

FINAL REPORT:

# **Pugwash Multipurpose Centre Business Plan & Building Concept**

*for the Municipality of the County of Cumberland*

10 March 2021



ARCHITECTURE

49





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## 1 INTRODUCTION

In 2015, the Municipality of the County of Cumberland (the Municipality) advanced the preparation of a concept plan for the Pugwash Waterfront to facilitate community economic development in the Pugwash area. In the years since, the Pugwash Waterfront Development Master Plan was developed, with the support of the Municipality, the Village of Pugwash (or the Village), and various levels of government.

The Pugwash Waterfront Development Master Plan explored the development of the following four areas.

- The Eaton Park
- **The Pugwash Multipurpose Centre**
- The Harbour Centre; and
- The Village Square and walking trails.

The implementation of these various elements was to be phased over multiple years. To date, the construction of the new stage in **Eaton Park** has been completed. The next phase of the master plan focuses on the implementation of the Pugwash Multipurpose Centre (MPC). This phase includes the development of detailed design and tender documents for the Centre. Toward this goal, a 2014 Pugwash Centre Feasibility Study and Concept Design was completed, outlining the vision for the MPC's construction and operation.

In December 2020, Architecture49 (A49) and Group ATN Consulting Inc. (GATN) were engaged to update both the 2014 concept and business plan for the MPC.

The business plan includes a framework to complete the detailed design for the facility and to manage programs, events, facilities, and amenities in a cost-effective manner consistent with leading industry practices.

## 2 THE CONTEXT

In 2014, the Pugwash Centre Feasibility Study and Concept Design was developed. The report explored community needs, potential markets, conceptual design, and potential sites for the envisioned Centre.

The analysis identified the current library as an important and well-used community asset, however, challenges associated with the space in the former train station have emphasized the need for a new and improved facility to better serve community needs. Additionally, an analysis of local facilities highlighted the lack of purpose-built facilities for the general community and community recreational use; with current facilities offering only limited access in facilities adapted from their intended purposes. This lack of community space forces residents to travel to nearby communities to access such facilities and related services.

## Community Library

The need for a community library has been highlighted for several years: before the 2014 Pugwash Centre Feasibility Study and Concept Design was developed, it was established that building a new library was one of the key community priorities.

The current library is very small, at only 802 square feet, with limited storage and circulation space around library stacks. It is not accessible for those using wheelchairs, strollers and walkers, and it lacks programming space, computers, staffing space, storage and sufficient washroom facilities. In the Cumberland Public Libraries' facilities review, the Pugwash Library was the only one of seven libraries to be classified as being in "poor" condition.

The Pugwash Library, despite its current condition, is a remarkably well-used community asset. As of 2019, almost all Pugwash residents are members of the library, a measurable endorsement of the facility and value the community has for its public library.

## Community Recreation Space

In addition to a new and improved library, the community also requires a dedicated recreation space. Existing community / recreational facilities are detailed in the following table.

*Existing Community / Recreational Facilities*

| Facility Name                           | Location  | Primary Use                       |
|---|-----------|-----------------------------------|
| <b>Cumberland Curling Club</b>          | Pugwash   | Curling rink                      |
| <b>Cyrus Eaton gym</b>                  | Pugwash   | Elementary school                 |
| <b>EMO Headquarters</b>                 | Pugwash   | Ground search and rescue facility |
| <b>Linden Community Centre</b>          | Linden    | Community centre                  |
| <b>Malagash Community Centre</b>        | Malagash  | Community centre                  |
| <b>Malagash Miners' Museum</b>          | Malagash  | Museum                            |
| <b>Wallace Community Hall</b>           | Wallace   | Community hall                    |
| <b>Pugwash Village Hall</b>             | Pugwash   | Village Commission offices        |
| <b>Pugwash District High School gym</b> | Pugwash   | School                            |
| <b>Pugwash Firehall</b>                 | Pugwash   | Fire station                      |
| <b>Pugwash Legion</b>                   | Pugwash   | Social club                       |
| <b>The Meeting Place</b>                | Pugwash   | Church hall                       |
| <b>Thomas More Church</b>               | Pugwash   | Church hall                       |
| <b>St. Matthew's United Church</b>      | Pugwash   | Church hall                       |
| <b>Northumberland Curling Club</b>      | Pugwash   | Curling club                      |
| <b>7th Day Adventist Church</b>         | Pugwash   | Church hall                       |
| <b>Wallace Museum</b>                   | Wallace   | Museum                            |
| <b>Wallace United Church</b>            | Wallace   | Church hall                       |
| <b>Wentworth Recreation Centre</b>      | Wentworth | Recreation centre                 |

Currently, there is no facility purpose-built specifically for multi-purpose community recreational use. There are a variety of buildings used for recreational activities, but as noted, these are less accessible for the general community, as they exist to serve a variety of other purposes and have been adapted as well as could be from their intended uses.

Included in this list are the gymnasiums in the local elementary and high schools, which are used largely for school purposes. Outside of the school year, those who wish to rent the school gymnasiums must cover the cost of the custodian to be present on-site, and this expense is prohibitive to most potential users.

Other options for those who wish to deliver or participate in recreational activities and fitness programs, or those who require meeting space, include facilities that are not dedicated for these purposes. Examples include church halls, emergency service headquarters, area museums and schools. These facilities are not always available or properly equipped for recreational uses or as meeting spaces. Pugwash residents often have to travel to other communities to use dedicated recreational facilities, such as the Wentworth Recreational Centre.

### **Community Feedback**

In addition to the need for a larger library facility and flexible recreation space, stakeholder consultations held in 2014 indicate that there is also demand for the following:

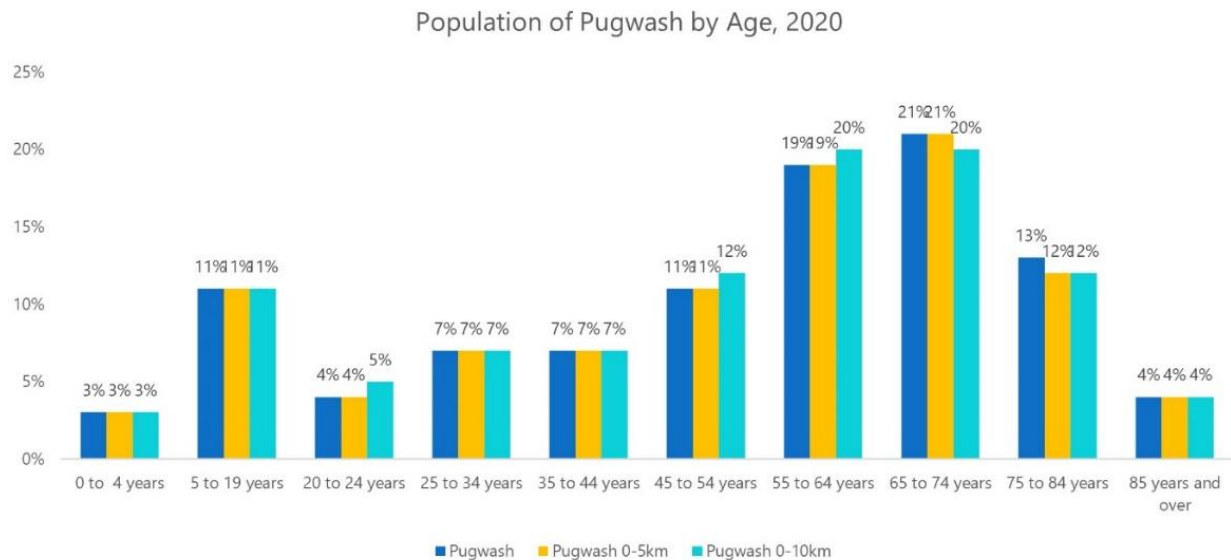
- **Increased number of public access computers.** The C@P program was developed to address the inadequate public access to computers in the community and is currently housed in the Village Commission offices. There is only enough space for two computer terminals at this site, and the program is funded via a small County grant in addition to self-generated user fees. A new library would have more computers and would therefore free up the current C@P site.
- **Facility for Pugwash Farmers' Market.** If the new multipurpose site were able to host the Pugwash Farmers' Market during the winter season, which currently draws up to 50 vendors and many customers to the community, it would enable more vendors to participate in the market and extend the market's operating season by providing access to running water, heat, and protection from the elements.

### 3 DEMOGRAPHIC & MARKET ANALYSIS

What follows is an analysis of the current demographic profile of Pugwash, which helps to illustrate the key target market for the new Multipurpose Centre.

#### Population

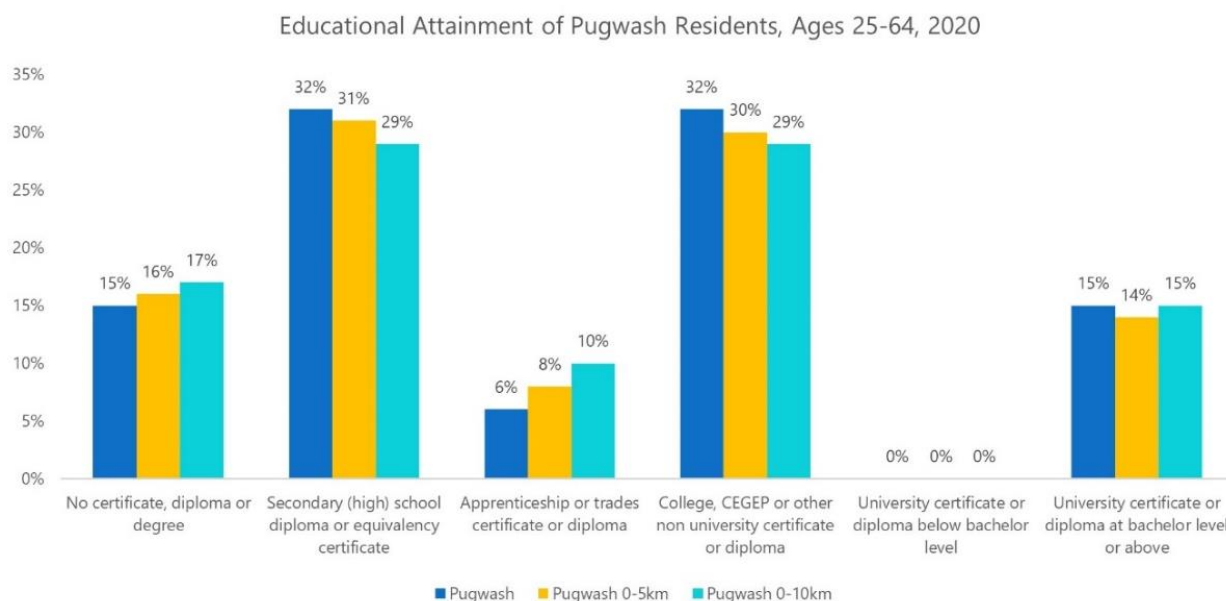
The total population of Pugwash is estimated to be 744 people for 2020, which increases to 1,095 and 1,957 when the census area increases by 5km and 10km from Pugwash, respectively. The population is projected to remain relatively constant over the next three years.



The population of Pugwash is ageing, with a median age of 59 years old.

### Educational Attainment

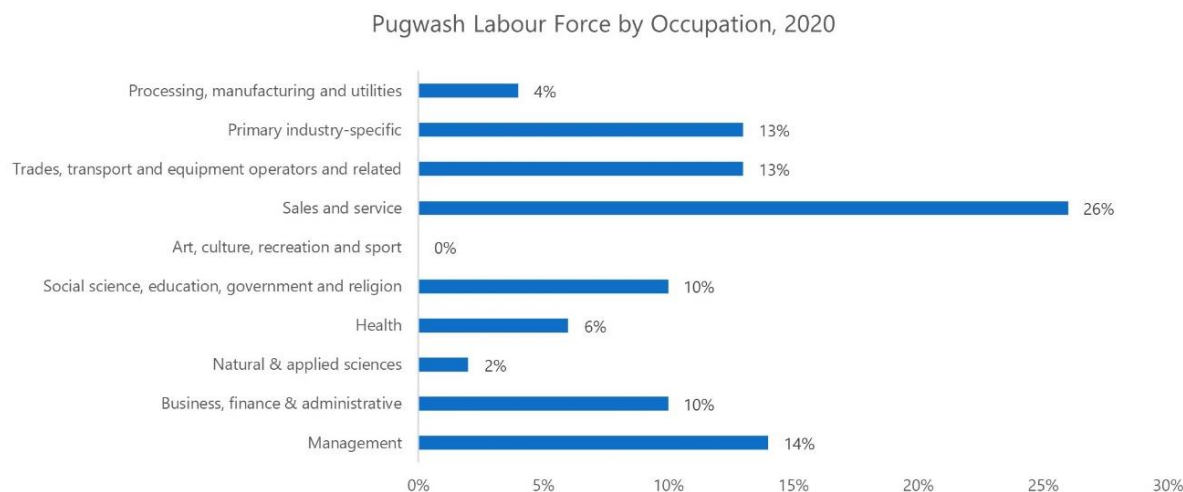
In terms of educational attainment, roughly one-third of the population aged 15 to 64 has either a high school diploma or equivalent, and another one-third of the population has a college, CEGEP or other non-university certificate. Approximately 15% of the population has a university



diploma at the bachelor level or higher.

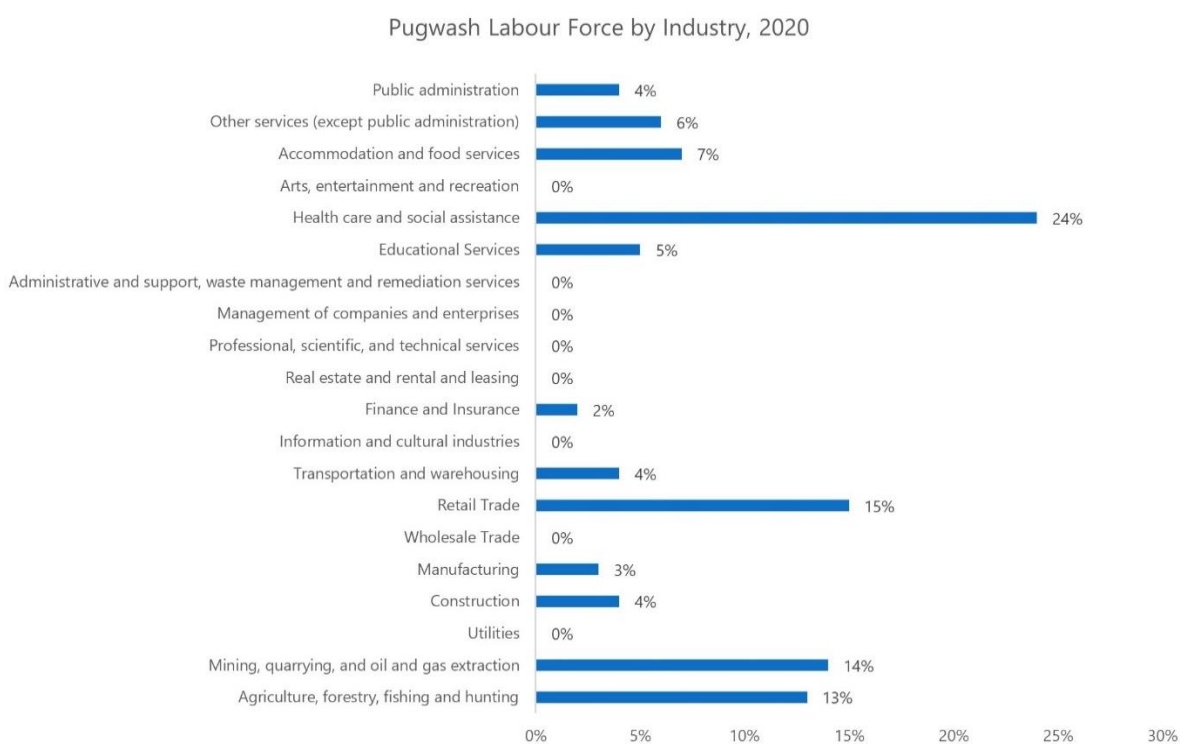
### Employment by Occupation

The most prominent occupations in Pugwash are sales and services occupations, which are held by 26% of the population. Other prominent occupations include management positions, held by 14% of the population; trades and similar, employing 13% of the population; and primary-industry specific, employing another 13%.



## Employment by Industry

The most prominent industry in Pugwash is the health care and social assistance industry, which employs roughly one-quarter of the residents of Pugwash. Another 15% of the population are employed in the retail trade industry, 14% in the mining, quarry and oil and gas extraction industry, and 13% in the agriculture, quarrying, and oil and gas extraction.

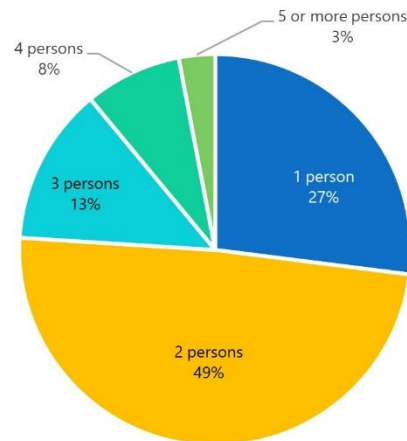


## Households

### *Households by Size*

Almost half (49%) of Pugwash households are comprised of two individuals. Just over one-quarter of households are single person households, while the remaining quarter are comprised of three or more individuals. The average number of people per census family is 2.5.

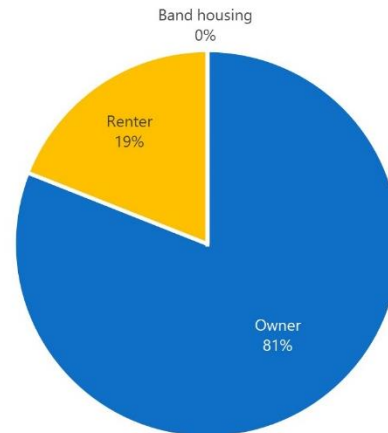
Pugwash Households by Size of Household, 2020



### *Occupied Private Dwellings by Tenure*

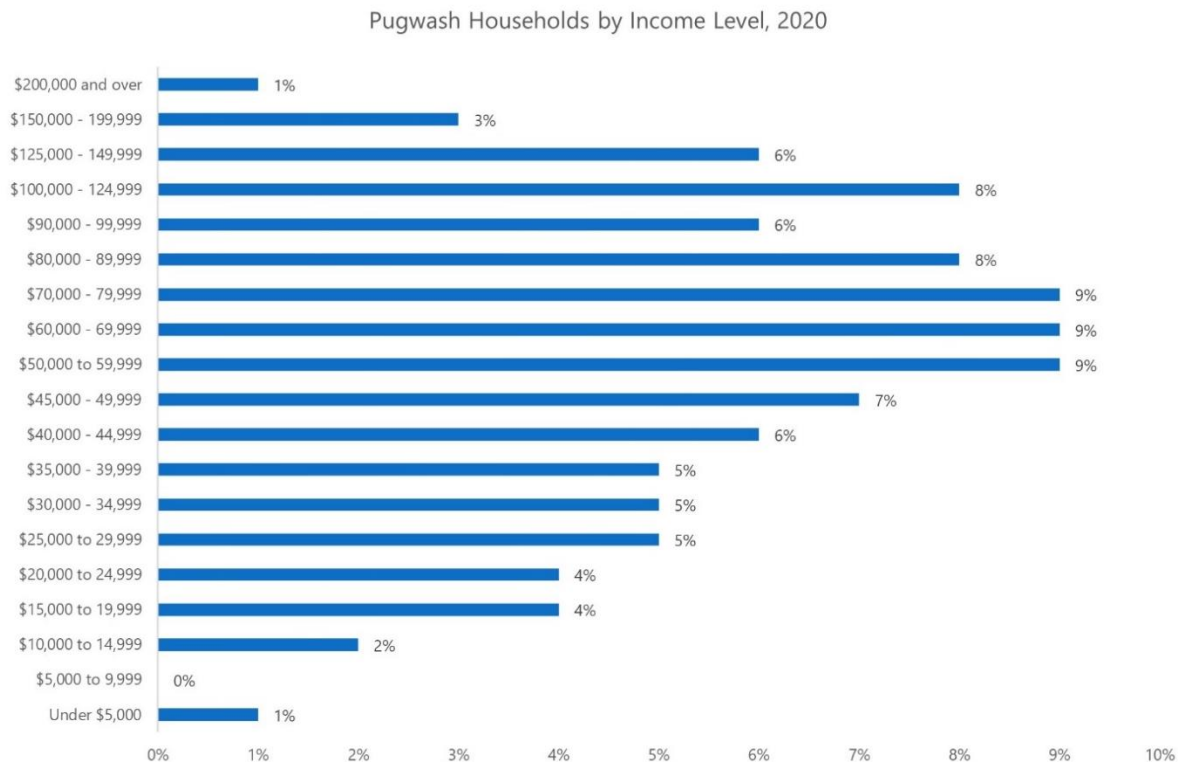
Most (81%) Pugwash residents own their private dwellings while 19% rent their accommodations. For those that own their homes, 86% live in single-detached houses.

Pugwash Occupied Private Dwellings by Tenure, 2020



## Household Income

Average household income in Pugwash is estimated to be \$74,060 for 2020 and is projected to increase by 10% within the next three years.

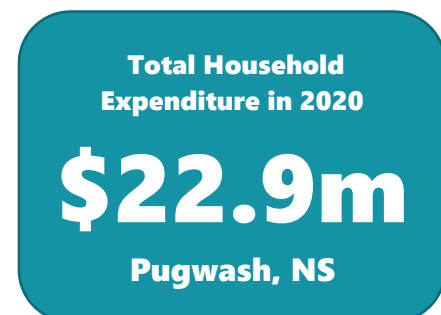


## Transportation

Most (89%) people living in Pugwash drive a vehicle to work, while 5% travel as a passenger in a vehicle and another 5% walk to work. As the distance from Pugwash increases, more individuals drive a vehicle to work; at a 5km radius from Pugwash, 90% of people drive, and at a 10km radius the number increases to 92%.

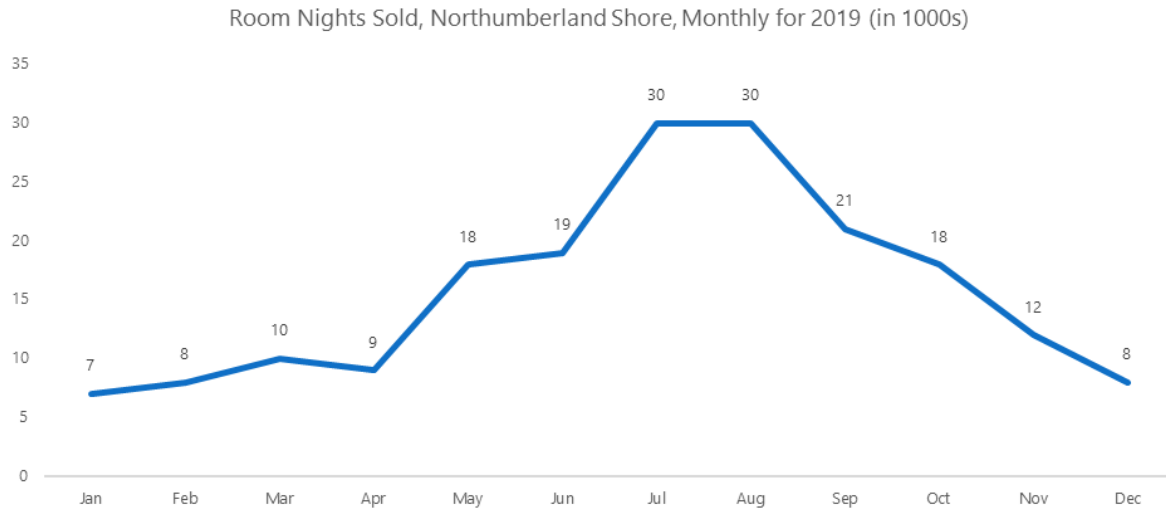
## Spending

Total household expenditure in Pugwash is estimated to be about \$22.9 million for 2020, or \$76,797 per household. The majority of household spending is on shelter, income taxes, and transportation, at 19%, 18%, and 16%, respectively. Of total expenditure on shelter, an estimated 57% is spent on owned living quarters and 18% on rented living quarters. It is estimated that 11% is spent on other accommodations, and 15% on utilities.



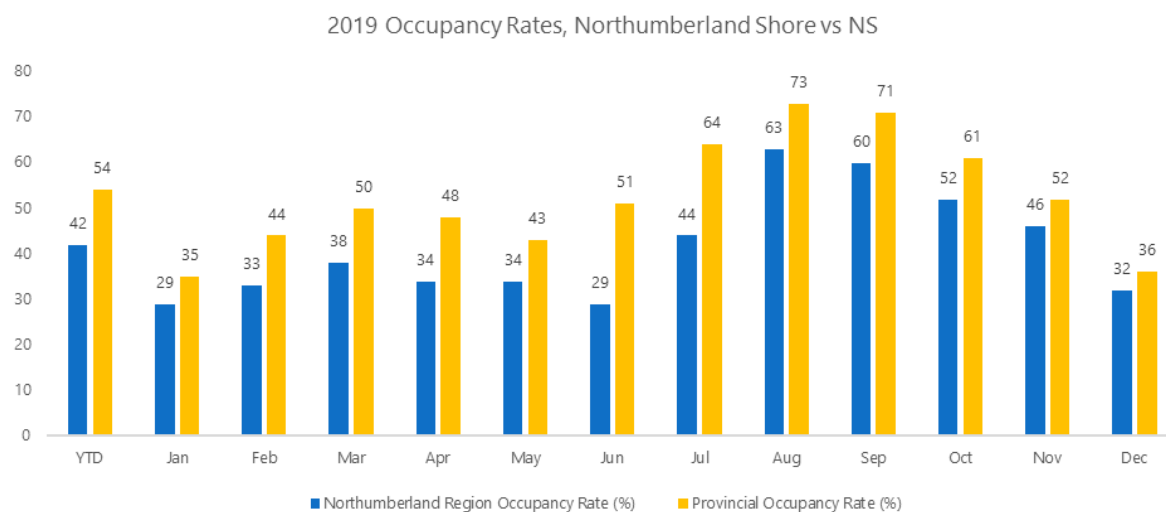
### Visitor / Accommodation Statistics

Tourism Nova Scotia (TNS) collects visitor and accommodation data by region for NS. While there are no visitor statistics specific to Pugwash, we can make some assumptions by looking at the trends in the broader area of the Northumberland Shore. All statistics and trends noted here are those pertaining to pre-Covid-19 conditions.



Predictably, number of room nights sold in the Northumberland Shore region peak in the summer months, with 30,000 room nights sold in both July and August in 2019. During the shoulder seasons (May-June and September-October) number of room nights sold range from 18,000 to 21,000 monthly. During the winter months, room nights sold range from 7,000 to 10,000 monthly.

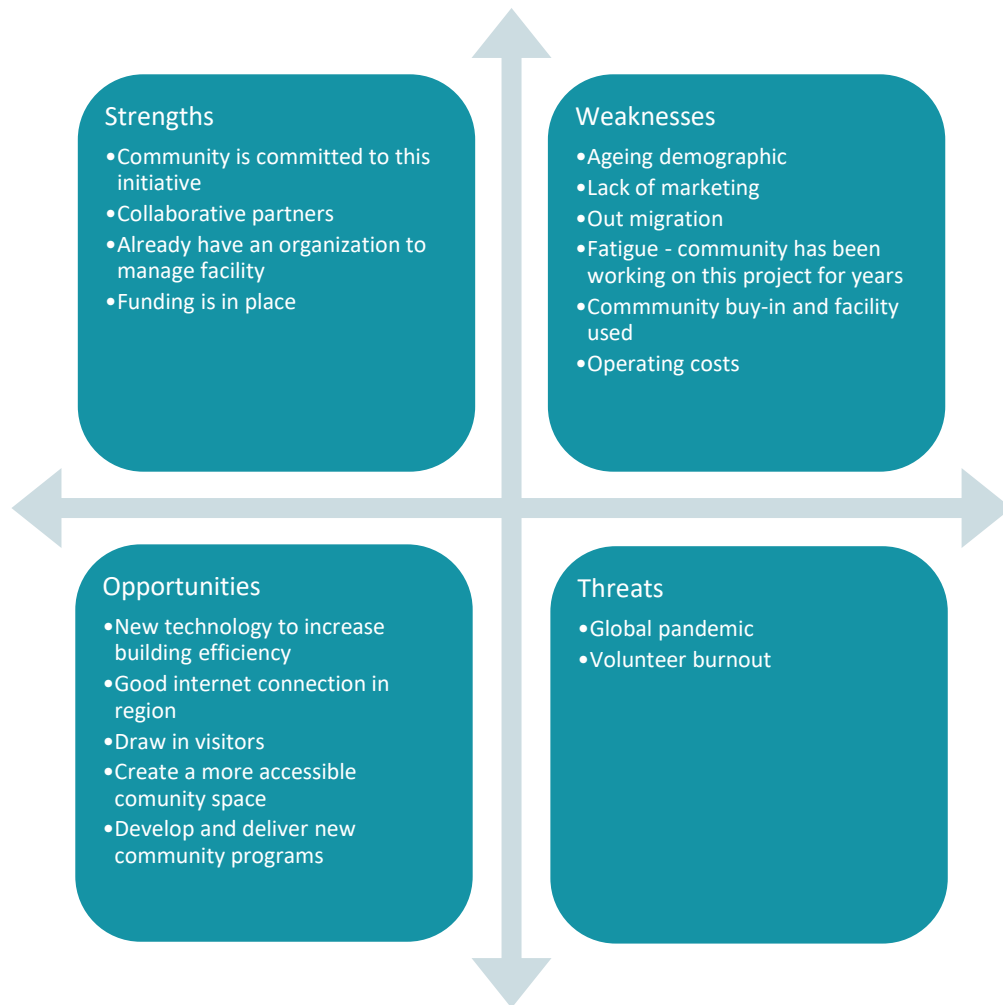
### Occupancy Rates



Occupancy rates in the Northumberland Shore closely follow the same trendline as occupancy rates for the overall province, with higher levels in the summer months and lower levels through the winter and spring. However, rates in the Northumberland Shore are smaller overall for each month when compared to the overall province.

### SWOT Analysis

What follows is an assessment of the strengths, weakness, opportunities and threats facing the Pugwash MPC, and relate to conditions that existed prior to Covid-19, acknowledging that Covid-19 may have changed migration patterns for the foreseeable future.



## 4 BUILDING CONCEPT

The envisioned Centre will include a library and community and recreational facilities; and is viewed as an opportunity to achieve the following **goals**.

- Promote healthy living and increased physical activity among all age groups and segments of the community.
- Enhance volunteer opportunities and participation broadly; and
- Enhance the overall community quality of life and place.

