcting the frost issues.

At the time of inspection a great deal of air movement was occurring in the roof cavity due to wind; it raised the concern that blowing snow could also enter the roof cavity during a storm event.

Additionally, the absence of a guttering system that would help move water runoff away from the structure, contributes to water ponding near the foundation.

[Winter frost build-up in roof truss cavity space]

[The culprit: improperly ventilated bathrooms]

[Wet insulation was removed and the structure was allowed to dry]

[Cellulose insulation, this remains a cold roof]

# INDOOR AIR QUALITY REPORT

## May 2012 Conditions - IAQ and Other Potential Contaminates

Solutions For Healthy Breathing, a building health specialist group located in Fairbanks Alaska, was subcontracted by CCHRC to travel to Unalakleet in order to complete a number of analyses on the existing 14-PLEX building. Karl Hough, an Indoor Air Quality Consultant, accompanied the team analyzing the structure, and assisting with other areas of inquiry. The following report, by Mr. Hough, identifies concerns as well as potential solutions.

## Site Notes

Indoor air quality seemed to be good, and is likely attributable to the amount of air leakage through the building envelope. Some noticeable issues existed, however: Dryer vents were not working properly and this was apparent in areas where dryers were operating. However, one family interviewed said that their general health had been good since moving in to their apartment in the 14-PLEX, an improvement over their last residence that they reported as being “moist and stuffy.”

No mechanical ventilation was apparent with the exception of bath fans. Envelope leakage provided air exchange and was likely increased by wind. Mr. Koutchak reported that average wind speeds are over 13 miles per hour and that the village supplied approximately one-third of its electricity from six wind generators on a hill nearby.

Concerns over the mold damage to the structure, resulting from lack of deliberate/intentional ventilation, were unrealized, leaking envelope allowed the structure to dry in cold and wet periods; ironically, lack of insulation seems to have preserved structural integrity.

[AWW Foundation, clear of rot and mold at time of inspection]

SOLUTIONS
For Healthy Breathing

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Solutions for Healthy Breathing was requested to conduct an Indoor Air Quality inspection at the above residence.
The assessment included mold, moisture, and general indoor air quality issues.

**General building Description:** 2x6 frame structure approximately 48'by 72'. Three floors. First floor is daylight basement. Four living units are located on the first floor, four on the second floor and six on the third floor.

**Heater(s)**: Building is heated with Hot water baseboard and the boilers are located on the first floor in a central boiler room. Although two Burnham boilers are in place, the newer one was inoperable at the time of inspection awaiting parts. The building is generally heated with one of the boilers and the second is backup. It appears that the boilers draw combustion air from openings in the boiler room floor and from the building.

**Ventilation**: Ventilation at the time of inspection was "exhaust only" with no provision for make-up air to balance the ventilation.

**Mold and Mold Sampling**: Mold and mold staining were observed in numerous places including window sills, bathroom tub and shower enclosures, laundry areas, beneath sinks and on walls and ceilings.
Air samples were taken in one empty apartment, in common areas on all three floors and outdoors for a control. Although the indoor samples were higher than the outdoor control, they were not considered "elevated" by the testing lab. The outdoor control was very low due to the fact that outdoor temperatures were below freezing and much of the surrounding area was still snow covered. Summer time outdoor levels would generally be much higher than the levels found in the building at the time of this inspection. (see attached Pro-Lab mold analysis report)

**VOC sampling**: Only minor VOC (volatile organic compounds, generally associated with fuel leaks or material off-gassing) levels were detected and were associated with cooking smells and some fresh paint in one remodeled unit.

**Carbon Monoxide**: Co monitoring during the walk through inspection, including a full cycle of the boiler, showed no measurable Co levels. A data tracking meter left overnight in the boiler room did indicate several spikes in Co levels to between 50 and 275ppm. These spikes occurred late at night and were of short duration (less than 15 minutes) and likely indicate poor boiler start up or backdrafting between cycles due to wind or stack effect. The cooking in the complex is electric by design. So the only strong potential for Co in the complex should be the boilers.

**Crawl Space**:There is no designated crawl space under the building, however there are several utility conduits that open into the boiler room and allow for soil gasses and other contaminants to potentially be drawn into the building air due to negative indoor air pressures caused by unbalanced ventilation and general stack effect.

**Observations and Comments**:

- Radon: A three day sampeling in the lowest living space was not possible, however for general information purposes, a 20 hour monitoring of the boiler room (lowest level and with openings to the ground) showed an average of 3.1pCi/L. This is below the EPA recommended safe level of

4pCi/L. It is unlikely that radon levels would be a problem in this building, especially if the floor were properly sealed from the ground and the ventilation were properly balanced.

- Lead: Paint samples were taken in Apt. #10 and under the stairway on the ground floor and submitted to Pro-Lab for analysis. These came in well below the EPA's "safe" level of 5000ppm. See attached Pro-Lab report.
- Building has many broken windows and doors leading to the "common" hallways are poorly sealed or left open. This and the fact that the hallways and stairways are open from bottom floor to top floor creates a strong potential for stack effect (the tendency for warmer air to rise) and for sharing of indoor air between tenants. This was confirmed by the fact that a resident cooking fish on the bottom floor smelled distinctly on the third floor. Also third floor residents complained that it was usually too hot even with thermostats turned down and residents on the bottom floor complained that they could not keep their apartments warm. During inspection of a third floor apartment it was noted that although the thermostat was turned down and the register was cold and the outside temperature was 15F, the temperature in the apartment was 84F.
- Although the grading around the building shows potential for rain and runoff to seep down around the foundation, this did not seem to be a problem at the time of inspection.
- There were signs of mold staining and moisture damage in several places but these appear to have been caused by reoccurring plumbing problems and/or improper venting of dryers and venting of the third floor apartments into the attic. These problems had been rectified at the time of inspection.
- The primary concern voiced by those responsible for maintenance and operation of this building was the fact that heating costs are approaching rental income. The long term solution will involve many factors. There is definitely much room for improvement in the thermal envelope. It will be critical to the indoor air quality to make improvements in air flow dynamics and ventilation along with any upgrades to the energy efficiency. The indoor air quality appears adequate at the time of inspection, however, this is generally due to a poorly sealed building and a generally dry cold climate. The fact that many doors and windows do not seal properly combined with the free flow of air from bottom floor to top floor through common hallways and the tendency for top floor residents to open windows to control excess heat all are adding to the heating inefficiency.

**Recommendations**:

1. ASHRAE standards require a mechanical ventilation rate of 35cfm (continuous) for the one bedroom units and 55cfm (continuous) for the two bedroom units. This could be achieved with a combination of programmable bathroom fans and passive fresh air inlets. This is not possible with "exhaust only" fans that rely on make up air from other areas of the building. For long term energy efficiency HRV (heat recovery ventilation) systems would be best. There are small HRV units available that would suit the needs of these apartments and allow tenants to individually control their ventilation as needed.
2. Even though cooking is with electricity, it is very important for range hoods to vent outside in order to control humidity and other air pollutants caused by cooking.
3. Thermally efficient and properly sealed windows are critical to the heating efficiency and air flow dynamics of this building.
4. Although the individual units open to a common hallway, it is critical that the doors be well sealed when closed. This would greatly reduce the potential for warm air being pulled away from bottom units and drawn upstairs. It would also reduce the spread of cooking and other odors between apartments.
5. Well sealed doors between floors in hallways would reduce air movement and increase heating efficiency.
6. Boiler room should have a designated combustion air supply that does not rely on the leakiness of the building envelope or air pulled up through holes in the floor to supply combustion air.
7. All holes in the lower floor should be sealed to prevent indoor air being contaminated by pollutants pulled up from the ground.
8. All units and common areas should have functioning Co monitors and smoke alarms.
9. All the above suggestions will be even more important as the building envelope is tightened to achieve better heating efficiency.
10. In conclusion, I do not see any Indoor air quality reasons that this building can not continue functioning as a multi family living unit. Energy retrofitting would surely make heating more efficient and attention to the above recommendations should maintain healthy indoor air quality.

The preceding information is true and correct to the best of my knowledge.

This Air Quality Assessment in no way implies health or medical advice or any solicitation for additional services. We advise contacting your health care provider for medical assistance. We recommend you contact professional contractors to assist in correcting any deficiencies.

Karl Hough - Indoor Air Quality Consultant

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SOLUTIONS FOR HEALTHY BREATHING
PO BOX 10918
FAIRBANKS, AK 99710

# Certificate of Mold Analysis

| | |
|---|---|
| Prepared for: | SOLUTIONS FOR HEALTHY BREATHING |
| Phone Number: | (907) 460-6653 |
| Fax Number: | (907) 378-4108 |
| Project Name: | UNALAKLEET 14 PLEX |
| Test Location: | 14 PLEX |
| | UNALAKLEET, AK 99684 |
| Chain of Custody #: | 577254 |
| Received Date: | May 7, 2012 |
| Report Date: | May 8, 2012 |

John D. Shane Ph.D., Technical Manager

Currently there are no Federal regulations for evaluating potential health effects of fungal contamination and remediation. This information is subject to change as more information regarding fungal contaminants becomes available. For more information visit http://www.epa.gov/mold or www.nyc.gov/html/doh/html/epi/mold.shtml. This document was designed to follow currently known industry guidelines for the interpretation of microbial sampling, analysis, and remediation. Since interpretation of mold analysis reports is a scientific work in progress, it may as such be changed at any time without notice. The client is solely responsible for the use or interpretation. PRO-LAB/SSPTM Inc. makes no express or implied warranties as to health of a property from only the samples sent to their laboratory for analysis. The Client is hereby notified that due to the subjective nature of fungal analysis and the mold growth process, laboratory samples can and do change over time relative to the originally sampled material. PRO-LAB/SSPTM Inc. reserves the right to properly dispose of all samples after the testing of such samples are sufficiently completed or after a 7 day period, whichever is greater.

AIHA LAP, LLC
ACCREDITED LABORATORY
ENVIRONMENTAL MICROBIOLOGY
ISO/IEC 17025:2005
WWW.AIHAACCREDITEDLABS.ORG
LAB # 163230

**For more information please contact PRO-LAB at (954) 384-4446 or email info@prolabinc.com**

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1675 North Commerce Parkway, Weston, FL 33326 (954) 384-4446

**Prepared for :** SOLUTIONS FOR HEALTHY BREATHING **Test Address :** UNALAKLEET 14 PLEX
14 PLEX
UNALAKLEET, AK 99684

| | | | | |
|---|---|---|---|---|
| **ANALYSIS METHOD** | Spore trap analysis | Spore trap analysis | Spore trap analysis | Spore trap analysis |
| **LOCATION** | Outdoor/control | Top Floor Hallway | Bottom Floor Hallway S | Middle Floor Hallway |
| **COC / LINE #** | 577254-3 | 577254-4 | 577254-5 | 577254-6 |
| **SAMPLE TYPE & VOLUME** | Z5 - 25L | Z5 - 25L | Z5 - 25L | Z5 - 25L |
| **SERIAL NUMBER** | Z689071 | Z690029 | Z689496 | Z689088 |
| **COLLECTION DATE** | **May 4, 2012** | **May 4, 2012** | **May 4, 2012** | **May 4, 2012** |
| **ANALYSIS DATE** | **May 8, 2012** | **May 8, 2012** | **May 8, 2012** | **May 8, 2012** |
| **CONCLUSION** | **CONTROL** | **NOT ELEVATED** | **NOT ELEVATED** | **NOT ELEVATED** |

| **IDENTIFICATION** | Raw Count | Spores per $m^3$ | Percent of Total | Raw Count | Spores per $m^3$ | Percent of Total | Raw Count | Spores per $m^3$ | Percent of Total | Raw Count | Spores per $m^3$ | Percent of Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cladosporium** | 2 | 80 | 40 | 3 | 120 | 20 | 1 | 40 | 11 | 1 | 40 | 9 |
| **Other Basidiospores** | 1 | 40 | 20 | | | | 1 | 40 | 11 | 1 | 40 | 9 |
| **Penicillium/Aspergillus** | 2 | 80 | 40 | 12 | 480 | 80 | 7 | 280 | 78 | 8 | 320 | 73 |
| **Unidentified Spores** | | | | | | | | | | 1 | 40 | 9 |
| **TOTAL SPORES** | 5 | 200 | 100 | 15 | 600 | 100 | 9 | 360 | 100 | 11 | 440 | 100 |
| **MINIMUM DETECTION LIMIT*** | 1 | 40 | | 1 | 40 | | 1 | 40 | | 1 | 40 | |
| **BACKGROUND DEBRIS** | Moderate | | | too heavy for accurate count. | | | Moderate | | | Moderate | | |
| **Cellulose Fiber** | 1 | 40 | | 6 | 240 | | 4 | 160 | | 10 | 400 | |
| **Fiberglass** | | | | | | | 1 | 40 | | | | |
| **OBSERVATIONS & COMMENTS** | | | | Counts are estimated. Actual numbers of spores probably higher. | | | | | | | | |

Background debris qualitatively estimates the amount of particles that are not pollen or spores and directly affects the accuracy of the spore counts. The categories of Light, Moderate, Heavy and Too Heavy for Accurate Count, are used to indicate the amount of deposited debris. Increasing amounts of debris will obscure small spores and can prevent spores from impacting onto the slide. The actual number of spores present in the sample is likely higher than reported if the debris estimate is 'Heavy' or 'Too Heavy for Accurate Count'. All calculations are rounded to two significant figures and therefore, the total percentage of spore numbers may not equal 100%.
***Minimum Detection Limit**. Based on the volume of air sampled, this is the lowest number of spores that can be detected and is an estimate of the lowest concentration of spores that can be read in the sample. **NA** = Not Applicable.

**Spores that were observed from the samples submitted are listed on this report. If a spore is not listed on this report it was not observed in the samples submitted.**

**Interpretation Guidelines:** A determination is added to the report to help users interpret the mold analysis results. A mold report is only one aspect of an indoor air quality investigation. The most important aspect of mold growth in a living space is the availability of water. Without a source of water, mold generally will not become a problem in buildings. These determinations are in no way meant to imply any health outcomes or financial decisions based solely on this report. For questions relating to medical conditions you should consult an occupational or environmental health physician or professional.

**Control** is a baseline sample showing what the spore count and diversity is at the time of sampling. The control sample(s) is usually collected outside of the structure being tested and used to determine if this sample(s) is similar in diversity and abundance to the inside sample(s).

**Elevated** means that the amount and/or diversity of spores, as compared to the control sample(s), and other samples in our database, are higher than expected. This can indicate that fungi have grown because of a water leak or water intrusion. Fungi that are considered to be indicators of water damage include, but are not limited to: *Chaetomium*, *Fusarium*, *Memnoniella*, *Stachybotrys*, *Ulocladium*.

**Not Elevated** means that the amount and/or the diversity of spores, as compared to the control sample and other samples in our database, are lower than expected and may indicate no problematic fungal growth.

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**Prepared for :** SOLUTIONS FOR HEALTHY BREATHING **Test Address :** UNALAKLEET 14 PLEX
14 PLEX
UNALAKLEET, AK 99684

| | | | | |
|---|---|---|---|---|
| **ANALYSIS METHOD** | Spore trap analysis | INTENTIONALLY BLANK | INTENTIONALLY BLANK | INTENTIONALLY BLANK |
| **LOCATION** | Apt #10 | | | |
| **COC / LINE #** | 577254-7 | | | |
| **SAMPLE TYPE & VOLUME** | Z5 - 25L | | | |
| **SERIAL NUMBER** | Z691742 | | | |
| **COLLECTION DATE** | **May 4, 2012** | | | |
| **ANALYSIS DATE** | **May 8, 2012** | | | |
| **CONCLUSION** | **NOT ELEVATED** | | | |

| **IDENTIFICATION** | Raw Count | Spores per $m^3$ | Percent of Total | Raw Count | Spores per $m^3$ | Percent of Total | Raw Count | Spores per $m^3$ | Percent of Total | Raw Count | Spores per $m^3$ | Percent of Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cladosporium** | | | | | | | | | | | | |
| **Other Basidiospores** | 3 | 120 | 30 | | | | | | | | | |
| **Penicillium/Aspergillus** | 6 | 240 | 60 | | | | | | | | | |
| **Unidentified Spores** | 1 | 40 | 10 | | | | | | | | | |
| **TOTAL SPORES** | 10 | 400 | 100 | | | | | | | | | |
| **MINIMUM DETECTION LIMIT*** | 1 | 40 | | | | | | | | | | |
| **BACKGROUND DEBRIS** | too heavy for accurate count. | | | | | | | | | | | |
| **Cellulose Fiber** | 8 | 320 | | | | | | | | | | |
| **Fiberglass** | | | | | | | | | | | | |
| **OBSERVATIONS & COMMENTS** | Counts are estimated. Actual numbers of spores probably higher. | | | | | | | | | | | |

Background debris qualitatively estimates the amount of particles that are not pollen or spores and directly affects the accuracy of the spore counts. The categories of Light, Moderate, Heavy and Too Heavy for Accurate Count, are used to indicate the amount of deposited debris. Increasing amounts of debris will obscure small spores and can prevent spores from impacting onto the slide. The actual number of spores present in the sample is likely higher than reported if the debris estimate is 'Heavy' or 'Too Heavy for Accurate Count'. All calculations are rounded to two significant figures and therefore, the total percentage of spore numbers may not equal 100%.
***Minimum Detection Limit**. Based on the volume of air sampled, this is the lowest number of spores that can be detected and is an estimate of the lowest concentration of spores that can be read in the sample. **NA** = Not Applicable.

**Spores that were observed from the samples submitted are listed on this report. If a spore is not listed on this report it was not observed in the samples submitted.**

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**Control** is a baseline sample showing what the spore count and diversity is at the time of sampling. The control sample(s) is usually collected outside of the structure being tested and used to determine if this sample(s) is similar in diversity and abundance to the inside sample(s).

**Elevated** means that the amount and/or diversity of spores, as compared to the control sample(s), and other samples in our database, are higher than expected. This can indicate that fungi have grown because of a water leak or water intrusion. Fungi that are considered to be indicators of water damage include, but are not limited to: *Chaetomium*, *Fusarium*, *Memnoniella*, *Stachybotrys*, *Ulocladium*.

**Not Elevated** means that the amount and/or the diversity of spores, as compared to the control sample and other samples in our database, are lower than expected and may indicate no problematic fungal growth.

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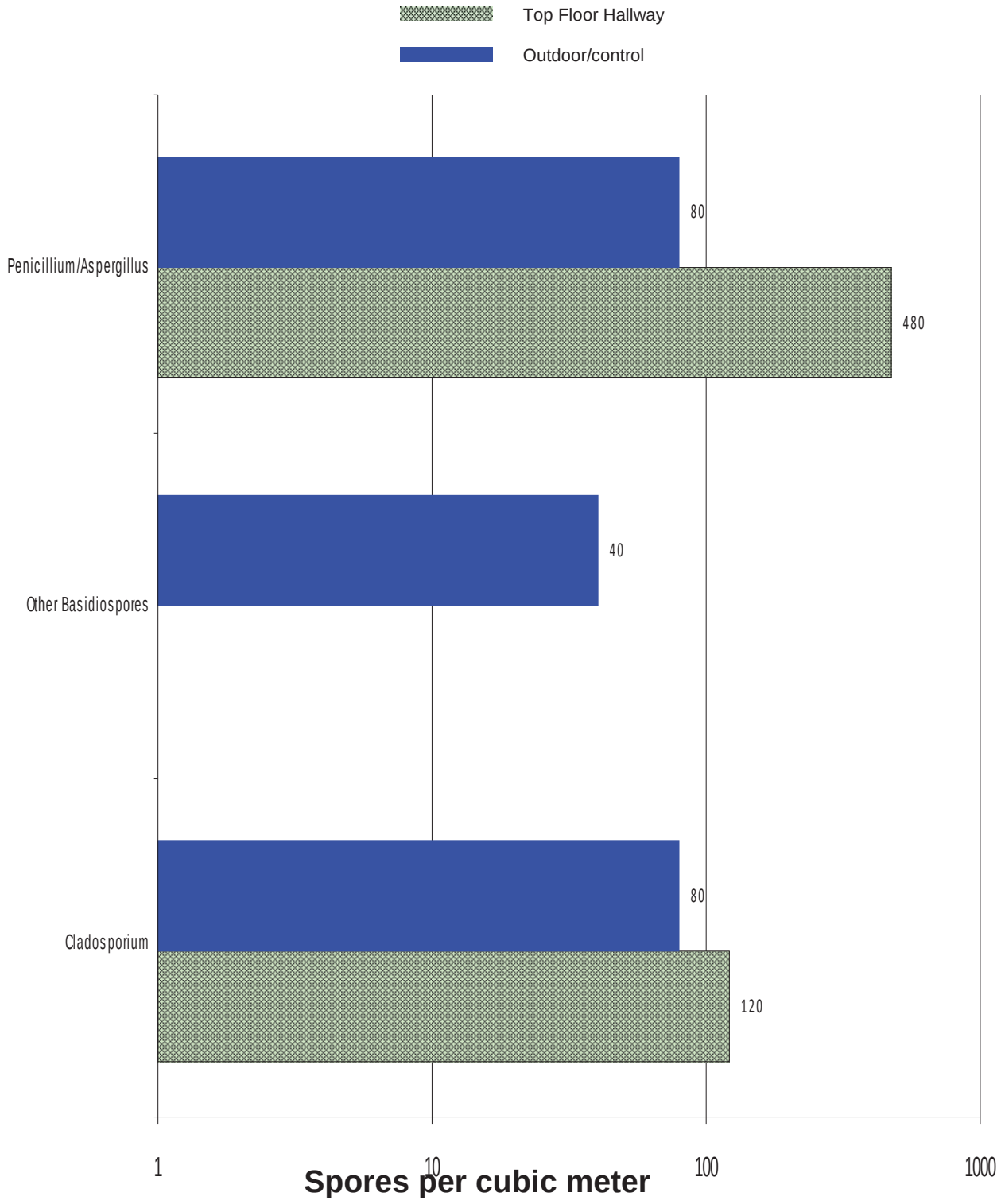
**Chain of Custody #** 577254



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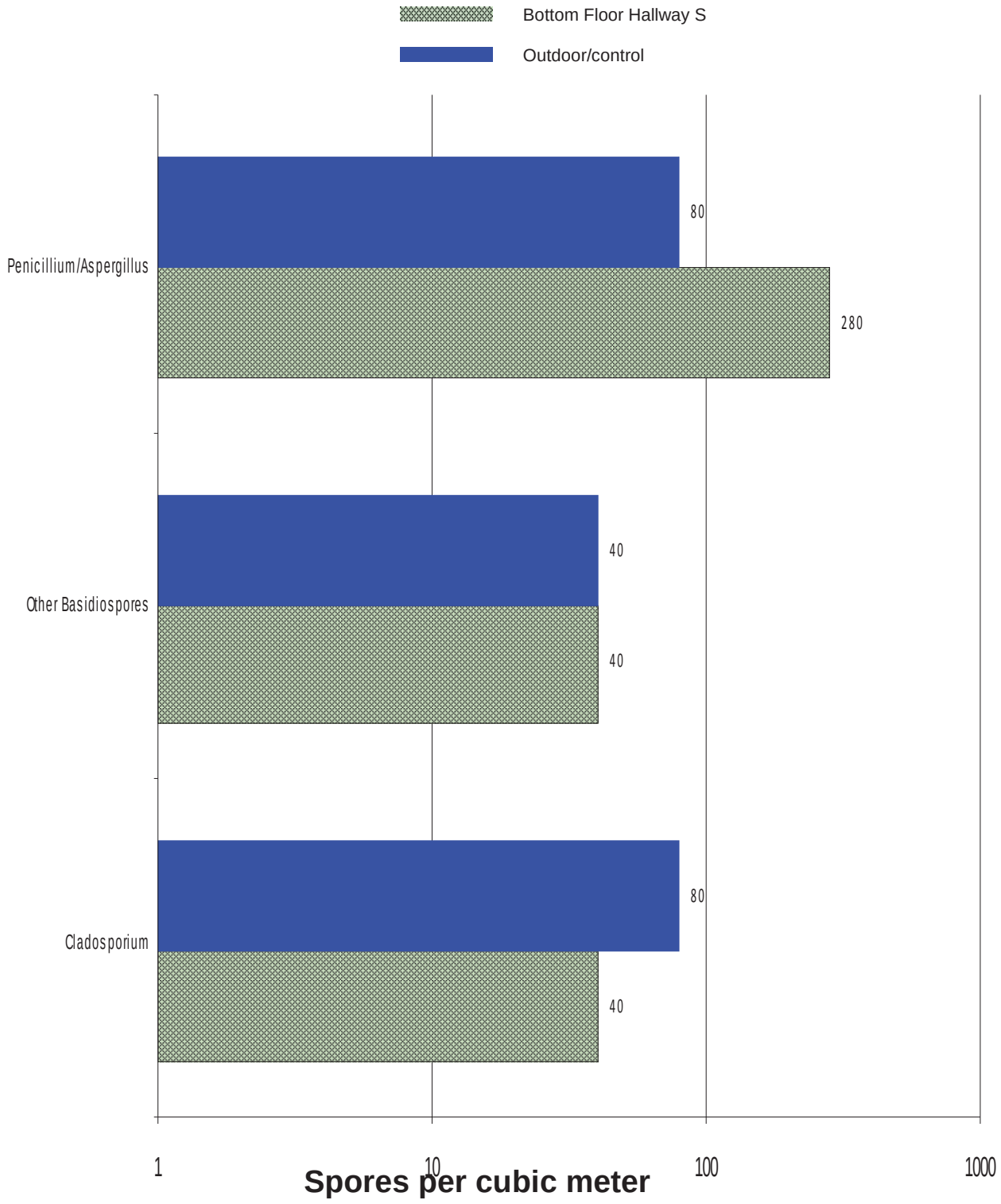