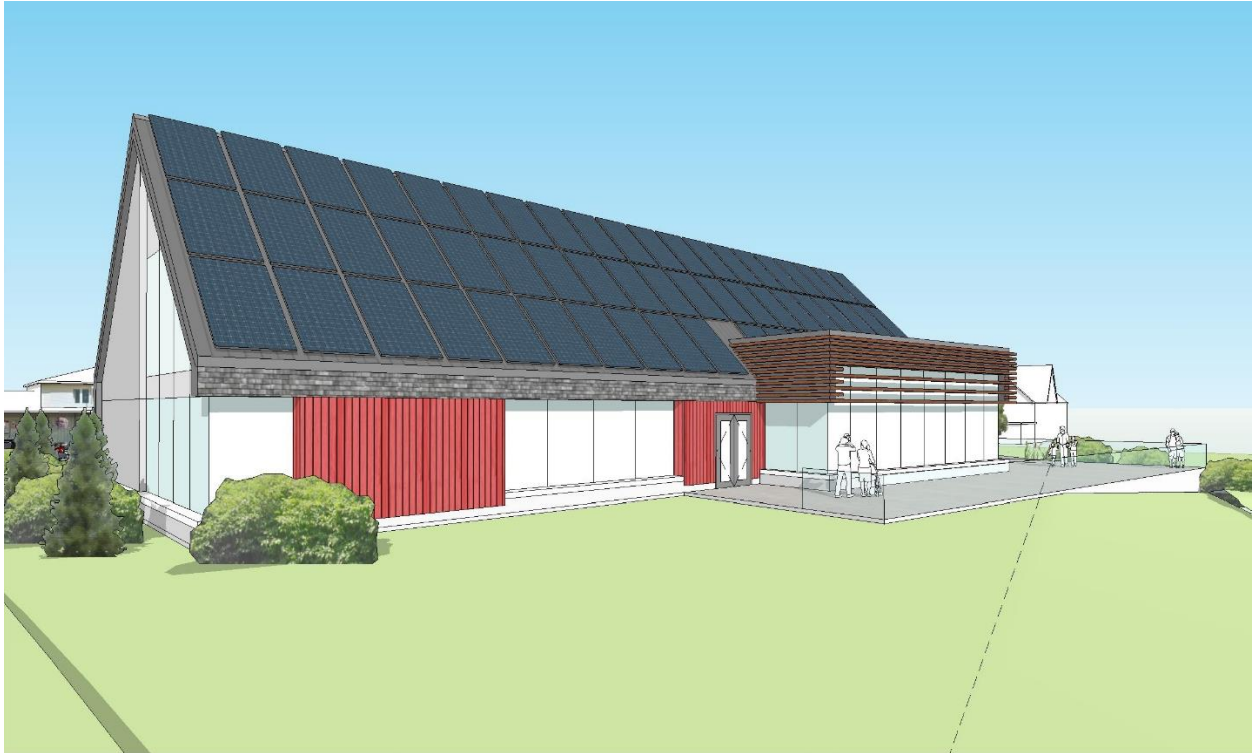
As of 2020, the Centre is expected to house the following facilities and programming.

- A Library, including space for library administration, a program room, a meeting room, and a work room
- Two multipurpose rooms
- Storage
- Living rooms
- Kitchen; and
- Walking circuit

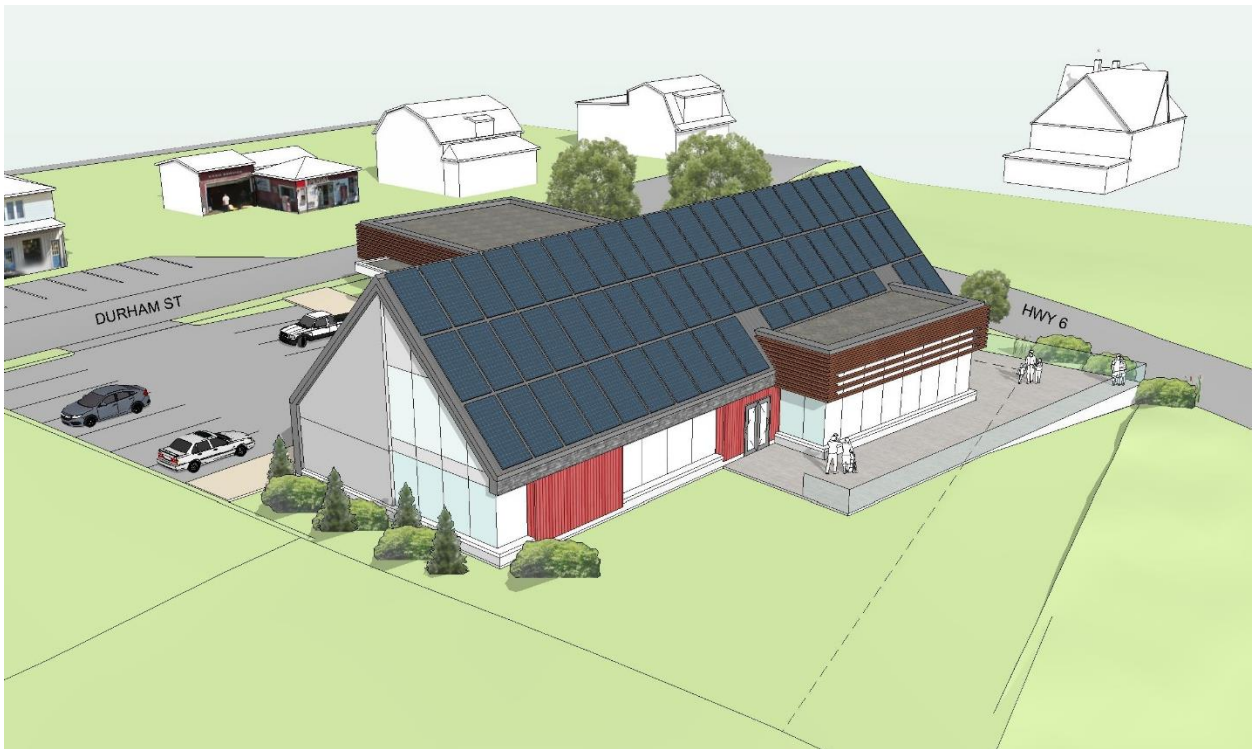
The total gross floor area of the building is approximately 8,150 square feet, with an exterior deck of 1,950 square feet overlooking the Estuary on the south side of the building.



*View from Durham St*



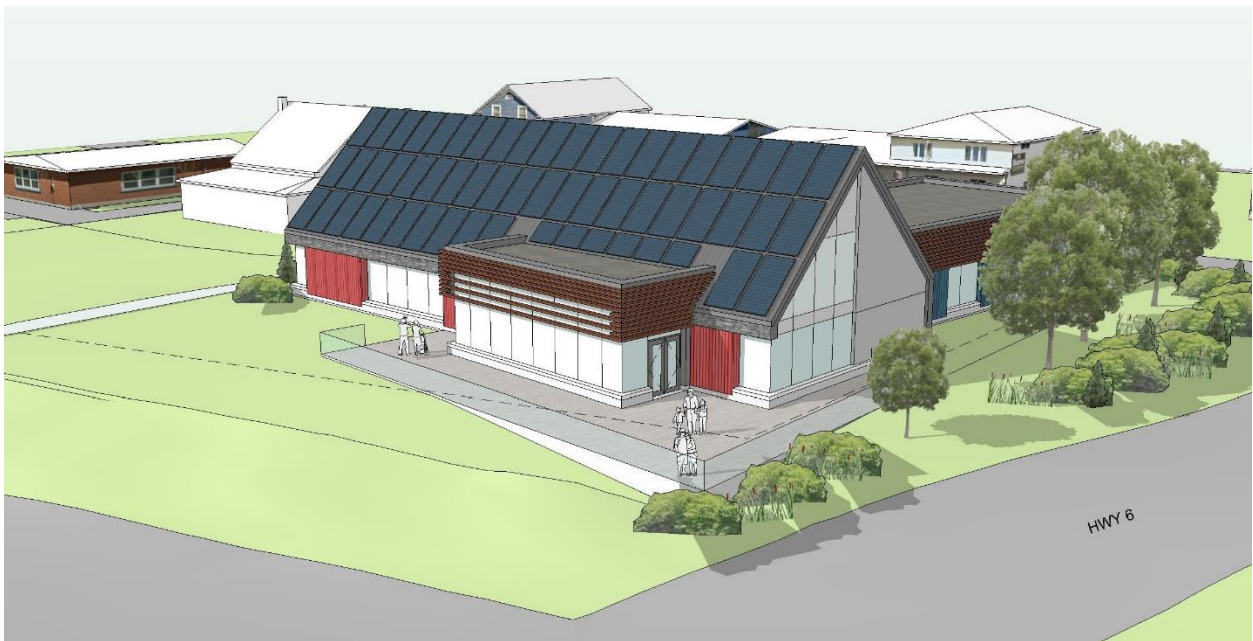
*View from Waterfront*



*Aerial view, overlooking Library Wing and waterfront deck*



*Aerial view, from Durham St*



*Aerial view, from Highway 6*



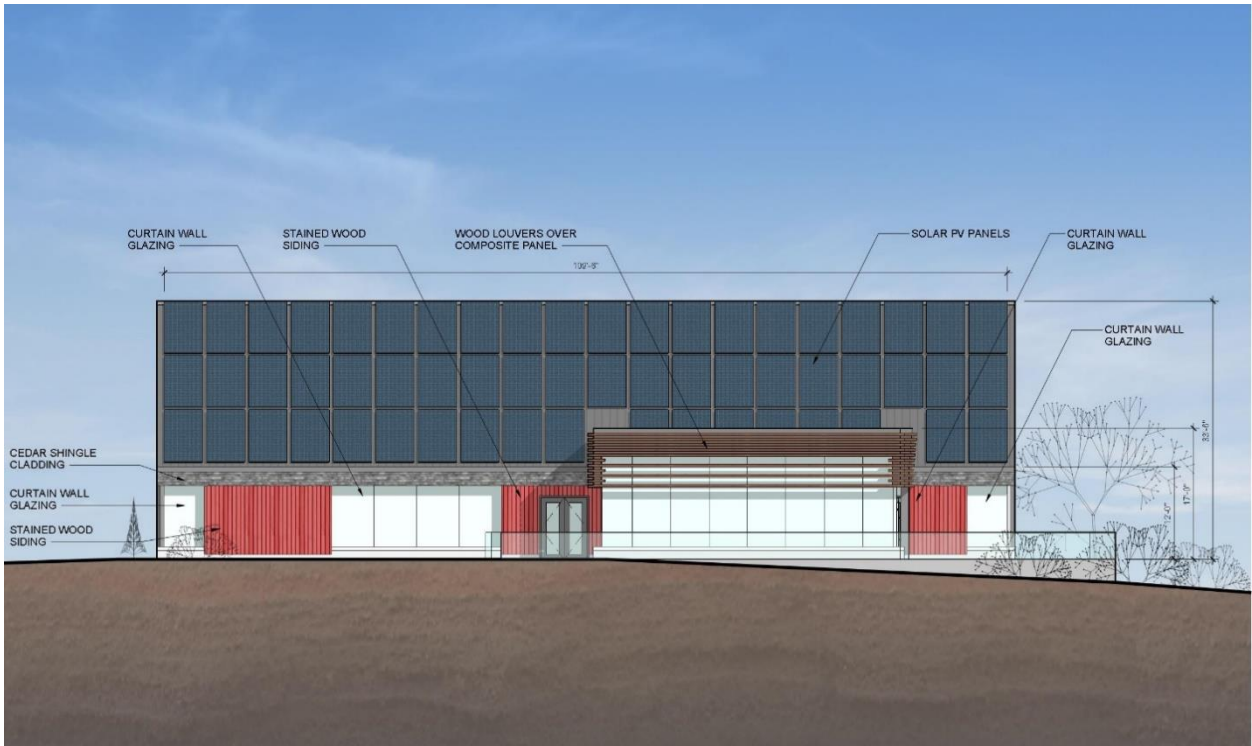
Aerial view, corner of Highway 6 & Durham St



Site Plan



Elevation – West



Elevation – South



Elevation – East



Elevation – North (Durham St)

## Building Description

The building has been located to take advantage of the prominence of the site when viewed from the Highway 6 bridge, with the major mass forming the south side of the civic block and highly visible from Highway 6, whether approaching from the east or the south. The form consists of a principal pitched-roof volume with its glazed gable ends facing east and west and the current Pugwash Library (Train Station), intersected by a secondary lower, flat-roofed mass. This opens up two of the major building uses – the library collection and reading room and an informal “village living room” – for views in and out of the building.

| Program Group        | Program Spaces     | Area (sf) | Area of Group (sf) |
|----------------------|--------------------|-----------|--------------------|
| Library              | Library            | 1,451     | 2,360              |
|                      | Program Room       | 170       |                    |
|                      | Library Admin      | 264       |                    |
|                      | Admin Meeting Room | 340       |                    |
|                      | Admin Work Room    | 135       |                    |
| Multi-Purpose Centre | Multi-purpose #1   | 573       | 5,130              |
|                      | Multi-purpose #2   | 460       |                    |
|                      | MP Storage         | 176       |                    |
|                      | Living Room(s)     | 678       |                    |
|                      | Kitchen            | 293       |                    |
|                      | Washroom           | 469       |                    |
|                      | Walking Circuit    | 1,865     |                    |
|                      | Corridor (Misc)    | 240       |                    |
|                      | Vestibule          | 155       |                    |
|                      | Service/Storage    | 220       |                    |

|                                      |          |
|--------------------------------------|----------|
| <b>Gross Floor Area of Building:</b> | 8,158 sf |
| Exterior Deck:                       | 1,946 sf |

The multi-purpose centre has the more civic view over Durham Street, extending near the lot line to give an edge to the street and a civic presence to the building. The view to the water, and the view from the water and the bridge, are given to the village living room and main library space. This concept is borrowed from the new Halifax Central Library, where the most prominent and popular spaces in the building connect the activity inside the building to the city and its context.

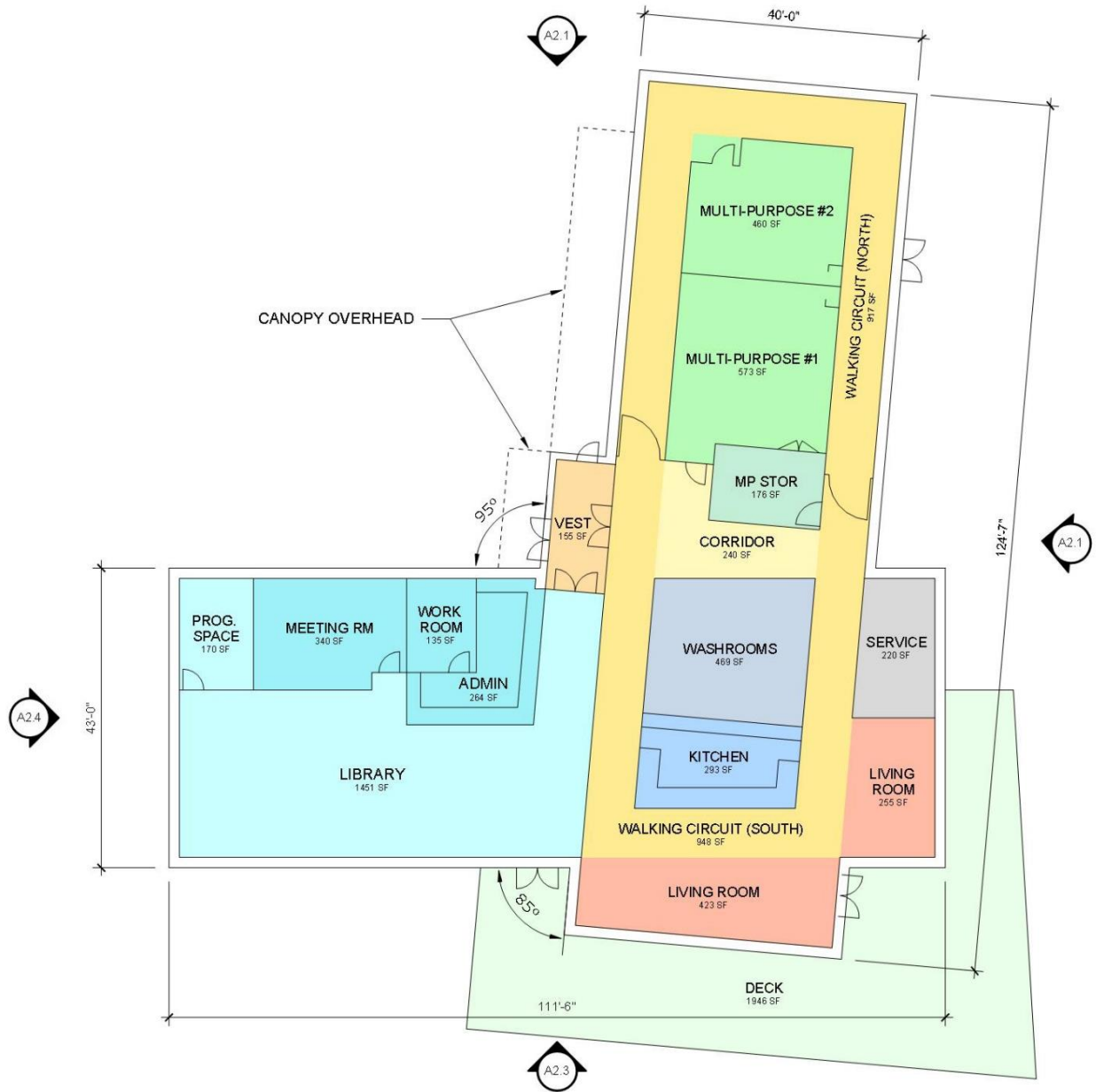
The simple pitched roof form recalls a common pattern of house construction while the long roof ridge and 1:1 slope has been oriented for south-facing exposure, to optimize solar power generation potential. The wood shingle exterior wall material also references the traditional local palette, while the addition of brightly coloured trims adds life to the exterior and complements the interior colour scheme.

The lower mass is placed to give views outward from the Activity Rooms towards the street, maintaining a visual connection to the community. There is less emphasis here on the views into the building so eye-catching height is not a particular advantage. Instead, the focus is on the transparency of the façade and the placement of windows reinforces this.

The building concept has been developed to allow the library and community activity spaces to take advantage of shared facilities, such as a common entrance, shared public washrooms and a kitchen, but at the same time, to ensure that the spaces are able to function independently. In other words, the facilities have been planned to allow direct access to the community spaces or

archives when the library isn't open (or vice versa), while maintaining after-hours security for each component. By placing the circulation areas in the multi-purpose wing of the building around the core functions, a space that can be used as a walking circuit is created. While somewhat less efficient from a building area point of view, this does add considerably to the "multi-purpose" character of the design.

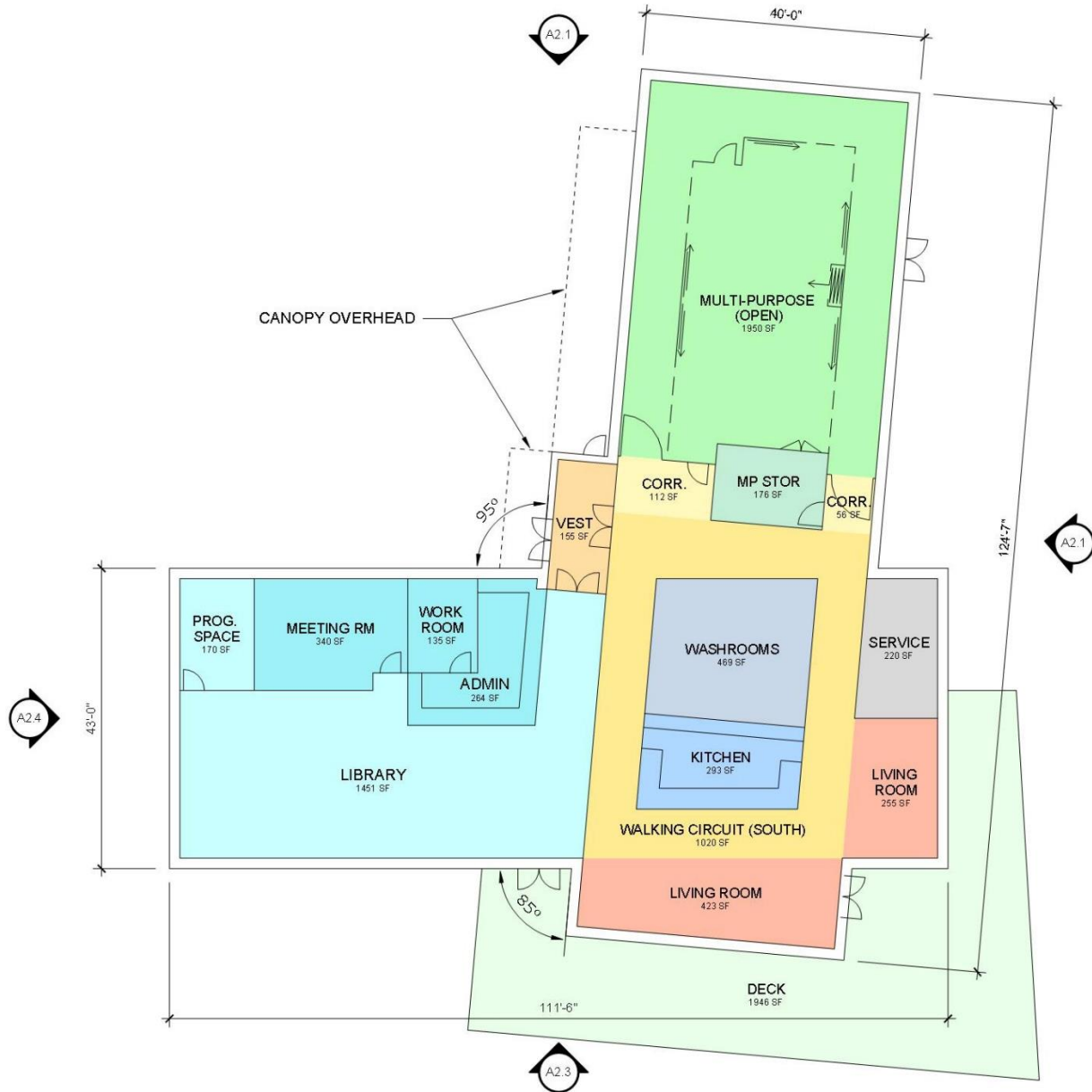
Several stakeholders emphasized the importance of having a flexible facility that is able to host a variety of functions for a range of group sizes. Concerns were also expressed that the 800 square feet allocated in the 2014 concept might not be large enough. Instead of two activity rooms of equal size, the proposed concept contains two rooms of slightly different sizes, giving the possibility of having two rooms, one of 460 square feet and another of 570 square feet, or one room of 1,030 square feet. The moveable partition between the two rooms would be solid (opaque) allowing simultaneous use for separate functions. The perimeter walls facing the street and public areas of the site would be glazed, allowing users of the activity space to feel a sense of connection with the community.



*Program plan – Primary configuration*

In previous iterations of the design, we heard that even the combined area of the two multi-purpose rooms might not be large enough for some of the group activities that could be held in the facility. The design team considered how best to accommodate the request for more area without enlarging the building, which was already pressed close to the buildable limits of the site and concluded that, through the use of moveable partitions and pivoting slab doors, the entire north end of the multi-purpose wing could be closed off from the south end and opened up for a single use, giving a room of 1,950 square feet. The location

of the large pivoting doors allows an alternate shorter configuration of the walking circuit, which would be able to maintain its function even while the facility hosts larger events.



Program plan – Alternate configuration

## 5 CONSTRUCTION COSTS

A Class “D” capital cost estimate (Appendix E) had been prepared for the concept presented in **Section 4**. Information contained in the estimate has also been used to inform the selection of Energy Conservation Measures (ECMs) that will allow the Multi-Purpose Centre to be economical and environmentally responsible in operation.

The cost estimate places construction cost for the Pugwash Library and Multi-Purpose Centre on the Durham Street site at \$4,698,800. Upon verification of the capital costs and Return on Investment (ROI) period for each of the examined Energy Conservation Measures, it was determined that the additional cost for triple glazing would not return sufficient benefit to warrant the expenditure. The rationale is explored in more detail in the following section, **“Operating Cost and Carbon Reduction”**. Eliminating this from the project results in a cost saving of \$261,680, resulting in a revised construction estimate of **\$4,437,000**. (The net premium for triple glazing compared to standard glazing is \$179,080. When marked up with the customary fees and contingencies, this totals \$261,680.)

Compared to the Class D estimate prepared for the original concept that was developed in December 2017, this represents an increase of \$1,235,020 or 38.6%. The revised concept has resulted in a fractionally smaller building footprint (8,158 sf compared to 8,347 sf) which means that on a cost-per-square-foot basis, the increase is 41.8% compared to 2017.

This increase is due to several factors. The first is the general rise in costs over the intervening three years, which would account for an additional \$250,000-\$300,000. The second is that the revised design has been tailored to reflect the desire for the building to be carbon neutral in operation, a goal that was not part of the 2017 concept. This has entailed considerably more detail with respect to the sorts of materials and systems that would be needed to achieve this goal. The cost estimate developed in 2017 was based on assumptions of industry standard or Code-mandated approaches. The revised design incorporates several initiatives to reduce energy consumption and greenhouse gas emissions. These are described in more detail in Appendix F. The capital cost premium for these measures totals approximately \$200,000.

The third and more complex piece is the unexpected rise in material and labour costs due to the current COVID-19 pandemic situation. It is difficult to tease these apart from the baseline market increases but as the public sector in particular has turned to construction as a means to support economic activity, and as manufacturing and distribution have had to contend with new procedures, restrictions and periods of suspended activity, the interaction of supply and demand has caused prices to rise. This has affected different materials differently. Concrete and masonry have been relatively little affected; structural steel, aluminum, and glazing materials have risen by from 20 to as much as 40%; lumber and wood products have risen by as much as

100% for some items. This building was envisioned to be primarily of wood construction, for its low embodied carbon, the natural sequestration of carbon, and to enable construction by smaller, local contractors, so it is particularly affected by this.

It is difficult to predict what will happen to these conditions after the pandemic situation eases. As restrictions are removed and normal operations resume, many of the premiums should fade away, though it might be too optimistic to say that there will be an immediate return to the pre-pandemic norm.

## Operating Cost and Carbon Reduction

An energy modeling report (Appendix F) was prepared by WSP in order to evaluate potential Energy Conservation Measures for the new Pugwash Library and Multi-Purpose Centre. Key building components considered include the high-performance building envelope, consisting of wall insulation, roof insulation, high performance double glazing and triple glazing. As well, the report evaluated HVAC system options, ground source heat pump (GSHP), air source heat pump (ASHP), exhaust air heat recovery, CO<sub>2</sub> sensors, a high-performance boiler, natural ventilation, and on-site electricity generation by means of a solar photovoltaic panel installation.

The table below presents a summary of the energy conservation measures and the associated energy savings, greenhouse gas emissions reductions, incremental costs and periods of return on investment (ROI) for each of the evaluated measures.

| Energy Conservation Measures (ECM) |                                 |                |                   |          |                        |                  |                  |
|------------------------------------|---------------------------------|----------------|-------------------|----------|------------------------|------------------|------------------|
| #                                  | Description                     | Annual savings |                   |          |                        | Net measure cost | Simple ROI (yrs) |
|                                    |                                 | Propane (L)    | Electricity (kWh) | \$       | CO <sub>2</sub> (tons) |                  |                  |
| 1                                  | Increase wall insulation 20%    | 380            | 264               | \$ 290   | 0.8                    | \$ 14,330        | 49.4             |
| 2                                  | Increase roof insulation 20%    | 346            | 264               | \$ 265   | 0.7                    | \$ 14,270        | 53.8             |
| 3                                  | High performance double glazing | 788            | 352               | \$ 569   | 1.4                    | \$ 61,750        | 108.5            |
| 4                                  | Triple glazing                  | 1,101          | 2,375             | \$ 1,098 | 3.4                    | \$ 179,080       | 163.1            |
| 5                                  | Ground source heat pump         | 15,398         | -45,127           | \$ 4,202 | -9.2                   | \$ 50,000        | 11.9             |
| 6                                  | Air source heat pump            | 14,489         | -30,671           | \$ 5,572 | -0.1                   | \$ 30,000        | 5.4              |
| 7                                  | Exhaust air heat recovery       | 784            | 323               | \$ 652   | 1.4                    | \$ 6,600         | 10.1             |
| 8                                  | CO <sub>2</sub> sensors         | 534            | 733               | \$ 485   | 1.3                    | \$ 3,000         | 6.2              |
| 9                                  | High performance boiler         | 5,534          | -29               | \$ 3,595 | 8.4                    | \$ 4,200         | 1.2              |
| 10                                 | Natural ventilation             | 0              | 6,879             | \$ 921   | 5.0                    | \$ 4,000         | 4.3              |
| 11                                 | Photovoltaic panels             | 0              | 18,209            | \$ 2,451 | 13.1                   | \$ 60,000        | 24.5             |

It is apparent from these numbers that high-efficiency glazing (ECMs 3 and 4), while saving energy and reducing CO<sub>2</sub> production, have extremely long payback periods, exceeding the anticipated lifespan of these elements by a factor of 2 or 3. Consequently, these have been removed from consideration.

A comparison between a ground-source heat pump and an air-source heat pump reveals that the lower installed cost and greater yearly operating cost savings of the air-source heat pump make it the more advantageous option. The energy required to operate a ground-source pump results in an increase in CO<sub>2</sub> production of approximately 9 tons, while operating the air-source pumps carries a CO<sub>2</sub> production penalty of 0.1 tons. This is due to the relatively dirty mix of electricity generating sources currently in use in Nova Scotia. As this mix becomes less carbon-heavy, this carbon penalty will disappear.

Other items with comparatively long paybacks are the increase in wall and roof insulation to 20% above the current National Energy Code requirements, and the solar photovoltaic panels. These measures have remained on the list of recommended measures because the payback period is within the anticipated life expectancy of the component. For the insulation, that life expectancy is effectively indefinite, as it should continue to perform for the lifetime of the building. Adding even more insulation begins to come up against the law of diminishing returns, as each inch adds the same – or a slightly increasing – incremental cost, while that same inch returns a smaller percentage increase in thermal performance compared to the inch the preceded it. During design development, a more detailed calculation could be done to find the optimum insulation value, but it is unlikely to be significantly different than the one used in these bundles.

The payback period on the solar panels is very close the anticipated lifespan of 25-30 years, but grants and incentive programs for solar installations would greatly reduce the net capital cost and therefore the ROI period. It is also reasonable to expect that the current trend towards lower cost and higher-efficiency solar panels will mean that the first replacement panels will cost less to install in real terms and make a greater contribution to the building's energy budget, meaning their payback period would likely be considerably shorter than their anticipated lifespan.