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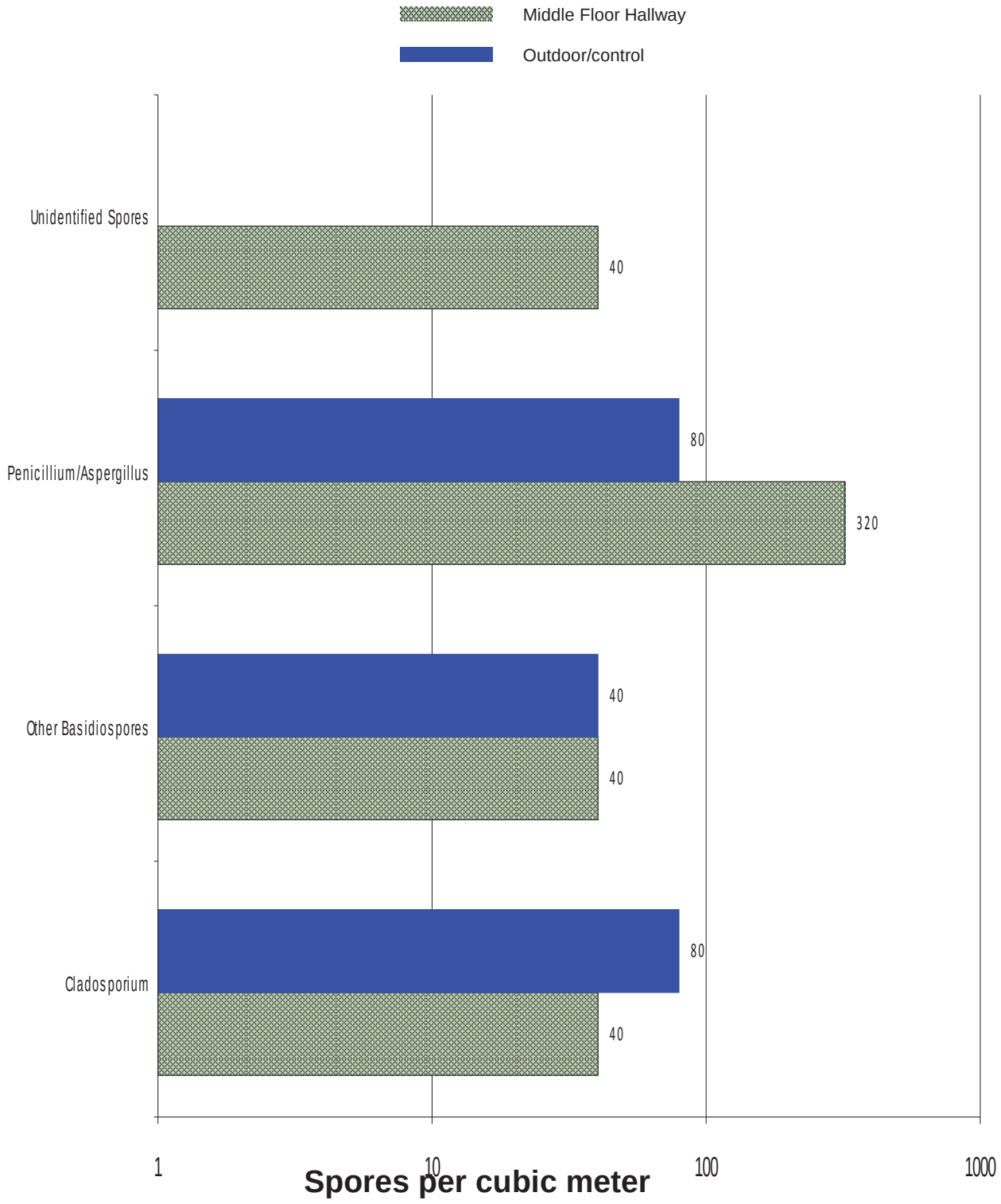

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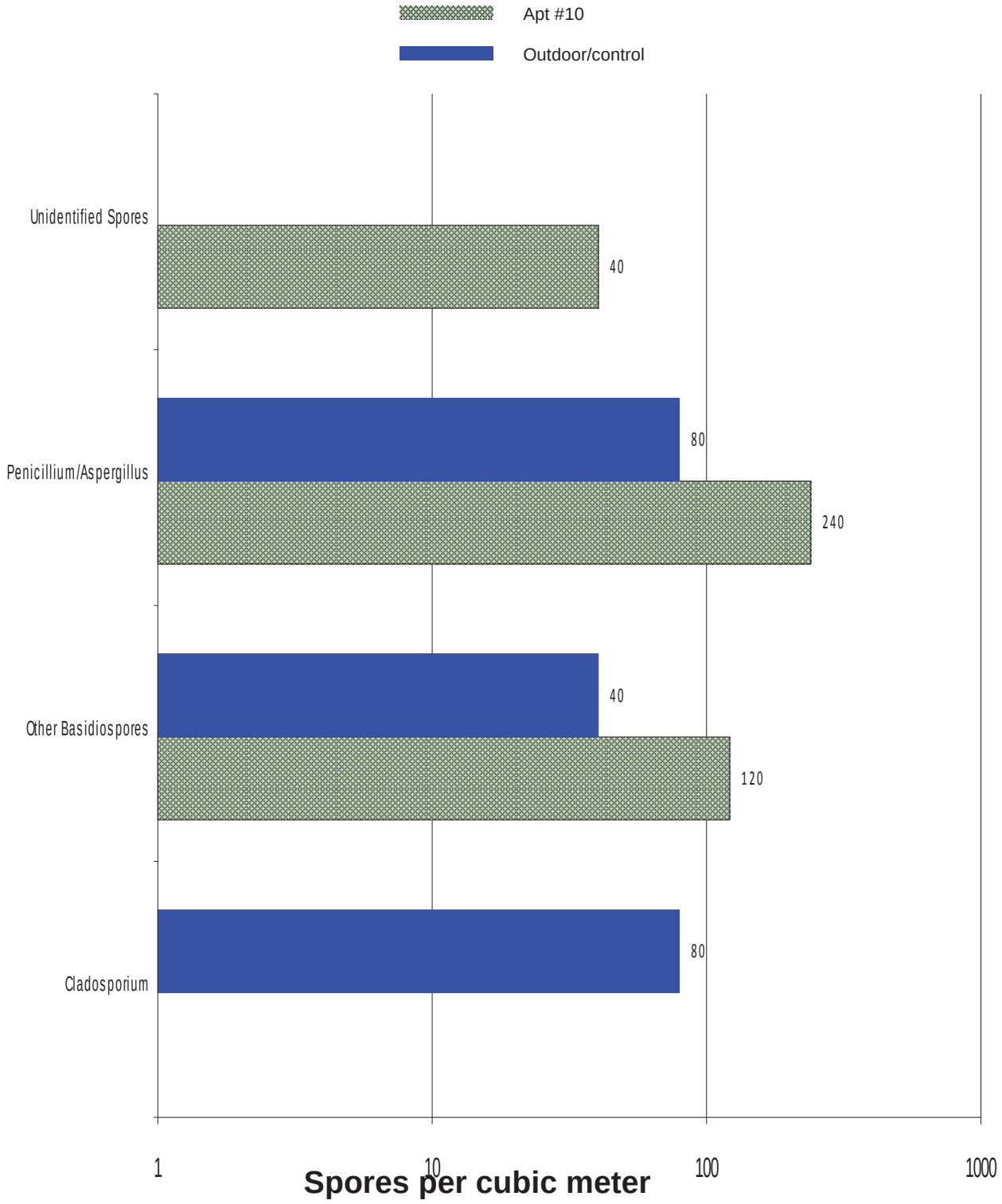
**Chain of Custody #** 577254



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| Identification | Outdoor Habitat | Indoor Habitat | Allergic Potential | Comments |
|---|---|---|---|---|
| Cladosporium | The most common spore type reported in the air worldwide. Found on dead and dying plant litter, and soil. | Commonly found on wood and wallboard. Commonly grows on window sills, textiles and foods. | Type I (hay fever and asthma), Type III (hypersensitivity pneumonitis) allergies. | A very common and important allergen source both outdoors and indoors. |
| Basidiospores | Commonly found everywhere, especially in the late summer and fall. | Not normally found growing indoors. Can grow on wet lumber, especially in crawlspaces. | Some allergenicity reported. Type I (hay fever, asthma) and Type III (hypersensitivity pneumonitis). | Among this group are dry rot fungi Serpula and Poria that are particularly destructive to buildings. |
| Penicillium/Aspergillus | Common everywhere. Normally found in the air in small amounts in outdoor air. Grows on nearly everything. | Wetted wallboard, wood, food, leather, etc. Able to grow on many substrates indoors. | Type I (hay fever and asthma) allergies and Type III (hypersensitivity pneumonitis) allergies. | This is a combination group of Penicillium and Aspergillus and is used when only the spores are seen. The spores are so similar that they cannot be reliably separated into their respective genera. |
| Unidentified Spores | Common everywhere. Grow on decaying plant litter and other plant-derived material. | Wetted cellulosic material. | None known. | This group of spores is reserved for spores whose identity is unknown. These kinds of spores have usually never been seen before in spore traps by our laboratory and/or are of such morphology that they cannot be identified with any degree of certainty to a particular genus. |

# BUILDING SYSTEMS

## Current State

The Mechanical room is located on the lowest level in the center of the 14-PLEX. This location contains the central heating plant for the building's hydronic heating system. Two Burnham boilers (described below) supply heat to the entire building[1] - each apartment unit utilizes baseboard heat. No make-up air has been provided for combustion and as a result can cause depressurization (and increased envelope leakage) of the building. The boilers exhaust via a roof stack.

At the time of inspection only one of Burnham boilers was in working order while the other awaited replacement parts; the building typically utilizes a single boiler, with the redundancy for back up (reference IAQ Report notes).

Brian Johnson, NVU plumber, was very familiar with the building and had worked on it for many years. He reported that during construction domestic water lines had used a light gauge copper that was prone to leaking and failure. The copper lines to the hot water baseboard were a heavier copper and had not been a problem.

The Heating Plants used in the building are:

**Burnham Hydronics Boiler V8H5 water**

| | |
|---|---|
| Fuel Type: | #1 Oil |
| Input Rating: | 231,000 BTU/hr |
| Steady State Efficiency: | 85.3 % |
| Idle Loss: | 0 % |
| Heat Distribution Type: | Glycol |
| Boiler Operation: | All Year |

Thoughts: The AFUE is 85.3%. The idle loss was set to 0 since AFUE should take into account steady state thermal efficiency and idle loss

**Burnham America Boiler (Old)**

| | |
|---|---|
| Fuel Type: | #1 Oil |
| Input Rating: | 186,000 BTU/hr |
| Steady State Efficiency: | 83.2 % |
| Idle Loss: | 0 % |
| Heat Distribution Type: | Glycol |
| Boiler Operation: | All Year |

Notes: The AFUE comes from contacting the manufacturer directly.

[Lower Level Mechanical Room: Burnham Boilers and Superstor Ultra DHW Storage tanks]

(1) Brian Johnson reported as much as 600 gallons of fuel was used in winter 2011 in a five-day period to keep the building warm during a cold spell of 30 to 40 below.

# Appliances and Fixtures

All tenants share common coin-operated washer/dryer facilities; they are located in the hallway spaces, three dryers are located on the second level, and a single washer located on the third level. **The dryers do not currently ventilate to the exterior, and account for large amounts of humidity in the building interior during use**.

Virtually all fixtures in the common areas are 48" 2-bulb florescent fixtures.

[ Laundry Facilities: (1) washer on L3 and (3) dryers on L2 ]

[ Lighting in common areas ]

Inside the units, the appliance sets are nearly identical:

- Electric range
- Refrigerator (ranging from 10 - 28 cu.ft.)
- Microwave oven

[Unit range appliance]

# Feasibility Study for the NVU 14-PLEX ENERGY MODELS

# ENERGY MODELING

## Comparison Process

Following the team's site visit, CCHRC staff used AkWarm[1] to create energy models of three building scenarios. An energy model was created for the existing building conditions and, while infinite permutations for design alternatives exist, two follow-through option were developed and modeled. CCHRC is prepared to discuss tiered versions of the recommendations listed, but for the brevity of this report the discussion has been simplified.

[1] **EXISTING BUILDING** model
This model is created using data[2] collected on site. It outlines current inefficiencies of the 14-PLEX. This is described in terms of: existing building components, associated efficiencies, and Operations and Maintenance (O&M) costs.

[2] **NEW CONSTRUCTION, PROPOSED Commercial BEES** model
Designed to conform with Commercial BEES[3] standards for Region 8[4] (the region in which the Native Village of Unalakleet resides), this is described in terms of: current minimum standards for new construction, prescribed building components, associated efficiencies, and estimated construction/O&M costs.[4]

[3] **CCHRC RECOMMENDED RETROFIT** model
Information from the EXISTING BUILDING analysis was used to create a tailored retrofit strategy. This option directly addresses current areas of inefficiency and outlines a course of action for an upgrade to the existing building. This is described in terms of: adjusted building components, associated efficiencies, and estimated construction/O&M costs.[5]

*** NOTE ***
It is advised that before undertaking any course of action, CCHRC or other project partners be consulted to discuss the implications of partial adoption of project recommendations.

(1) Alaska Housing Finance Corporation (AHFC) released AkWarm in 1996 as a software tool for builders, designers, energy raters, lenders, and homeowners. The software can be used for energy design, retrofit, or to determine an energy rating.
http://www.ahfc.us/efficiency/learn-and-diy/research-information-center/ric-links-interest/akwarm-energy-rating-software/

(2) This includes information from the building supervisor, maintenance personnel and on-site observations/testing.