These systems were considered in two bundles:

- **Bundle 1** includes the combination of energy conservation measures selected to maximize greenhouse gas emissions reduction.

| Bundle 1                          |                              |                |                   |                     |             |                   |                  |
|-----------------------------------|------------------------------|----------------|-------------------|---------------------|-------------|-------------------|------------------|
| Energy Conservation Measure (ECM) |                              | Annual savings |                   |                     |             | Net measure cost  | Simple ROI (yrs) |
| #                                 | Description                  | Propane (L)    | Electricity (kWh) | Operating Cost (\$) | CO2 (tons)  |                   |                  |
| 1                                 | Increase wall insulation 20% | 380            | 264               | \$ 290              | 0.8         | \$ 14,330         | 49.4             |
| 2                                 | Increase roof insulation 20% | 346            | 264               | \$ 265              | 0.7         | \$ 14,270         | 53.8             |
| 7                                 | Exhaust air heat recovery    | 784            | 323               | \$ 652              | 1.4         | \$ 6,600          | 10.1             |
| 8                                 | CO2 sensors                  | 534            | 733               | \$ 485              | 1.3         | \$ 3,000          | 6.2              |
| 9                                 | High performance boiler      | 5,534          | -29               | \$ 3,595            | 8.4         | \$ 4,200          | 1.2              |
| 10                                | Natural ventilation          | 0              | 6,879             | \$ 921              | 5.0         | \$ 4,000          | 4.3              |
| 11                                | Photovoltaic panels          | 0              | 18,209            | \$ 2,451            | 13.1        | \$ 60,000         | 24.5             |
| <b>Total</b>                      |                              | <b>7,578</b>   | <b>26,643</b>     | <b>\$ 8,659</b>     | <b>30.7</b> | <b>\$ 106,400</b> | <b>12.3</b>      |

- **Bundle 2** provides combination of energy conservation measures selected to maximize operating cost savings.

| Bundle 2                          |                              |                |                   |                     |             |                   |                  |
|-----------------------------------|------------------------------|----------------|-------------------|---------------------|-------------|-------------------|------------------|
| Energy Conservation Measure (ECM) |                              | Annual savings |                   |                     |             | Net measure cost  | Simple ROI (yrs) |
| #                                 | Description                  | Propane (L)    | Electricity (kWh) | Operating Cost (\$) | CO2 (tons)  |                   |                  |
| 1                                 | Increase wall insulation 20% | 380            | 264               | \$ 290              | 0.8         | \$ 14,330         | 49.4             |
| 2                                 | Increase roof insulation 20% | 346            | 264               | \$ 265              | 0.7         | \$ 14,270         | 53.8             |
| 6                                 | Air source heat pump         | 14,489         | -30,671           | \$ 5,572            | -0.1        | \$ 30,000         | 5.4              |
| 7                                 | Exhaust air heat recovery    | 784            | 323               | \$ 652              | 1.4         | \$ 6,600          | 10.1             |
| 8                                 | CO2 sensors                  | 534            | 733               | \$ 485              | 1.3         | \$ 3,000          | 6.2              |
| 9                                 | High performance boiler      | 5,534          | -29               | \$ 3,595            | 8.4         | \$ 4,200          | 1.2              |
| 10                                | Natural ventilation          | 0              | 6,879             | \$ 921              | 5.0         | \$ 4,000          | 4.3              |
| 11                                | Photovoltaic panels          | 0              | 18,209            | \$ 2,451            | 13.1        | \$ 60,000         | 24.5             |
| <b>Total</b>                      |                              | <b>22,067</b>  | <b>-4,028</b>     | <b>\$ 14,231</b>    | <b>30.6</b> | <b>\$ 136,400</b> | <b>9.6</b>       |

What is immediately apparent from these data is that the lower-carbon bundle (Bundle 1) produces only 0.1 tons less CO<sub>2</sub> per year than the lower operating cost bundle (Bundle 2), while Bundle 2 provides considerably greater operating cost reductions; \$14,230 annually, compared to \$8,660. The difference between the two bundles is the installation of an air-source heat pump in Bundle 2. While this increases the cost by \$30,000, it shortens the ROI period from 12.3 years to 9.6 years.

These are “simple” ROI calculations, meaning that the future rise in energy costs is not factored in. The “real” ROI period will almost certainly be shorter than the ones shown in these tables.

It is also apparent that neither of these bundles on its own would take the building all the way to Zero Carbon in operation, but either would permit considerable reductions in energy consumption and greenhouse gas emissions. The energy consumption side of the equation is more within the control of the designers, through demand reduction, whereas the greenhouse gas emissions remain at least partially dependent on the electrical generation sources employed by the utility.

While it is at least theoretically possible to generate all of the building’s electric power needs using on-site renewable sources, the space required and the capital cost make this impractical, especially as the utility is rapidly moving towards a lower-carbon generation mix.

Nova Scotia is presently the third-dirtiest jurisdiction in Canada for electricity generation (behind Alberta and Nunavut). NS Power released a report in November 2020 that details what they will be doing to meet the Province’s targets of a 53% reduction in GHG emissions by 2030 and net zero by 2050. (That report can be found at: <https://irp.nspower.ca/>)

It is recommended that the energy source employed to meet the make-up heating requirements should be electricity, in spite of the temporarily higher CO<sub>2</sub> generation that results. The emission factor for propane is 1.515 kg CO<sub>2</sub>/L and this is not going to change. The emission factor for electricity is presently higher but will drop significantly over the next 29 years (to 2050), well within the life of this building, and this will greatly lower the building's carbon footprint over its lifetime.

If a faster route to low- or zero-carbon electric power is required, there are alternatives to straight utility-sourced power. A contract with a green-energy supplier could provide an immediate means to achieve zero-carbon output in operations. The cost of such a contract could not be determined without detailed discussions with a potential supplier, which is outside the scope of the present study.

## MAJOR COMPONENT REPLACEMENT & BUILDING MAINTENANCE SCHEDULES

A building component replacement schedule sets out the anticipated frequency of replacement or renewal of various components of a building as they reach the limits of their useful life. The replacement schedule for the major components of the Pugwash Multi-Purpose Centre is laid out in the table on page 27.

This schedule is based on the following assumptions:

### Architectural Components:

The estimated useful life of these components is based on experience and has been compared to CSA Standard S478 Guideline on Durability in Buildings. Where there are discrepancies with the standard, the figures have been derived from industry publications.

The building structure and foundations are assumed to have an indefinite lifespan, requiring little or no maintenance. CSA S478 describes the maintenance of these items as “little/none, significant if failure.” They are designed to last for the anticipated service life of the building.

### Mechanical:

Plumbing, piping, valves and fittings, (including roof drains, floor drains, cleanouts, etc.) are expected to last the life of the building. Periodically valves will fail and/or leak; the water quality dictates the longevity of the piping systems.

### Electrical:

The life of electrical equipment is often triggered by a decision to add to, relocate or modify electrical elements, only to find that spare parts are no longer available. It is at this point that components are replaced simply because they cannot be modified to suit the new intent.

### Site and Landscape:

Paved parking areas and concrete surfaces should last 20-25 years with only minor repairs before needing resurfacing or other more significant repairs. Stone paved inlays and other specialized paving will require slightly more annual or bi-annual maintenance to prevent deterioration, but should last indefinitely if cared for properly and if minor repairs are carried out promptly.

Landscaping will require on-going maintenance and replacement of dead materials, in the area of 5-15% replacement per year (decreasing annually). Unlike building construction, which has progressively greater levels of maintenance as the building ages, site work has the greatest levels of maintenance in the first few years. After that point, plants are more established, more durable, larger (shadowing out weeds, etc.) and less susceptible to vandalism (larger, stouter limbs, etc.).

| <b>Pugwash Multi-Purpose Centre Building Component Replacement Schedule</b> |  | <b>Replacement Period:</b> |                   |                    |                    |                    |                    |                    |                    |
|---|--|----------------------------|-------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
|   |  | <b>Yrs 1 - 5</b>           | <b>Yrs 6 - 10</b> | <b>Yrs 11 - 15</b> | <b>Yrs 16 - 20</b> | <b>Yrs 21 - 25</b> | <b>Yrs 26 - 30</b> | <b>Yrs 31 - 40</b> | <b>Yrs 41 - 50</b> |
| Woodwork  | Replace wood siding/shingles                 |                            |                   |                    |                    |                    |                    |                    | •                  |
|   | Stain/Oil wood siding/shingles               |                            | •                 |                    | •                  |                    | •                  | •                  |                    |
|   | Replace architectural millwork               |                            |                   |                    |                    | •                  |                    |                    | •                  |
| Roofing   | Replace Flat Roof Membrane                   |                            |                   |                    |                    | •                  |                    |                    |                    |
|   | Replace Metal Roofing                        |                            |                   |                    |                    |                    |                    |                    | •                  |
|   | Replace Flashings                            |                            |                   |                    |                    |                    | •                  |                    |                    |
| Metals/<br>Glazing  | Replace aluminum curtain wall framing system |                            |                   |                    |                    |                    |                    |                    | •                  |
|   | Replace exterior steel and aluminum doors    |                            |                   |                    |                    |                    | •                  |                    |                    |
|   | Replace interior wood doors                  |                            |                   |                    |                    |                    |                    |                    | •                  |
|   | Replace Composite Panels                     |                            |                   |                    |                    |                    |                    |                    | •                  |
| Interior<br>Finishes  | Replace resilient flooring                   |                            |                   |                    |                    | •                  |                    |                    |                    |
|   | Refinish wood flooring                       |                            |                   |                    | •                  |                    |                    | •                  |                    |
|   | Replace porcelain tiles                      |                            |                   |                    |                    |                    |                    |                    | •                  |
|   | Replace ceiling tiles (partial)              |                            |                   |                    |                    | •                  |                    |                    | •                  |
|   | Repaint interior walls                       |                            | •                 |                    | •                  |                    | •                  |                    | •                  |
| Equipment   | Replace washroom partitions                  |                            |                   |                    |                    |                    | •                  |                    |                    |
|   | Replace moveable partitions                  |                            |                   |                    |                    |                    | •                  |                    |                    |
|   | Replace kitchen equipment                    |                            |                   |                    | •                  |                    |                    | •                  |                    |
| Mechanical  | Grilles, Diffusers, Ductwork, Dampers        |                            |                   |                    |                    |                    | •                  |                    |                    |
|   | Centrifugal Fans                             |                            |                   |                    |                    | •                  |                    |                    |                    |
|   | Fans, Coils, Condensers, Pumps               |                            |                   |                    | •                  |                    |                    |                    | •                  |
|   | Molded Pipe Insulation                       |                            |                   |                    | •                  |                    |                    |                    | •                  |
|   | Pipe-Mounted Inline Pumps                    |                            | •                 |                    | •                  |                    | •                  |                    | •                  |
|   | Sump Pumps                                   |                            | •                 |                    | •                  |                    | •                  |                    | •                  |
|   | Electric Motors/Controls                     |                            |                   |                    |                    |                    |                    |                    | •                  |
|   | Electronic Controls                          |                            |                   | •                  |                    |                    | •                  |                    |                    |
|   | SCR's (Electric Coils)                       |                            |                   | •                  |                    |                    | •                  |                    |                    |
|   | Electric Domestic Hot Water Heaters          |                            | •                 |                    | •                  |                    | •                  |                    | •                  |
|   | Plumbing Fixtures                            |                            |                   |                    |                    |                    |                    |                    | •                  |
|   | Plumbing Fixture Trim                        |                            |                   |                    | •                  |                    |                    |                    | •                  |
|   | Portable Fire Extinguishers                  |                            |                   | •                  |                    |                    | •                  |                    |                    |
|   | Electric Force Flow Heaters                  |                            |                   | •                  |                    |                    | •                  |                    |                    |
|   | Plumbing Piping                              |                            |                   |                    |                    |                    |                    |                    | •                  |
|   | Sprinkler Heads & Piping                     |                            |                   |                    |                    |                    |                    |                    | •                  |
| Electrical  | Lighting Fixtures                            |                            |                   |                    |                    |                    | •                  |                    |                    |
|   | Wiring Devices (switches & receptacles)      |                            |                   |                    | •                  |                    |                    | •                  |                    |
|   | Starters and Drives                          |                            |                   |                    |                    | •                  |                    |                    |                    |
|   | Distribution Equipment                       |                            |                   |                    |                    | •                  |                    |                    |                    |
|   | Dimming Equipment                            |                            |                   |                    | •                  |                    |                    |                    | •                  |
|   | Fire Alarm Equipment                         |                            |                   |                    | •                  |                    |                    | •                  |                    |
|   | Communications                               |                            | •                 |                    | •                  |                    | •                  |                    | •                  |
|   | Wire and Cable                               |                            |                   |                    |                    |                    |                    |                    | •                  |
| Solar Panels  |  |                            |                   |                    |                    | •                  |                    |                    |                    |
| Site and<br>Landscape   | Paved parking/concrete surfaces              |                            |                   |                    |                    | •                  |                    |                    |                    |
|   | Plantings (see notes)                        |                            |                   |                    |                    |                    |                    |                    |                    |

Note that this schedule is an estimate only and should not be considered a substitute for the ongoing assessment of capital assets as the building and site age.

In addition to the expected life span of the major components, Appendix B provides a sample building maintenance and monitoring template. In practice, this would be updated with information relevant and important to the building owners and used to guide a systematic and periodic check of the condition of building elements.

## 6 MARKETING & PROMOTIONS STRATEGY

The following section provides a high-level overview of key market segments, marketing channels and methodologies to motivate market segments for the Pugwash MPC to consider.

### Key Market Segments

Key target market segments for the Pugwash MPC include the following:

- Families with young children
- Youth
- Working population
- Retirees
- Visitors and seasonal residents
- Elementary schools and daycare centres (field trips)
- Associations
  - Sporting associations
  - Art, music and culture associations
  - Community groups

### Marketing Channels

The following list of marketing channels can be used by the Municipality to promote the new MPC to the key market segments.

#### Social media

- Regular posts to Twitter, Instagram, Facebook, and other social media accounts (these channels will evolve as social media platforms change) to engage local community with program offerings and special events.
- The broad spectrum will help ensure that as many cohorts are reached (i.e., Facebook is the domain of those over 40, while Instagram is used more by younger generations).

#### Website

- The website will include basic information such as operational hours, schedules of events, registration forms, as well as promotional materials detailing services and programming

available to the community. It can also be used to post notices and events. Tied into a POS booking system, it could also be used to collect fees for meeting room bookings.

### Promoters / Public Relations

- There may be co-marketing opportunities with other libraries / recreation centres / facilities in the region.
- The MPC could also work with a venue promoter to market bookings of venue space and to facilitate event planning as part of a county wide effort. Note, we understand through the interview process that management of the Dr. Carson & Marion Murray Community Centre is moving toward this format. If this could become a county-wide position, there may be a benefit to all facilities within the municipality and a centralized online booking system could help with both revenue collection and avoiding double bookings.

### Partnership Programs

- The MPC may work with local schools to both gauge what programs would be of interest to students and their families, as well as promote information to youth.
- The MPC may wish to engage local community groups in an advertising partnership.

### Flyers and brochures

More traditional flyers and brochures can be posted in the following community locations:

- Grocery stores
- Doctors' offices
- Childcare centres
- Children's clothing stores and local stores that carry children's items
- Children's programs
- Bookstores - children's book section; and
- Fitness centers - child care area.

Similarly, digital flyers and brochures can be distributed via PTA newsletters and other paper / digital media in the community.

### Events

- The MPC could host special events including a grand opening and holiday events to draw in first time or infrequent users.

### Methodologies to Motivate Market Segments

*Cross-Marketing of MPC and Library Use*

By having the library and MPC in the same building, it is anticipated that library users would be drawn into other programs running in or through the MPC and vice versa.

This natural cross-pollination of advertising and positioning may be further bolstered by developing campaigns that encourage use of both the library and MPC (i.e., encourage users to come walk the circuit while listening to audiobooks, accessible via app through the library, with tech support available onsite to help users who are less tech savvy).

#### *Drawing in New Families*

One way to encourage the use of the MPC by young families is to offer parent-and-tot programming, thereby encouraging the continued use of MPC as children grow up and explore different interests (i.e., a parent brings their baby to parent-and-tot yoga, enjoys MPC as a safe community space, continues to bring that child back for various children's workshops, camps, activities, etc.).

#### *Appealing to Community Groups*

The MPC might consider offering discounted rental rates to non-profit community groups and initiatives to both instill goodwill and to encourage people to come see the space. Prospective MPC users may be drawn in to take advantage of program offerings after coming into the space for a Rotary Club meeting, for example.

#### *Community / Visitor Access to WiFi*

Making WiFi available in the parking lot may be a way to draw in more individuals, from parents who need to work remotely while their kids are doing youth programming in the Centre, to travelers who want to access WiFi and use the community facilities for drop-in programs. If available inside and outside the facility, the availability of WiFi may encourage visitors to stop, and support operations of outdoor markets.

## 7 MANAGEMENT PLAN

The following section provides an overview of the ownership, governance structure and management of the proposed MPC.

### Ownership

All of the public regional libraries in Nova Scotia (NS) are owned by the municipalities in which they are located. The proposed MPC is owned by the Municipality of the County of Cumberland, and as such the Municipality will be responsible of building maintenance and operating costs of the building.

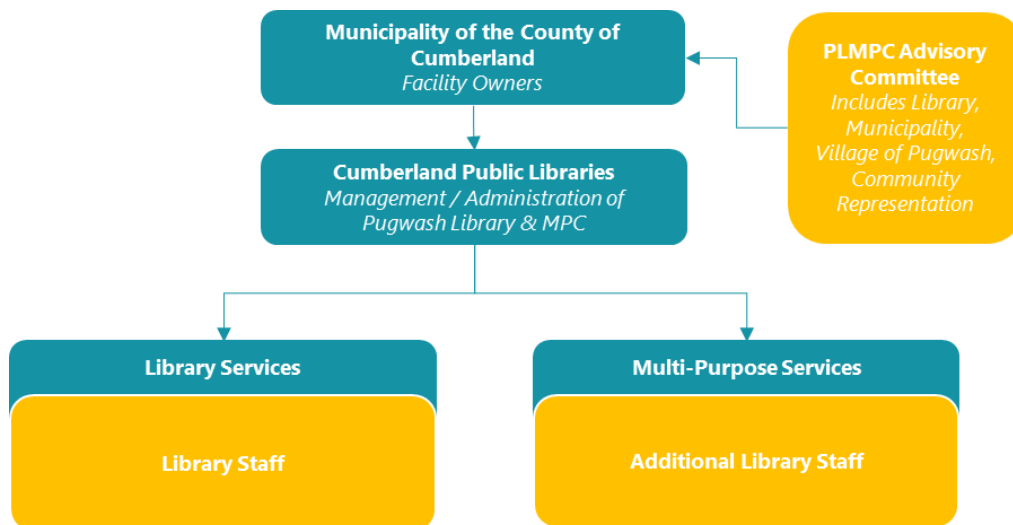
### Governance Structure

The Pugwash Library has a mandate to manage the library, and by agreement will also manage the MPC and its associated programming. This means that two streams of activities will be under the administration of the library, including the MPC and the library itself. This has a variety of advantages, in particular that there is no need to create a new organization to manage this new community asset. Library operations will continue to be managed and governed as it they are currently.

An advisory committee comprised of the Library, the Municipality, the Village of Pugwash, and community members would be formed as a channel through which community input on programming and services offered at the MPC can be managed.

The proposed organizational chart is illustrated below.

#### Organizational Chart



*Roles:*

- **Facility Owners:** The Municipality of the County of Cumberland are the facility owners and have the overall responsibility for the security, management, and maintenance of the building, as well as determining allowable uses.
- **Advisory Committee:** In providing the facility, the Municipality invites the formation of a PLMPC Advisory Committee, comprised of the Village of Pugwash, community representation, CPL staff, and the Municipality. The group will provide their guidance on facility uses, programming, hours of operation, as well as provide for any fundraising / community advocacy / awareness work that may be required to support the sustainability of the facility. This group will help ensure that the facility remains relevant to and has buy-in from the broader community.
- **Cumberland Public Libraries:** Through an agreement between the Municipality and the CPL, the CPL assumes the responsibility for the day-to-day administration and operation of the building, excluding those duties related to the physical maintenance and upkeep of the property and building. This includes opening, closing, and booking rental spaces, and interacting with the public who are using the facility.

Within the CPL operations there are two silos of activities that the CLP will assume.

- **Library Operations:** As they currently provide, the CPL will continue to provide library services in the Village of Pugwash, effectively moving the current operations from the former train station (the archives will remain there) to the new facility. The library will be operated at the same scale as is currently provided. In practice, this means that the CPL will have a staff equivalent of about 0.70 FTEs provided thought their current service levels for the community. The collection will be about the same scale as now, with a much better layout and more room between stacks and other furniture.
- **Multi-Purpose Services:** The services offered by the MPC side of the complex consist of a walking circuit, meeting rooms, and a living room looking out toward the Pugwash Yacht Club. Activities such as booking the rooms, allowing access to that side of the facility, welcoming the facility users, and other related activities, are all new services that will be provided (by agreement) through the CLP. In practice, the CLP will provide a financial contribution such that the cost of providing these 'new services' are reimbursed. Although seamlessly integrated into the CPL's day-to-day operation, the new services will change the hours of operations of the library beyond their normal offering and so, not only add to the library operating hours, but also increase staffing demands.

## 8 FUNDING OPPORTUNITIES: KEY TAKEAWAYS

Several funding opportunities were identified through this exercise (**Appendix C**). Opportunities to reduce initial capital costs through programs such as the Recreation Facility Development Grant, Investing in Canada Infrastructure Program and the Provincial-Territorial Infrastructure Component: Small Communities Fund, may significantly decrease the burden of construction costs. Funding streams are either tailored for rural community infrastructure or for community development. Each program offers funding opportunities for community infrastructure such as community centers, libraries, and recreation.

The FCM program regarding the construction of new energy-efficient facilities may be of particular interest for the present project. This presents an opportunity to fund part of the initial capital expenditure, while integrating measures decreasing operational cost, particularly relating to utilities. The net metering programs offered by Nova Scotia Power may allow the center to decrease operational costs by reducing expenditure relating to utilities.

Additionally, the many social benefits presented by the facility, notably the high demand for such a facility, the promotion of well-being and physical activity, and youth engagement opportunities through volunteering opportunities, align with social benefit requirements outlines in FCM's fund for new construction of energy-efficient facilities.

Finally, funding opportunities with the potential to reduce program development costs, among others, were identified. Programs such as Recreation Community Development Grant, Nova Scotia Amateur Sport Fund and the Provincial Recreation / Physical Activity Project Funding align with the Center's mission to promote active living and increased physical activity. An overview of funding opportunities identified is presented in **Table 1**.

Table 1: Overview of Funding Opportunities

| Program name   | Focus   | Eligible Initiatives  | Eligible Applicants   |
|--|---|---|---|
| Recreation Facility Development Grant (RDF)  | Develop facilities to increase public use of facilities and participation in sport and recreation.                            | <ul style="list-style-type: none"> <li>Community centres</li> <li>Pools, arenas, and athletic fields</li> <li>Parks and playgrounds; and</li> <li>Enhancements to schools for community use and other facilities that promote active living.</li> </ul>   | <ul style="list-style-type: none"> <li>Public organizations incorporated as a “not-for-profit” or equivalent.</li> <li>Municipalities or Band Councils</li> <li>Schools or universities</li> </ul>  |
| Investing in Canada Infrastructure Program (ICIP)                                  | Create long-term economic growth, build inclusive, sustainable communities, and support a low carbon, green economy.          | <ul style="list-style-type: none"> <li>Improve cultural infrastructure, like museums and Indigenous heritage centres.</li> <li>Support upgrades to recreational facilities, like arenas and both indoor and outdoor recreational spaces; and</li> <li>Improve community infrastructure, like community centres and libraries.</li> </ul>  | <ul style="list-style-type: none"> <li>Municipal and not-for-profit Provincial projects</li> <li>Indigenous partners’ projects</li> <li>For-profit private sector projects (Except the CCRI stream)</li> </ul>  |
| Provincial-Territorial Infrastructure Component: Small Communities Fund (PTIC-SCF) | Creating economic growth, a clean environment and strengthen communities in municipalities with fewer than 100,000 residents. | <ul style="list-style-type: none"> <li>Disaster mitigation infrastructure</li> <li>Connectivity and broadband</li> <li>Innovation</li> <li>Wastewater</li> <li>Green energy</li> <li>Drinking water</li> <li>Solid waste management</li> <li>Passenger ferries services infrastructure</li> <li>Culture</li> <li>Recreation</li> <li>Tourism; and</li> <li>Civic assets and municipal buildings.</li> </ul> | <ul style="list-style-type: none"> <li>Municipal and regional governments.</li> <li>Provincial or territorial entity providing municipal-type infrastructure services to communities.</li> <li>Band Councils or equivalent</li> <li>Public sector bodies providing municipal-type infrastructure services to communities; and</li> <li>Private sector bodies, including for-profit organizations and not-for-profit organizations.</li> </ul> |
| Innovative Communities Fund (ICF)  | The diversification and enhancement of the economies of Atlantic communities.   | <ul style="list-style-type: none"> <li>Develop competitive, productive, strategic industry sectors.</li> <li>Strengthen community infrastructure in rural communities; and</li> <li>Enhance communities’ capacity to overcome economic development challenges and take advantage of their strengths, assets and opportunities presented.</li> </ul>   | <ul style="list-style-type: none"> <li>Local development associations.</li> <li>Municipalities and their agencies.</li> <li>Business or technology institutes.</li> <li>Industry/sector associations.</li> <li>Economic development associations.</li> <li>Local co-operatives; and</li> <li>Universities and educational institutions.</li> </ul>  |
| New construction of energy-efficient municipal facilities                          | Fund feasibility studies for initiatives that target net zero energy performance in new municipal facilities.                 | <ul style="list-style-type: none"> <li>Design and construction approaches.</li> <li>Passive energy efficiency</li> <li>Alternative building components and materials</li> <li>Advanced automation and control systems.</li> <li>Advanced HVAC systems</li> <li>Harvesting energy from process loads or waste; and</li> <li>On-site renewable energy generation and storage.</li> </ul>                      | <ul style="list-style-type: none"> <li>Municipalities</li> <li>Private sector entities</li> <li>Indigenous communities</li> <li>Municipally owned corporations</li> <li>A regional, provincial, or territorial organization delivering municipal services</li> <li>Non-governmental organizations</li> <li>Not-for-profit organizations</li> <li>Research institutes (e.g., universities)</li> </ul>  |
| Retrofit of municipal facilities   | Reduce energy efficiency through reduced use of energy, ultimately reducing greenhouse  | <ul style="list-style-type: none"> <li>Upgraded building components and materials.</li> <li>Advanced automation and control systems.</li> <li>Upgraded HVAC systems.</li> </ul>   | <ul style="list-style-type: none"> <li>Municipalities</li> <li>Private sector entities</li> <li>Indigenous communities</li> <li>Municipally owned corporations</li> </ul>   |

More information about funding programs can be found in **Appendix C**.

## 9 STAFFING & OPERATIONS

### Current Operations (Estimate)

The following table provides a snapshot of the current library staffing at the train station. This is provided based on current operating hours for the Winter schedule (September to May) and Summer hours (June to August).

| Status Quo - Current Operations (Estimated)               |                    |             |             |            |            |             |             |
|---|--------------------|-------------|-------------|------------|------------|-------------|-------------|
| Pre-Covid Winter Hours                                    | September to May   |             |             |            |            |             |             |
| Details   | Su                 | M           | Tu          | W          | Th         | F           | Sa          |
| Open  |                    | 11:00:00 AM | 11:00:00 AM | 2:00:00 PM | 2:00:00 PM | 12:00:00 PM | 10:00:00 AM |
| Close   |                    | 4:00:00 PM  | 4:00:00 PM  | 7:00:00 PM | 7:00:00 PM | 5:00:00 PM  | 1:00:00 PM  |
| Hours   |                    | 5.00        | 5.00        | 5.00       | 5.00       | 5.00        | 3.00        |
| Number of Staff (Positions)                               |                    | 1.00        | 1.00        | 1.00       | 1.00       | 1.00        | 1.00        |
| <b>Total Hours of Operation Per</b>                       | <b>28.00</b>       |             |             |            |            |             |             |
| <b>Total Staff Hours Per Week</b>                         | <b>28.00</b>       |             |             |            |            |             |             |
| Estimated NEW FTEs / Week                                 | 0.70               |             |             |            |            |             |             |
| Total Weeks   | 39.00              |             |             |            |            |             |             |
| <b>Estimated NEW Wages and Salaries Cost @ \$17.09/hr</b> | <b>\$18,662.28</b> |             |             |            |            |             |             |

| Pre-Covid Summer Hours                                    | June to August     |   |             |            |            |             |            |
|---|--------------------|---|-------------|------------|------------|-------------|------------|
| Details   | Su                 | M | Tu          | W          | Th         | F           | Sa         |
| Open  |                    |   | 12:00:00 PM | 2:00:00 PM | 2:00:00 PM | 12:00:00 PM | 9:00:00 AM |
| Close   |                    |   | 5:00:00 PM  | 7:00:00 PM | 7:00:00 PM | 5:00:00 PM  | 2:00:00 PM |
| Hours   |                    |   | 5.00        | 5.00       | 5.00       | 5.00        | 5.00       |
| Number of Staff (Positions)                               |                    |   | 1.00        | 1.00       | 1.00       | 1.00        | 1.00       |
| <b>Total Hours of Operation Per</b>                       | <b>25.00</b>       |   |             |            |            |             |            |
| <b>Total Staff Hours Per Week</b>                         | <b>25.00</b>       |   |             |            |            |             |            |
| Estimated NEW FTEs / Week                                 | 0.63               |   |             |            |            |             |            |
| Total Weeks   | 13.00              |   |             |            |            |             |            |
| <b>Estimated NEW Wages and Salaries Cost @ \$17.09/hr</b> | <b>\$5,554.25</b>  |   |             |            |            |             |            |
| <b>Yearly Hours</b>                                       | <b>1,417.00</b>    |   |             |            |            |             |            |
| <b>Yearly Wages and Salaries</b>                          | <b>\$24,216.53</b> |   |             |            |            |             |            |
| <b>Average Yearly FTEs</b>                                | <b>0.71</b>        |   |             |            |            |             |            |

The table provides estimates of about 0.71 FTEs (actual FTEs are closer to 0.67) based on about 28 operating hours per week in the winter and about 25 hours in the summer. The total annual wages and salaries for current operations are estimated at just over \$24,000. CPL currently pays

for all library staff, materials, and expenses related to the library operations, but it does not pay for the use of the train station, which is supported by the Village of Pugwash.

In 2014 this was estimated at the equivalent of \$9.41/sf. for utilities and maintenance at the train station building, about \$10.35 in 2021 dollars. At 820 square feet, this works out to about \$8,500 per year. As the Municipality will no longer be paying for the costs associated with the train station, these will be covered by the Village.

Effectively the 'base case', the CPL has indicated their intentions to continue to support the library operations on the same basis as they do now. Therefore, any incremental costs associated with the expanded operations will be borne by other project proponents. The following provides an analysis of the new operations.

| <b>New Operations - Winter: 55 hours / week, 7 days / week<br/>Summer: 32 hours / week, 7 days / week</b> |                         |             |             |             |             |             |             |
|---|-------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|   | <b>September to May</b> |             |             |             |             |             |             |
| <b>Details</b>  | <b>Su</b>               | <b>M</b>    | <b>Tu</b>   | <b>W</b>    | <b>Th</b>   | <b>F</b>    | <b>Sa</b>   |
| Open  | CLOSED                  | 10:00:00 AM | 10:00:00 AM | 10:00:00 AM | 10:00:00 AM | 10:00:00 AM | 10:00:00 AM |
| Close   |                         | 8:00:00 PM  | 8:00:00 PM  | 8:00:00 PM  | 8:00:00 PM  | 5:00:00 PM  | 5:00:00 PM  |
| Hours   | -                       | 10.00       | 10.00       | 10.00       | 10.00       | 7.00        | 7.00        |
| Number of Staff (Positions)   | -                       | 2.00        | 2.00        | 2.00        | 2.00        | 2.00        | 2.00        |
| <b>Total Hours of Operation Per Week</b>  | <b>108.00</b>           |             |             |             |             |             |             |
| <b>Total Staff Hours Per Week</b>   | <b>162.00</b>           |             |             |             |             |             |             |
| Estimated NEW FTEs / Week   | 4.05                    |             |             |             |             |             |             |
| Total Weeks   | 39.00                   |             |             |             |             |             |             |
| <b>Estimated NEW Wages and Salaries Cost @ \$17.09/hr</b>   | <b>\$107,974.62</b>     |             |             |             |             |             |             |

|   | <b>June to August</b> |            |            |            |            |             |            |
|---|-----------------------|------------|------------|------------|------------|-------------|------------|
| <b>Details</b>  | <b>Su</b>             | <b>M</b>   | <b>Tu</b>  | <b>W</b>   | <b>Th</b>  | <b>F</b>    | <b>Sa</b>  |
| Open  | CLOSED                | 9:00:00 AM | 9:00:00 AM | 2:00:00 PM | 2:00:00 PM | 12:00:00 PM | 9:00:00 AM |
| Close   |                       | 1:00:00 PM | 1:00:00 PM | 7:00:00 PM | 7:00:00 PM | 5:00:00 PM  | 5:00:00 PM |
| Hours   | -                     | 4.00       | 4.00       | 5.00       | 5.00       | 5.00        | 8.00       |
| Number of Staff (Positions)                               | -                     | 1.00       | 1.00       | 1.00       | 1.00       | 1.00        | 2.00       |
| <b>Total Hours of Operation Per Week</b>                  | <b>39.00</b>          |            |            |            |            |             |            |
| <b>Total Staff Hours Per Week</b>                         | <b>39.00</b>          |            |            |            |            |             |            |
| Estimated NEW FTEs / Week                                 | 0.98                  |            |            |            |            |             |            |
| Total Weeks   | 13.00                 |            |            |            |            |             |            |
| <b>Estimated NEW Wages and Salaries Cost @ \$17.09/hr</b> | <b>\$8,664.63</b>     |            |            |            |            |             |            |
| <b>Yearly Hours</b>                                       | <b>4,719.00</b>       |            |            |            |            |             |            |
| <b>Yearly Wages and Salaries</b>                          | <b>\$116,639.25</b>   |            |            |            |            |             |            |
| <b>Average Yearly FTEs</b>                                | <b>2.36</b>           |            |            |            |            |             |            |

## Proposed Operations

It is assumed that the expanded features of the new MPC will need to be available for more hours of the day and week. The following table provides a possible operating scenario.

| Difference from Base Case             |          |
|---------------------------------------|----------|
| Increase in Yearly Hours              | 3,302    |
| Increase in Yearly Wages and Salaries | \$92,423 |
| Average Yearly FTEs                   | 1.65     |

In this configuration, the library is operational for the same hours that the MPC is open to the public with the effect that more staff time is required to operate the library and new staff time is required to operate the MPC. In this scenario winter hours increases to 55 hours per week, with the facility open 7 days / week so that residents and visitors to the community can access the walking circuit, library, and other facility services each day of the week. Summer hours are increased to 32 hours / week, and the facility is open 7 days / week, with more afternoon / early closures than is the case during the winter. This ensures that the walking circuit is available each day of the week and is reflective of the expectation that demand for the facility during the balance of the day will be reduced in the warmer months.

In addition to continuing with all CPL duties, the MPC's expanded staff will take responsibility for managing the booking of the community activity spaces. As a result, the roughly 0.7 FTEs increases to 2.97 FTEs (in this scenario) with an increase in wages and salaries cost (based on \$17.09 per hour) of \$128,081 per annum (up from \$24,217 to \$152,298).

## 10 FINANCIAL ANALYSIS

This section provides the financial analysis, with assumptions to follow.

| Pugwash Library Centre: Current and Projected Estimated Costs to Operate |   |                  | New MPC          | New MPC          | New MPC          | New MPC          | New MPC          |
|--|---|------------------|------------------|------------------|------------------|------------------|------------------|
| Line #   | Description                                       | Existing Library | Year 1           | Year 2           | Year 3           | Year 4           | Year 5           |
|  | <i>Total ft2</i>                                  | 802              | 8,158            | 8,158            | 8,158            | 8,158            | 8,158            |
| <b>1.00</b>  | <b>Revenue</b>                                    |                  |                  |                  |                  |                  |                  |
| 1.01   | Room Rentals                                      | \$0              | \$6,360          | \$7,380          | \$8,400          | \$9,420          | \$10,440         |
| 1.02   | <b>Total Revenue</b>                              | <b>\$0</b>       | <b>\$6,360</b>   | <b>\$7,380</b>   | <b>\$8,400</b>   | <b>\$9,420</b>   | <b>\$10,440</b>  |
| <b>2.00</b>  | <b>Expenses</b>                                   |                  |                  |                  |                  |                  |                  |
| <b>2.01</b>  | <b>Salaries and Wages</b>                         |                  |                  |                  |                  |                  |                  |
| 2.02   | Salaries & Wages                                  | \$24,217         | \$152,298        | \$155,343        | \$158,450        | \$161,619        | \$164,852        |
| 2.03   | <i>Net Cost Wages and Salaries</i>                | <i>\$24,217</i>  | <i>\$128,081</i> | <i>\$131,127</i> | <i>\$134,234</i> | <i>\$137,403</i> | <i>\$140,635</i> |
|  |   |                  |                  |                  |                  |                  |                  |
| <b>3.000</b>   | <b>Facility Costs</b>                             |                  |                  |                  |                  |                  |                  |
| 3.01   | Utilities and maintenance                         | \$8,000          | \$48,948         | \$49,927         | \$50,925         | \$51,944         | \$52,983         |
| 3.02   | Photocopier                                       | \$1,261          | \$1,500          | \$1,530          | \$1,561          | \$1,592          | \$1,624          |
| 3.03   | Internet and Telephone                            |                  | \$1,800          | \$1,836          | \$1,873          | \$1,910          | \$1,948          |
| 3.04   | Cleaning services                                 | \$1,680          | \$22,500         | \$22,950         | \$23,409         | \$23,877         | \$24,355         |
| 3.05   | Cleaning Supplies & Materials                     |                  | \$2,400          | \$2,448          | \$2,497          | \$2,547          | \$2,598          |
| 3.06   | Subtotal- Facility                                | \$10,941         | \$77,148         | \$78,691         | \$80,265         | \$81,870         | \$83,507         |
| <b>3.16</b>  | <b>Total Expenses</b>                             | <b>\$35,158</b>  | <b>\$205,229</b> | <b>\$209,818</b> | <b>\$214,499</b> | <b>\$219,273</b> | <b>\$224,143</b> |
| <b>4.00</b>  | <b>Excess of Expenses Over Revenues</b>           | <b>\$35,158</b>  | <b>\$198,869</b> | <b>\$202,438</b> | <b>\$206,099</b> | <b>\$209,853</b> | <b>\$213,703</b> |
| <b>4.10</b>  | <b>Incremental Operating Cost of New Facility</b> |                  | <b>\$163,711</b> | <b>\$167,280</b> | <b>\$170,941</b> | <b>\$174,695</b> | <b>\$178,545</b> |

The table shows an estimate of existing operations along with projections for year 1 to 5 based on the new MPC, showing an annual incremental cost of operation (i.e., the added costs beyond the existing operations of the library). This is based on the following assumptions:

### Revenues

There will be one meeting room in the MPC that can be divided into two "rooms" that are available for rent. The divided rooms will have a capacity of 23-57 persons and 29-71 persons respectively and, as one larger room, it will have a capacity of 98-242 persons. These capacities are based on typical occupancy loads per the National Building Code of Canada 2015 and the ranges account for various possible types of use. The following table provides room rates and assumptions for utilization.

| Room / Duration         | Rate  | Year 1 #  | Year 1 \$      | Year 2 #  | Year 2 \$      | Year 3 #  | Year 3 \$      | Year 4 #   | Year 4 \$      | Year 5 #   | Year 5 \$       |
|-------------------------|-------|-----------|----------------|-----------|----------------|-----------|----------------|------------|----------------|------------|-----------------|
| <b>Small - Hourly</b>   | \$20  | 24        | \$480          | 26        | \$520          | 28        | \$560          | 30         | \$600          | 32         | \$640           |
| <b>Small - Half Day</b> | \$75  | 12        | \$900          | 14        | \$1,050        | 16        | \$1,200        | 18         | \$1,350        | 20         | \$1,500         |
| <b>Small - Full Day</b> | \$150 | 12        | \$1,800        | 13        | \$1,950        | 14        | \$2,100        | 15         | \$2,250        | 16         | \$2,400         |
| <b>Large - Hourly</b>   | \$40  | 12        | \$480          | 14        | \$560          | 16        | \$640          | 18         | \$720          | 20         | \$800           |
| <b>Large- Half Day</b>  | \$150 | 6         | \$900          | 8         | \$1,200        | 10        | \$1,500        | 12         | \$1,800        | 14         | \$2,100         |
| <b>Large- Full Day</b>  | \$300 | 6         | \$1,800        | 7         | \$2,100        | 8         | \$2,400        | 9          | \$2,700        | 10         | \$3,000         |
| <b>Total</b>            |       | <b>72</b> | <b>\$6,360</b> | <b>82</b> | <b>\$7,380</b> | <b>92</b> | <b>\$8,400</b> | <b>102</b> | <b>\$9,420</b> | <b>112</b> | <b>\$10,440</b> |

## **Expenses**

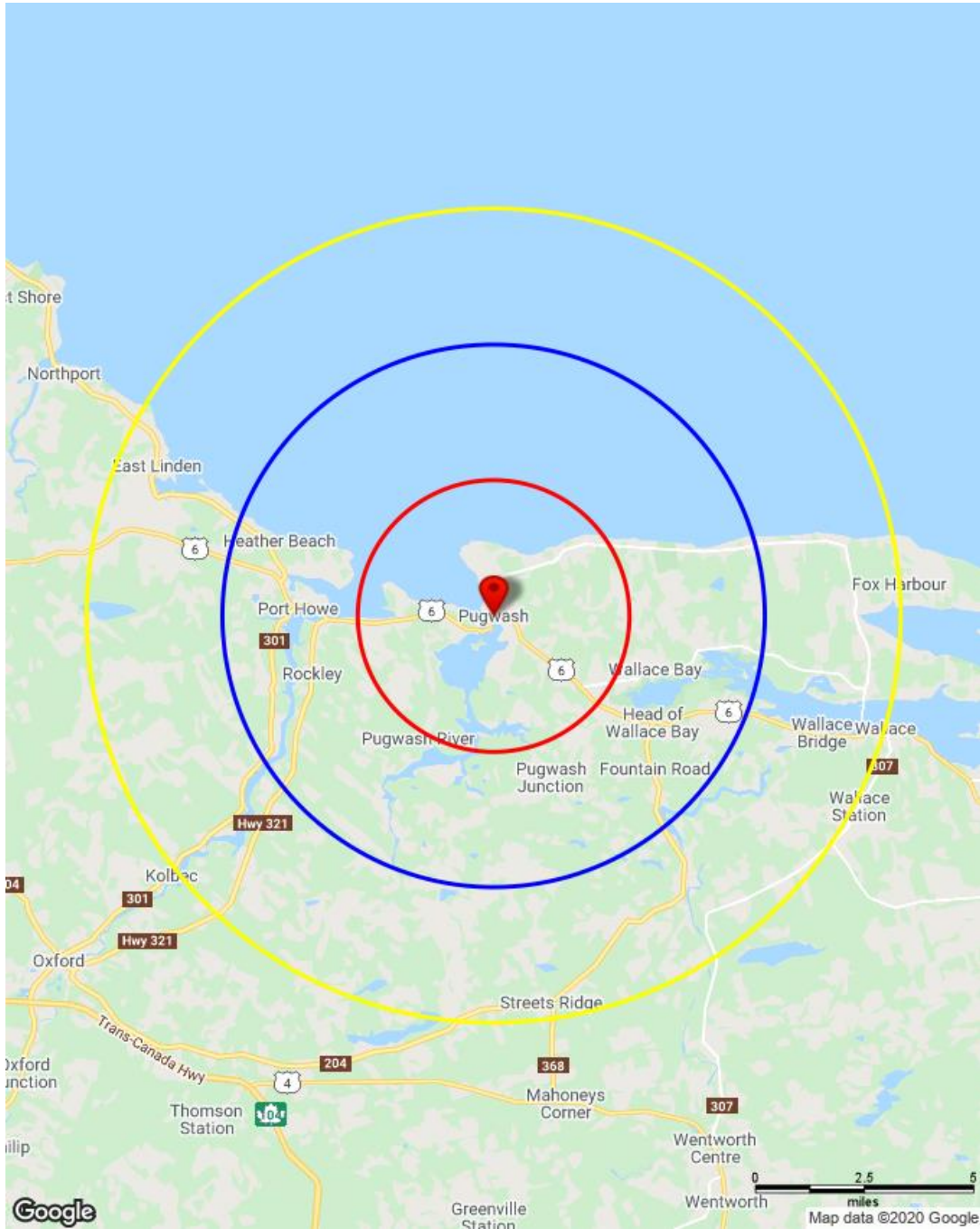
Expenses include the following:

- **Salaries and Wages:** As outlined early in the section, this assumes the CPL will continue paying for salaries and wages up to the current total costs for the same in the existing facility and the Municipality to cover the difference.
- **Utilities and Maintenance:** Utilities and maintenance of the MPC are assumed to cost roughly \$6 per sq ft, as per industry standard for new energy efficient buildings.
- **Photocopier:** Assume a modest increase in photocopier and telephone costs at the new building relative to the existing library operations
- **Internet and Telephone:** Assume a charge of \$150 per month for phone and internet costs.
- **Cleaning services:** Assume a custodian is at the building for 3 hours a day for 6 days a week at a cost of \$25 an hour (under contract), 50 weeks of the year.
- **Cleaning Supplies & Materials:** Assume a cost of \$200 per month in cleaning supplies and sanitary supplies.

We have also assumed insurance, banking, office equipment, software, advertising and promotion, property maintenance (i.e., grass cutting, snow removal, garbage removal), legal and professional fees will be provided through the Municipality.

It must be noted that although no one can predict the future with certainty, the assumptions that underlie the revenue and expense projections must be considered reasonable at the time the projections were prepared. It must also be noted that the assumptions are presented as planning tools for the purposes of the projections. Assumptions, and therefore projections, are both subject to modification in the future as circumstances change and as planning decisions are finalized.

# APPENDIX A: CENSUS MAP OF PUGWASH, NS



## APPENDIX B: EXAMPLE MAINTENANCE LOG FORM

| TASK/EQUIP              | DUE DATE | D | W | M | Q | S | A | Other Schedule | Within Tolerance (Y/N) | FOLLOW UP TEST Y/N | COMP. DATE |  | COMMENTS |
|-------------------------|----------|---|---|---|---|---|---|----------------|------------------------|--------------------|------------|--|----------|
| Roadway                 |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Parking Lot             |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Sidewalk                |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Storm Drain             |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Foundation              |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Stair & Steps           |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Exterior Wall           |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Interior Wall           |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Floor                   |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Structural Steel        |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Handrail                |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Cabinetry               |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Roofing and Fix         |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Waterproofing at wall   |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Flashing & Gutter       |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Joint Sealant Caulking  |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Door                    |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Window                  |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Drywall                 |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Painting                |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Ceiling                 |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| HVAC                    |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Air Handler             |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Exhaust Fan             |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Chiller                 |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| CHW Pump                |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Cooling Tower           |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Condenser Water Pump    |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| HV Boiler               |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| HW Pump                 |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Con. Return System      |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Gas Furnace             |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Elec. Heater            |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Domestic HW Heater      |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Building Air Compressor |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Cont. Air Compressor    |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Water Cooler            |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Kitchen Equipment       |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Piping                  |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Sump Pump               |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Fire Sprinklers         |          |   |   |   |   |   |   |                |                        |                    |            |  |          |
| Stand Pipes & Hoses     |          |   |   |   |   |   |   |                |                        |                    |            |  |          |

|                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|-------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Portable Extinguishers        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Alarm & Smoke Detection       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Electric Panels               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Electric Wiring & Disconnects |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Switch, Plug & Recept         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Indoor Lighting               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Outdoor Lighting              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Special Lighting              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Pest Control                  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Machine Equipment & Cleaning  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Exit Signs                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Emergency Lights              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Add Others</b>             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

**KEY:**

- D – DAILY
- W – WEEKLY
- M – MONTHLY
- Q – QUARTERLY
- S – SEMI-ANNUALLY

## APPENDIX C: FUNDING PROGRAMS

### Recreation Facility Development Grant

The Recreation Facility Development Grant (RFD) was developed by Nova Scotia's Department of Communities, Culture and Heritage (CCH) to assist community groups, municipalities, and other 'not-for-profit' organizations to develop facilities to increase public use of facilities and participation in sport and recreation.

Eligible facilities must be open to all members of the public at reasonable times and rate and may include the following.

- Community centres
- Pools, arenas, and athletic fields
- Parks and playgrounds; and
- Enhancements to schools for community use and other facilities that promote active living.

The program offers grants beyond construction costs and may include large permanent furnishings and equipment (e.g. ice re-surfacer, trail groomer, soccer goals) integral to the functioning / operation of a facility, and capital conservation work involving repair and / or replacement needs of any major components directly related to a facility's structural or operational integrity.

Eligible applicants include the following.

- Public organizations incorporated as a "not-for-profit" entity under the Societies Act of Nova Scotia or other organizations deemed equivalent by the Province; and
- Municipalities (incorporated communities), Mi'kmaq Band Councils, Schools through Regional Centres for Education (RCE), and Universities.

The program covers up to one-third of the total capital costs of the project, to a maximum of \$150,000. While additional provincial grants may be used to fund the remaining costs of the project, provincial funding cannot exceed three-quarters of the total project costs.

Additional details on eligible costs and the application process are found in the [Recreation Facility Development \(RDF\) Grant – Guidelines 2021-22](#).

### Investing in Canada Infrastructure Program

The Investing in Canada Infrastructure Program (ICIP) provides long-term, stable funding delivered by Infrastructure Canada to achieve the following objectives.

- Help communities reduce air and water pollution, provide clean water, increase resilience to climate change and create a clean-growth economy.

- Build strong, dynamic, and inclusive communities; and
- Ensure Canadian families have access to modern, reliable services that improve their quality of life.

The program includes four funding streams: Public Transit; Green Infrastructure; Community, Culture and Recreation Infrastructure; and Rural and Northern Communities Infrastructure. Through the Community, Culture and Recreation Infrastructure (CCRI), investment aims to achieve the following.

- Improve cultural infrastructure, like museums and Indigenous heritage centres.
- Support upgrades to recreational facilities, like arenas and both indoor and outdoor recreational spaces; and
- Improve community infrastructure, like community centres and libraries.

Fund allocated under integrated bilateral agreement will be funded on a cost-shared basis, with investments of up to 40% for municipal and not-for-profit projects, with one-third of these funds allocated by the province, and the remaining by the Federal Government.

Additional eligible applicants include:

- Provincial Projects, with investments of up to 50%.
- Indigenous partners' projects, with investments of up to 75%; and
- For-profit private sector projects, with investments up to 25%.

Around \$828M is expected to be invested in Nova Scotia infrastructure in the next decade under this program.

### **Provincial-Territorial Infrastructure Component: Small Communities Fund**

The [Provincial-Territorial Infrastructure Component - Small Communities Fund](#) (PTIC-SCF) provides \$1B over 10 years for projects creating economic growth, a clean environment and strengthen communities in municipalities with fewer than 100,000 residents. The fund operates under a cost-shared principal, with federal government covering up to 50% of the project's costs.

Eligible categories under the PTIC-SCF include, but are not limited to:

- Disaster mitigation infrastructure
- Connectivity and broadband
- Innovation
- Wastewater
- Green energy
- Drinking water
- Solid waste management
- Passenger ferries services infrastructure

- Culture
- Recreation
- Tourism; and
- Civic assets and municipal buildings.

Eligible applicants include the following.

- Municipal and regional governments.
- Provincial or territorial entity (e.g., a department, corporation or agency) that provides municipal-type infrastructure services to communities, as defined in provincial or territorial statute.
- Band Councils within the meaning of section 2 of the Indian Act; or a government or authority established pursuant to a Self-Government Agreement or a Comprehensive Land Claim Agreement.
- Public sector bodies that are established by or under provincial or territorial statute or by regulation or is wholly owned by a province, territory, municipal or regional government which provides municipal-type infrastructure services to communities; and
- Private sector bodies, including for-profit organizations and not-for-profit organizations, whose application is supported by a municipal or regional government referred to above. Such support could take the form of a resolution from the municipal or regional government council.

Project identification is undertaken by the Province, who then submit eligible projects to Infrastructure Canada. Nova Scotia's Finance and Treasury Board should be contacted for inquiries relating to program application.

### **New Construction of Energy-Efficient Municipal Facilities**

[Funding for new construction of energy-efficient municipal facilities](#) is provided by the Federation of Canadian Municipalities (FCM). Funds are available for feasibility studies for initiatives that target net zero energy performance in new municipal facilities.

Eligible studies should include either the financial performance of environmentally proven initiatives, or the financial or environmental performance of a new initiative. These initiatives may focus on the following areas.

- Design and construction approaches.
- Passive energy efficiency (e.g., directional orientation, natural features).
- Alternative building components and materials (e.g., insulation, walls, windows).
- Advanced automation and control systems.
- Advanced HVAC systems (e.g., heat pumps, ejector systems).
- Harvesting energy from process loads or waste (e.g., sewer heat recovery); and

- On-site renewable energy generation and storage (e.g., solar, wind, geothermal exchange systems).

Additionally, social benefits relating to the initiative should be included assessed, including health outcomes, job creation, youth engagement, among other.

Funds are typically allocated to projects in municipally owned buildings, but a non-municipally owned building may also be eligible if mostly used for municipal purposes. Eligible applicants include all municipalities and their partners, including:

- Private sector entities
- Indigenous communities
- Municipally owned corporations
- A regional, provincial, or territorial organization delivering municipal services
- Non-governmental organizations
- Not-for-profit organizations; and
- Research institutes (e.g., universities).

Applicants are eligible for grants covering up to 50% of costs, up to \$175,000. Applications are accepted year-round and should be submitted to the FCM.

### **Retrofit of Municipal Facilities**

Funding for retrofit of municipal facilities is provided by the FCM. The project aims to reduce energy efficiency through reduced use of energy, ultimately reducing greenhouse gas emissions (GHGs) and improving their air quality.

Eligible capital project must use a combination of energy efficient retrofits which reduce a municipal facility's energy consumption by 30% (minimum of 20% through energy efficiency and maximum of 10% through on-site, renewable energy). Retrofits may include the following.

- Upgraded building components and materials (e.g., insulation, walls, windows).
- Advanced automation and control systems.
- Upgraded HVAC systems (e.g., heat pumps, ejector systems).
- On-site renewable energy generation and storage (e.g., solar, wind or geothermal exchange systems).
- Fuel switching (e.g., connecting to district energy systems).
- Harvesting energy from process loads or waste (e.g., sewer heat recovery); and
- Energy efficient processes (e.g., variable frequency drives, high efficiency equipment).

Initiatives must occur in municipal facilities including administration buildings, police stations and fire halls, recreation centers and arenas, wastewater treatment plants, etc.

Funds are typically allocated to projects in municipally owned buildings, but a non-municipally owned building may also be eligible if mostly used for municipal purposes. Eligible applicants include all municipalities and their partners, including:

- Private sector entities
- Indigenous communities
- Municipally owned corporations
- A regional, provincial or territorial organization delivering municipal services
- Non-governmental organizations
- Not-for-profit organizations; and
- Research institutes (e.g., universities).

The following two funding options are granted.

- The regular loans and grants, which include a loan of up to \$5M and a grant worth 15% of the loan, covering up to 80% of the project costs.
- High-ranking project loans and grants, which include a loan of up to \$10M and a grant worth 15% of the loan, covering up to 80% of the project costs.

Applications are accepted year-round and should be submitted to the FCM.

### Recreation Community Development Grant

The [Recreation Community Development Grant](#) (RCD) was developed by Nova Scotia's Department of Communities, Culture and Heritage (CCH) to support initiatives which respond to the recreation goals and priorities of communities and the [Shared Strategy for Advancing Recreation in Nova Scotia](#). This strategy identified five following goals: active living, inclusion and access, connecting people and nature, supportive environments, and recreation capacity development.

Eligible Initiatives include the following.

- Program and policy development and implementation.
- Leadership, education, and capacity development.
- Resource development, planning, and evaluation.
- Marketing and awareness campaigns.
- Organizational and partnership development; and
- Other COVID-19 recovery initiatives and needs in support of recreations.

Eligible applicants include the following.

- Municipalities and communities (e.g. villages).
- Community associations and registered non-profit Societies in good standing, including clubs and associations.

"The purpose of the *Shared Strategy for Advancing Recreation in Nova Scotia* is to clarify a shared vision and set of priorities that reflects the aspirations and the broader potential of the recreation sector in the province. It is also intended to strengthen alignment of plans and policies and facilitate even richer opportunities for collaboration and resource sharing."

<https://www.recreationns.ns.ca/initiatives/344-shared-strategy/file.html>

- Mi'kmaq Band Councils; and
- Schools, through centres for education (Excluding curriculum components and school sport teams).

The program typically covers up to half of the project's, with a maximum of \$10,000 annually. Under certain circumstances related to COVID-19, applicants may be eligible to receive grants covering up to three-quarter of project cost. Initiatives can apply for funding annually and may obtain funding for up to 3 years.

Additional details on eligible costs and the application process are found in the [Recreation Community Development Grant – Program 2020-21](#).

### **Nova Scotia Amateur Sport Fund**

The Nova Scotia Amateur Sport Fund (NSASF) was developed to support quality and sustainable programming to provide more opportunities for Nova Scotians to take part in sport. The program focuses on community sport initiatives and supports initiatives seeking to achieve the following.

- Increase sustainable quality sport participation (either new programming or the expansion of existing programs).
- Increase Long Term Development in Sport and Physical Activity alignment.
- Coaching seminars or conferences that will have a positive impact on the quality of coaching in Nova Scotia (non-NCCP specific); and
- Increase the participation of diverse populations in quality sport opportunities.



These programs may include equipment and/or program quality sport alignment, field of play resources, and leadership development.

Eligible applicants include the following.

- Local sport clubs and community sport organizations who are members in good standing of a Provincial Sport Organization (PSO).
- Community organizations who provide sport opportunities and are incorporated with active status as a "not for profit" society under the Joint Stocks Societies Act of Nova Scotia.
- Municipalities, villages, or First Nation communities.

The program covers up to \$5,000 per project on a cost-shared basis. Applications are accepted six times per year on the starting February 15th, and every two months thereafter.

Additional details on eligible costs and the application process are found in the [Sport Fund – Applicant Reference Guide](#).

### Provincial Recreation / Physical Activity Project Funding

The [Provincial Recreation / Physical Activity Project Funding](#) was developed by the CCH to support provincial organizations to undertake initiatives that address specific recreation and physical activity priorities. Supported initiatives must align with the goals and priorities of provincial recreation organizations and the CCH, Communities, Sport & Recreation (CSR) division. These priority areas are the same as those found in the Shared Strategy for Advancing Recreation in Nova Scotia. Eligible initiatives include the following.



- Program Development & Implementation
- Leadership & Capacity Development
- Marketing & Public Awareness
- Planning & Organizational Development; and
- Education, Knowledge Transfer & Resource Development.

Eligible applicants include the following.

- Municipalities
- Provincial Recreation Organizations that have either a primary mandate for recreation/physical activity or deliver recreation/physical activity program(s) as a means to achieve their mandate; and
- Projects that are provincial in scope and/or the outcome and outputs have a provincial impact.

The level of contribution is determined on a project-basis. However, the applicant is expected to cover at a minimum 50% of project costs. Additional detail on eligible costs and the application process are found in the [Provincial Recreation / Physical Activity Project Funding](#).

### Enhanced Net Metering Program

The [Enhanced Net Metering Program \(ENM\)](#) was developed by Nova Scotia Power and allows participants to reduce utility costs by installing and using alternative energy sources and simply drawing from the Nova Scotia power grid when needed. Cost reduction results from the reduced energy consumption and reliance on the power grid, as well as the opportunity to bank electricity surplus generated which fed back into the grid and discounted on future utility bills.

Eligible alternative energy sources include the following.

- Solar
- Wind
- Run-of-the-river hydroelectric
- Ocean-powered
- Tidal
- Wave
- Sustainably harvested biomass; and
- Landfill gas.

Alternative energy sources may have a production capacity of up to 100kW. However, eligible system must be sized to meet, but not exceed the building's expected yearly electricity consumption.

Eligible applicants include the following.

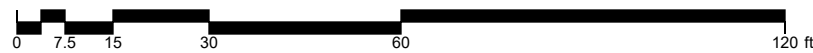
- All Nova Scotia Power customers
- Individuals
- Businesses; and
- Community and not-for-profit groups.

While application is needed to participate to the program, no application fees are charged.