(3) Building Energy Efficiency Standard (BEES) is a metric/guideline developed by AHFC to delineate baseline construction criteria for regions in Alaska
http://www.ahfc.us/efficiency/energy-programs/new-home-rebate/bees/

(4) BEES Regions http://www.energycodes.gov/sites/default/files/documents/AK_2009IECC_amendments.pdf - Page 3

(5) Preliminary estimates are based on existing data provided by local housing authorities, contractors and other companies familiar with regional expenses. Logistic, material, and labor estimates are based on prevailing rates at the time of this documents' publication. These numbers, while rough, paint a general picture of comparison between the two proposed paths forward; NEW CONSTRUCTION and the CCHRC RECOMMENDED RETROFIT.

# NOTES FOR:
# 3.3 AkWarm© Commercial Building Simulation

An accurate model of the building performance can be created by simulating the thermal performance of the walls, roof, windows, and floors of the building. The HVAC system and central plant are modeled as well, accounting for the outside air ventilation required by the building and the heat recovery equipment in place.

The model uses local weather data and is trued up to historical energy use to ensure its accuracy. The model can be used now and in the future to measure the utility bill impact of all types of energy projects, including improving building insulation, modifying glazing, changing air handler schedules, increasing heat recovery, installing high efficiency boilers, using variable air volume air handlers, adjusting outside air ventilation, and adding cogeneration systems.

For the purposes of this study, the Unalakleet 14-PLEX was modeled using AkWarm© energy use software to establish a baseline space heating and cooling energy usage. Climate data from Unalakleet was used for analysis. From this, the model was calibrated to predict the impact of theoretical energy saving measures. Once annual energy savings from a particular measure were predicted and the initial capital cost was estimated, payback scenarios were approximated. Equipment cost estimate calculations are provided in Appendix D.

## Limitations of AkWarm© Models

• The model is based on typical mean year weather data for Unalakleet. These data represent the average ambient weather profile as observed over approximately 30 years. As such, the gas and electric profiles generated will not likely compare perfectly with actual energy billing information from any single year. This is especially true for years with extreme warm or cold periods, or even years with unexpectedly moderate weather.

• The heating and cooling load model is a simple two-zone model of the building's core interior spaces and the building's perimeter spaces. This simplified approach loses accuracy for buildings that have large variations in cooling/heating loads across different parts of the building.

• The model does not model HVAC systems that simultaneously provide both heating and cooling to the same building space (typically done as a means of providing temperature control in the space).

# [1] EXISTING BUILDING

## EXISTING BUILDING Model Introduction

Following the team's site visit, CCHRC staff compiled collected data and created an energy model to describe current efficiencies. This information was entered into AkWarm and used to create projections of energy use. Data has been separated into individual categories to help further understand and dissect energy use in the building.

## Building Components

**Envelope:**
- Above grade: 2x6, R19 fiberglass batts
- Below grade: 2x6 All weather wood, (insulation unknown)

**Floors:**
- Below grade, uninsulated

**Roof:**
- 12" blown in cellulose

**Windows:**
- Double pane

**Mechanical Systems:**
- No mechanical ventilation
- Oil boilers have an AFUE of near 85%
- Air infiltration due to the leaky envelope

[ Digital Model of EXISTING Building ]

# EXISTING BUILDING Energy Model Summary

Native Village of Unalakleet pays approximately $66,579 annually for electricity and other fuel costs for the Unalakleet 14-PLEX. This is based on the following average energy rates: **Electricity** at $ 0.41/kWh and **#1 Heating Oil** at $ 6.27/gallons (units are metered individually and electricity rate is NOT adjusted for Price Cost Equalization (PCE)). The chart below itemizes the costs by the various uses in the EXISTING 14-PLEX.

## Glossary

**Space Heating** is energy used to heat the structure and condition incoming air

**Water Heating** is the energy needed to make hot water for sinks, showers, laundry and other residential uses

**Lighting** includes energy used to illuminate both private and public spaces

**Refrigeration** includes energy used to power private refrigerators

**Other Electrical** includes private appliances (microwaves, TV's etc), and electrical items not accounted for in the other categories

**Cooking** includes electric cook stoves/ovens

**Ventilation** is energy required to power HRVs and fans

| ESTIMATED ANNUAL ENERGY USE: | *EXISTING Building:* |
|---|---|
| Fuel use (gallons / year) | 7,200 |
| Electricity use (KWh / year) | 59,895 |

| ESTIMATED ANNUAL ENERGY COSTS ($ / year) | *EXISTING Building:* |
|---|---|
| Total Energy Costs | $56,422 |
| Space Heating | $28,010 |
| Water Heating | $19,252 |
| Lighting | $8,441 |
| Refrigeration | $6,840 |
| Other Electrical | $4,036 |
| Clothes Drying | $2,565 |
| Cooking | $387 |
| Ventilation Fans | $0 |
| Estimated Annual Energy Cost, Electricity | $24,557 |
| Estimated Annual Energy Cost, #1 Oil | $45,144 |

Electrical cost does not take into account PCE.

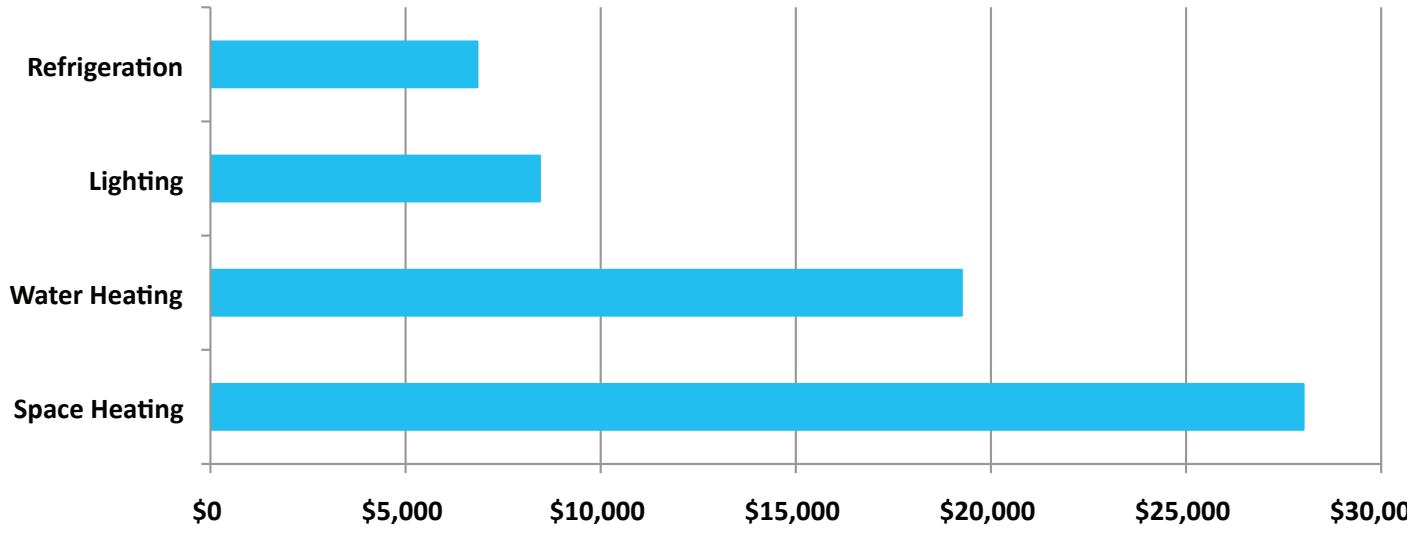
## Notes

- Fuel and electricity usage was verified with building maintenance

- No current value for Ventilation fans due to the absence of air circulation systems (specifically: air handling units that provide fresh air exchange, such as HRVs or other technology)

# EXISTING BUILDING Energy Costs by End Use

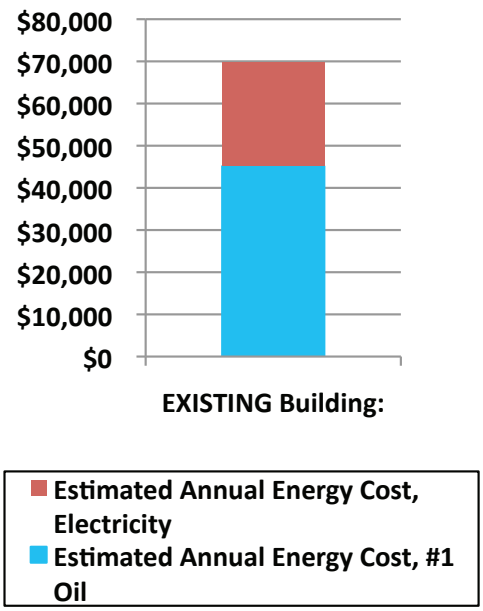
The AkWarm program grouped energy demand/useage into the following major categories: Space Heating, Water Heating, Lighting, Refrigeration, Other Electrical, Clothes Drying, Cooking and Ventilation Fans. Focus will be placed on Space Heating, Water heating, Lighting and Refrigeration as categories for comparison in the EXISTING, NEW CONSTRUCTION and the RETROFIT.




[Annual Energy Costs by Use Type]

## Fuel Type

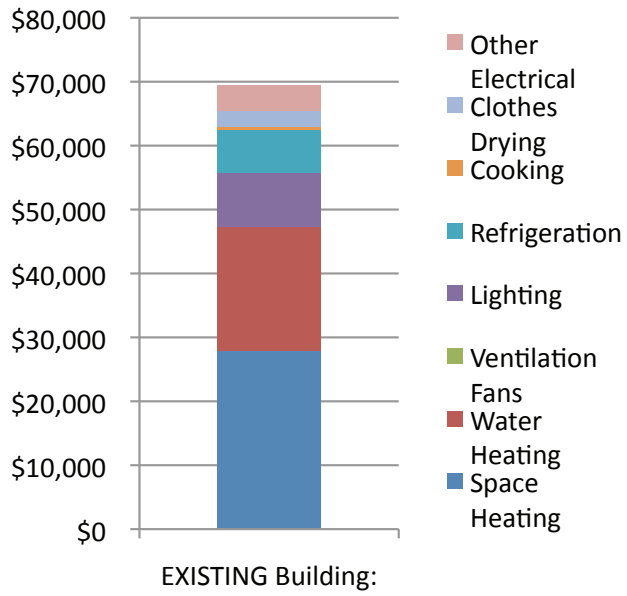
The chart below points out the two energy types utilized in the 14-PLEX building operation and their usage ratios with respect to each other. #1 Oil is nearly 2/3rds of the current usage.




[Annual Energy Costs by Fuel Type]

## Cost by Use

The chart below describes overall energy costs, and further breaks down use into categories; this describes ratios. In the 14-PLEX space heating is approaching half of the energy costs.




[Annual Energy Costs by Use]

# [2] NEW CONSTRUCTION, Commercial BEES

## NEW CONSTRUCTION Model Introduction

In the event that the 14-PLEX were compromised in a manner that prohibited its ongoing use, either due to structural instability or other life-safety violations, new construction would be the solution to housing replacement. The benefits with new construction include: entirely new systems top to bottom and a relatively simplistic construction process without having to accommodate existing design conditions.

## Energy Modeling

The NEW CONSTRUCTION energy model parameters are delineated using AHFC's Commercial BEES guidelines; The Native Village of Unalakleet is located within Region 8. BEES is selected to illustrate the likely construction standards by which new construction would be built as a baseline. Any additional improvements/upgrades to this design baseline, would cause construction costs to increase accordingly.

The BEES system is a set of Alaskan-specific amendments to the International Energy Conservation Code (IECC). These amendments are intended to prescribe minimum amounts of insulation, as well as mechanical system behaviors.

**PROPOSED COMMERCIAL BEES 2012**

**Table A402.2 Opaque Thermal Element Requirements a**

| Climate Zone | 8 |
|---|---|
| | Group R |
| **Roofs** | |
| Insulation entirely above deck | R-35 ci |
| Metal Buildings(withcR-5 thermal blocks) [b, c] | R-30 + R-11 LS |
| Attic and other | R-49 |
| **Walls, Above Grade** | |
| Mass | 25 ci |
| Metal building | R-21 + R-10 ci |
| Metal framed | R-13 + R-16.7 ci |
| Wood framed and other | R-13 + R-15.6 ci |
| **Walls, Below Grade** | |
| Below grade wall [c] | R-15 ci |
| **Floors** | |
| Mass | R-18.8 ci |
| Joist/framing [d] | R- 38 / R-43 |
| **Slab-on-Grade Floors** | |
| Unheated slabs | R-15 for 48" below |
| Heated slabs [c] | R-20 for 48" below |
| **Opaque Doors** | |
| Swinging | U-0.37 |
| Roll-up or sliding | R-4.75 |

For SI: 1 inch = 25.4 mm. ci = Continuous insulation.

LS = Liner System – A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA 90.1 Appendix A.

b. Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table A402.1.2.

c. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

# NEW CONSTRUCTION Component Comments

A new construction scenario benefits from the following design parameters: an insulated slab reducing heat loss (insulation of the EXISTING building slab is difficult if not entirely cost prohibitive.) Updated appliances; electricity usage numbers are in this model expecting appliances with higher operating efficiency (refrigeration accounts for a large portion of electricity costs/demand.) Low flow fixtures; standard with faucets and other plumbing components

## Model Components

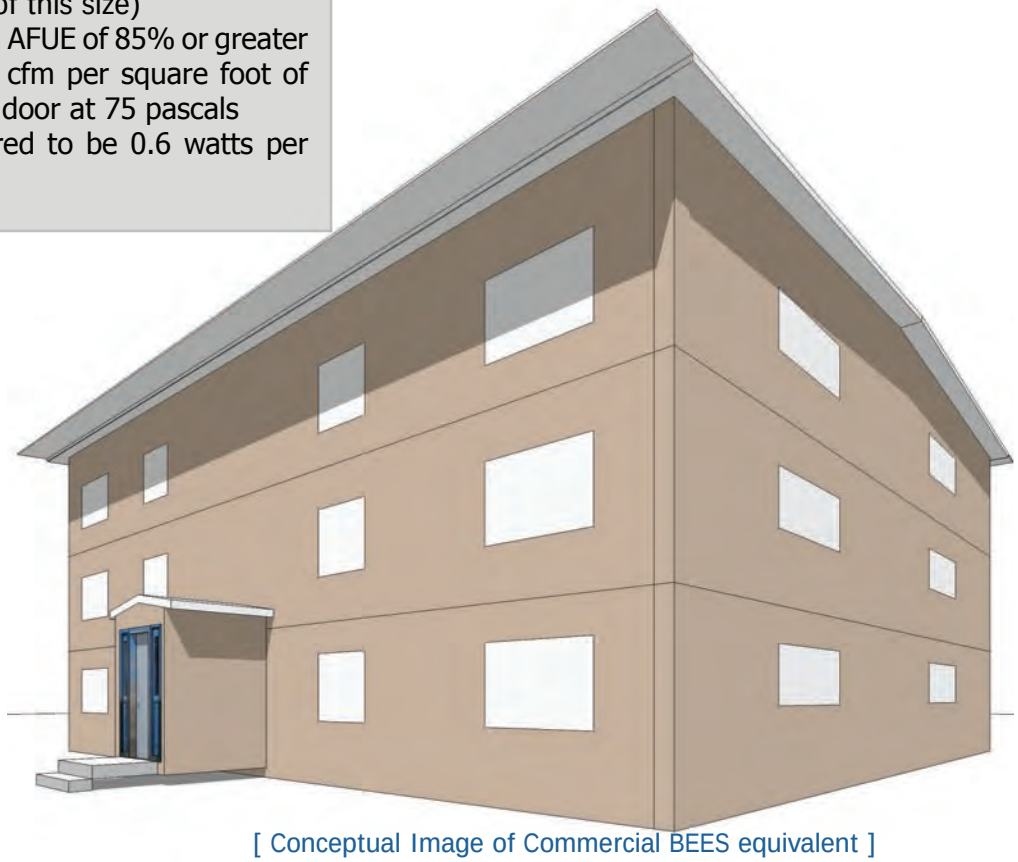
**Envelope:**
- Above grade: 2x4, R13 fiberglass batts, 3" XPS rigid foam
- Below grade: All weather wood w/ 3" exterior XPS

**Floors:**
- Below grade, 4" XPS for 4' perimeter section

**Roof:**
- 13" blown in cellulose

**Windows:**
- Triple pane, u-0.25

**Mechanical Systems:**
- 750 cfm of mechanical ventilation required (no heat recovery necessary for a building of this size)
- Oil boilers are required to have an AFUE of 85% or greater
- Air infiltration is limited to 0.40 cfm per square foot of floor space, as tested by a blower door at 75 pascals
- Lighting power density is required to be 0.6 watts per square foot of floor space or less



[ Conceptual Image of Commercial BEES equivalent ]

# NEW CONSTRUCTION Energy Model Summary

CCHRC staff compiled Commercial BEES parameters and used them to create an energy model using AkWarm; the result describes projected efficiencies. These values have been separated into individual categories to help further understand and dissect energy use in the NEW CONSTRUCTION model.

The NEW CONSTRUCTION model, placed in the Native Village of Unalakleet, is projected to run $47,544 in annual energy costs. This is based on the following average energy costs: **Electricity** at $ 0.41/kWh and **#1 Heating Oil** at $ 6.27/gallons (units would be metered individually and electricity rate is NOT adjusted for Price Cost Equalization (PCE)). The chart below itemizes the costs by the various applications in the NEW CONSTRUCTION model.

## Glossary

**Space Heating** is energy used to heat the structure and condition incoming air

**Water Heating** is the energy needed to make hot water for sinks, showers, laundry and other residential uses

**Lighting** includes energy used to illuminate both private and public spaces

**Refrigeration** includes energy used to power private refrigerators

**Other Electrical** includes private appliances (microwaves, TV's etc), and electrical items not accounted for in the other categories

**Cooking** includes electric cook stoves/ovens

**Ventilation** is energy required to power HRVs and fans

| ESTIMATED ANNUAL ENERGY USE: | *New Construction, BEES* |
|---|---|
| Fuel use (gallons / year) | 5,202 |
| Electricity use (KWh / year) | 39,800 |

| ESTIMATED ANNUAL ENERGY COSTS ($ / year) | *New Construction, BEES* |
|---|---|
| Total Energy Costs | $48,823 |
| Space Heating | $23,079 |
| Water Heating | $11,657 |
| Lighting | $4,029 |
| Refrigeration | $2,850 |
| Other Electrical | $4,036 |
| Clothes Drying | $2,565 |
| Cooking | $387 |
| Ventilation Fans | $220 |
| Estimated Annual Energy Cost, Electricity | $16,318.00 |
| Estimated Annual Energy Cost, #1 Oil | $32,616.54 |

Electrical cost does not take into account PCE.

## Notes

- Fuel use has dropped as a result of increased insulation in the envelope

- Increased efficiencies in the thermal envelope have lowered costs for space heating

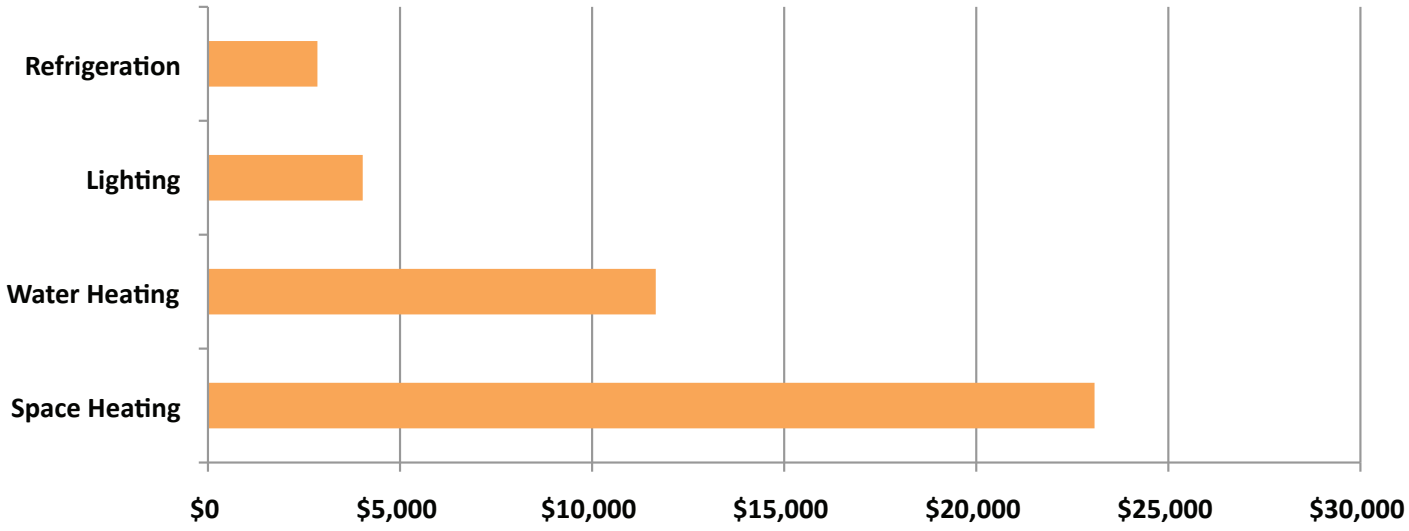
- Domestic hot water usage has dropped as a result of low-flow fixtures

- Refrigeration costs have dropped assuming that units would be outfitted with the late model Energy-Star rated appliances

- Ventilation fans value includes simple through-wall fans (ref, Panasonic Whisper Green fans or similar models)

# NEW CONSTRUCTION Energy Costs by End Use

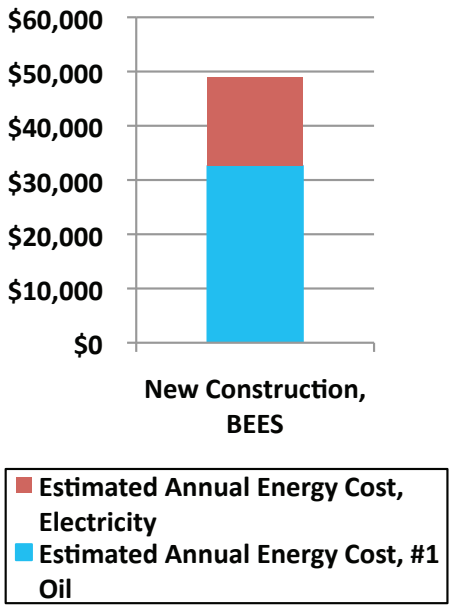
The following chart describes current energy uses by category.




[Annual Energy Costs by Use Type]

## Fuel Type

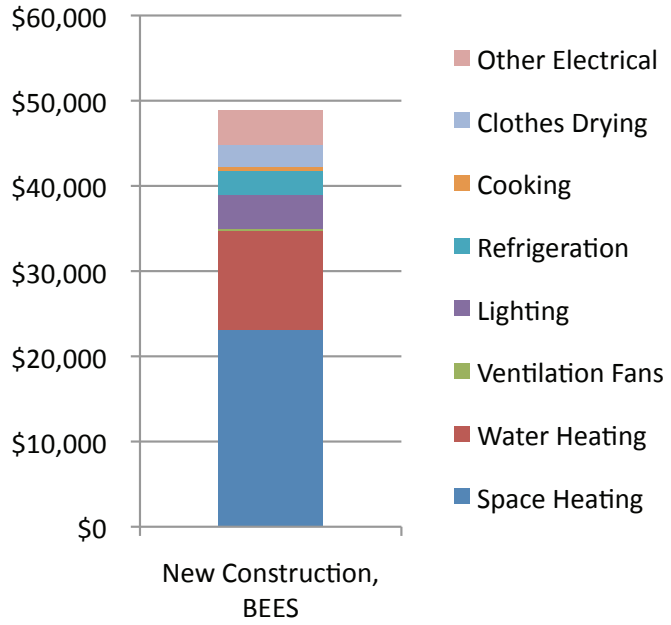
The chart below identifies two fuel types utilized in the Commercial BEES model and their usage ratios with respect to each other. Similar to the EXISTING model #1 Oil is nearly 2/3rds of the current energy usage.




[Annual Energy Costs by Fuel Type]

## Cost by Use

The chart below describes overall energy costs, and further breaks down use into categories; this describes ratios. The Commercial BEES model exhibits very similar ratios to that of the EXISTING 14-PLEX, with notable drops in space and water heating.




[Annual Energy Costs by Use]

# NEW CONSTRUCTION Cost Estimation:

See table below for preliminary estimates for NEW CONSTRUCTION. These ranges in prices per-sq-ft (for structures placed-on-ground) were identified through conversations with area housing authorities, contractors and builders[1]. The costs include overhead, labor, materials, freight, and other associated project costs for the Norton Sound region. The area listed (11,229 sq.ft.) is identical the EXISTING 14-PLEX conditioned area.

Some items unaccounted for are acquiring site control, and land purchasing. Costs related to accommodating potentially challenging sites, such as specialized foundation strategies, are also omitted.

| | **Price** (sq.ft.) | **Building Area** (sq.ft.) | **TOTAL Cost** |
|---|---|---|---|
| New construction - high | | | |
| High | $ 500.00 | 11,229 | $ 5,614,500.00 |
| Low | $ 450.00 | 11,229 | $ 5,053,050.00 |
| Privately financed/large scale | $ 400.00 | 11,229 | $ 4,491,600.00 |
| | | | |
| Large Scale Low | $ 300.00 | 11,229 | $ 3,368,700.00 |

(1) Conversations with the Bering Straights Regional Housing Authority (BSRHA) and the Bering Straits Development Corporation (BSDC) helped uncover current placed-in-ground costs per sq.ft. for housing in the region; specific information on these statistics can be obtained by contacting CCHRC

# [3] CCHRC RECOMMENDED RETROFIT

## RETROFIT Model Introduction

Following the team's site visit, CCHRC staff concluded that the 14-PLEX is in a viable condition, and a good candidate for a deep-energy retrofit. The steps associated with this are outlined in greater detail below.