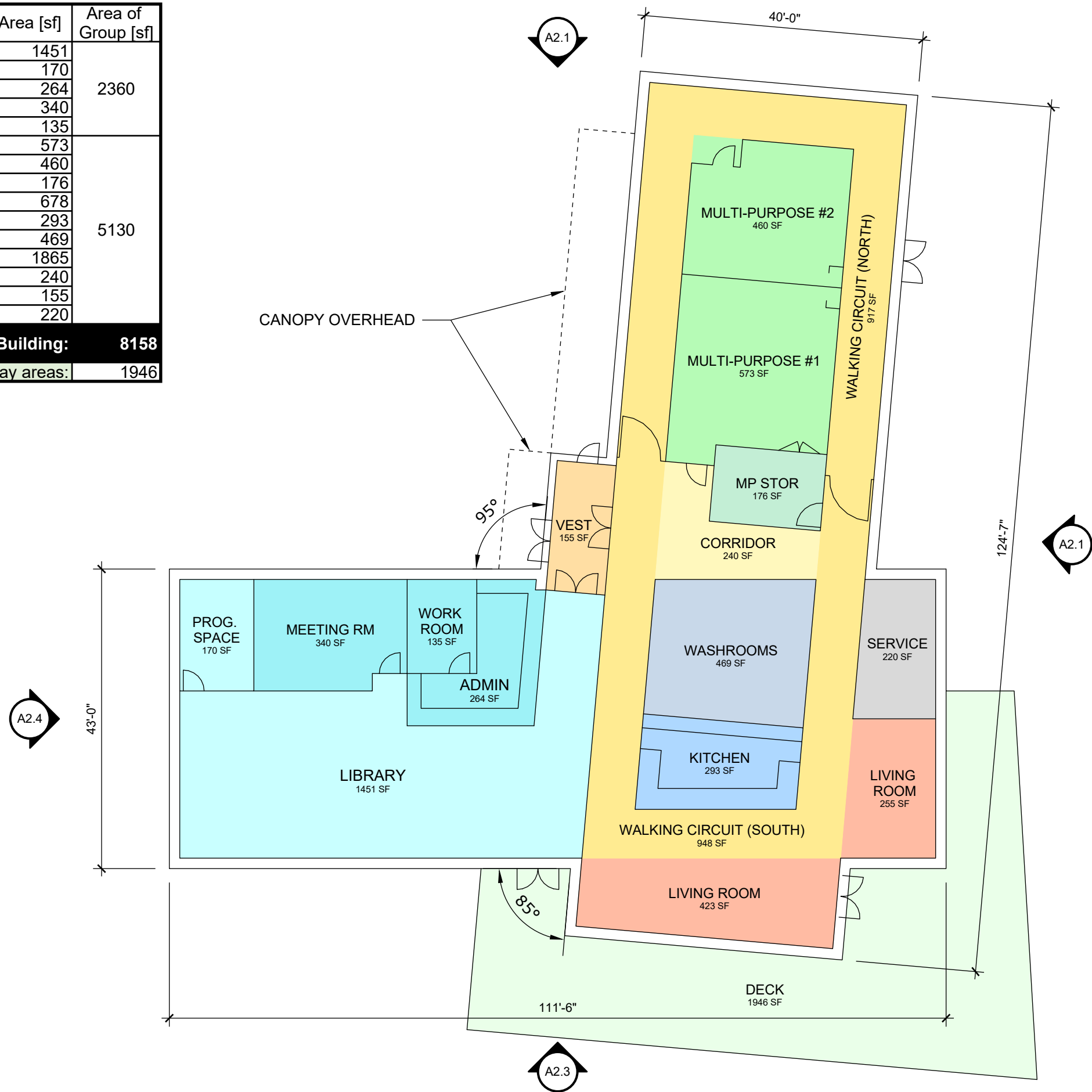
## **APPENDIX D:**

# **Concept Drawings**

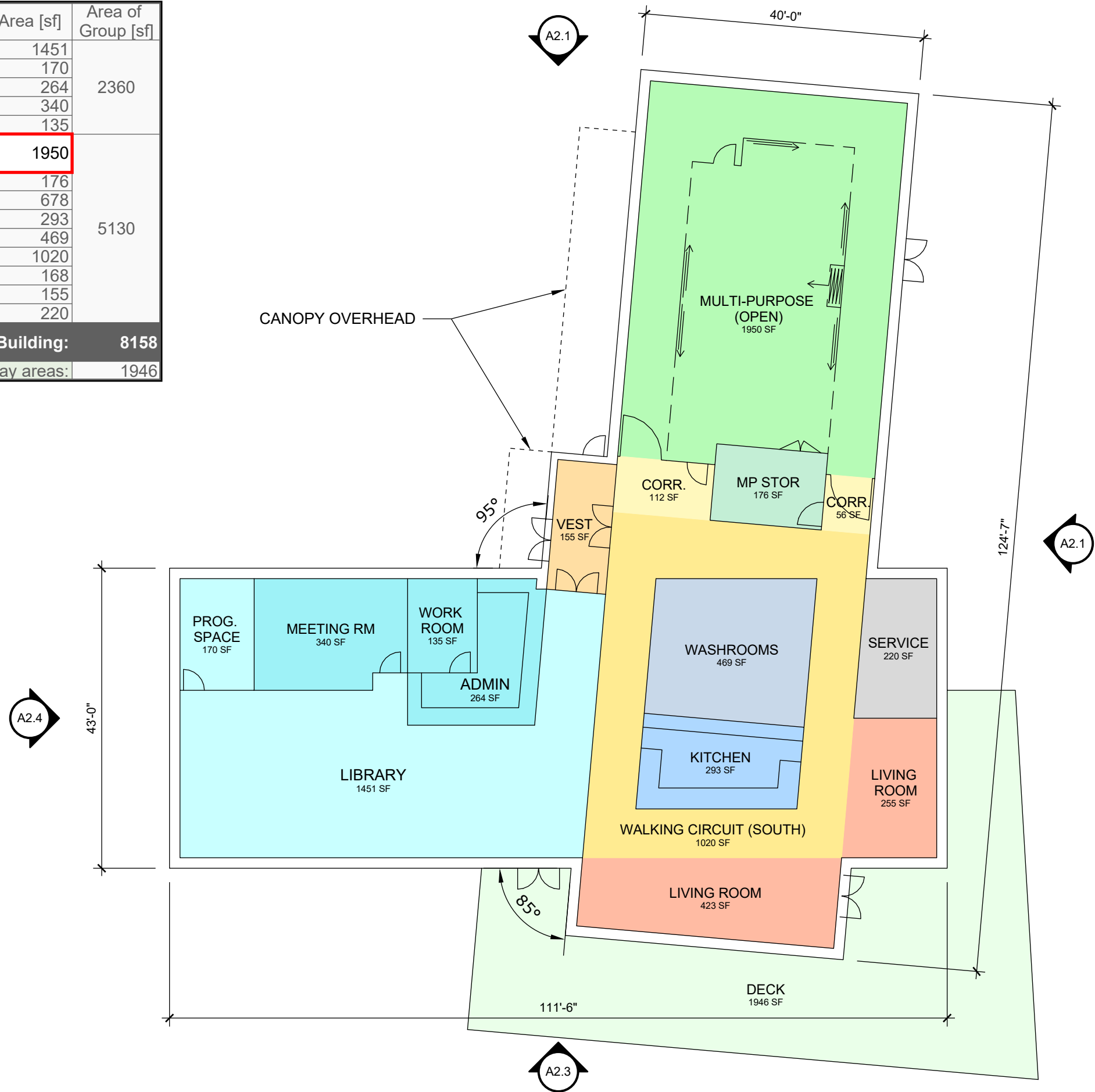


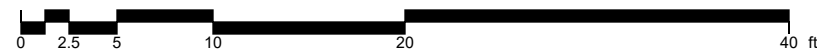


| Program Group               | Program Spaces                       | Area [sf] | Area of Group [sf] |
|-----------------------------|--------------------------------------|-----------|--------------------|
| Library                     | Library                              | 1451      | 2360               |
|                             | Program Room                         | 170       |                    |
|                             | Library Admin                        | 264       |                    |
|                             | Admin Meeting Room                   | 340       |                    |
|                             | Admin Work Room                      | 135       |                    |
| Multi-Purpose Centre        | Multi-Purpose #1                     | 573       | 5130               |
|                             | Multi-Purpose #2                     | 460       |                    |
|                             | MP Storage                           | 176       |                    |
|                             | Living Room(s)                       | 678       |                    |
|                             | Kitchen                              | 293       |                    |
|                             | Washrooms                            | 469       |                    |
|                             | Walking Circuit                      | 1865      |                    |
|                             | Corridor (Misc)                      | 240       |                    |
|                             | Vestibule                            | 155       |                    |
|                             | Service/Storage                      | 220       |                    |
|                             | <b>Gross Floor Area of Building:</b> |           |                    |
| Exterior Deck & play areas: |                                      | 1946      |                    |



| Program Group               | Program Spaces                       | Area [sf] | Area of Group [sf] |
|-----------------------------|--------------------------------------|-----------|--------------------|
| Library                     | Library                              | 1451      | 2360               |
|                             | Program Room                         | 170       |                    |
|                             | Library Admin                        | 264       |                    |
|                             | Admin Meeting Room                   | 340       |                    |
|                             | Admin Work Room                      | 135       |                    |
| Multi-Purpose Centre        | Multi-Purpose (Open config.)         | 1950      | 5130               |
|                             | MP Storage                           | 176       |                    |
|                             | Living Room(s)                       | 678       |                    |
|                             | Kitchen                              | 293       |                    |
|                             | Washrooms                            | 469       |                    |
|                             | Walking Circuit                      | 1020      |                    |
|                             | Corridor (Misc)                      | 168       |                    |
|                             | Vestibule                            | 155       |                    |
|                             | Service/Storage                      | 220       |                    |
|                             | <b>Gross Floor Area of Building:</b> |           |                    |
| Exterior Deck & play areas: |                                      | 1946      |                    |



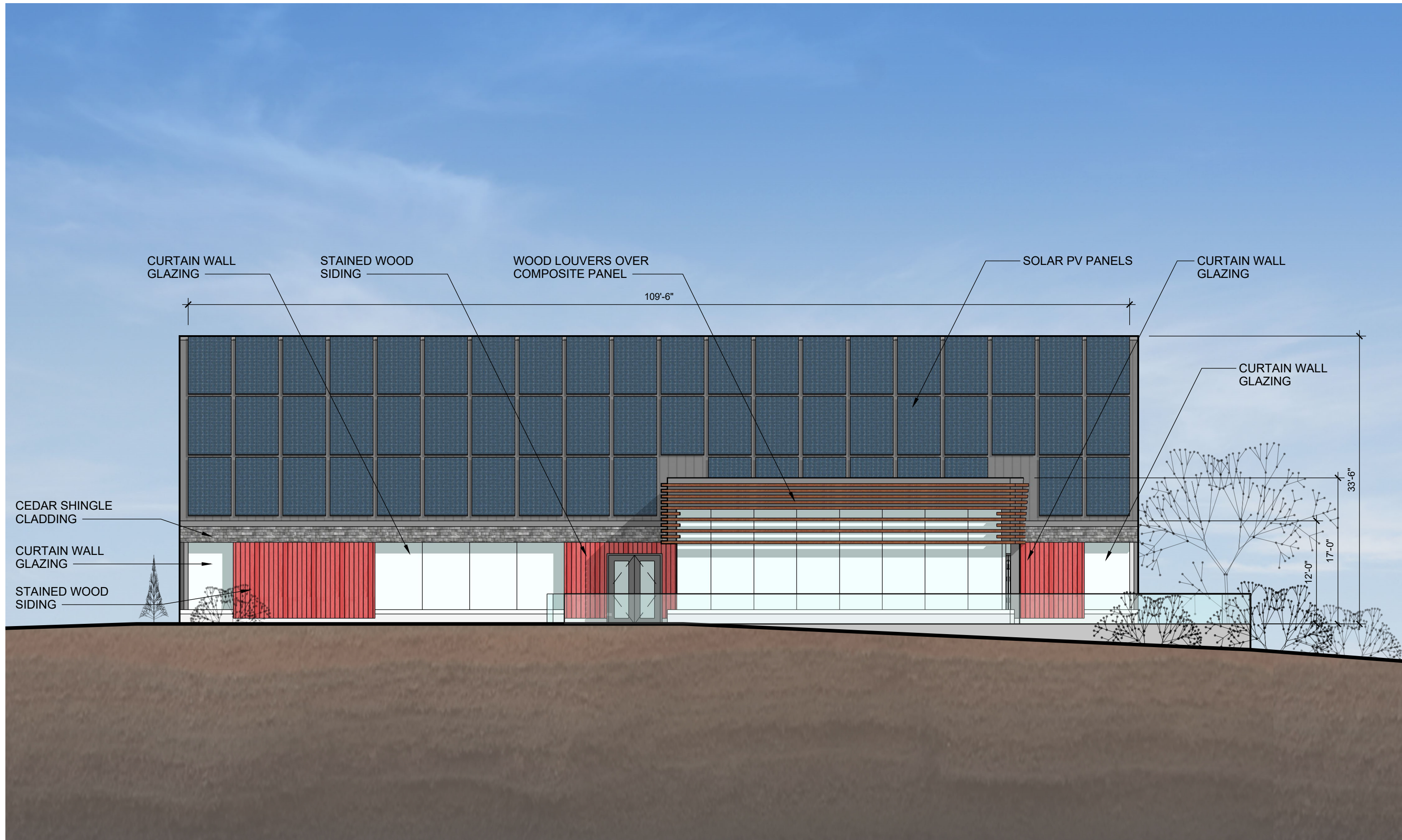




SOLAR PV PANEL  
 SOLERA INSULATED GLAZING  
 COMPOSITE PANEL  
 GUARDRAIL  
 WOOD LOUVERS OVER COMPOSITE PANEL  
 STAINED WOOD SIDING  
 CURTAIN WALL GLAZING

WOOD LOUVERS OVER COMPOSITE PANEL  
 CURTAIN WALL GLAZING  
 33'-6"  
 17'-0"  
 12'-0"





CURTAIN WALL  
GLAZING

STAINED WOOD  
SIDING

WOOD LOUVERS OVER  
COMPOSITE PANEL

SOLAR PV PANELS

CURTAIN WALL  
GLAZING

109'-6"

CURTAIN WALL  
GLAZING

CEDAR SHINGLE  
CLADDING

CURTAIN WALL  
GLAZING

STAINED WOOD  
SIDING

33'-6"

17'-0"

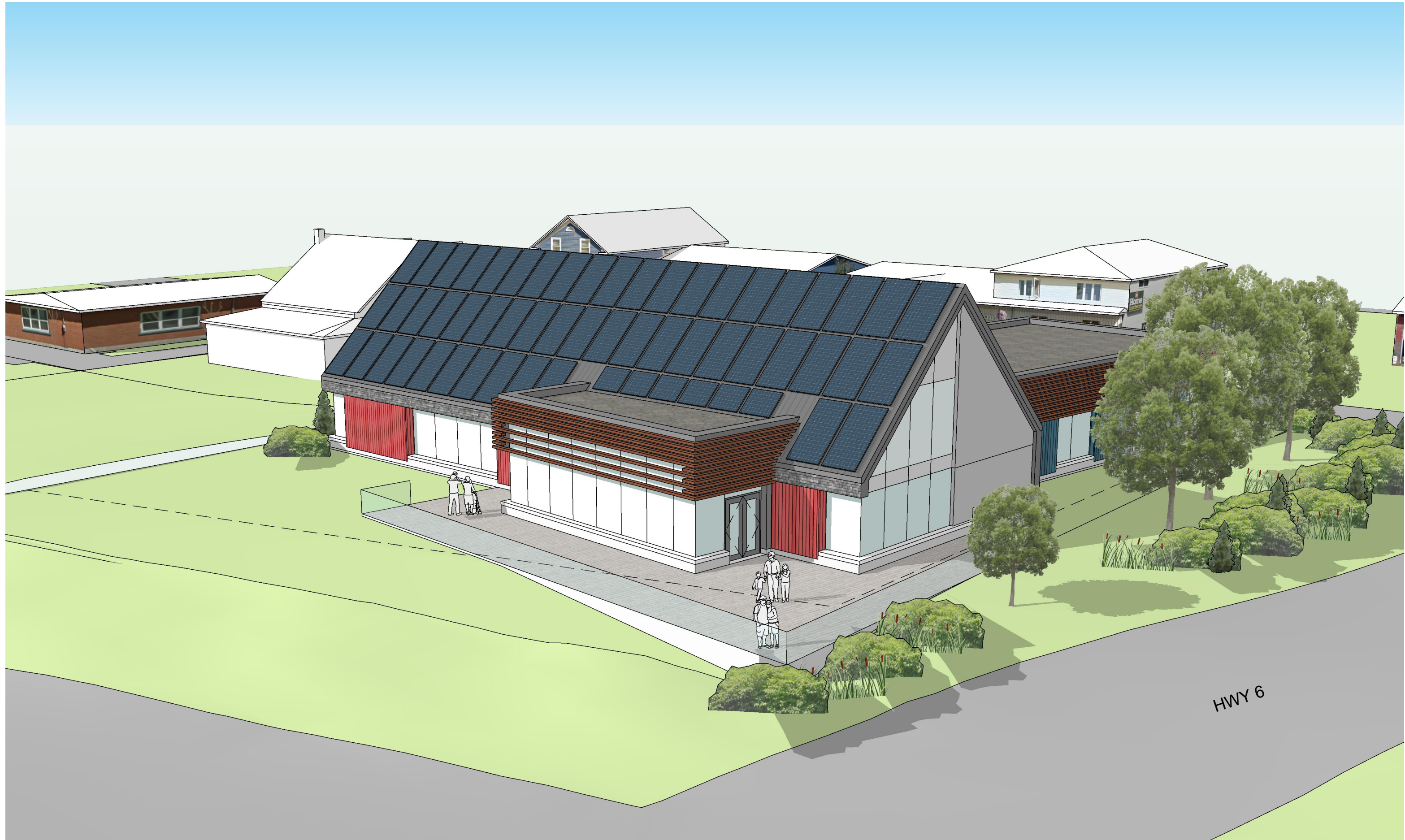
12'-0"

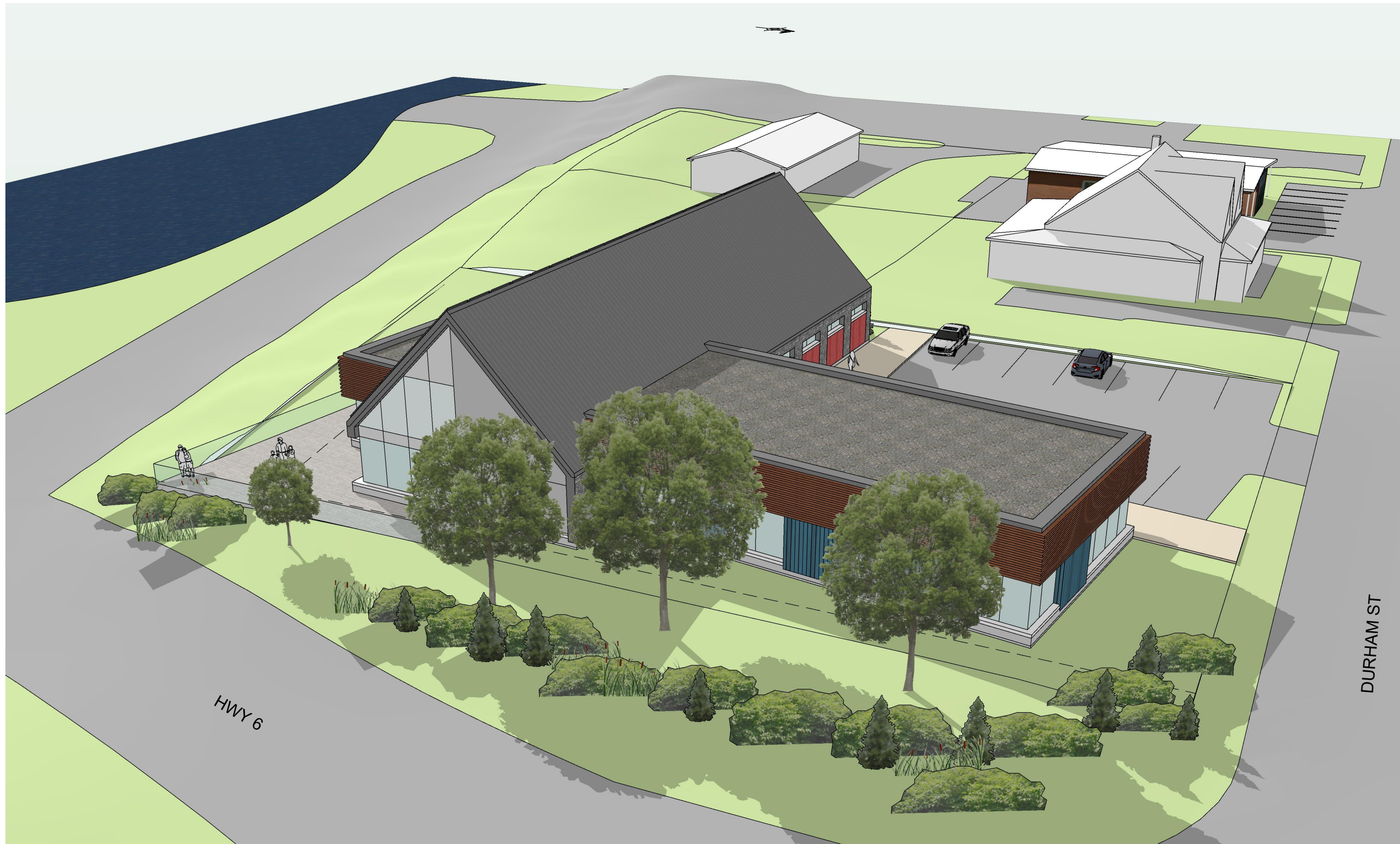




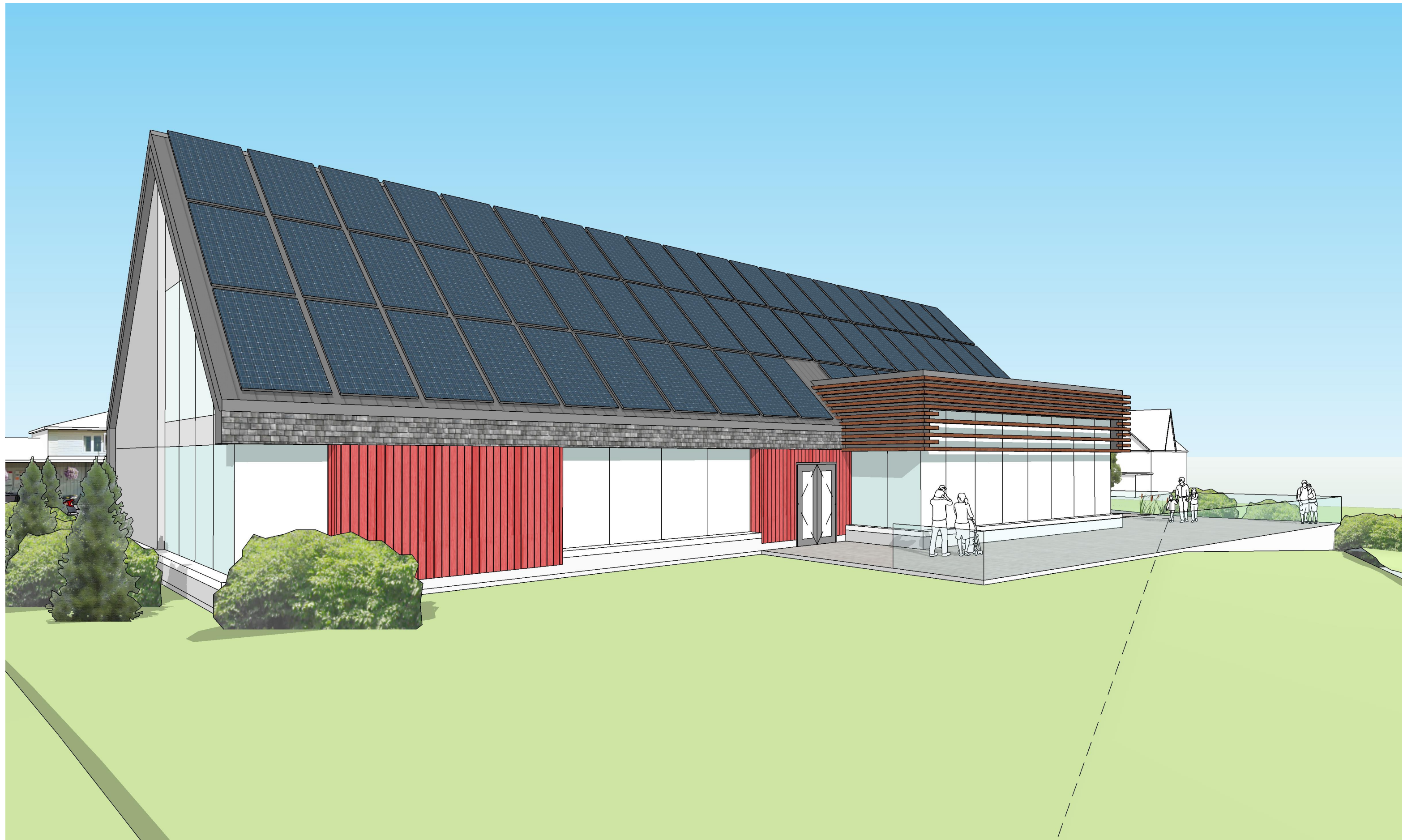












**APPENDIX E:**

**Class “D” Estimate**



**PUGWASH LIBRARY &  
MULTI-PURPOSE CENTRE  
NEW CONSTRUCTION  
PUGWASH, NOVA SCOTIA**

**CLASS 'D' ESTIMATE**

**March 10, 2021**

**Hanscomb**

**PUGWASH LIBRARY & MULTI-PURPOSE CENTRE  
NEW CONSTRUCTION  
PUGWASH, NOVA SCOTIA**

**CLASS 'D' ESTIMATE**

**Prepared For:**

**ARCHITECTURE 49 INC.  
1640 MARKET STREET**

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B3J 2C8**

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**Prepared by:**

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**TEL: (902) 422-3620**

**March 10, 2021**

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| 3. | Cost Considerations                | 5 |
| 4. | Gross Floor Area                   | 7 |
| 5. | Construction Cost Estimate Summary | 8 |

**Appendices**

A - Detailed Elemental Cost Estimate

B - Drawing List

## **1. INTRODUCTION**

---

1.1 Purpose: This Class 'D' Estimate is intended to provide a realistic allocation of direct and indirect construction costs for the demolition of the existing stage and construct new, located in Pugwash, Nova Scotia, with exceptions of items listed in 1.4 below.

1.2 Methodology: From the documentation and information provided, quantities of all major elements were assessed or measured where possible and priced at rates considered competitive for a project of this type under a stipulated sum form of contract in Pugwash, Nova Scotia.

Pricing shown reflects probable construction costs obtainable in the Pugwash, Nova Scotia area on the effective date of this report. This estimate is a determination of fair market value for the construction of this project. It is not a prediction of low bid. Pricing assumes competitive bidding for every portion of the work.

1.3 Specifications: For building components and systems where specifications and design details are not available, quality standards have been established based on discussions with the design team.

1.4 Exclusions: This Class 'D' Estimate does not provide for quantities of works or costs in excess of what is specified in this estimate for the following items:

- Cost of Design Exclusions, Omissions, & Errors
- Professional Fees and Expenses
- Phased Construction Premiums
- Escalation Allowance
- Land Acquisition and Impost Charges
- Development Charges
- Permits (Building, Plumbing, Access, etc)
- Legal Fees and Expenses
- Value Added Taxes (GST, HST, QST, etc.)
- Right of Way Charges or Easement Requirements
- Financing Fee's & Carrying Costs
- Fund Raising Requirements
- Owner's Staff and Associated Management
- Owner Furnished Material or Associated Labour
- Any cost increases or premiums due to Covid -19 Pandemic

**1. INTRODUCTION**

---

1.4 Exclusions:  
(continued)

- Impact of Adjacent Properties and their Conditions
- Mitigation of Water Conditions
- Winter Conditions Affecting the Work

## **2. DOCUMENTATION**

---

This Class 'D' Estimate has been prepared from documentation included in Appendix B of this report, and received from Architecture 49.

Design changes and / or additions made subsequent to this issuance of the documentation noted above have not been incorporated in this report.

### **3. COST CONSIDERATIONS**

---

- 3.1 Cost Base: All costs are estimated on the basis of competitive bids (a minimum of 5 to 6 general contractor bids and at least 4 to 5 subcontractor bids for each trade) being received in March 2021 from general contractors and all major subcontractors and suppliers based on a stipulated sum form of contract.
- 3.2 Escalation: No allowance has been made for construction cost escalation that may occur between March 2021 and the anticipated bid date of for the project. It is recommended that the Owner make separate provision for construction cost escalation in the overall project budget.
- 3.3 Contingencies: An allowance of 10.0% has been included to cover design and pricing unknowns. This allowance is not intended to cover any program space modifications but rather to provide some flexibility for the designers and cost planners during the remaining contract document stages.
- An allowance of 5.0% has been made to cover construction (post contract) unknowns.
- 3.4 Unit Rates: The unit rates in the preparation of this Class 'D' Estimate include labour and material, equipment, Subcontractor's overheads and profits.
- 3.5 Taxes: No provision has been made for the HST. It is recommended that the owner make separate provision for HST in the project budget.
- 3.6 Statement of Probable Costs: Hanscomb has no control over the cost of labour and materials, the Contractor's method of determining prices, or competitive bidding and market conditions. This opinion of probable cost of construction is made on the basis of experience, qualifications and best judgement of the professional consultant familiar with the construction industry. Hanscomb cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from this or subsequent cost estimates.

**3. COST CONSIDERATIONS (cont'd)**

---

3.6 Statement of  
Probable Costs:  
(continued)

Hanscomb has prepared this estimate in accordance with generally accepted principles and practices. Hanscomb's staff are available to discuss its contents with any interested party.

3.7 Ongoing Cost  
Control:

Hanscomb recommends that the Owner and Design Consultant carefully review this document, including line item description, unit prices, clarifications, exclusions, inclusions and assumptions, contingencies, escalation and mark-ups. If the Project is over budget, or if there are unresolved budgeting issues, alternative systems / schemes should be evaluated before proceeding into the next design phase.

Requests for modifications of any apparent errors or omissions to this document must be made to Hanscomb within ten (10) days of receipt of this estimate. Otherwise, it will be understood that the contents have been concurred with and accepted.

It is recommended that a final update estimate be produced by Hanscomb using bid documents to determine overall cost changes which may have occurred since the preparation of this estimate. The final updated estimate will address changes and additions to the documents, as well as addenda issued during the bidding process. Hanscomb cannot reconcile bid results to any estimate not produced from bid documents including all addenda.

**4. GROSS FLOOR AREA**

---

| <b>Description</b>            | <b>New Construction<br/>SF</b> |
|-------------------------------|--------------------------------|
| New Construction              | 8,158                          |
| <b>Total Gross Floor Area</b> | <b>8,158</b>                   |

The above areas have been measured in accordance with the Canadian Institute of Quantity Surveyors' Method of Measurement of Buildings by Area and Volume.