## Suggested RETROFIT Improvements:

**Envelope:**

- Add 8" EPS Type XIV 40 psi to exterior above and below grade walls
- Replace windows with triple pane, low-E windows with U-value of 0.20 or less
- Spray soy-based polyurethane against the roof sheathing from inside the roof cavity for R-60
- Above improvements expected to reduce air infiltration by 70%, to 2730 cfm at 50 pascals

**Mechanical:**

- Replace old boiler with Energy Kinetics EK1 Frontier 0.68 gph oil fired boiler (AFUE: 87.9%, 83,000 BTU/hr)
- Install (14) Venmar Kubix HRVs to ensure adequate ventilation

**Domestic Hot Water:**

Currently, domestic hot water is modeled at 1,125 gallons per day. Over the course of a year, this adds up to about $18,000 per year. CCHRC recommends that steps be taken to reduce water usage, such as:

- Installing low-flow shower heads (1.5 gallons per minute)
- Installing demand-controlled pumps and zoning the circulation loops to minimize distribution losses, which recent studies suggest waste an average of 34% of the energy used for DHW
- Replace clothes washers with EnergyStar rated appliances

An additional strategy to consider is the installation of a supplementary **solar thermal** system. This system would be used to convert solar energy into thermal energy

This particular application would be used to boost the Domestic Hot Water system in the 14-PLEX, and reduce the amount of heating oil used by the boilers; such systems are viable and already in use in Nome and other nearby villages. These panels can be easily mounted to the southern facade (which has ample space for an array) and routing the hydronic lines back to the mechanical room can be easily achieved using the existing public corridor.

[See: http://www.alaskasun.org/pdf/ActiveSolar.pdf]

[South Elevation: potential solar thermal panel locations]

# RETROFIT Component Comments

The components selected in this RETROFIT energy model are a direct response to the current building inefficiencies of the EXISTING 14-PLEX. The largest advantage of this strategy is the continued use of a viable structure in the community.

## Model Components

**Envelope:**
• Above/Below grade: Add 8" EPS foam (2 lifts of 4") to existing 2x6, R19 fiberglass batts, exterior wall

**Floors:**
• No improvement suggested

**Roof:**
• Add soy-based polyurethane foam on sheathing underside to attain R-60 insulated value (in addition to existing 6" of blown-in cellulose)

**Windows:**
• Replace double-pane with triple-pane, low-E, argon filled units, < u-0.20

**Mechanical Systems:**
• Install low-flow fixtures and faucets
• Replace old boiler with Energy Kinetics EK1 Frontier 0.68 gph oil fired boiler
• Install (14) Venmar Kubix HRV insuring healthy IAQ
• Mount (10) 4' x 10' solar thermal panels to the south facade, supplimenting the Domestic Hot Water system

[ Conceptual Image of RETROFIT ]

# RETROFIT Energy Model Summary

CCHRC staff analyzed the EXISTING model data and created a tailored strategy, this is modeled here using AkWarm; the result describes projected efficiencies. These values have been separated into individual categories to help further understand and dissect energy use in the RETROFIT model.

The RETROFIT model, placed in the Native Village of Unalakleet, is projected to run $40,449 in annual energy costs. This is based on the following average energy costs: **Electricity** at $ 0.41/kWh and **#1 Heating Oil** at $ 6.27/gallons (units would be metered individually and electricity rate is NOT adjusted for Price Cost Equalization (PCE)). The chart below itemizes the costs by the various applications in the RETROFIT model.

## Glossary

**Space Heating** is energy used to heat the structure and condition incoming air

**Water Heating** is the energy needed to make hot water for sinks, showers, laundry and other residential uses

**Lighting** includes energy used to illuminate both private and public spaces

**Refrigeration** includes energy used to power private refrigerators

**Other Electrical** includes private appliances (microwaves, TV's etc), and electrical items not accounted for in the other categories

**Cooking** includes electric cook stoves/ovens

**Ventilation** is energy required to power HRVs and fans

| ESTIMATED ANNUAL ENERGY USE: | CCHRC Retrofit: |
|---|---|
| Fuel use (gallons / year) | 3,201 |
| Electricity use (KWh / year) | 45,150 |

| ESTIMATED ANNUAL ENERGY COSTS ($ / year) | CCHRC Retrofit: |
|---|---|
| Total Energy Costs | $38,456 |
| Space Heating | $13,174 |
| Water Heating | $9,017 |
| Lighting | $4,029 |
| Refrigeration | $2,850 |
| Other Electrical | $4,036 |
| Clothes Drying | $2,565 |
| Cooking | $387 |
| Ventilation Fans | $2,398 |
| Estimated Annual Energy Cost, Electricity | $18,511.50 |
| Estimated Annual Energy Cost, #1 Oil | $20,070.27 |

Electrical cost does not take into account PCE.

[AkWarm Energy Data; Projected costs/usages are the result of a tailored RETROFIT strategy]

## Notes

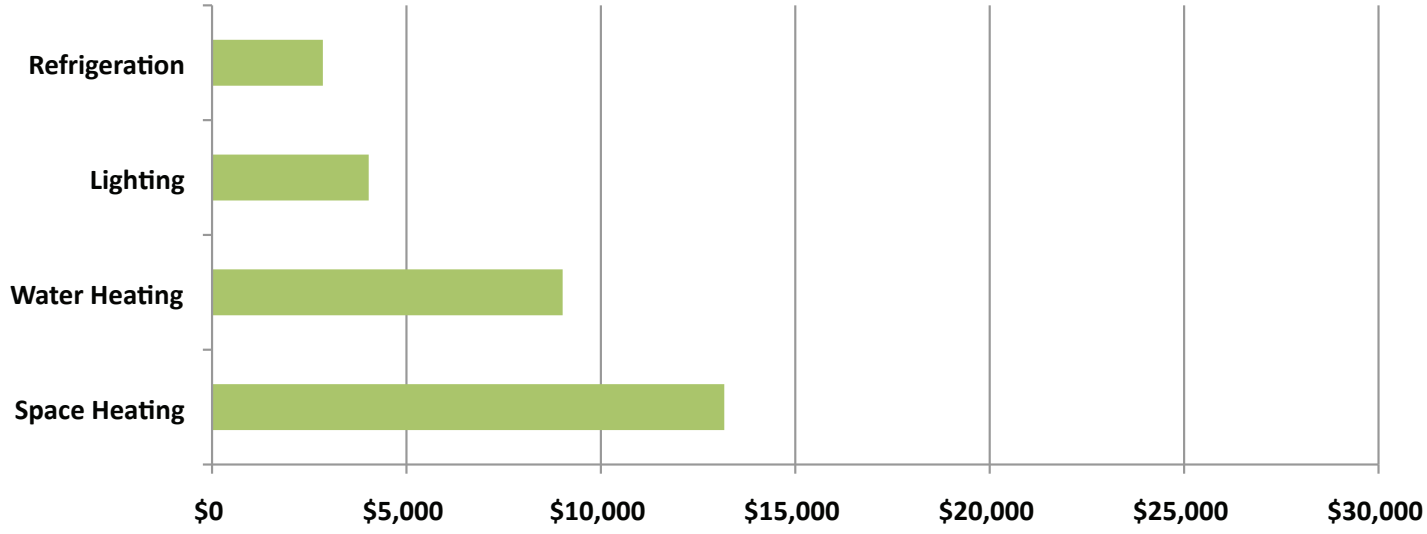
- Fuel use has dropped to below half of the EXISTING 14-PLEX usage; the result of significantly increased insulation in the building envelope, and an updated boiler system.

- Water heating has been reduced through installing low-flow fixtures, and installing a 10 panel solar thermal array on the south facade.

- Ventilation fans energy costs have risen; the result of installing (14) HRVs (one per unit) in order to encourage fresh air exchange, and discourage mold growth.

# RETROFIT Energy Costs by End Use

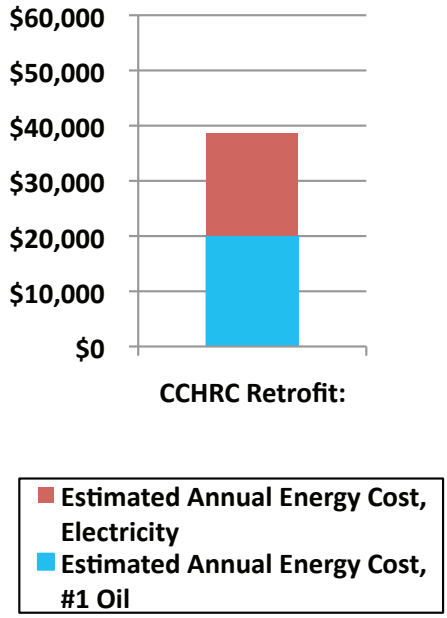
The following chart describes current energy uses by category.




[Annual Energy Costs by Use Type]

## Fuel Type

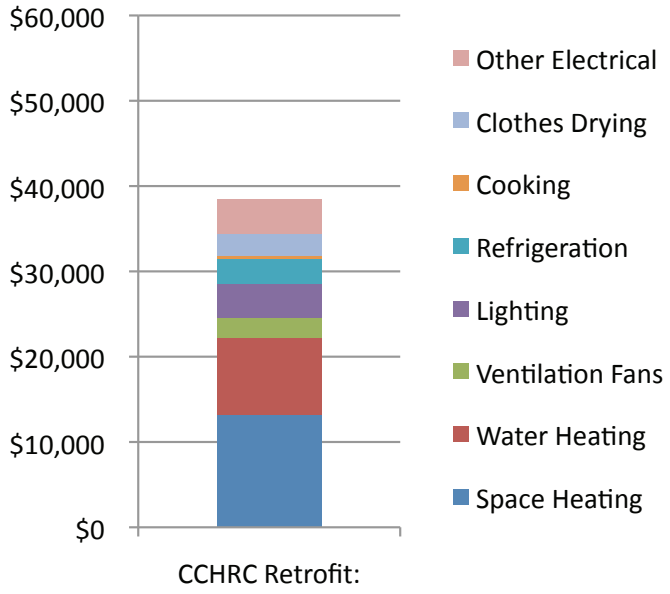
The chart below identifies two fuel types utilized in the RETROFIT model and their usage ratios with respect to each other. Compared to the EXISTING model #1 Oil is has dropped by nearly 40% in the RETROFIT.




[Annual Energy Costs by Fuel Type]

## Cost by Use

The chart below describes overall energy costs, and further breaks down use into categories; this describes ratios. The space heating value of the RETROFIT is 60% less than that of the EXISTING 14-PLEX.




[Annual Energy Costs by Use]

# RETROFIT Cost Estimation

Numerical data for the cost estimation on the RETROFIT is the result of conversation with groups operating in the Norton Sound region[1].

Conservative cost estimates place a retrofit in the $780k range; even adding a 50% buffer, this option remains well below costs associated with new construction. Tertiary benefits, like workforce development and job creation in the village, are difficult to quantify and therefore not taken into financial consideration at this time.

## 14-PLEX RETROFIT CONSTRUCTION

| | | |
|---|---|---|
| *Material & Labor Costs* | $ | 630,040.00 |
| *Design* | $ | 85,004.00 |
| *10% Contingiency* | $ | 63,004.00 |
| **Total Costs** | **$** | **778,048.00** |

| **DESIGN AND ENGINEERING** | | *Fees* |
|---|---|---|
| Architectural | $ | 63,004.00 |
| Mechanical | $ | 7,000.00 |
| Plumbing | $ | 5,000.00 |
| Structural | $ | 5,000.00 |
| Permitting & coordination | $ | 5,000.00 |
| (1) **TOTAL COST** | **$** | **85,004.00** |

| **CREW** | | *Rate* | *Hours* | | *Cost* |
|---|---|---|---|---|---|
| [1] Foreman | $ | 60.00 | 960 | $ | 57,600.00 |
| [5] Laborers | $ | 22.50 | 4,800 | $ | 108,000.00 |
| Specialized | $ | 90.00 | 240 | $ | 21,600.00 |
| | | | *Nights* | | |
| Lodging | $ | 200.00 | 50 | $ | 10,000.00 |
| | | | **TOTAL COST** | **$** | **197,200.00** |

| **EQUIPMENT** | *Price (ea)* | *Number* | | *Cost* |
|---|---|---|---|---|
| New boiler | $ 15,000.00 | 1 | $ | 15,000.00 |
| HRV | $ 1,500.00 | 14 | $ | 21,000.00 |
| Fixtures and appliances | $ 2,500.00 | 14 | $ | 35,000.00 |
| Solar Thermal | $ 25,000.00 | 1 | $ | 25,000.00 |
| | | **TOTAL COST** | **$** | **96,000.00** |

| **FOUNDATION** (Regrading, Insulating, etc) *unverified rough estimation | *Price (ea)* | *Number* | | *Cost* |
|---|---|---|---|---|
| 8" Rigid Foam | $ 3.20 | 1,000 | $ | 3,200.00 |
| Gravel | $ 5,000.00 | 1 | $ | 5,000.00 |
| Equip/operator | $ 10,000.00 | 1 | $ | 10,000.00 |
| | | **TOTAL COST** | **$** | **18,200.00** |

| **ENVELOPE** | *Price (ea)* | *Number* | | *Cost* |
|---|---|---|---|---|
| Windows | $ 800.00 | 34 | $ | 27,200.00 |
| Doors | $ 1,000.00 | 2 | $ | 2,000.00 |
| Envelope (lumber, etc) | $ 40,000.00 | 1 | $ | 40,000.00 |
| Misc materials | $ 40,000.00 | 1 | $ | 40,000.00 |
| | | **TOTAL COST** | **$** | **109,200.00** |

| **RIGID FOAM** (WALL) | *Price (sq.ft.)* | *Area (sq.ft.)* | | *Cost* |
|---|---|---|---|---|
| WALLS: 8" Thick | $ 3.20 | 6,300 | $ | 20,160.00 |

| **LOGISTICS** (Barge) | *Price (ea)* | *Number* | | *Cost* |
|---|---|---|---|---|
| 20' SLC **Platform** | $ 14,000.00 | 1 | $ | 14,000.00 |
| Fuel **Surcharge** (28%) | | | $ | 3,920.00 |
| | | **TOTAL COST** | **$** | **38,080.00** |

| **SPRAY FOAM** (ROOF) | *Price (ea)* | *Number* | | *Cost* |
|---|---|---|---|---|
| Material | $ 2,000.00 | 8 | $ | 16,000.00 |
| Labor-equip etc | | | $ | 40,000.00 |

| **LOGISTICS** (Barge) | *Price (ea)* | *Number* | | *Cost* |
|---|---|---|---|---|
| 20' SLC **Container** | $ 12,000.00 | 1 | $ | 12,000.00 |
| Fuel **Surcharge** (28%) | | | $ | 3,360.00 |
| | | **TOTAL COST** | **$** | **71,360.00** |

| **LOGISTICS** (material shipping) | *Price (ea)* | *Voyages* | | *Cost* |
|---|---|---|---|---|
| Charter Flight | $ 50,000.00 | 1 | $ | 50,000.00 |
| Barge | $ 40,000.00 | 1 | $ | 40,000.00 |
| Misc flights | $ 10,000.00 | 1 | $ | 10,000.00 |
| (2) | | **TOTAL COST** | **$** | **100,000.00** |