5. CONSTRUCTION COST ESTIMATE SUMMARY

COST SUMMARY:

| Element  |       | Cdn \$              |
|--|-------|---------------------|
| Shell  |       | \$ 1,774,200        |
| Interiors  |       | \$ 425,000          |
| Mechanical - Bldg                                  |       | \$ 356,900          |
| Electrical - Bldg                                  |       | \$ 402,500          |
| <b>Total - Less Site</b>                           |       | <b>\$ 2,958,600</b> |
| Site Development                                   |       | \$ 145,900          |
| Mechanical Site Services                           |       | \$ 40,000           |
| Electrical Site Services                           |       | \$ 71,500           |
| Demolition   |       | \$ -                |
| Alterations  |       | \$ -                |
| <b>Net Building Costs - Including Site</b>         |       | <b>\$ 3,216,000</b> |
| General Requirements & Fee                         | 15.0% | \$ 482,400          |
| Design & Pricing Contingency                       | 10.0% | \$ 369,800          |
| Escalation Contingency                             | 0.0%  |                     |
| Construction Contingency                           | 5.0%  | \$ 203,400          |
| Location Factor                                    | 10.0% | \$ 427,200          |
| <b>Total Construction Estimate - Contingencies</b> |       | <b>\$ 4,698,800</b> |
| Taxes - excluded                                   | 0.0%  | \$ -                |
| <b>Total Construction Estimate</b>                 |       | <b>\$ 4,698,800</b> |

**Appendix  
A - Detailed Elemental Cost Estimate**

|            |  |             |               |
|------------|--|-------------|---------------|
| Project    | : PUGWASH LIBRARY & MULTI-PURPOSE CENTRE | Report date | : 10 Mar 2021 |
|            | : NEW CONSTRUCTION                       | Page No.    | : A - 1       |
| Location   | : PUGWASH, NOVA SCOTIA                   | Bldg Type   | : 530         |
| Owner      | : Village of Pugwash                     | C.T. Index  | : 0.0         |
| Consultant | : Architecture 49 INC.                   | GFA         | : 8,158 SF    |

**ELEMENTAL COST SUMMARY**

| Element   | Ratio to GFA | Elemental Cost |            | Elemental Amount |                     | Rate per SF |                  | %     |
|---|--------------|----------------|------------|------------------|---------------------|-------------|------------------|-------|
|   |              | Quantity       | Unit rate  | Sub-Total        | Total               | Sub-Total   | Total            |       |
| <b>A SHELL</b>  |              | 8,158 SF       |            |                  | 1,774,200           |             | 217.48           | 48.0  |
| <b>A1 SUBSTRUCTURE</b>                                    |              |                |            |                  | 160,000             |             | 19.61            | 4.3   |
| A11 Foundations   | 1.000        | 8,158 SF       | 18.30      | 149,300          |                     | 18.30       |                  |       |
| A12 Basement Excavation                                   |              |                |            | 0                |                     | 0.00        |                  |       |
| A13 Special Conditions                                    | 0.000        | Sum            | 10,700.00  | 10,700           |                     | 1.31        |                  |       |
| <b>A2 STRUCTURE</b>                                       |              |                |            |                  | 346,600             |             | 42.49            | 9.4   |
| A21 Lowest Floor Construction                             | 1.000        | 8,158 SF       | 8.50       | 69,300           |                     | 8.49        |                  |       |
| A22 Upper Floor Construction                              | 0.000        | Sum            | 0.00       | 0                |                     | 0.00        |                  |       |
| A23 Roof Construction                                     | 1.000        | 8,158 SF       | 34.00      | 277,300          |                     | 33.99       |                  |       |
| <b>A3 EXTERIOR ENCLOSURE</b>                              |              |                |            |                  | 1,267,600           |             | 155.38           | 34.3  |
| A31 Walls Below Grade                                     |              |                |            | 0                |                     | 0.00        |                  |       |
| A32 Walls Above Grade                                     | 0.990        | 8,079 SF       | 102.80     | 830,800          |                     | 101.84      |                  |       |
| A33 Windows & Entrances                                   | 0.001        | 10 No.         | 3,110.00   | 31,100           |                     | 3.81        |                  |       |
| A34 Roof Coverings  | 1.000        | 8,158 SF       | 28.40      | 231,500          |                     | 28.38       |                  |       |
| A35 Projections   | 0.000        | Sum            | 174,200.00 | 174,200          |                     | 21.35       |                  |       |
| <b>B INTERIORS</b>  |              | 8,158 SF       |            |                  | 425,000             |             | 52.10            | 11.5  |
| <b>B1 PARTITIONS &amp; DOORS</b>                          |              |                |            |                  | 187,300             |             | 22.96            | 5.1   |
| B11 Partitions  | 0.830        | 6,771 SF       | 21.60      | 146,400          |                     | 17.95       |                  |       |
| B12 Doors   | 0.003        | 21 Lvs         | 1,947.60   | 40,900           |                     | 5.01        |                  |       |
| <b>B2 FINISHES</b>  |              |                |            |                  | 169,100             |             | 20.73            | 4.6   |
| B21 Floor Finishes  | 1.000        | 8,158 SF       | 11.00      | 89,900           |                     | 11.02       |                  |       |
| B22 Ceiling Finishes                                      | 1.000        | 8,158 SF       | 6.60       | 53,600           |                     | 6.57        |                  |       |
| B23 Wall Finishes   | 1.678        | 13,686 SF      | 1.90       | 25,600           |                     | 3.14        |                  |       |
| <b>B3 FITTINGS &amp; EQUIPMENT</b>                        |              |                |            |                  | 68,600              |             | 8.41             | 1.9   |
| B31 Fittings & Fixtures                                   | 1.000        | 8,158 SF       | 8.40       | 68,600           |                     | 8.41        |                  |       |
| B32 Equipment   | 1.000        | 8,158 SF       | 0.00       | 0                |                     | 0.00        |                  |       |
| B33 Elevators   |              |                |            | 0                |                     | 0.00        |                  |       |
| B34 Escalators  |              |                |            | 0                |                     | 0.00        |                  |       |
| <b>C SERVICES</b>   |              | 8,158 SF       |            |                  | 759,400             |             | 93.09            | 20.5  |
| <b>C1 MECHANICAL</b>                                      |              |                |            |                  | 356,900             |             | 43.75            | 9.7   |
| C11 Plumbing & Drainage                                   | 1.000        | 8,158 SF       | 11.70      | 95,500           |                     | 11.71       |                  |       |
| C12 Fire Protection                                       | 1.000        | 8,158 SF       | 0.20       | 1,600            |                     | 0.20        |                  |       |
| C13 HVAC  | 1.000        | 8,158 SF       | 27.30      | 223,100          |                     | 27.35       |                  |       |
| C14 Controls  | 1.000        | 8,158 SF       | 4.50       | 36,700           |                     | 4.50        |                  |       |
| <b>C2 ELECTRICAL</b>                                      |              |                |            |                  | 402,500             |             | 49.34            | 10.9  |
| C21 Service & Distribution                                | 1.000        | 8,158 SF       | 15.30      | 125,100          |                     | 15.33       |                  |       |
| C22 Lighting, Devices & Heating                           | 1.000        | 8,158 SF       | 19.00      | 155,000          |                     | 19.00       |                  |       |
| C23 Systems & Ancillaries                                 | 1.000        | 8,158 SF       | 15.00      | 122,400          |                     | 15.00       |                  |       |
| <b>NET BUILDING COST - EXCLUDING SITE</b>                 |              |                |            |                  | <b>\$ 2,958,600</b> |             | 362.66           | 80.0  |
| <b>D SITE &amp; ANCILLARY WORK</b>                        |              | 8,158 SF       |            |                  | 257,400             |             | 31.55            | 7.0   |
| <b>D1 SITE WORK</b>                                       |              |                |            |                  | 257,400             |             | 31.55            | 7.0   |
| D11 Site Development                                      | 0.000        | 1 Sum          | 145,900.00 | 145,900          |                     | 17.88       |                  |       |
| D12 Mechanical Site Services                              | 0.000        | 1 Sum          | 40,000.00  | 40,000           |                     | 4.90        |                  |       |
| D13 Electrical Site Services                              | 0.000        | 1 Sum          | 71,500.00  | 71,500           |                     | 8.76        |                  |       |
| <b>D2 ANCILLARY WORK</b>                                  |              |                |            |                  | 0                   |             | 0.00             | 0.0   |
| D21 Demolitions   |              |                |            | 0                |                     | 0.00        |                  |       |
| D22 Alterations   |              |                |            | 0                |                     | 0.00        |                  |       |
| <b>NET BUILDING COST - INCLUDING SITE</b>                 |              |                |            |                  | <b>\$ 3,216,000</b> |             | 394.21           | 87.0  |
| <b>Z1 GENERAL REQUIREMENTS &amp; FEE</b>                  |              |                |            |                  | 482,400             |             | 59.13            | 13.0  |
| Z11 General Requirements & Fee                            |              | 15.0 %         |            | 482,400          |                     | 59.13       |                  |       |
| <b>TOTAL CONSTRUCTION ESTIMATE - EXCLUDING ALLOWANCES</b> |              |                |            |                  | <b>\$ 3,698,400</b> |             | 453.35           | 100.0 |
| <b>Z2 ALLOWANCES</b>                                      |              |                |            |                  | 1,000,400           |             | 122.63           |       |
| Z21 Design & Pricing Allowance                            |              | 10.0 %         |            | 369,800          |                     | 45.33       |                  |       |
| Z22 Escalation Allowance                                  |              | 0.0 %          |            | 0                |                     | 0.00        |                  |       |
| Z23 Construction Allowance                                |              | 5.0 %          |            | 203,400          |                     | 24.93       |                  |       |
| Z24 Location Factor                                       |              | 10.0 %         |            | 427,200          |                     | 52.37       |                  |       |
| <b>TOTAL CONSTRUCTION ESTIMATE - INCLUDING ALLOWANCES</b> |              |                |            |                  | <b>\$ 4,698,800</b> |             | 575.97           |       |
| <b>VALUE ADDED TAX (GST/HST)</b>                          |              |                |            |                  | 0                   |             | 0.00             |       |
| Value Added Tax (GST/HST)                                 |              | 0.0 %          |            | 0                |                     | 0.00        |                  |       |
| <b>TOTAL CONSTRUCTION ESTIMATE</b>                        |              |                |            |                  | <b>\$ 4,698,800</b> |             | <b>\$ 575.97</b> |       |

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| A1 SUBSTRUCTURE   | Quantity   | Unit rate   | Amount   |
|---|--|---|--|
| <p>A11 Foundations</p> <p>1 Exterior reinforced concrete frost wall and strip footings</p> <ul style="list-style-type: none"> <li>- reinforced concrete frost wall c/w concrete, formwork and rebar, allow 5'</li> <li>- reinforced concrete strip footings , c/w concrete, formwork and rebar</li> </ul> <p>2 Interior reinforced concrete frost wall and strip footings</p> <ul style="list-style-type: none"> <li>- reinforced concrete frost wall c/w concrete, formwork and rebar, allow 5'</li> <li>- reinforced concrete strip footings , c/w concrete, formwork and rebar</li> </ul> <p>3 Allowance for miscellaneous pad footings</p> <p>4 Excavation and backfill</p> | <p>2,355 SF</p> <p>2,355 sf</p> <p>471 lf</p> <p>240 SF</p> <p>240 sf</p> <p>48 lf</p> | <p>34.40</p> <p>28.00</p> <p>32.00</p> <p>34.40</p> <p>28.00</p> <p>32.00</p> <p>Allow</p> <p>Sum</p> | <p>81,010</p> <p>65,940</p> <p>15,070</p> <p>8,260</p> <p>6,720</p> <p>1,540</p> <p>15,000</p> <p>45,000</p> |
| <p>A11 Foundations</p> <p style="text-align: right;"><b>TOTAL : \$</b></p>  | <p>8,158 SF</p>  | <p>18.30</p>  | <p>149,300</p>   |
| <p>A13 Special Conditions</p> <p>1 Dewatering, erosion and sediment control</p> <p>2 Winter heating - assuming construction takes place during winter months</p>  |  | <p>Allow</p> <p>Allow</p>   | <p>3,200</p> <p>7,500</p>  |
| <p>A13 Special Conditions</p> <p style="text-align: right;"><b>TOTAL : \$</b></p>   | <p>1 #Sum</p>  | <p>10,700.00</p>  | <p>10,700</p>  |

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| A2 STRUCTURE                  |   | Quantity          | Unit rate | Amount  |
|-------------------------------|---|-------------------|-----------|---------|
| A21 Lowest Floor Construction |   |                   |           |         |
| 1                             | Reinforced 4" concrete slab on grade<br>c/w concrete, formwork, rebar and<br>rigid insulation | 8,158 SF          | 8.50      | 69,340  |
| A21 Lowest Floor Construction |   | <b>TOTAL : \$</b> | 8.49      | 69,300  |
| A23 Roof Construction         |   |                   |           |         |
| 1                             | Main roof - sloped<br>( Plan Area )   | 5,082 SF          | 42.00     | 213,440 |
|                               | - pre-engineered heavy timber trusses,<br>timber columns & sheathing                          | 5,082 sf          | 42.00     | 213,440 |
| 2                             | Flat roof   | 3,076 SF          | 18.00     | 55,370  |
|                               | - dimensional lumber joists, LVL beams &<br>timber columns                                    | 3,076 sf          | 18.00     | 55,370  |
| 3                             | Extra over - miscellaneous steel<br>reinforcement and connections to roof<br>construction     |                   | Allow     | 8,500   |
| A23 Roof Construction         |   | <b>TOTAL : \$</b> | 33.99     | 277,300 |

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| A3 EXTERIOR ENCLOSURE   | Quantity            | Unit rate | Amount  |
|---|---------------------|-----------|---------|
| A32 Walls Above Grade   |                     |           |         |
| 1 Curtain wall, triple-glazed, thermally broken, Argon-filled, low-E, fiberglass frames (proposed glass) and spandrel glazing <ul style="list-style-type: none"> <li>- double-glazed, thermally broken, Argon-filled, low-E, aluminum framed (reference)</li> <li>- triple-glazed, thermally broken, Argon-filled, low-E, fiberglass framed (proposed) - Premium</li> <li>- Alternative: triple-glazed, thermally broken, argon-filled, Low-E alum'frame-premium - \$25/sf</li> </ul> | 2,470 SF            | 177.50    | 438,430 |
|   | 2,470 sf            | 105.00    | 259,350 |
|   | 2,470 sf            | 72.50     | 179,080 |
|   |                     | nil       |         |
| 2 Solera insulated glazing  | 300 SF              | 95.00     | 28,500  |
| 3 Cedar shingle on thermally broken girts c/w sheathing, wood stud, framing, insulation, stapping and GWB   | 620 SF              | 32.00     | 19,840  |
| 4 Composite panel cladding c/w air/vb, semi-rigid insulation, sheathing stud and GWB  | 3,572 SF            | 60.00     | 214,320 |
| 5 Extra over, wood slat screen attached over the composite panel cladding   | 2,194 SF            | 19.50     | 42,780  |
| 6 Vertical siding c/w air/vb, semi-rigid insulation, sheathing stud and GWB   | 1,117 SF            | 65.00     | 72,610  |
| 7 Premium to increase the R-value from R23 to R28   | 5,309 SF            | 2.70      | 14,330  |
| 8 Exposed concrete foundation above grade, no finish  |                     | NIL       |         |
| A32 Walls Above Grade   | TOTAL : \$ 8,079 SF | 102.83    | 830,800 |

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| A3 EXTERIOR ENCLOSURE   | Quantity        | Unit rate       | Amount         |
|---|-----------------|-----------------|----------------|
| <b>A33 Windows &amp; Entrances</b>  |                 |                 |                |
| 1 Aluminum entry doors c/w frame, hardware and finish - fully glazed              | 9 Lvs           | 2,533.30        | 22,800         |
| - single  | 1 lvs           | 2,800.00        | 2,800          |
| - double  | 4 pair          | 5,000.00        | 20,000         |
| 2 Hollow metal door c/w frame, hardware and finish - fully glazed                 | 1 Lvs           | 1,250.00        | 1,250          |
| - single  | 1 lvs           | 1,250.00        | 1,250          |
| 3 Extra over - automatic door operators - allow at main entrance vestibule doors  | 2 No            | 3,500.00        | 7,000          |
| <b>A33 Windows &amp; Entrances TOTAL : \$</b>                                     | <b>10 No.</b>   | <b>3,110.00</b> | <b>31,100</b>  |
| <b>A34 Roof Coverings</b>   |                 |                 |                |
| 1 Flat roof - 2 ply modified bitumen  | 3,076 SF        | 20.00           | 61,520         |
| 2 Sloped roof - profiled metal roof ( Plan Area )                                 | 5,082 SF        | 30.60           | 155,660        |
| - standing seam metal roof - sloped area  | 6,315 sf        | 24.65           | 155,660        |
| 3 Premium to increase the R-value from R36.4 to R44 ( (Plan Area) )               |                 | Sum             | 14,270         |
| - flat roof area  | 3,076 sf        | 1.25            | 3,850          |
| - sloped roof area  | 6,315 sf        | 1.65            | 10,420         |
| <b>A34 Roof Coverings TOTAL : \$</b>  | <b>8,158 SF</b> | <b>28.38</b>    | <b>231,500</b> |
| <b>A35 Projections</b>  |                 |                 |                |
| 1 West canopy c/w structural framing and supports, roof coverings & soffit finish | 700 SF          | 95.00           | 66,500         |
| 2 Parapet construction  |                 | NIL             |                |
| <b>Carried Forward :</b>  |                 |                 | <b>66,500</b>  |

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| A3 EXTERIOR ENCLOSURE   | Quantity          | Unit rate                | Amount  |
|---|-------------------|--------------------------|---------|
| A35 Projections (Continued)   |                   | <b>Brought Forward :</b> | 66,500  |
| 3 Chimney for fireplace including bracing for chimney   |                   | Sum                      | 2,500   |
| 4 Tempered glass railing to exterior deck at the end of the library ( it appears that the other exterior decks do not require railings) | 156 LF            | 275.00                   | 42,900  |
| 5 Wooden deck to seating areas  | 1,946 SF          | 32.00                    | 62,270  |
| A35 Projections   | TOTAL : \$ 1 #Sum | 174,200.00               | 174,200 |

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| B1 PARTITIONS & DOORS            |  | Quantity        | Unit rate       | Amount         |
|----------------------------------|--|-----------------|-----------------|----------------|
| <b>B11 Partitions</b>            |  |                 |                 |                |
| 1                                | Typical partition c/w abuse resistant<br>GWB, stud, and insulation                   | 5,040 SF        | 10.50           | 52,920         |
| 2                                | Typical dividing partition c/w abuse<br>resistant GWB, studs and insulation          | 555 SF          | 10.50           | 5,830          |
| 3                                | Glazed partitions to vestibule   | 228 SF          | 85.00           | 19,380         |
| 4                                | Sliding, non glazed accoustical<br>partition   | 684 SF          | 62.00           | 42,410         |
| 5                                | Sliding glazed partition   | 264 SF          | 98.00           | 25,870         |
| <b>B11 Partitions TOTAL : \$</b> |  | <b>6,771 SF</b> | <b>21.62</b>    | <b>146,400</b> |
| <b>B12 Doors</b>                 |  |                 |                 |                |
| 1                                | Solid core wood door and frame c/w<br>hardware and finish                            | 13 Lvs          | 1,500.00        | 19,500         |
|                                  | - single   | 13 lvs          | 1,500.00        | 19,500         |
| 2                                | Aluminum framed, fully glazed door c/w<br>hardware and finishes - vestibule          | 4 Lvs           | 2,100.00        | 8,400          |
|                                  | - double   | 2 pair          | 4,200.00        | 8,400          |
| 3                                | Sliding barn doors c/w hardware and<br>finish to corridors around activity<br>rooms  | 2 No            | 3,500.00        | 7,000          |
| 4                                | Swinging barn doors c/w hardware and<br>finish to corridors around activity<br>rooms | 2 No            | 3,000.00        | 6,000          |
| <b>B12 Doors TOTAL : \$</b>      |  | <b>21 Lvs</b>   | <b>1,947.62</b> | <b>40,900</b>  |

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| B2 FINISHES                 |  | Quantity          | Unit rate        | Amount       |               |
|-----------------------------|--|-------------------|------------------|--------------|---------------|
| <b>B21 Floor Finishes</b>   |  |                   |                  |              |               |
| 1                           | 10mm rubber flooring to walking circuit and multi-purpose space                      | 2,898 SF          | 10.00            | 28,980       |               |
| 2                           | Anti-slip vinyl flooring c/w integral base to kitchen                                | 293 SF            | 5.20             | 1,520        |               |
| 3                           | 12mm cork backed engineered wood flooring to library and community living room space | 4,498 SF          | 12.00            | 53,980       |               |
| 4                           | Porcelain tile to washrooms  | 469 SF            | 11.50            | 5,390        |               |
| <b>B21 Floor Finishes</b>   |  | <b>TOTAL : \$</b> | <b>8,158 SF</b>  | <b>11.02</b> | <b>89,900</b> |
| <b>B22 Ceiling Finishes</b> |  |                   |                  |              |               |
| 1                           | ACT - suspended, t-bar acoustic ceiling  | 7,689 SF          | 6.50             | 49,980       |               |
| 2                           | GWB (moisture resistant) c/w suspended support framing to washrooms                  | 469 SF            | 7.80             | 3,660        |               |
| <b>B22 Ceiling Finishes</b> |  | <b>TOTAL : \$</b> | <b>8,158 SF</b>  | <b>6.57</b>  | <b>53,600</b> |
| <b>B23 Wall Finishes</b>    |  |                   |                  |              |               |
| 1                           | Exterior walls - paint   | 2,496 SF          | 1.50             | 3,740        |               |
| 2                           | Interior walls - paint   | 10,686 SF         | 1.50             | 16,030       |               |
| 3                           | Porcelain wall tile to bathrooms up to 7'  | 504 SF            | 11.50            | 5,800        |               |
| <b>B23 Wall Finishes</b>    |  | <b>TOTAL : \$</b> | <b>13,686 SF</b> | <b>1.87</b>  | <b>25,600</b> |

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| B3 FITTINGS & EQUIPMENT            |  | Quantity          | Unit rate    | Amount        |
|------------------------------------|--|-------------------|--------------|---------------|
| <b>B31 Fittings &amp; Fixtures</b> |  |                   |              |               |
| 1                                  | <b>Bathroom accessories</b>                                |                   | <b>Sum</b>   | <b>5,080</b>  |
|                                    | - grab bars  | 4 no              | 350.00       | 1,400         |
|                                    | - toilet paper dispensers                                  | 3 no              | 125.00       | 380           |
|                                    | - paper towel dispenser / receptacle                       | 3 no              | 300.00       | 900           |
|                                    | - soap dispensers  | 4 no              | 65.00        | 260           |
|                                    | - clothes hook   | 4 no              | 35.00        | 140           |
|                                    | - baby change table  | 2 no              | 500.00       | 1,000         |
|                                    | - mirror   | 4 no              | 250.00       | 1,000         |
| 2                                  | <b>Toilet partitions</b>                                   |                   | <b>Sum</b>   | <b>7,750</b>  |
|                                    | - standard   | 1 no              | 1,500.00     | 1,500         |
|                                    | - accessible   | 3 no              | 1,750.00     | 5,250         |
|                                    | - urinal screens   | 2 no              | 500.00       | 1,000         |
| 3                                  | <b>Millwork</b>  |                   | <b>Sum</b>   | <b>49,290</b> |
|                                    | - circulation desk   | 47 lf             | 450.00       | 21,150        |
|                                    | - allow for miscellaneous millwork                         |                   | allow        | 5,000         |
|                                    | - library shelving, tables, seating by tenant              |                   | nil          |               |
|                                    | - washroom vanities  | 14 lf             | 185.00       | 2,590         |
|                                    | - kitchen counters and cavinets                            | 19 lf             | 450.00       | 8,550         |
|                                    | - work counter in library along exterior wall              | 60 lf             | 200.00       | 12,000        |
| 4                                  | <b>Corner guards to public corridors and service areas</b> |                   | <b>Allow</b> | <b>3,000</b>  |
| 5                                  | <b>Fireplace to community living room c/w mantal</b>       |                   | <b>Sum</b>   | <b>3,500</b>  |
| <b>B31 Fittings &amp; Fixtures</b> |  | <b>TOTAL : \$</b> | <b>8.41</b>  | <b>68,600</b> |
| <b>B32 Equipment</b>               |  |                   |              |               |
| 1                                  | <b>Equipment - assume not required</b>                     |                   | <b>NIC</b>   |               |
| <b>B32 Equipment</b>               |  | <b>TOTAL : \$</b> | <b>0.00</b>  | <b>0</b>      |

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| C1 MECHANICAL                      |  | Quantity          | Unit rate    | Amount        |
|------------------------------------|--|-------------------|--------------|---------------|
| <b>C11 Plumbing &amp; Drainage</b> |  |                   |              |               |
| 1                                  | Fixtures & rough-in  | 1 Sum             | 38,900.00    | 38,900        |
|                                    | - Water closet, flr. mt'd tank type                          | 7 No.             | 900.00       | 6,300         |
|                                    | - Water closet, flr. mt'd tank type , HC                     | 4 No.             | 925.00       | 3,700         |
|                                    | - Urinal   | 2 No.             | 1,350.00     | 2,700         |
|                                    | - Lavatory, countertop, manual faucet                        | 10 No.            | 825.00       | 8,250         |
|                                    | - Kitchen sink   | 1 No.             | 1,300.00     | 1,300         |
|                                    | - Janitor sink   | 1 No.             | 850.00       | 850           |
|                                    | - Drinking fountain, allow                                   | 2 No.             | 2,500.00     | 5,000         |
|                                    | - Fixture rough-in   | 27 No.            | 400.00       | 10,800        |
| 2                                  | Domestic water   | 1 Sum             | 29,350.00    | 29,350        |
|                                    | - Water meter & backflow preventor assembly                  | 1 Sum             | 5,000.00     | 5,000         |
|                                    | - Electric DHW heater, 60USG, 6kW                            | 1 No.             | 3,000.00     | 3,000         |
|                                    | - DHW recirc. pump   | 1 No.             | 1,350.00     | 1,350         |
|                                    | - Allow for piping distribution c/w valves, NFHB etc.        | 1 Sum             | 20,000.00    | 20,000        |
| 3                                  | Sanitary draiange & vent - Allow c/w PVC XFR for above grade | 1 Sum             | 25,000.00    | 25,000        |
| 4                                  | Storm drainge - slope roof, gutters and down spout by arch.  | 1 Nil             | 0.00         | 0             |
| 5                                  | Natural gas - Not provided                                   | 1 Nil             | 0.00         | 0             |
| 6                                  | Miscellaneous  | 1 Sum             | 2,200.00     | 2,200         |
|                                    | - Setting out & sleeving                                     | 1 Sum             | 1,000.00     | 1,000         |
|                                    | - Tagging & identification                                   | 1 Sum             | 200.00       | 200           |
|                                    | - Testing & disinfecting                                     | 1 Sum             | 1,000.00     | 1,000         |
| <b>C11 Plumbing &amp; Drainage</b> |  | <b>TOTAL : \$</b> | <b>11.71</b> | <b>95,500</b> |
| <b>C12 Fire Protection</b>         |  |                   |              |               |
| 1                                  | Sprinkler system - Not sprinklered                           | 1 Nil             | 0.00         | 0             |
| 2                                  | Fire extinguishers   | 8,158 SF          | 0.20         | 1,630         |
| <b>C12 Fire Protection</b>         |  | <b>TOTAL : \$</b> | <b>0.20</b>  | <b>1,600</b>  |

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| C1 MECHANICAL           |   | Quantity | Unit rate | Amount  |
|-------------------------|---|----------|-----------|---------|
| C13 HVAC                |   |          |           |         |
| 1                       | Electric heating - Allow for Entrance heaters , BBH etc.                  | 8,158 SF | 1.80      | 14,680  |
| 2                       | Air distribution equipment  | 8,158 SF | 11.60     | 95,000  |
|                         | - Packaged heat pump units c/w DX cooling, electric heating, total 30 ton | 1 Sum    | 95,000.00 | 95,000  |
| 3                       | Air distribution ductwork & devices                                       | 8,158 SF | 9.80      | 79,950  |
| 4                       | Exhaust & ventilation   | 8,158 SF | 1.70      | 13,870  |
| 5                       | 24/ 7 cooling, allow  | 1 Sum    | 5,000.00  | 5,000   |
| 6                       | Testing, adjusting & balancing  | 1 Sum    | 4,000.00  | 4,000   |
| 7                       | Commissioning   | 1 Sum    | 6,000.00  | 6,000   |
| 8                       | Miscellaneous   | 1 Sum    | 4,600.00  | 4,600   |
|                         | - Setting out & sleeving  | 1 Sum    | 1,000.00  | 1,000   |
|                         | - Tagging & identification  | 1 Sum    | 600.00    | 600     |
|                         | - Rigging of equipment  | 1 Sum    | 3,000.00  | 3,000   |
| C13 HVAC TOTAL : \$     |   | 8,158 SF | 27.35     | 223,100 |
| C14 Controls            |   |          |           |         |
| 1                       | DDC controls  | 8,158 SF | 4.50      | 36,710  |
| C14 Controls TOTAL : \$ |   | 8,158 SF | 4.50      | 36,700  |

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| C2 ELECTRICAL                              |   | Quantity          | Unit rate       | Amount       |                |
|--|---|-------------------|-----------------|--------------|----------------|
| <b>C21 Service &amp; Distribution</b>      |   |                   |                 |              |                |
| 1  | 400A 600V 3P 4W main distribution c/w breakers, metering & SPD                            |                   | Sum             | 26,000       |                |
| 2  | Balance of distribution equipment, feeders & grounding                                    | 8,158 SF          | 4.00            | 32,630       |                |
| 3  | Permits, fees, inspections, as-built drawings, etc.                                       |                   | Sum             | 6,500        |                |
| 4  | Allowance for Solar Photovoltaic Panels, 25kW capacity (2,932 sf)                         |                   | Sum             | 60,000       |                |
| <b>C21 Service &amp; Distribution</b>      |   | <b>TOTAL : \$</b> | <b>8,158 SF</b> | <b>15.33</b> | <b>125,100</b> |
| <b>C22 Lighting, Devices &amp; Heating</b> |   |                   |                 |              |                |
| 1  | Lighting supply, install & wiring   | 8,158 SF          | 9.00            | 73,420       |                |
|  | - allow for architectural LED lighting, high bay fixtures & LED troffers in meeting rooms | 8,158 SF          | 9.00            | 73,420       |                |
| 2  | Exit & emergency lighting   | 8,158 SF          | 0.70            | 5,710        |                |
|  | - allow for running man exit lights, remote heads & emergency battery units               | 8,158 SF          | 0.70            | 5,710        |                |
| 3  | Lighting control  | 8,158 SF          | 1.90            | 15,500       |                |
|  | - provision for local switches, dimming switches, occupancy & vacancy sensors             | 8,158 SF          | 1.90            | 15,500       |                |
| 4  | Power outlets, devices & connections  | 8,158 SF          | 4.20            | 34,260       |                |
|  | - allow for power outlets, devices & connections  | 8,158 SF          | 4.20            | 34,260       |                |
| 5  | Electric heating  | 8,158 SF          | 2.00            | 16,320       |                |
|  | - provision for electric baseboard heating throughout building                            | 8,158 SF          | 2.00            | 16,320       |                |
| 6  | Mechanical connections - allow  | 8,158 SF          | 1.20            | 9,790        |                |
| <b>C22 Lighting, Devices &amp; Heating</b> |   | <b>TOTAL : \$</b> | <b>8,158 SF</b> | <b>19.00</b> | <b>155,000</b> |

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| C2 ELECTRICAL                        |  | Quantity          | Unit rate    | Amount         |
|--------------------------------------|--|-------------------|--------------|----------------|
| <b>C23 Systems &amp; Ancillaries</b> |  |                   |              |                |
| 1                                    | Fire alarm   | 8,158 SF          | 3.70         | 30,180         |
|                                      | - provision for fully addressable, single stage FA system                    | 8,158 SF          | 3.70         | 30,180         |
| 2                                    | Communications empty conduit   | 8,158 SF          | 1.20         | 9,790          |
|                                      | - allow for communications rough-in, zone conduit, cable tray & firestopping | 8,158 SF          | 1.20         | 9,790          |
| 3                                    | Communications cabling   | 8,158 SF          | 3.50         | 28,550         |
|                                      | - allow for horizontal drops, fibre optic cabling & cable management         | 8,158 SF          | 3.50         | 28,550         |
| 4                                    | Security intrusion alarm system  | 8,158 SF          | 5.00         | 40,790         |
|                                      | - provision for intrusion alarm system c/w devices, wiring & testing         | 8,158 SF          | 5.00         | 40,790         |
| 5                                    | Public address system  | 8,158 SF          | 1.20         | 9,790          |
|                                      | - allow for PA system c/w speakers, cabling & head-end equipment             | 8,158 SF          | 1.20         | 9,790          |
| 6                                    | CATV system  | 8,158 SF          | 0.40         | 3,260          |
|                                      | - allow for outlets, cables, splitters/attenuators & distribution amplifiers | 8,158 SF          | 0.40         | 3,260          |
| <b>C23 Systems &amp; Ancillaries</b> |  | <b>TOTAL : \$</b> | <b>15.00</b> | <b>122,400</b> |