(1) Labor quantities estimate a crew of 5 and project duration of four months

(2) Logistic costs are subject to change based on timing and phasing approach. Estimates were provided by Northland Services (Barge), and working knowledge of Air charter rates. Foam quantities/pricing was provided by Insulfoam; other materials were estimated using recent pricing on CCHRC projects. Labor references 2012 Department of Labor fair wage rates.

# RETROFIT Advantages

## GENERAL

### Utilize existing investment

There is already a large material investment placed in-ground in the 14-PLEX. The value of this should not be ignored.

### Site control

Because the structure is already placed its possible to forgo costly, and time-consuming, processes associated with permitting construction on a new site (Environmental Review, Army Corps of Engineers delineations, etc, etc). This benefit alone saves a significant amount of time and money.

### Construction Staging

Construction on the 14-plex largely occurs in common spaces and on exterior surfaces. This reduces disruption for building tenants, and eliminates the need of temporary housing for displaced people. More invasive forms of renovation, in more compromised building situations (i.e interior demolition/ rehabilitation), would require residents to be removed from their homes, and put a burden on NVU's already strained housing stock.

### Cost

The RETROFIT option can be built at a fraction of that for NEW CONSTRUCTION, and with much higher efficiency of operations; consider the peripheral costs above in addition and the case to renovate is even stronger.

# Shell RETROFIT Benefits

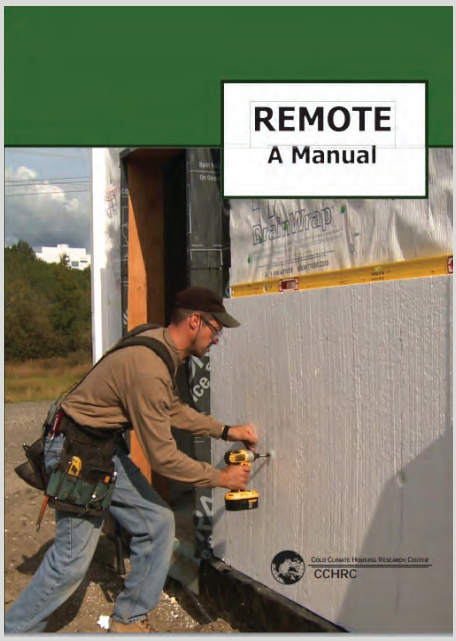
**Currently:**
- Above grade: 2x6, R19 fiberglass batts
- Below grade: 2x6 All weather wood, (uninsulated?)

**REMOTE Wall Upgrade:**
- Addition of 8″ EPS foam to exterior increases thermal insulation and tightens envelope; reducing overall BTU demands of the building.

- Construction can take place **without displacing residents** as it is an exterior application directly against the existing 2x6 wall.

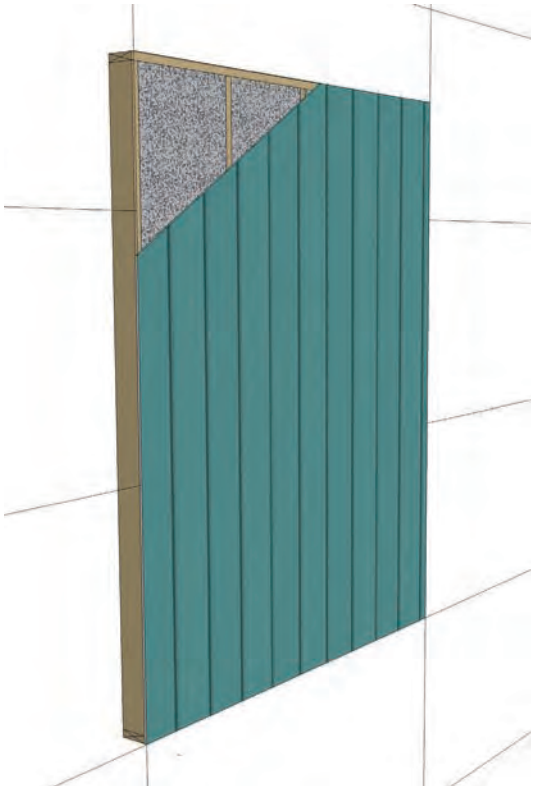
- Use of rigid foam (rather than spray application foam) on exterior expands the range of environmental conditions in which construction may be staged (spray foam should be applied within certain thermal and humidity parameters for optimum curing/expansion). Additionally, storage of rigid foam does not required conditioned space, where as spray foam drums do.

- Rigid foam installation requires only semi-skilled labor and NO special application equipment - reducing costs.

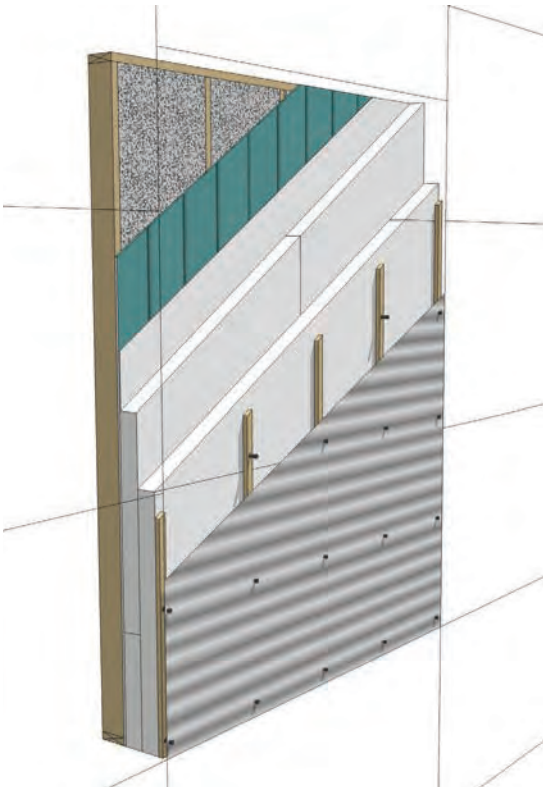



For further information reference:
http://cchrc.org/docs/best_practices/REMOTE_Manual.pdf

14 PLEX EXTERIOR ENVELOPE



[EXISTING wall - 2x6 stud wall - R19]



[UPGRADED wall - EXISTING + REMOTE]

# RETROFIT Phased Approach

*Acknowledging potential limitations in either funding, or scheduling (or both), CCHRC has broken the RETROFIT into phases, that compliment one another. This specific ordering allows pieces to be undertaken as available, and without compromising the structure.*

## Near Future Actions

*Implementation of these items is simple and fast and should be taken as financially or logistically able.*

### Low-Flow Fixtures

Currently, domestic hot water demands are high as a result of high occupancy and occupant behavior. Replacement of Faucets, shower heads, and potentially toilets, will help reduce domestic hot water usage, lowering currently high energy costs associated with heating water. Additionally The installation of a supplementary solar thermal array will begin to reduce overall energy investment required in running these systems

### Excavation and grading

In order to protect the foundation from potential future freeze-thaw damage, the following measures should be taken: below-grade foundation wall should be insulated with 8” of EPS foam, horizontal insulation should be added at the footing to prevent frost drive, and the gravel should be regraded to ensure positive drainage of material away from the building.

### Appliances

Older electric ranges, and refrigerators create considerable demand, and their replacement impact is tangible when carried across into 14-units; older appliances should be considered for upgrade.

### Lighting

The implementation and use of high efficiency LED/CFL fixtures/bulbs reduces over all electricity demand, lowering electricity costs for tenants, O&M costs for the building owners, and overall lowered demand on the NVU generators.

## Priority A

*Implementation of these items can be accomplished in a stand-alone way; tangibly improving building performance, without compromising the structure due to the absence of mechanical ventilation.*

### Windows and Doors

Upgrading windows and doors to more insulated units, bridges the gap between much needed natural light and lowering heating costs due to building inefficiencies. A tighter envelope ensures that dollars invested in heating are not quickly lost to inadequate insulation.

### Roof Envelope

Spraying the underside of the roof with polyurethane foam create “hot roof” with a target R-value of 60. The use of spray foam around the roof trusses ensures that the insulation is tight and minimizes air infiltration. Additionally, heat loss through the roof is reduced and the non-mechanically ventilated structure is not yet tight enough to promote mold growth. Roofing assembly should be updated to prevent water infiltration into the new spray foam.

## Priority B

*Implementation of these items produces the most noticeable increase in efficiency and care should be taken to ensure proper design and detailing*

### Shell

A tighter envelope ensures that dollars invested in heating are not quickly lost to inadequate insulation. A very serious side effect of this tightened envelope is the increased risk of mold growth and rot if the building is not adequately ventilated. Therefore it is critical that a deliberate and vigorous mechanical ventilation strategy be adopted; see HRV below.

### Heat Recovery Ventilators

Heat Recovery Ventilators (HRV) are a solution to providing fresh air while salvaging BTUs during the air exchange process. One HRV per unit ensures that balance is maintained given the occupant's individual behaviors, and reduces mixing of air between tenant spaces. This individual user-control and balancing also works to reduce stack effect at the building scale

## Priority C

*Upgrading the building systems as a last step ensures that the boiler is properly sized for the modified building; in addition, the Solar Thermal panels are now mounted on the upgraded envelope.*

### Boiler

The tighter and more insulated 14-PLEX envelope has a decreased BTU requirement and could utilize a smaller, more efficient boiler.

### Solar Thermal / DHW

Currently, domestic hot water demands are high as a result of high occupancy and occupant behavior. In addition to Low-flow fixtures, A supplementary solar thermal array will reduce the overall fuel energy costs required in providing DHW.

# Feasibility Study for the NVU 14-PLEX

# ENERGY MODEL COMPARISONS

# COMPARISON

## Analysis Summary

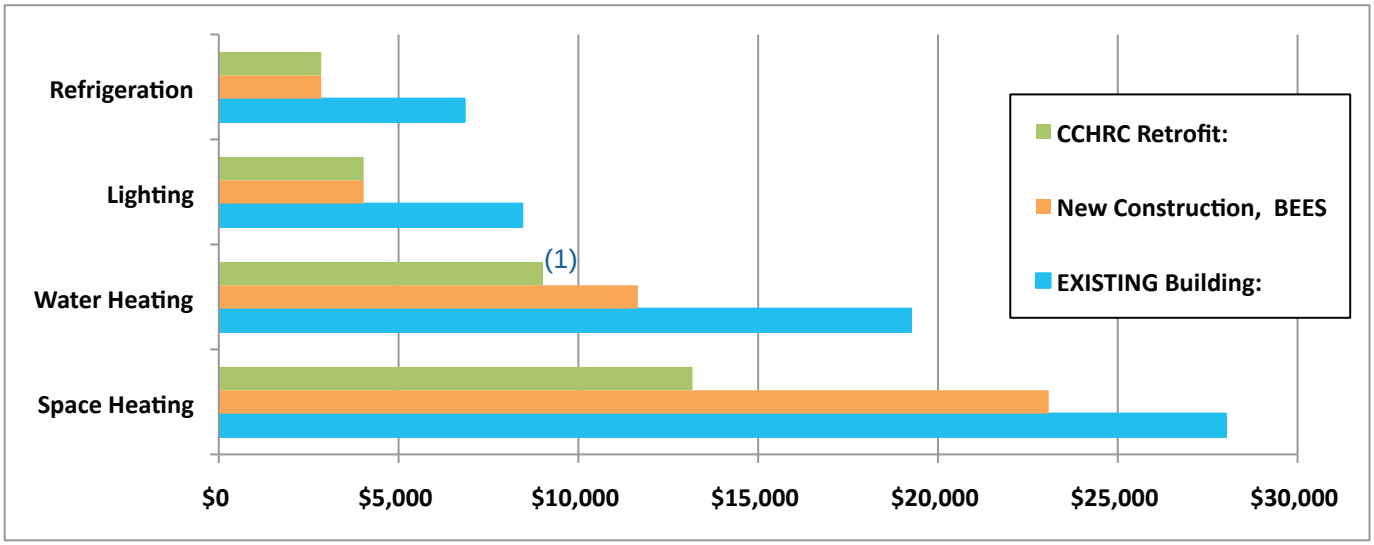
The costs associated with NEW CONSTRUCTION are more than four times as high as a RETROFIT of the existing building. Additionally, NEW CONSTRUCTION, and the building standards to which it would likely be built do not approach the efficiency proposed in the RETROFIT option.