**PUGWASH LIBRARY & MULTI-PURPOSE CENTRE  
NEW CONSTRUCTION  
PUGWASH, NOVA SCOTIA**

Report date : March 2021

Page No. : A - 14

| D1 SITE WORK   | Quantity     | Unit rate         | Amount         |
|--|--------------|-------------------|----------------|
| D11 Site Development   |              |                   |                |
| 1 Asphalt c/w typical subgrade below   | 5,082 SF     | 5.50              | 27,950         |
| 2 Curb to perimeter of parking   | 319 LF       | 32.00             | 10,210         |
| 3 Concrete slab to pathways  | 2,291 SF     | 9.50              | 21,760         |
| 4 Concrete ramps c/w tempered glass  |              | Allow             | 12,000         |
| 5 Main entrance stairs and landing   | 188 SF       | 25.00             | 4,700          |
| 6 Unit pavers at front entry way   | 913 SF       | 35.00             | 31,960         |
| 7 Stone walkway to outdoor program area                                      | 116 SF       | 65.00             | 7,540          |
| 8 Fence enclosure, allow for wooden frame and finish to outdoor program area | 67 LF        | 98.00             | 6,570          |
| 9 Topsoil and SOD to entrance areas  | 1,043 SF     | 2.50              | 2,610          |
| 10 Topsoil and seeding   | 4,228 SF     | 1.10              | 4,650          |
| 11 Line painting   |              | Allow             | 1,500          |
| 12 Allowance for soft landscapes and plantings                               |              | Allow             | 7,500          |
| 13 Allowance for signage   |              | Allow             | 5,000          |
| 14 Bike racks  | 4 No         | 480.00            | 1,920          |
| 15 Site furnishings - NIC  |              | NIC               |                |
| D11 Site Development <b>TOTAL : \$</b>                                       | <b>1 Sum</b> | <b>145,900.00</b> | <b>145,900</b> |
| D12 Mechanical Site Services   |              |                   |                |
| 1 Water main   | 1 Sum        | 20,000.00         | 20,000         |
| - Allow for street connection, max. 100' from building                       | 1 Sum        | 20,000.00         | 20,000         |
| <b>Carried Forward :</b>   |              |                   | <b>20,000</b>  |

**PUGWASH LIBRARY & MULTI-PURPOSE CENTRE  
NEW CONSTRUCTION  
PUGWASH, NOVA SCOTIA**

Report date : March 2021

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| D1 SITE WORK  | Quantity | Unit rate                | Amount |
|---|----------|--------------------------|--------|
| D12 Mechanical Site Services (Continued)  |          | <b>Brought Forward :</b> | 20,000 |
| 2 Sanitary drainage<br>- Allow for street connection, max. 100'<br>from building      | 1 Sum    | 20,000.00                | 20,000 |
|   | 1 Sum    | 20,000.00                | 20,000 |
| 3 Storm drainge - Assume not provided,<br>surface run off                             | 1 Nil    | 0.00                     | 0      |
| D12 Mechanical Site Services <b>TOTAL : \$</b>  | 1 Sum    | 40,000.00                | 40,000 |
| D13 Electrical Site Services<br><u>Incoming power</u>                                 |          |                          |        |
| 1 Primary ductbank - allow  |          | Sum                      | 10,000 |
| 2 Transformer by Utility  |          | Nil                      |        |
| 3 Transformer pad & grounding - allow   |          | Sum                      | 8,500  |
| 4 Secondary ductbank & cabling - allow  |          | Sum                      | 20,000 |
| <u>Incoming communication</u>   |          |                          |        |
| 5 Incoming U/G communication ductbank -<br>allow                                      |          | Sum                      | 6,000  |
| <u>Site lighting</u>  |          |                          |        |
| 6 Provision for building mounted<br>luminaires - full cut-off & dark sky<br>compliant |          | Sum                      | 12,000 |
| 7 Miscellaneous parking lot lighting c/w<br>U/G conduit & wiring                      |          | Sum                      | 15,000 |
| D13 Electrical Site Services <b>TOTAL : \$</b>  | 1 Sum    | 71,500.00                | 71,500 |

**Appendix  
B - Drawing List**

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**APPENDIX B - Drawing List**

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**ARCHITECTURAL**

| <b>Number</b> | <b>Drawing<br/>Title</b>  | <b>Dated</b> | <b>Received</b> |
|---------------|---|--------------|-----------------|
| A0            | Site Plan   | 22-Jan-21    | 22-Jan-21       |
| A1.1          | Plan - Primary<br>Configuration   | 22-Jan-21    | 22-Jan-21       |
| A1.2          | Plan - Alternate Multi-Purpose<br>Configuration                               | 22-Jan-21    | 22-Jan-21       |
| A2.1          | Elevation - North<br>(Front)  | 22-Jan-21    | 22-Jan-21       |
| A2.2          | Elevation - East  | 22-Jan-21    | 22-Jan-21       |
| A2.3          | Elevation - South   | 22-Jan-21    | 22-Jan-21       |
| A2.4          | Elevation - West  | 22-Jan-21    | 22-Jan-21       |
| Email         | Cost Estimate Amendments & Envelope Material with<br>Quantities from SketchUp |              | 23-Feb-21       |
| Email         | Revised Envelope Material with Quantities from<br>SketchUp                    |              | 10-Mar-21       |



**APPENDIX F:**

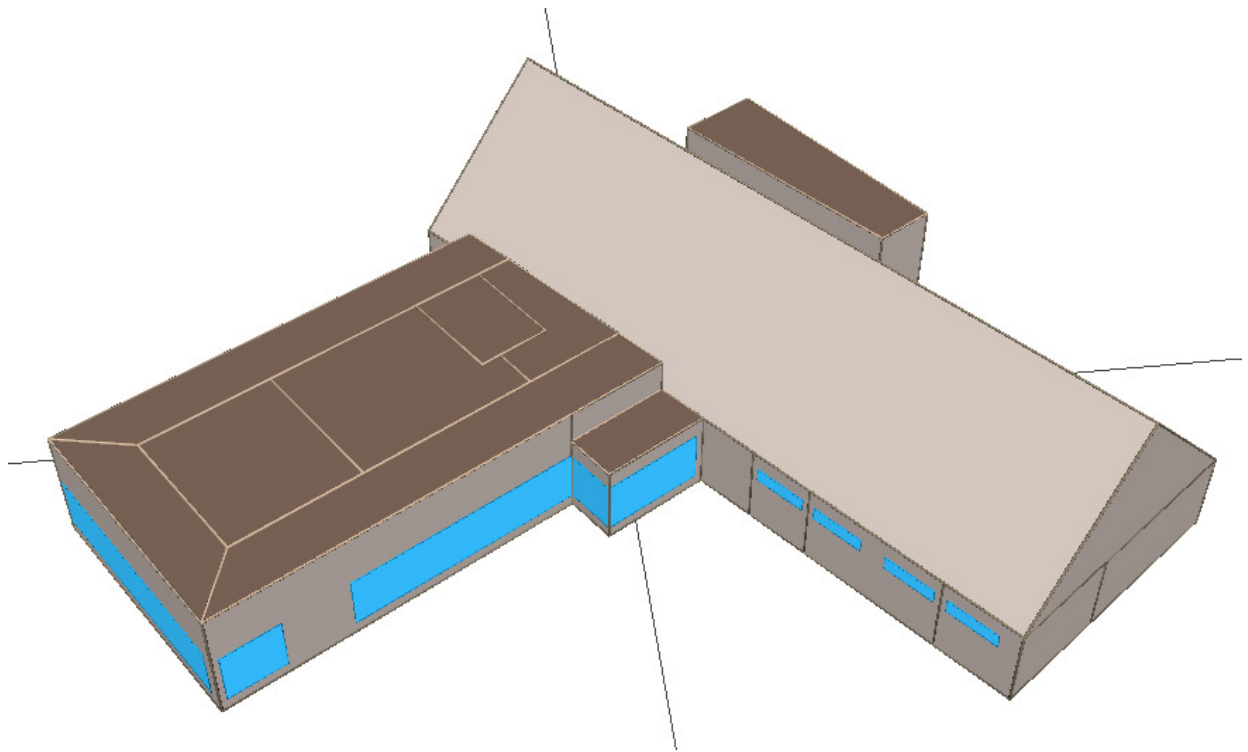
**Energy Modelling Report**



REPORT N°: 209-00244-00

# PUGWASH LIBRARY & MULTI-PURPOSE CENTRE PRELIMINARY ENERGY MODELING REPORT

MARCH 2021







# PUGWASH LIBRARY & MULTI-PURPOSE CENTRE

## PRELIMINARY ENERGY MODELING REPORT

PUGWASH VILLAGE COMMISSION

REVISION 3

PROJECT NO.: 209-00224-00  
DATE: 2021-03-14

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# SIGNATURES

PREPARED BY



March 14, 2021

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Date

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March 14, 2021

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---

Date

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# EXECUTIVE SUMMARY

This energy modeling report was prepared by WSP in order to evaluate energy conservation measures for the new Pugwash Library & Multi-Purpose Centre.

High performance building envelope:

- Wall insulation
- Roof insulation
- High performance double glazing
- Triple glazing

HVAC systems and on-site electricity generation:

- Ground Source Heat Pump (GSHP)
- Air Source Heat Pump (ASHP)
- Exhaust air heat recovery
- CO2 sensors
- High performance boiler
- Natural ventilation
- Photovoltaics

Table 1 below presents a summary of the energy conservation measures and the associated energy savings, greenhouse gas emissions reductions, incremental costs and periods of return on investment (ROI).

Table 1 - Summary of energy conservation measures

| Energy Conservation Measure (ECM) |                                 | Annual savings |                   |        |            | Net measure cost | Simple ROI (yrs) |
|-----------------------------------|---------------------------------|----------------|-------------------|--------|------------|------------------|------------------|
| #                                 | Description                     | Propane (L)    | Electricity (kWh) | \$     | CO2 (tons) |                  |                  |
| 1                                 | Wall insulation                 | 380            | 264               | 290    | 0.8        | 14 330 \$        | 49.4             |
| 2                                 | Roof insulation                 | 346            | 264               | 265    | 0.7        | 14 270 \$        | 53.8             |
| 3                                 | High Performance Double Glazing | 788            | 352               | 569    | 1.4        | 6 273 \$         | 11.0             |
| 4                                 | Triple Glazing                  | 1 101          | 2 375             | 1 098  | 3.4        | 117 330 \$       | 106.9            |
| 5                                 | Ground Source Heat Pump         | 15 398         | -45 127           | 4 202  | -9.2       | 50 000 \$        | 11.9             |
| 6                                 | Air Source Heat Pump            | 14 489         | -30 671           | 5 572  | -0.1       | 30 000 \$        | 5.4              |
| 7                                 | Exhaust air heat recovery       | 784            | 323               | 652    | 1.4        | 6 600 \$         | 10.1             |
| 8                                 | CO2 sensors                     | 534            | 733               | 485    | 1.3        | 3 000 \$         | 6.2              |
| 9                                 | High performance boiler         | 5 534          | -29               | 3 595  | 8.4        | 4 200 \$         | 1.2              |
| 10                                | Natural ventilation             | 0              | 6 879             | 921    | 5.0        | 4 000 \$         | 4.3              |
| 11                                | Photovoltaics                   | 0              | 18 209            | 2 451  | 13.1       | 60 000 \$        | 24.5             |
| Bundle 1                          | ECM 1/2/4/7/8/9/10/11           | 8 062          | 28 357            | 9 184  | 32.6       | 223 730 \$       | 24.4             |
| Bundle 2                          | ECM 1/2/4/6/7/8/9/10/11         | 20 303         | -3 789            | 12 847 | 28.0       | 253 730 \$       | 19.7             |





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# 1 INTRODUCTION

---

## 1.1 PURPOSE

The report summarizes the energy modeling methodology, inputs, assumptions, results and conclusions for new Pugwash Library & Multi-Purpose Centre in Nova Scotia. The report is divided into three main sections: one for the baseline building, one for the energy conservation measures and one for the bundles of energy conservation measures.

---

## 1.1 DISCLAIMER

Note that the simulations performed during this assignment are only intended to evaluate the energy cost performance of several energy conservation measures compared to a baseline building. Energy cost results cannot be interpreted as actual expectations while the building is in operation. Variation in occupancy, variations in control and maintenance, variations in weather, changes in energy rates and precision of the simulation program are potential reasons why the actual building performance may differ from the predictions.

# 2 BASELINE MODEL

---

## 2.1 BUILDING DESCRIPTION

The project is a new construction located in Pugwash, Nova Scotia. It is a one-storey 8,200 ft<sup>2</sup> building which consists of a library section (Library, library admin, program room, admin meeting room, work room) and multi-purpose centre (Multi-purpose #1, multipurpose #2, storage, living rooms, kitchen, washroom, walking circuit, corridor, vestibule, service/storage).

---

## 2.2 REFERENCE DOCUMENTS

The energy model is based on the following documents:

- Architectural drawings – January 22<sup>th</sup>, 2021
  - National Energy Code for Buildings 2017 (NECB 2017)
  - Correspondence with the architects and sustainability specialist
- 

## 2.3 MODELING METHODOLOGY

The energy model was created with eQuest v3.65 simulation software which uses the DOE 2.3 simulation engine and calculates energy consumption and cost on an hourly basis, based on a detailed set of inputs that includes the following:

- Building orientation
- Building configuration
- Glass to wall ratio
- Type of glazing
- Type of building materials and construction
- Internal and external shading
- Internal lighting types and schedules
- Heating and cooling loads and schedules
- Zone temperature set point and schedules
- Terminal equipment characteristics and performance
- Central system characteristics and performance
- Energy type and cost

## 2.4 DETAILED MODELING INPUTS

The following table presents the baseline building parameters. Please note that the baseline building is not entirely based on NECB 2017. For instance, HVAC system type is not the theoretical one required by the code but one which seems a more realistic choice considering the project size and function.

**Table 1 : Summary of baseline building parameters**

| <b>Baseline building</b>  |
|---|
| Climatic Zone: NECB 2017 - Zone 6   |
| Weather data: CWEC file of Greenwood, Nova Scotia   |
| Schedules: NECB Schedule C for the entire building (see Appendix for details).<br>Outdoor air is provided only during occupied hours. |
| Modeled Floor Area: 8 182 ft <sup>2</sup>   |
| <b>Envelope performance</b>   |
| As per NECB 2017 requirements:  |
| <b>Walls</b><br>U = 0.043 BTU/h.ft <sup>2</sup> .°F, R=23 h.ft <sup>2</sup> °F/BTU  |
| <b>Roofs</b><br>U = 0.027 BTU/h.ft <sup>2</sup> .°F, R=37 h.ft <sup>2</sup> °F/BTU  |
| <b>Windows</b><br>U = 0.33 BTU/h.ft <sup>2</sup> .°F, R=3 h.ft <sup>2</sup> °F/BTU - SHGC = 0.40                                      |
| <b>Interior Lighting</b>  |
| As per NECB 2017 requirements based on space function:  |
| Food Preparation Area: 1.06 W/ft <sup>2</sup>   |
| Storage: 0.63 W/ft <sup>2</sup>   |
| Electrical/Mechanical Room: 0.43 W/ft <sup>2</sup>  |
| Library (reading area): 0.82 W/ft <sup>2</sup>  |
| Library (stacks): 1.20 W/ft <sup>2</sup>  |
| Office: 0.93 W/ft <sup>2</sup>  |
| Corridors: 0.66 W/ft <sup>2</sup>   |
| Multi-Purpose, Conference: 1.07 W/ft <sup>2</sup>   |
| Washrooms: 0.85 W/ft <sup>2</sup>   |

## Receptacle Loads

As per NECB 2017 requirements based on space function:

Food Preparation Area: 0.93 W/ft<sup>2</sup>

Storage: 0.09 W/ft<sup>2</sup>

Electrical/Mechanical Room: 0.09 W/ft<sup>2</sup>

Library (reading area): 0.09 W/ft<sup>2</sup>

Library (stacks): 0.00 W/ft<sup>2</sup>

Office: 0.70 W/ft<sup>2</sup>

Corridors: 0.00 W/ft<sup>2</sup>

Multi-Purpose, Conference: 0.09 W/ft<sup>2</sup>

Washrooms: 0.09 W/ft<sup>2</sup>

## Occupants

As per NECB 2017 default values:

Food Preparation Area: 215 ft<sup>2</sup>/occ

Storage: 1,076 ft<sup>2</sup>/occ

Electrical/Mechanical Room: 2,152 ft<sup>2</sup>/occ

Library (reading area): 215 ft<sup>2</sup>/occ

Library (stacks): 215 ft<sup>2</sup>/occ

Office: 215 ft<sup>2</sup>/occ

Corridors: 1,076 ft<sup>2</sup>/occ

Multi-Purpose, Conference: 54 ft<sup>2</sup>/occ

Washrooms: 323 ft<sup>2</sup>/occ

## Waterside HVAC

Baseline waterside HVAC concept is an assumption made by WSP:

### Heating:

- Propane boiler, 85% eff., capacity: auto-sized
- Hot water loop: T<sub>supply</sub>=120°F, Delta T=10°F, no reset
- Hot water pump: head: 40 ft, mechanical eff. 77%, motor eff. 90%, variable volume with VFD

### Domestic Hot Water:

- Electric domestic hot water heater with autosized capacity and autosized tank volume
- Domestic hot water demand: based on default W/occ values from NECB 2017

## Airside HVAC

Baseline airside HVAC concept is an assumption made by WSP:

One variable air volume system with reheat for the whole building:

- Supply fan: total static pressure: 4 in H<sub>2</sub>O, mechanical eff. 61%, motor eff. 90%
- Return fan: total static pressure: 1 in H<sub>2</sub>O, mechanical eff. 33%, motor eff. 90%

- Hydronic heating, capacity auto-sized, two-way valve
- DX cooling, capacity auto-sized, EER=9.5
- Dual Enthalpy economizer
- No heat recovery

### Minimum Outdoor/Exhaust Airflows

Outdoor airflows were estimated based on ASHRAE 62.1 ventilation procedure rate based on space function. A zone effectiveness of 0.80 was assumed. A diversity of 1.0 was considered.

#### Outdoors Airflows:

Conference/Meeting: 5 CFM/occ + 0.06 CFM/ft<sup>2</sup>

Corridors: 0.06 CFM/ft<sup>2</sup>

Office: 5 CFM/occ + 0.06 CFM/ft<sup>2</sup>

Library: 5 CFM/occ + 0.12 CFM/ft<sup>2</sup>

Total Area-Based outdoor flowrate: 955 CFM

Total Occupant-Based outdoor flowrate: 365 CFM

Total outdoor flowrate: 1,320 CFM

#### Exhaust Airflows:

Washrooms: 50 CFM/unit (Assumed 10 units)

Kitchen: 0.30 CFM/ft<sup>2</sup>

Total exhaust flowrate: 588 CFM

Minimum outdoor airflows are considered constant during occupied hours only (no demand control ventilation).

### Utility Rates

#### Propane:

0.65 \$/L based on data from another project in Nova Scotia

#### Electricity:

- Energy charge:
  - <= 200 kWh: 0.1254 \$/kWh
  - Rest of energy: 0.09266 \$/kWh
- Demand charge: 10.50 \$/kW

### Greenhouse Gas Emission Factors

#### Propane:

1.515 kg CO<sub>2</sub>e/L

#### Electricity:

0.720 kg CO<sub>2</sub>e/kWh

---

## 2.5 BASELINE MODEL RESULTS

---

### 2.5.1 ENERGY USE

Table 2 – Baseline building annual energy use breakdown

| Baseline Building |                  |              |            |
|-------------------|------------------|--------------|------------|
|                   | Electricity (MJ) | Propane (MJ) | Total (MJ) |
| Lights            | 108 410          | 0            | 108 410    |
| Misc. Equip.      | 12 773           | 0            | 12 773     |
| Space Heating     | 0                | 653 839      | 653 839    |
| Space Cooling     | 30 190           | 0            | 30 190     |
| Pumps & Hum.      | 50 035           | 0            | 50 035     |
| Fans              | 78 537           | 0            | 78 537     |
| DHW               | 26 707           | 0            | 26 707     |
| Total             | 306 652          | 653 839      | 960 490    |

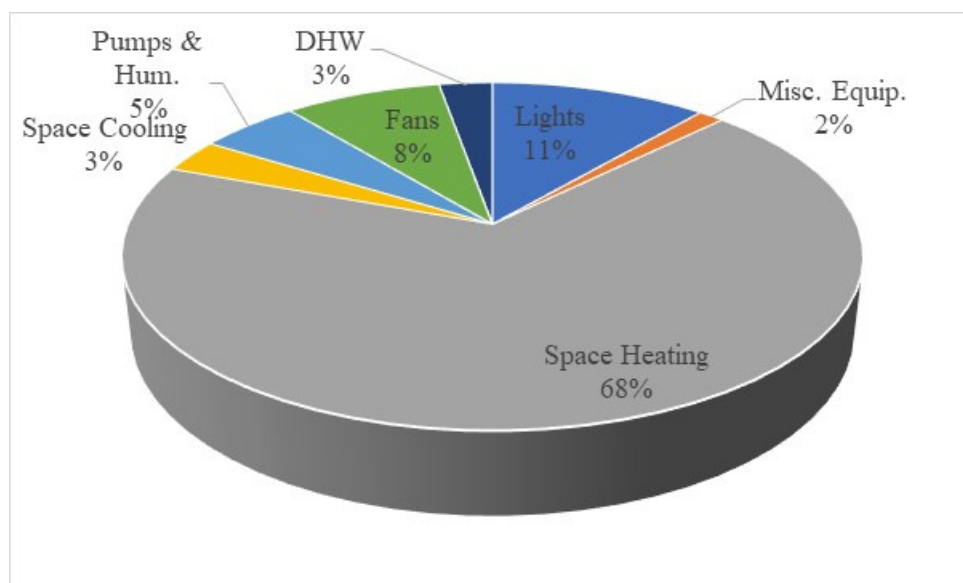


Figure 1 - Baseline building energy use breakdown

---

## 2.5.2 ENERGY COSTS

Table 3 - Annual energy costs

|                | Electricity | Propane   | Total     |
|----------------|-------------|-----------|-----------|
| Operating Cost | 11 492 \$   | 16 791 \$ | 28 283 \$ |

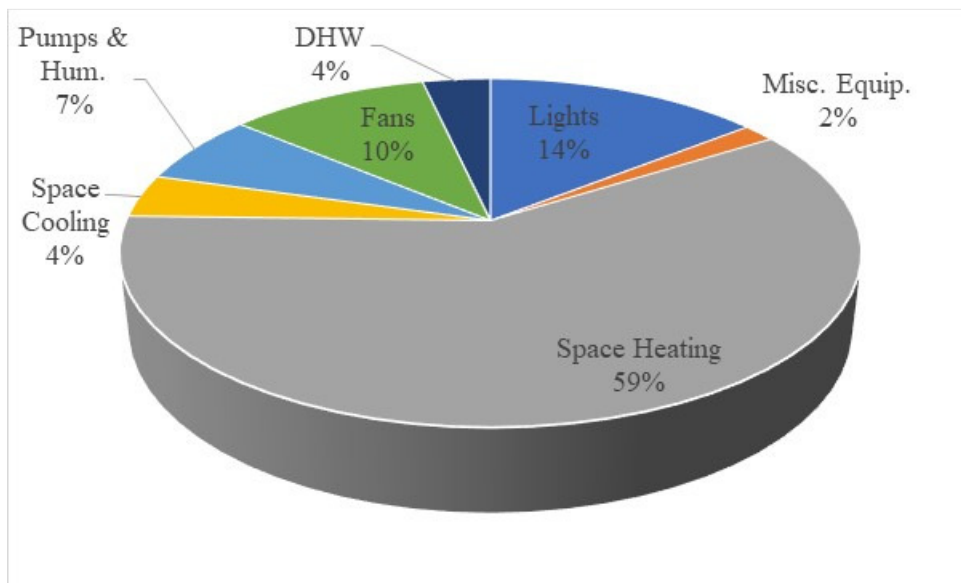


Figure 2 - Baseline building energy cost breakdown

# 3 ENERGY CONSERVATION MEASURES

The preliminary energy model was used to evaluate the energy cost savings and greenhouse emissions reduction performance of eleven energy conservation measures (ECM).

Each measure is compared separately to the baseline in order to determine whether its implementation represents an interesting investment. The period of return on investment (ROI) is also presented.

---

## 3.1 ENVELOPE PERFORMANCE

---

### 3.1.1 EXTERIOR WALLS INSULATION

#### Baseline walls

The exterior walls thermal performance meets the NECB 2017 requirements:

$$U = 0.043 \text{ BTU/h.ft}^2\text{°F}, R=23 \text{ h.ft}^2\text{°F/BTU}$$

#### Improved walls

It is proposed to increase the exterior walls thermal resistance by 20% over the NECB 2017, which translates into adding one inch of R-5 insulation.

$$U = 0.036 \text{ BTU/h.ft}^2\text{°F}, R=28 \text{ h.ft}^2\text{°F/BTU} (+20\%/NECB 2017)$$

ECM cost provided by the cost consultant: \$14,330

Table 4 – ECM #1: Improved exterior walls insulation

| Energy Conservation Measure (ECM) |                 | Annual savings |                   |     |            | Net measure cost | Simple ROI (yrs) |
|-----------------------------------|-----------------|----------------|-------------------|-----|------------|------------------|------------------|
| #                                 | Description     | Propane (L)    | Electricity (kWh) | \$  | CO2 (tons) |                  |                  |
| 1                                 | Wall insulation | 380            | 264               | 290 | 0.8        | 14 330 \$        | 49.4             |

---

### 3.1.2 ROOFS INSULATION

#### Baseline Roofs

The roofs thermal performance meets the NECB 2017 requirements:

$$U = 0.027 \text{ BTU/h.ft}^2\text{°F}, R=37 \text{ h.ft}^2\text{°F/BTU}$$

#### Improved Roofs

It is proposed to increase the roofs thermal resistance by 20% over the NECB 2017, which translates into adding one inch of R-6 insulation.

$$U = 0.023 \text{ BTU/h.ft}^2\text{°F}, R=44.4 \text{ h.ft}^2\text{°F/BTU} (+20\%/NECB 2017)$$

ECM cost provided by the cost consultant: \$14,270

Table 5 - ECM #2: Improved roofs insulation

| Energy Conservation Measure (ECM) |                 | Annual savings |                   |     |            | Net measure cost | Simple ROI (yrs) |
|-----------------------------------|-----------------|----------------|-------------------|-----|------------|------------------|------------------|
| #                                 | Description     | Propane (L)    | Electricity (kWh) | \$  | CO2 (tons) |                  |                  |
| 2                                 | Roof insulation | 346            | 264               | 265 | 0.7        | 14 270 \$        | 53.8             |

### 3.1.3 HIGH PERFORMANCE DOUBLE GLAZING

#### Baseline windows

The windows thermal performance meets the NECB 2017 requirements:

$U = 0.33 \text{ BTU/h.ft}^2\text{°F} / \text{SHGC} = 0.40$  (Note: the SHGC is an assumption made by WSP)

#### Improved windows

It is proposed to improve the windows thermal resistance by approximately 10% by using high performance double glazing with a lower emissivity.

$U = 0.29 \text{ BTU/h.ft}^2\text{°F} / \text{SHGC} = 0.40$  (Note: It is assumed the SHGC will remain the same as in baseline)

ECM cost: 2.94 \$/ft<sup>2</sup>

Table 6 – ECM #3: High performance double glazed windows

| Energy Conservation Measure (ECM) |                                 | Annual savings |                   |     |            | Net measure cost | Simple ROI (yrs) |
|-----------------------------------|---------------------------------|----------------|-------------------|-----|------------|------------------|------------------|
| #                                 | Description                     | Propane (L)    | Electricity (kWh) | \$  | CO2 (tons) |                  |                  |
| 3                                 | High Performance Double Glazing | 788            | 352               | 569 | 1.4        | 6 273 \$         | 11.0             |

### 3.1.4 TRIPLE GLAZING

#### Baseline windows

The windows thermal performance meets the NECB 2017 requirements:

$U = 0.33 \text{ BTU/h.ft}^2\text{°F} / \text{SHGC} = 0.40$  (Note: the SHGC is an assumption made by WSP)

#### Improved windows

It is proposed to improve the windows thermal resistance by approximately 33% by using triple glazing with two layers of low-e coating.

$U = 0.22 \text{ BTU/h.ft}^2\text{°F} / \text{SHGC} = 0.32$

ECM cost provided by the cost consultant: \$117,330

Table 7 – ECM #4: Triple glazed windows

| Energy Conservation Measure (ECM) |                | Annual savings |                   |       |            | Net measure cost | Simple ROI (yrs) |
|-----------------------------------|----------------|----------------|-------------------|-------|------------|------------------|------------------|
| #                                 | Description    | Propane (L)    | Electricity (kWh) | \$    | CO2 (tons) |                  |                  |
| 4                                 | Triple Glazing | 1 101          | 2 375             | 1 098 | 3.4        | 117 330 \$       | 106.9            |

## 3.2 GROUND SOURCE HEAT PUMP (GSHP)

### Baseline heating and cooling

In the baseline building, all the heating is provided by a propane boiler which serves a hydronic loop whereas all the cooling is provided by a direct expansion coil in the air handling unit.

### Improved heating and cooling

It is proposed to implement a ground source heat pump (GSHP) to provide all the cooling and part of the heating of the building. A ground source heat pump is a central heating and cooling system that transfers heat to or from the ground by using a vapor-compression refrigeration cycle. The ground source heat pump would be connected to a series of closed loop vertical boreholes. Since it is not economical to size the ground source heat pump and borehole field for the building peak cooling load, it would be sized for the peak cooling load and a propane boiler would be installed to provide the remaining of heating loads. It is assumed that the propane boiler would be sized for the building peak heating load. The ground source heat pump COP is assumed to be 3.3 in heating mode and 3.7 in cooling mode. The geothermal pump is assumed to be constant volume, with a head of 80 ft, a mechanical efficiency of 77% and a motor efficiency of 90%.

ECM cost: ground source heat pump + boreholes: 4,000 \$/ton (1,500 \$/ton for the DX coil to be subtracted)

Table 8 – ECM #5: Ground source heat pump

| Energy Conservation Measure (ECM) |                         | Annual savings |                   |       |            | Net measure cost | Simple ROI (yrs) |
|-----------------------------------|-------------------------|----------------|-------------------|-------|------------|------------------|------------------|
| #                                 | Description             | Propane (L)    | Electricity (kWh) | \$    | CO2 (tons) |                  |                  |
| 5                                 | Ground Source Heat Pump | 15 398         | -45 127           | 4 202 | -9.2       | 50 000 \$        | 11.9             |

## 3.3 AIR SOURCE HEAT PUMP (ASHP)

### Baseline heating and cooling

In the baseline building, all the heating is provided by a propane boiler which serves a hydronic loop whereas all the cooling is provided by a direct expansion coil in the air handling unit.