| ESTIMATED ANNUAL ENERGY USE: | *EXISTING Building:* | *New Construction, BEES* | CCHRC Retrofit: | RETROFIT COST SAVINGS |
|---|---|---|---|---|
| Fuel use (gallons / year) | 7,200 | 5,202 | 3,201 | 56% |
| Electricity use (KWh / year) | 59,895 | 39,800 | 45,150 | 25% |
| | | | | |
| **ESTIMATED ANNUAL ENERGY COSTS ($ / year)** | ***EXISTING Building:*** | ***New Construction, BEES*** | **CCHRC Retrofit:** | |
| Total Energy Costs | $69,531 | $48,823 | $38,456 | **45%** |
| Space Heating | $28,010 | $23,079 | $13,174 | 53% |
| Water Heating | $19,252 | $11,657 | $9,017 | 53% |
| Lighting | $8,441 | $4,029 | $4,029 | 52% |
| Refrigeration | $6,840 | $2,850 | $2,850 | 58% |
| Other Electrical | $4,036 | $4,036 | $4,036 | - |
| Clothes Drying | $2,565 | $2,565 | $2,565 | - |
| Cooking | $387 | $387 | $387 | - |
| Ventilation Fans | $0 | $220 | $2,398 | - |
| Estimated Annual Energy Cost, Electricity | $24,557 | $16,318 | $18,512 | 25% |
| Estimated Annual Energy Cost, #1 Oil | $45,144 | $32,617 | $20,070 | 56% |
| Electrical cost does not take into account PCE. | | | | |

[AkWarm Energy Data; A comparison of the projected costs/usages for all three energy models]

# Energy Costs by End Use

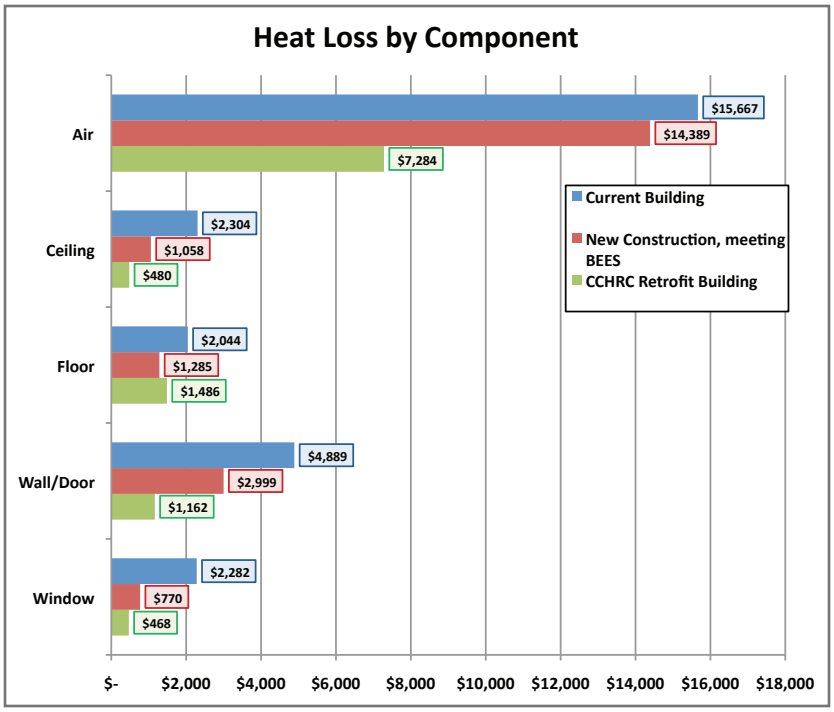
The following chart describes current energy uses by category and compares each of the three energy models




(1) See Solar Thermal note on the RETROFIT model description page.

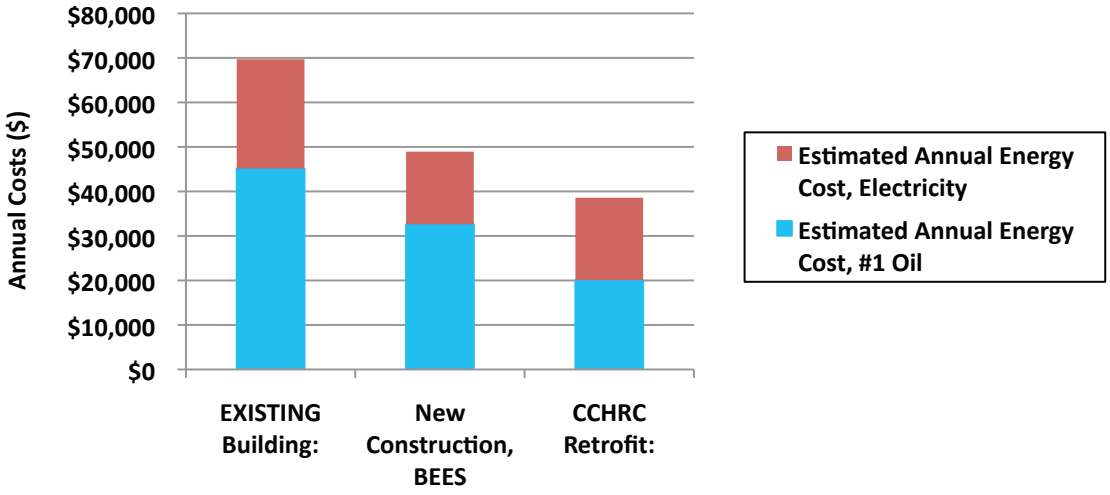
# Energy Losses by Building Component

The following chart describes current energy loses through envelope components for each of the three energy models.



# Fuel Usage by Type

The chart below identifies two fuel types utilized in the three energy models and their usage ratios with respect to each other. Compared to the EXISTING model, #1 Oil is has dropped by an estimated 56% in the RETROFIT.

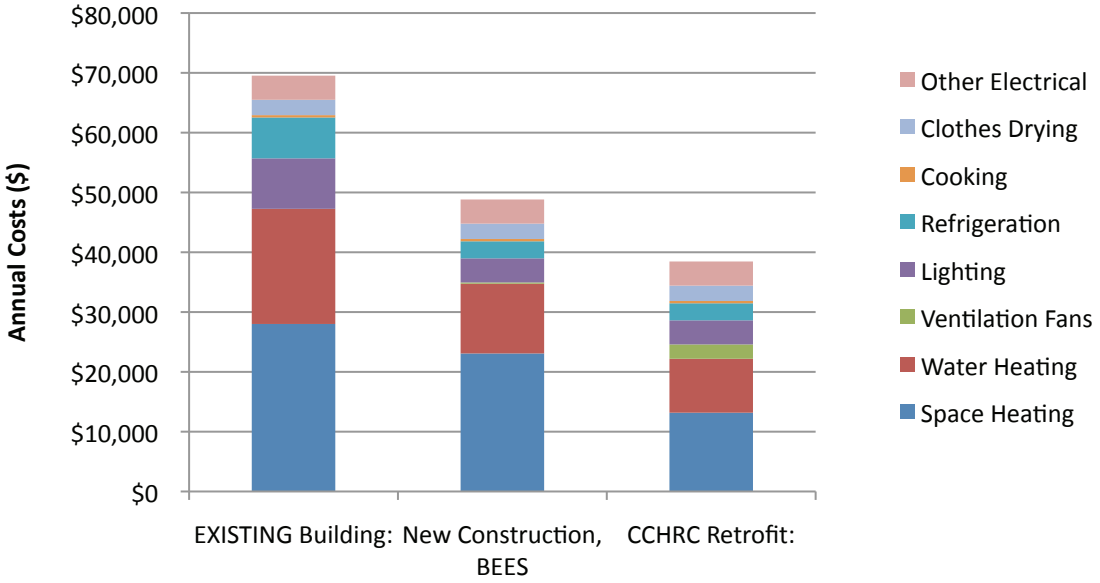



[Annual Energy Costs by Fuel Type]

# MODEL COMPARISONS Costs by Use

The chart below describes overall energy costs between models, and further breaks down use into categories. NEW CONSTRUCTION overall estimated annual savings, compared to EXISTING lowers energy usage by $20,776. RETROFIT overall estimated annual savings are projected to be $31,119 over the EXISTING. The RETROFIT space heating savings alone are estimated at $14,836 over the EXISTING 14-PLEX.

**At an estimated annual savings of $31,119, and a conservative RETROFIT estimate of $778k, this RETROFIT has a simple payback of 25 years. In our strained energy climate, increases in price may occur, under theses circumstances the payback period will shorten.**




[MODEL COMPARISONS Annual Energy Costs by Use]

# Conclusion

It is the opinion and conclusion of the analysis team that, given the observed state of the 14-PLEX, RETROFITTING offers the best path forward, for a number of reasons:

**Reduction of Operations and Maintenance costs**
A more efficient boiler system pulls more BTUs out of the fuel investment. Upgrading the envelope, and increasing tightness, ensures that heat (and the $$ invested in producing it) is not lost through leakage. Additionally insulating the exterior, or [ex]sulating, allows tenants to remain in the building during construction - this eliminates any costs associated with housing displaced occupants.

**Occupant and structural health**
Upgraded mechanical ventilation systems address and improve Indoor Air Quality. The benefit is two-fold: (1) fresh air promotes occupant health and discourages mold protecting the building structure, and (2) heat/BTUs/$$ typically lost through a direct-vent fan or hole, are salvaged using the heat exchangers integrated into the HRVs.

**It is of the UTMOST importance that if these measures are taken they are both done. Increasing tightness without proper ventilation will invite the growth of mold. This assures compromising the health of the occupants, and ultimately the failure of the structure due to rot.**

The recommended retrofit protects the investment already in the 14-PLEX. NEW CONSTRUCTION would have a substantially higher price tag without being more efficient than the RETROFIT option. Done according to the recommendations, a RETROFIT would reduce energy costs by ~$30k per year and improve indoor air quality and comfort of the building.

# Feasibility Study for the NVU 14-PLEX APPENDIX

# Commercial BEES GUIDELINES

The Alaska **Building Energy Efficiency Standard** was established by the Alaska Housing Finance Corporation to promote the construction of energy efficient buildings. It sets building energy use standards for thermal resistance, air leakage, moisture protection and ventilation. It is relevant in this analysis because AHFC often provides supplementary funding for construction projects in Alaska and requires BEES.

See link for further information: http://www.ahfc.us/efficiency/energy-programs/new-home-rebate/bees/

**PROPOSED COMMERCIAL BEES 2012**

**Table A402.2 Opaque Thermal Element Requirements a**

| Climate Zone | 8 |
|---|---|
| | Group R |
| **Roofs** | |
| Insulation entirely above deck | R-35 ci |
| Metal Buildings(withcR-5 thermal blocks) [a,b] | R-30 + R-11 LS |
| Attic and other | R-49 |
| **Walls, Above Grade** | |
| Mass | 25 ci |
| Metal building | R-21 + R-10 ci |
| Metal framed | R-13 + R-16.7 ci |
| Wood framed and other | R-13 + R-15.6 ci |
| **Walls, Below Grade** | |
| Below grade wall [c] | R-15 ci |
| **Floors** | |
| Mass | R-18.8 ci |
| Joist/framing [d] | R- 38 / R-43 |
| **Slab-on-Grade Floors** | |
| Unheated slabs | R-15 for 48" below |
| Heated slabs [c] | R-20 for 48" below |
| **Opaque Doors** | |
| Swinging | U-0.37 |
| Roll-up or sliding | R-4.75 |

For SI: 1 inch = 25.4 mm. ci = Continuous insulation.

LS = Liner System – A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA 90.1 Appendix A.

b. Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table A402.1.2.

c. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

d. Steel floor joist systems shall be insulated to the larger value; wood systems to the smaller value.

**RESIDENTIAL BEES 2012**

**Table A402.1.1 Nominal Insulation and Glazing Minimum R-values by Component**

| Climate Zone | 8 |
|---|---|
| Windows, Doors & Skylights | R-4.5 |
| Ceiling[a] | R-59 or R-48 |
| Exterior Wood Frame Wall | R-30 |
| Below Grade Wall[b] | R-15 / R-19 |
| Crawl Space Wall[b] | R-15 / R-19 |
| Floor | R-38 |
| Slab[c] & Depth | R-15, 4ft |

a. The smaller value may be used with a properly sized, energy-heel truss.

b. "15/19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home.

c. R-5 shall be added to the required slab edge R-values for heated slabs.

# REFERENCES

Alaska Housing Finance Corporation http://www.ahfc.us/
International Energy Conservation Code (IECC)

# CONTACTS

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