### Improved heating and cooling

It is proposed to implement an air source heat pump (ASHP) to provide all the cooling and part of the heating of the building. An air source heat pump is a central heating and/or cooling system that transfers heat to or from the outdoor air by using a vapor-compression refrigeration cycle. When the outdoor air temperature is low, the air-source heat

pump heating capacity and performance decrease, therefore a back-up heating equipment is required. The air-source heat pump would be sized for the peak cooling load and a propane boiler would be installed to provide the remaining of heating loads. It is assumed that the propane boiler would be sized for the building peak heating load. The air source heat pump COP is assumed to be 2.7 in heating mode and 3.5 in cooling mode.

ECM cost: air source heat pump + boreholes: 3,000 \$/ton (1,500 \$/ton for the DX coil to be subtracted)

Table 9 – ECM #6: Air source heat pump

| Energy Conservation Measure (ECM) |                      | Annual savings |                   |       |            | Net measure cost | Simple ROI (yrs) |
|-----------------------------------|----------------------|----------------|-------------------|-------|------------|------------------|------------------|
| #                                 | Description          | Propane (L)    | Electricity (kWh) | \$    | CO2 (tons) |                  |                  |
| 6                                 | Air Source Heat Pump | 14 489         | -30 671           | 5 572 | -0.1       | 30 000 \$        | 5.4              |

## 3.4 EXHAUST AIR ENERGY RECOVERY

### Baseline exhaust air energy recovery

The baseline building does not have exhaust air energy recovery.

### Improved exhaust air energy recovery

The proposed installation of an energy recovery unit with an enthalpy wheel will allow sensible and latent energy to be recovered from the exhaust air to treat the fresh air entering the building. A sensible effectiveness of 70% and a latent effectiveness of 65% were assumed. It was also assumed that the enthalpy wheel would be operating when the AHU is not in economizer mode and that the wheel speed would modulate to maintain the desired mixed-air setpoint. An additional static pressure of 0.50 in H<sub>2</sub>O was considered on the outdoor air and exhaust air streams.

ECM cost: 5.00 \$/CFM

Table 10 – ECM #7: Exhaust air energy recovery

| Energy Conservation Measure (ECM) |                           | Annual savings |                   |     |            | Net measure cost | Simple ROI (yrs) |
|-----------------------------------|---------------------------|----------------|-------------------|-----|------------|------------------|------------------|
| #                                 | Description               | Propane (L)    | Electricity (kWh) | \$  | CO2 (tons) |                  |                  |
| 7                                 | Exhaust air heat recovery | 784            | 323               | 652 | 1.4        | 6 600 \$         | 10.1             |

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## 3.5 CO2 SENSORS

### Baseline minimum outdoor air control

In the baseline building, the minimum outdoor air flow is constant and there is no demand control ventilation strategy.

### Improved minimum outdoor air control

CO<sub>2</sub> sensors allow modulating the opening of outdoor dampers depending on the CO<sub>2</sub> concentrations reading in the zones, meaning the occupant based outdoor air flow can be reduced resulting in energy savings. The method outlined in LEED modeling guide was used in order to calculate an average outdoor airflow during occupied hours based on the variations of occupancy. Based on these calculations, the average outdoor airflow could be reduced by 15% with CO<sub>2</sub> sensors.

ECM cost: 1,500 \$/rooftop (controls) + 300 \$/sensor (5 sensors considered in the building)

Table 11 – ECM #8: CO2 sensors

| Energy Conservation Measure (ECM) |             | Annual savings |                   |     |            | Net measure cost | Simple ROI (yrs) |
|-----------------------------------|-------------|----------------|-------------------|-----|------------|------------------|------------------|
| #                                 | Description | Propane (L)    | Electricity (kWh) | \$  | CO2 (tons) |                  |                  |
| 8                                 | CO2 sensors | 534            | 733               | 485 | 1.3        | 3 000 \$         | 6.2              |

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## 3.6 CONDENSING BOILER

### Baseline boiler

In the baseline building, a standard efficiency propane boiler is considered (85% eff.)

### Improved boiler

It is proposed to install a condensing boiler. Condensing boilers achieve high efficiency (typically greater than 90% on the higher heating value) by condensing water vapour in the exhaust gases and so recovering its latent heat of vaporisation, which would otherwise have been wasted. An efficiency of 95% was assumed for the condensing boiler.

ECM cost: 14.00 \$/MBH

Table 12 – ECM #9: Condensing boiler

| Energy Conservation Measure (ECM) |                         | Annual savings |                   |       |            | Net measure cost | Simple ROI (yrs) |
|-----------------------------------|-------------------------|----------------|-------------------|-------|------------|------------------|------------------|
| #                                 | Description             | Propane (L)    | Electricity (kWh) | \$    | CO2 (tons) |                  |                  |
| 9                                 | High performance boiler | 5 534          | -29               | 3 595 | 8.4        | 4 200 \$         | 1.2              |

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## 3.7 NATURAL VENTILATION

### Baseline natural ventilation strategy

No natural ventilation strategy is considered in the baseline building.

### Improved natural ventilation strategy

Natural ventilation is the process of supplying air to and removing air from an indoor space without using the main airside mechanical systems. When conditions are favorable, this strategy can contribute to achieve indoor air quality requirements and can also provide free cooling which results in savings in fan and cooling energy. More specifically for this project, it was assumed that the natural ventilation would still require a low consumption exhaust fan. As this strategy cannot be modelled directly in DOE 2.3, savings of 30% in cooling energy and 20% in fan energy were assumed.

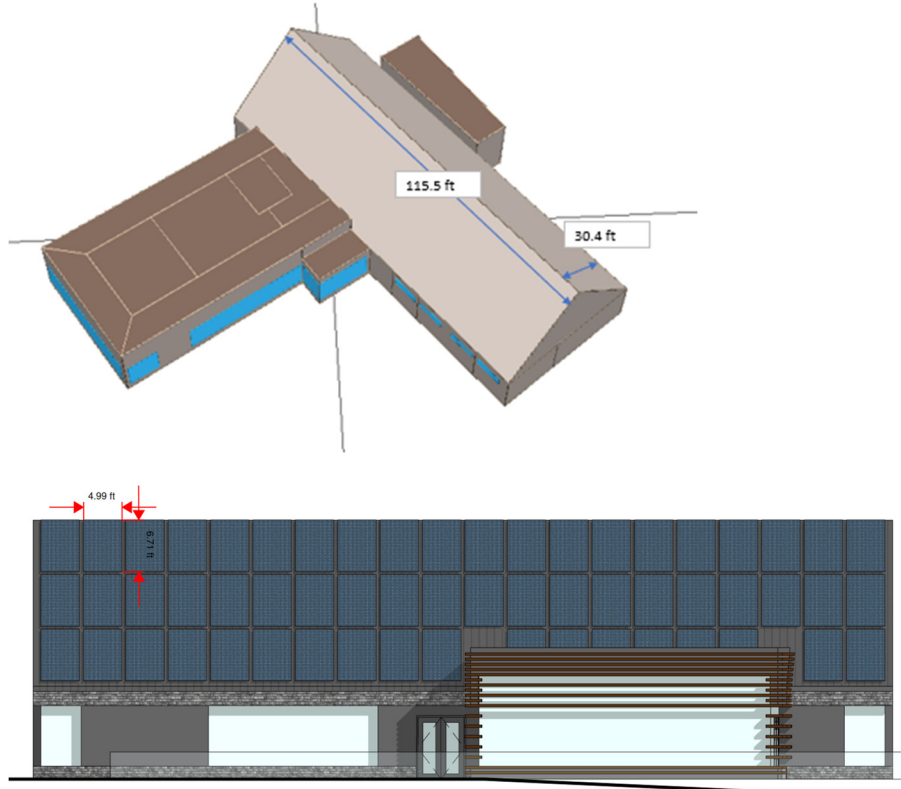
ECM cost: 4,000 \$/exhaust fan

Table 13 - ECM #10: Natural ventilation

| Energy Conservation Measure (ECM) |                     | Annual savings |                   |     |            | Net measure cost | Simple ROI (yrs) |
|-----------------------------------|---------------------|----------------|-------------------|-----|------------|------------------|------------------|
| #                                 | Description         | Propane (L)    | Electricity (kWh) | \$  | CO2 (tons) |                  |                  |
| 10                                | Natural ventilation | 0              | 6 879             | 921 | 5.0        | 4 000 \$         | 4.3              |

## 3.8 PHOTOVOLTAICS

It is proposed to install photovoltaic panels on the sloped roof facing south-east in order to produce electricity.



The area available on this roof is approximately 3,500 ft<sup>2</sup> and the slope is 45°. It was assumed that the PV panels would be fixed. Mono-Si panels with an efficiency of 13.1% were considered for a total installed capacity of 27 kW. The inverter efficiency was assumed to be 95% and miscellaneous losses to be 1%. A Retscreen calculation was performed in order to estimate the potential electricity production. It was assumed that all the electricity produced by the PV panels could be used in the building.

ECM cost provided by the cost consultant: \$60,000

Table 14 - ECM #11: Photovoltaics

| Energy Conservation Measure (ECM) |               | Annual savings |                   |       |            | Net measure cost | Simple ROI (yrs) |
|-----------------------------------|---------------|----------------|-------------------|-------|------------|------------------|------------------|
| #                                 | Description   | Propane (L)    | Electricity (kWh) | \$    | CO2 (tons) |                  |                  |
| 11                                | Photovoltaics | 0              | 18 209            | 2 451 | 13.1       | 60 000 \$        | 24.5             |

# 4 BUNDLES

## 4.1 BUNDLE #1: COMBINATION OF ENERGY CONSERVATION MEASURES SELECTED TO MAXIMIZE GREENHOUSE GAS EMISSIONS REDUCTION

The first bundle of energy conservation was chosen in order to maximize greenhouse gas emissions reduction. The following ECMs were combined:

- ECM #1: Improved Walls
- ECM #2: Improved Roofs
- ECM #4: Triple Glazed Windows
- ECM #7: Exhaust Air Energy Recovery
- ECM #8: CO2 sensors
- ECM #9: High Performance Boiler
- ECM #10: Natural Ventilation
- ECM #11: Photovoltaics

Table 15 – Bundle #1: Maximization of GHG emissions reduction

| Energy Conservation Measure (ECM) |                       | Annual savings |                   |       |            | Net measure cost | Simple ROI (yrs) |
|-----------------------------------|-----------------------|----------------|-------------------|-------|------------|------------------|------------------|
| #                                 | Description           | Propane (L)    | Electricity (kWh) | \$    | CO2 (tons) |                  |                  |
| Bundle 1                          | ECM 1/2/4/7/8/9/10/11 | 8 062          | 28 357            | 9 184 | 32.6       | 223 730 \$       | 24.4             |

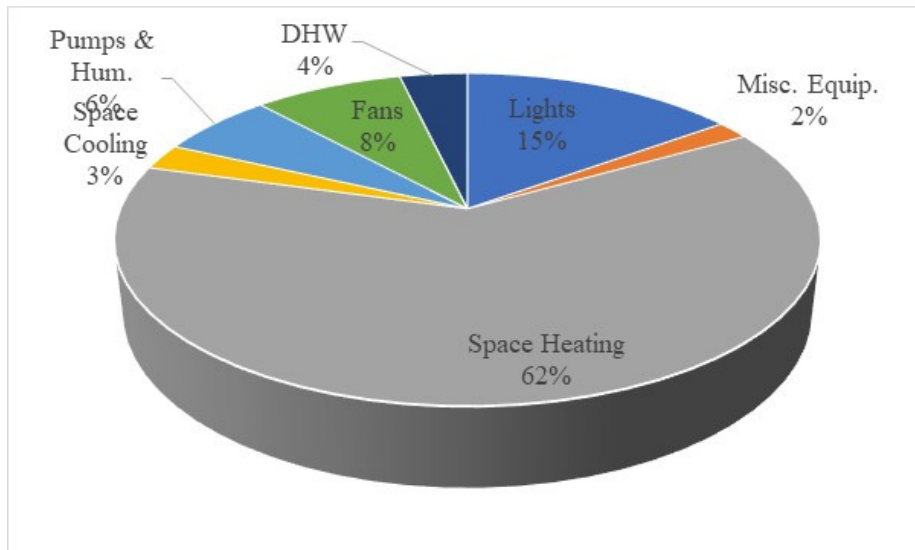


Figure 3 – Bundle #1 energy use breakdown (Before PV generation)

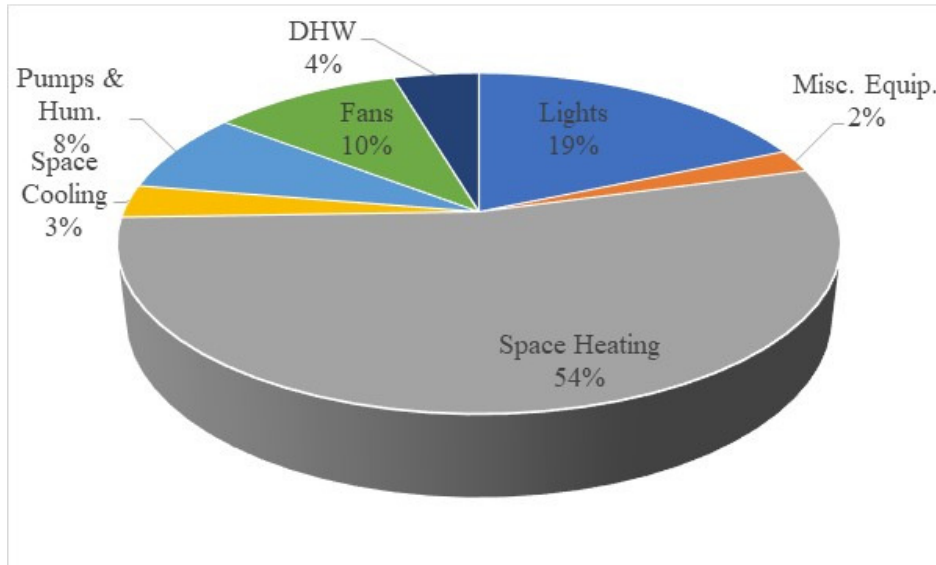


Figure 4 - Bundle #1 energy cost breakdown (Before PV generation)

## 4.2 BUNDLE #2: COMBINATION OF ENERGY CONSERVATION MEASURES SELECTED TO MAXIMIZE OPERATING COST SAVINGS

The second bundle of energy conservation was chosen in order to operating cost savings. The following ECMs were combined:

- ECM #1: Improved Walls
- ECM #2: Improved Roofs
- ECM #4: Triple Glazed Windows
- ECM #6: Air Source Heat Pumps
- ECM #7: Exhaust Air Energy Recovery
- ECM #8: CO2 sensors
- ECM #9: High Performance Boiler
- ECM #10: Natural Ventilation
- ECM #11: Photovoltaics

Table 16 – Bundle #2: Maximization of operating cost savings

| Energy Conservation Measure (ECM) |                         | Annual savings |                   |        |            | Net measure cost | Simple ROI (yrs) |
|-----------------------------------|-------------------------|----------------|-------------------|--------|------------|------------------|------------------|
| #                                 | Description             | Propane (L)    | Electricity (kWh) | \$     | CO2 (tons) |                  |                  |
| Bundle 2                          | ECM 1/2/4/6/7/8/9/10/11 | 20 303         | -3 789            | 12 847 | 28.0       | 253 730 \$       | 19.7             |

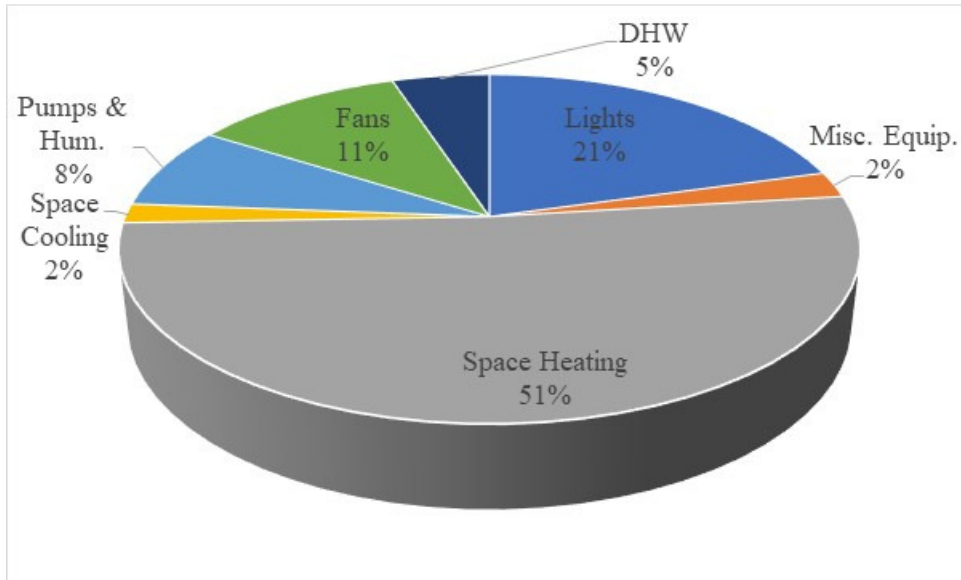


Figure 5 – Bundle #2 energy use breakdown (Before PV generation)

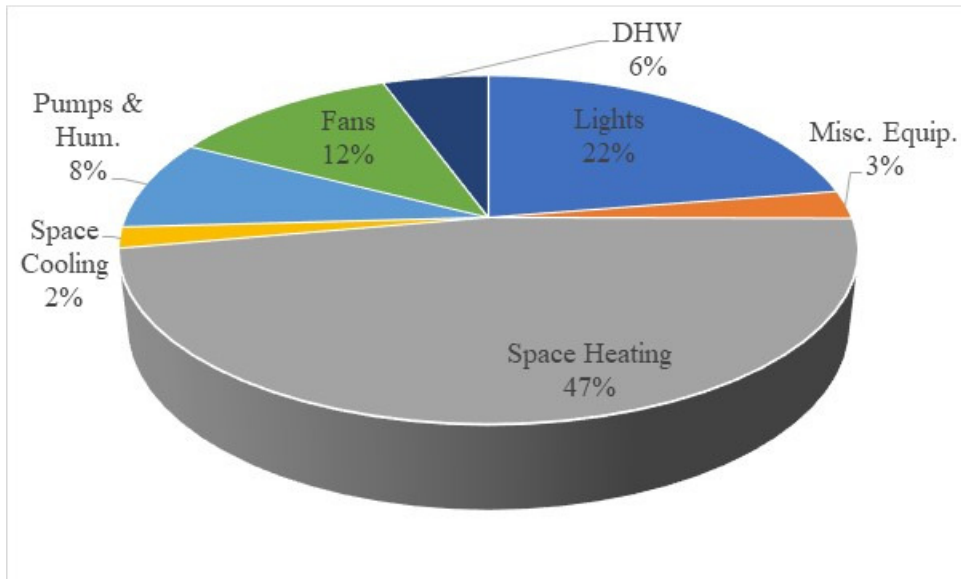


Figure 6 - Bundle #2 energy cost breakdown (Before PV generation)

# 5 CONCLUSION

A preliminary energy model of Pugwash Library and Multi-Purpose Centre was prepared and eleven energy conservation measures as well as two bundles of measures were analyzed. The baseline building is based on NECB 2017 requirements for building envelope performance, lighting power densities, plug loads, occupant densities and schedules. Baseline building HVAC systems were chosen in order to reflect a realistic concept for this type of building.

Increasing the insulation in walls and roofs and installing high performance windows reduces heating energy and fan energy. The ROI of building envelope measures range from 11 years to 107 years. Implementing a hybrid ground source heat pump and propane boiler waterside plant generates significant propane savings. However, due to the geothermal pump and the GSHP compressor energy, electricity use increases compared to the baseline. Overall, the ROI of this measure is around 12 years. Implementing a hybrid air source heat pump and propane boiler waterside plant generates significant propane savings although less than the previous ECM. However, electricity use increases less compared to the baseline (since the pumping energy is in the same range). Overall, the ROI of this measure is around 5.5 years. Installing an enthalpy wheel reduces the heating, humidification, cooling and dehumidification loads and associated energy use. However, there is a penalty on fan energy due to the additional pressure drop through the wheel. The ROI of this measure is around 10 years. Implementing CO<sub>2</sub> sensors to control the outdoor airflows based on occupancy has the same effect as the enthalpy wheel, however there is no penalty on fan energy and this measure is much cheaper than the enthalpy wheel resulting in a ROI of approximately 6 years. Choosing a condensing boiler instead of a conventional boiler leads to significant propane savings with a relatively low incremental cost thus a ROI of just above 1 year. Implementing a natural ventilation strategy has also a relatively low incremental cost (exhaust fan only) and can bring relatively high savings in fan and cooling energy resulting in a ROI of 4.5 years. Installing PV panels on the sloped roof facing SE for a total capacity of 27 kW would permit to produce more than 20% of the annual electricity use of the building. However, incremental costs are high resulting in a ROI of 24.5 years.

Finally, two bundles of ECMs were analyzed. A first one to maximize greenhouse gas emissions reduction and a second one to maximize operating cost savings. The first bundle consists in selecting building envelope measures (improved walls and roofs and triple glazed windows), HVAC measures (exhaust air energy recovery, CO<sub>2</sub> sensors, condensing boiler and natural ventilation) and photovoltaic panels but keeping the baseline heating and cooling concept (hydronic heating loop with propane boiler and DX cooling coil). The second bundle includes the same measures but with an air source heat pump providing all the cooling and part of the heating. The first bundle leads to a reduction of GHG emissions of 32.6 tons of CO<sub>2</sub>e per year whereas the second bundle leads to operating cost savings of \$12,850 per year.

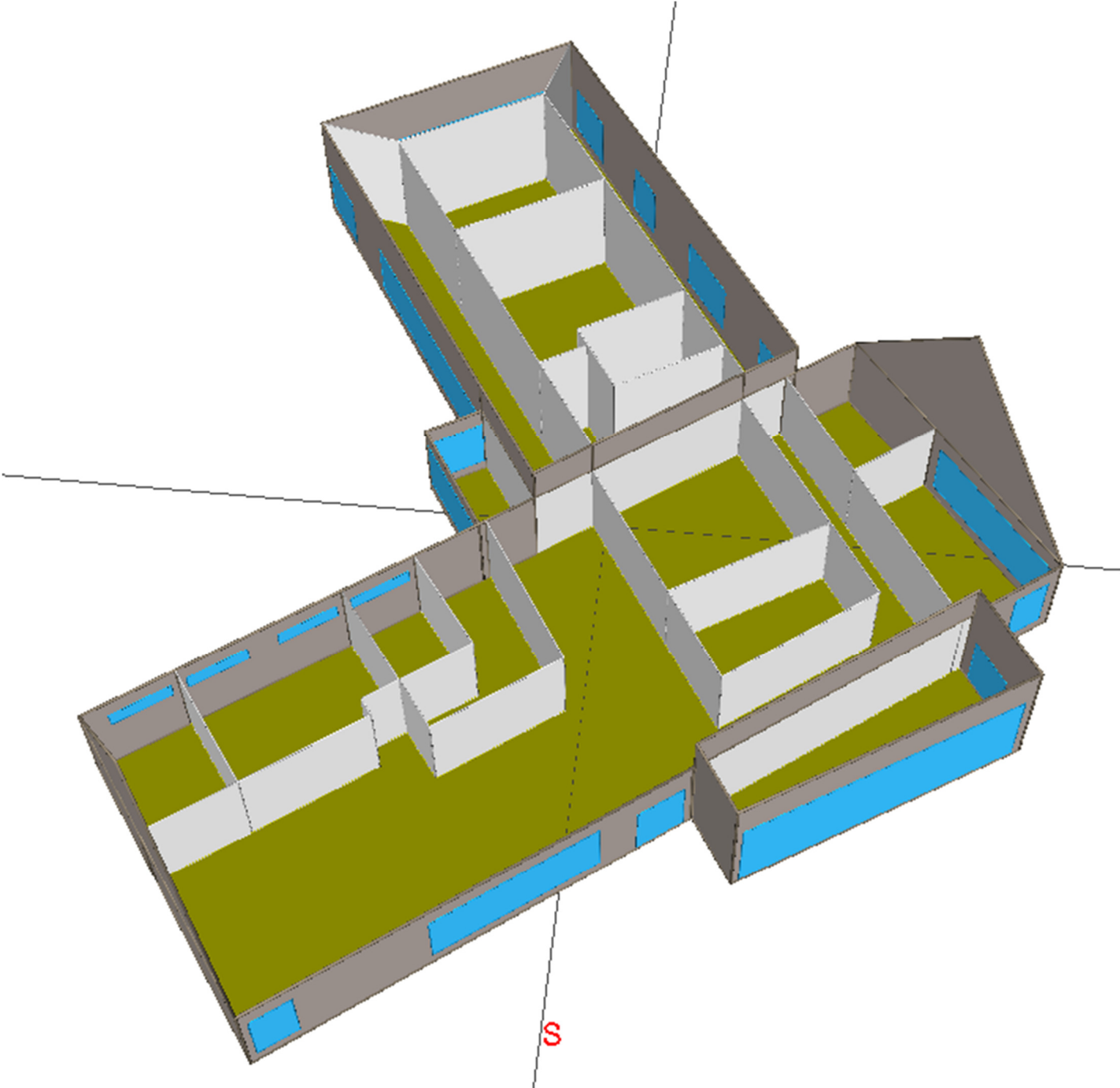
# APPENDIX

# A THERMAL ZONING

A large, white, geometric shape resembling a stylized 'V' or a folded corner is positioned in the lower-left quadrant of the page. It is composed of two white triangles meeting at a point at the bottom, with a white rectangular area extending upwards from the top-left corner of the 'V' shape.



# APPENDIX





# B SCHEDULES



# APPENDIX

**Table A-8.4.3.2.(1)-C  
Operating Schedule C**

| Day   | Time of Day |      |      |      |      |      |      |     |     |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |
|---|-------------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
|   | 1a          | 2a   | 3a   | 4a   | 5a   | 6a   | 7a   | 8a  | 9a  | 10a | 11a | 12  | 1p  | 2p  | 3p  | 4p  | 5p  | 6p  | 7p   | 8p   | 9p   | 10p  | 11p  | 12   |
| <b>Occupants, fraction occupied</b>                   |             |      |      |      |      |      |      |     |     |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |
| Mon - Fri   | 0           | 0    | 0    | 0    | 0    | 0    | 0    | 0.1 | 0.2 | 0.5 | 0.5 | 0.7 | 0.7 | 0.7 | 0.7 | 0.8 | 0.7 | 0.5 | 0.3  | 0.3  | 0    | 0    | 0    | 0    |
| Sat   | 0           | 0    | 0    | 0    | 0    | 0    | 0    | 0.1 | 0.2 | 0.5 | 0.6 | 0.8 | 0.9 | 0.9 | 0.9 | 0.8 | 0.7 | 0.5 | 0.2  | 0.2  | 0    | 0    | 0    | 0    |
| Sun   | 0           | 0    | 0    | 0    | 0    | 0    | 0    | 0.1 | 0.2 | 0.5 | 0.6 | 0.8 | 0.9 | 0.9 | 0.9 | 0.8 | 0.7 | 0.5 | 0    | 0    | 0    | 0    | 0    | 0    |
| <b>Lighting, fraction "on"</b>                        |             |      |      |      |      |      |      |     |     |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |
| Mon - Fri   | 0.05        | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.5 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.6  | 0.5  | 0.05 | 0.05 | 0.05 | 0.05 |
| Sat   | 0.05        | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.5 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.6  | 0.5  | 0.05 | 0.05 | 0.05 | 0.05 |
| Sun   | 0.05        | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.5 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| <b>Receptacle Equipment, fraction of load</b>         |             |      |      |      |      |      |      |     |     |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |
| Mon - Fri   | 0.05        | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.5 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.6  | 0.5  | 0.05 | 0.05 | 0.05 | 0.05 |
| Sat   | 0.05        | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.5 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.6  | 0.5  | 0.05 | 0.05 | 0.05 | 0.05 |
| Sun   | 0.05        | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.5 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| <b>Fans</b>   |             |      |      |      |      |      |      |     |     |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |
| Mon - Fri   | Off         | Off  | Off  | Off  | Off  | Off  | On   | On  | On  | On  | On  | On  | On  | On  | On  | On  | On  | On  | On   | On   | Off  | Off  | Off  | Off  |
| Sat   | Off         | Off  | Off  | Off  | Off  | Off  | On   | On  | On  | On  | On  | On  | On  | On  | On  | On  | On  | On  | On   | On   | Off  | Off  | Off  | Off  |
| Sun   | Off         | Off  | Off  | Off  | Off  | Off  | On   | On  | On  | On  | On  | On  | On  | On  | On  | On  | On  | On  | Off  | Off  | Off  | Off  | Off  | Off  |
| <b>Cooling System, °C</b>                             |             |      |      |      |      |      |      |     |     |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |
| Mon - Fri   | Off         | Off  | Off  | Off  | Off  | Off  | 24   | 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24   | 24   | Off  | Off  | Off  | Off  |
| Sat   | Off         | Off  | Off  | Off  | Off  | Off  | 24   | 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24   | 24   | Off  | Off  | Off  | Off  |
| Sun   | Off         | Off  | Off  | Off  | Off  | Off  | 24   | 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24  | 24  | Off  | Off  | Off  | Off  | Off  | Off  |
| <b>Heating System, °C</b>                             |             |      |      |      |      |      |      |     |     |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |
| Mon - Fri   | 18          | 18   | 18   | 18   | 18   | 18   | 20   | 22  | 22  | 22  | 22  | 22  | 22  | 22  | 22  | 22  | 22  | 22  | 22   | 22   | 18   | 18   | 18   | 18   |
| Sat   | 18          | 18   | 18   | 18   | 18   | 18   | 20   | 22  | 22  | 22  | 22  | 22  | 22  | 22  | 22  | 22  | 22  | 22  | 22   | 22   | 18   | 18   | 18   | 18   |
| Sun   | 18          | 18   | 18   | 18   | 18   | 18   | 18   | 20  | 22  | 22  | 22  | 22  | 22  | 22  | 22  | 22  | 22  | 22  | 18   | 18   | 18   | 18   | 18   | 18   |
| <b>Service Water Heating System, fraction of load</b> |             |      |      |      |      |      |      |     |     |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |
| Mon - Fri   | 0.05        | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.8 | 0.8 | 0.8 | 0.8 | 0.6 | 0.4 | 0.3 | 0.2  | 0.2  | 0.05 | 0.05 | 0.05 | 0.05 |
| Sat   | 0.05        | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.1 | 0.2 | 0.3 | 0.5 | 0.9 | 0.9 | 0.9 | 0.9 | 0.7 | 0.5 | 0.3 | 0.2  | 0.2  | 0.05 | 0.05 | 0.05 | 0.05 |
| Sun   | 0.05        | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.1 | 0.2 | 0.3 | 0.5 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.5 | 0.3 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |