STEVESTON FIRE HALL NO. 2

City of Richmond
6911 No. 3 Road
Richmond, BC
Canada

www.richmond.ca

Our Vision

"For the City of Richmond to be the most appealing, livable, and well-managed community in Canada."

Our City recognizes the importance of creating a sustainable community. It is a core strategy for achieving our corporate vision. Working towards sustainability means living within limits, understanding the interconnections and interdependence among the economy, society and the environment, and the equitable distribution of resources and opportunities. Our vision of a sustainable Richmond is a healthy, safe and enriched island community with an innovative and prosperous economy and thriving natural systems, sustained for current and future generations.

HCMA

FIRE EST. RICHMOND 1897 RESCUE

Richmond

Richmond Fire Hall No. 2

The Steveston Fire Hall No. 2 is on 3,072 square metres of land owned by the City of Richmond. The two-bay drive-through fire hall sits on a small corner lot. The footprint of the fire hall is set obliquely on the site to accommodate the ingress and egress of safety vehicles with large turning radii. Extensive traffic analysis was undertaken to achieve the optimal apparatus bay location and orientation on site.

Situated at the door step of the historic Steveston village community, the fire hall acts as a natural gateway to the community with its hose/training tower announcing its presence as a beacon. Facing the streets, the transparent apparatus bay proudly presents its inner workings to the public with the extensive use of windows; while the day room, kitchen/dining and dormitory are located behind, towards residential neighbourhood as a privacy buffer to residents.

The project consisted of the demolition of the former fire hall, relocating a heritage house and a sanitary line. The construction of the 727 square-metre facility is built to post disaster standards, and consists of a two-storey building with three main spaces: the fire hall, fire engine bays and hose drying tower. The fire hall contains the day room, kitchen, eating area, offices and training room on the ground floor and the dormitory, lounge and fitness room on the second floor. The fire engine bay includes space for two fire trucks, turn out gear room, workshop, equipment repair room and mechanical rooms. The hose drying tower is a three-storey tower which is used for hanging and drying fire hoses after service.

During construction, Richmond Fire-Rescue continued its operations with a temporary truck shelter and dormitory building located on the southern portion of this site.

CLIENT
- The City of Richmond

LOCATION
- Richmond, BC, Canada

COMPLETION
- 2011

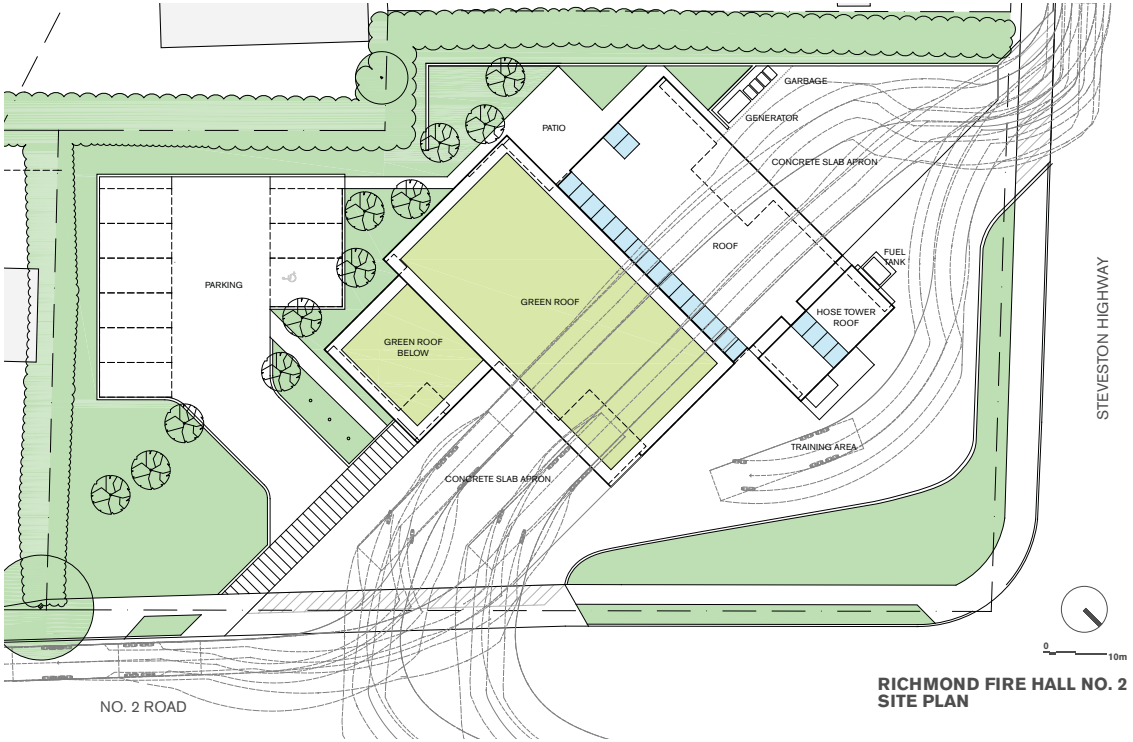
SITE AREA
- 3,072 m2

BUILDING AREA
- 727 m2

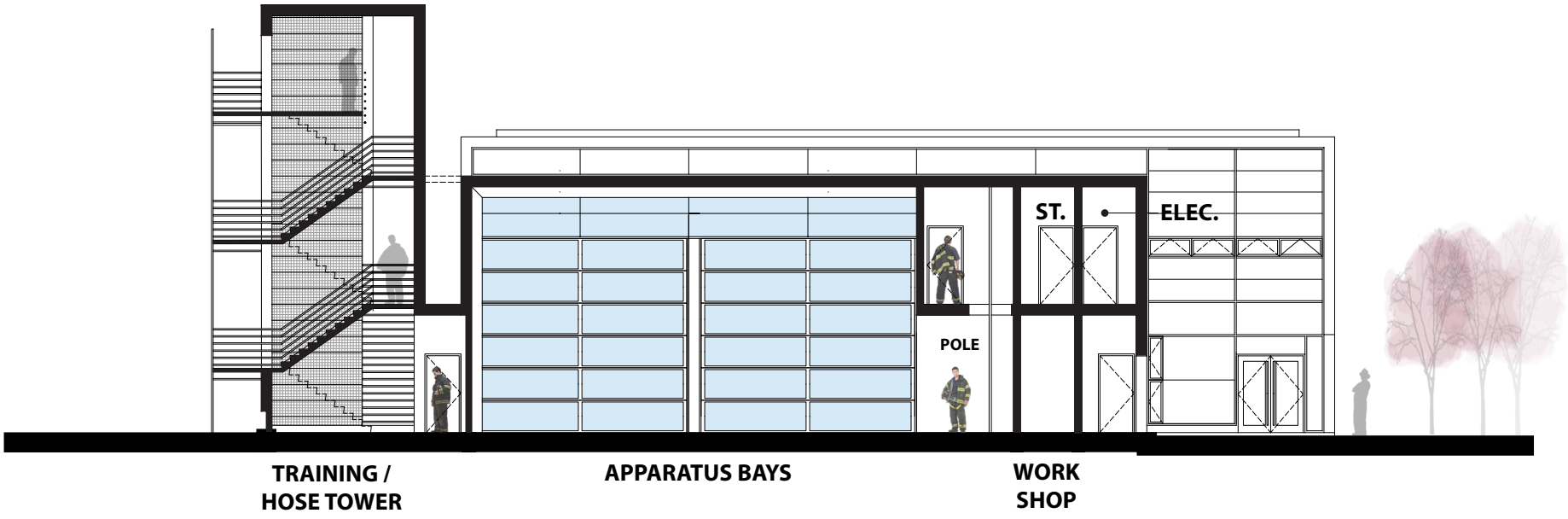
COST
- $4.1 M

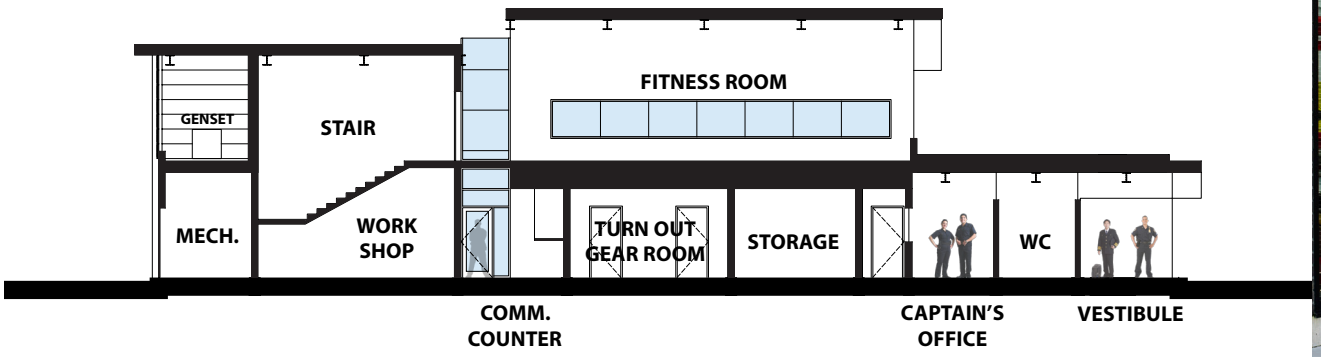
SPECIAL FEATURES
- Targeting LEED® Gold
- Geothermal heating/cooling, radiant floor heating and solar domestic water pre-heat system
- Use of pine beetle wood as structural and finished material
- On-site storm water management with rain gardens
- Green roofs and green walls
- Daylight harvesting
- Designed to post-disaster standard
- Two truck drive-through apparatus bay
- Gender neutral change rooms, washrooms and dormitory

DESIGN TEAM
- Architect: HCMA
- Structural: Fast + Epp Structural Engineers
- Mechanical: AME Consulting Group Ltd.
- Electrical: Roy Campbell Ltd.
- Landscape Architect: Space2Place
- Construction: Stuart Olson Dominion Construction Ltd.



RICHMOND FIRE HALL NO. 2
SITE PLAN




GENSET
STAIR
FITNESS ROOM
MECH.
WORK SHOP
TURN OUT GEAR ROOM
STORAGE
WC
COMM. COUNTER
CAPTAIN'S OFFICE
VESTIBULE

ENERGY

The building's energy savings are the result of a combination of design strategies and efficient systems including a high efficiency ground source heat pump system, high performance envelope, reduced lighting requirements, occupation sensors and ventilation air heat recovery. In addition, the roof-mounted solar panels preheat the domestic hot water to further reduce building energy use.

- **Projecting over 46% reduction in building energy cost compared to the energy cost of the MNECB (Model National Energy Code for Buildings) reference building.**
  The energy use for heating, cooling and lighting has been reduced by 73%, 80% and 23% respectively. Based on the design energy modeling, the building's total energy use is projected to be 38% lower than MNECB reference building.
- **Renewable energy provided through solar panels allows energy efficient production of preheated domestic water.**
  The system comprises four flat-panel collectors and a 120-gallon storage tank. This system will save approximately 19,800 Megajoules per year.
- **A commissioning authority has been overseeing the design, installation, initiation, testing, balancing and operation of the building systems.**
- **A Green Power Certificate will be purchased to partially offset the environmental impact of project power consumption.**
  A contract is being negotiated to purchase a Green Power Certificate to offset at least 50% of the project power consumption in its first two years.

WATER

Two major factors have resulted in significant potable water use reduction in the Steveston Fire Hall. First is the use of water efficient fixtures such as dual flush-toilets and low-flow faucets and shower-heads. These measures alone resulted in a reduction of 39% or 72,000 litres per year in potable water use. The second factor is using native and adaptive plants which require no irrigation; therefore, no potable water is used for landscaping.

- **There are significant savings in potable water use because the project does not have an irrigation system for landscaping.**
  In the first two years, a temporary irrigation system will help establish the native and adaptive plants which will require no irrigation thereafter.
- **Projecting more than 39% reduction in potable water use in the building by using water-efficient fixtures such as dual-flush toilets, sensor faucets and low-flow showers.**
  Calculations show reduction in water consumption by 72,000 litres per year.

Did you know?

The roof-mounted solar hot water panels on the Steveston Fire Hall preheat the domestic hot water resulting in a savings of **19,800 Megajoules per year**; that is roughly equivalent to the energy needed for brewing **12,790 cups** of coffee.

It is estimated that the project's total water use will be reduced by **72,000 litres per year**; that is approximately **16 months** of daily showering for a family of four.

674 metric tons or 84% of the project construction waste was recycled and diverted from landfill; that would equal **37 full** garbage truck loads.

USER HEALTH & COMFORT

The project team has designed the building with the goal of providing maximum health and comfort for users. Various building design features have contributed to achieving this goal; from operable windows and low-emitting materials to effective ventilation system and ample daylight.

- **The building's ventilation system is designed using a carbon dioxide monitor that measures air quality and delivers fresh air when necessary.**
- **Materials installed in the project were screened to minimize off-gassing and emission of volatile organic compounds and other pollutants.**
  From paints, coatings, adhesives and sealants to carpet and composite wood, the project team specified and installed products which meet environmental standards by credible organizations such as California South Coast Air Quality Management District rules and Carpet and Rug Institute (CRI) Green Label.
- **The users' thermal comfort is a priority in the design of the mechanical system and a monitoring system, together with operable windows providing individual controllability over fresh air and temperature.**
  Providing radiant floor heating in addition to dedicated heat pumps for dorm rooms, kitchen/eating area and captain office/dorm is another design strategy to provide maximum thermal comfort in most commonly used spaces.
- **Views throughout the building provide a pleasant and psychologically comfortable environment for the users.**
- **Daylight is provided for almost all regularly occupied spaces of the building.**
- **Daylight sensors and lighting controls not only help with energy saving but provide flexibility for the users as well.**

MATERIALS

Durability, as one of the key principles of sustainable design, guided the design of the building as a whole as well as its assemblies, components and the process of specifying products and materials.

- **All dimensional lumber (structural and otherwise) used in the building was sourced from wood salvaged from Pine Beetle infested forests in B.C.**
- **In the process of project procurement, materials with high recycled content and regional materials were specified and installed.**
  Almost a quarter - 24.26% - of the materials in the project (by value) was sourced locally and the recycled content of the materials in the project is over 10.5% (by value).

Energy Efficiency

The fire hall achieves 46% energy cost savings. Energy demand in the Fire Hall has been reduced by measures such as ample windows and occupancy sensors to minimize the need for electric lights during the day and reducing heat loss through a well-insulated, high-performance building envelope. At the same time, energy is provided by a combination of systems: a ground-source heat pump system; solar hot water panels on the roof; and, a heat recovery system which extracts heat from outgoing air and uses it to preheat the incoming air.

Solar Hot Water Panels

There are four solar panels on the roof of the fire hall which are used for preheating the water used in the building. The panels absorb the heat from sunlight and through heat exchange devices transfer the heat to water. The preheated water is then stored in a 450-litre tank at temperatures between 32 to 49°C. This water is further heated for domestic use inside the building but much less energy is required to heat the water to reach the appropriate temperature of 60°C.

Water Conservation

Two major factors have resulted in the significant reduction of potable water use in the fire hall. First is the use of water efficient fixtures such as dual flush-toilets and low-flow faucets and shower-heads. These measures alone resulted in a 39% or 72,000 litres per year reduction in potable water use. The second factor is using native and adaptive plants which require no irrigation; therefore, the project uses no potable water for landscaping.

SITE STRATEGIES

- **Sustainable Landscaping**
  The planting plan has been designed to be a non irrigated landscape once the planting has been established following a two-year grow-in period. The plants that have been specified represent a combination of local indigenous plants and drought resistant. The non-irrigated landscaping of the project reduced the landscaping capital cost as no irrigation system was installed. It also eliminated the need for potable water use for landscaping which together with no need for irrigation system maintenance reduce operational costs as well.
  Although small in its scale, the edible garden around the patio (plants include blueberries, blackberries, rosemary and kinnikinnick) promotes urban agriculture, organic farming and self-sustaining practices.
- **Alternative Transportation**
  Bike storage facilities that include exterior racks and a class A bike storage facility inside the hose tower.
  There is a dedicated and preferred electric vehicle parking stall equipped with a secure electric outlet for charging plug-in electric vehicles. There is also a dedicated conduit roughed in for future installation of an electric vehicle charging station.
  Dedicated and preferred parking stalls for car-pooling, together with a city-wide program, actively encourages carpooling by providing incentives.
  The ease of access to numerous public transit bus lines, which includes a bus stop immediately next to the south edge of the site.
- **Stormwater Management**
  Reducing the rate and quantity of stormwater run-off by reducing impervious surfaces, such as concrete, that previously dominated the site.
  Vegetated swales leading to a rain garden reduce stormwater run-off and act as filters to treat it.
  Stormwater runoff is captured at the base of swales, slopes into a rain garden, and allows stormwater to infiltrate the site, hydrate the soils, recharge the groundwater, and provide a source of water for site planting.
  The green roofs also reduce stormwater run-off. Green roofs act like sponges which could retain rainwater and therefore, reduce the loads on the City's stormwater systems.
- **Reducing the Heat Island Effect**
  Using light coloured materials for pavement and hard surfaces to reduce Heat Island Effect.
  The green roofs reduce the potential Heat Island Effect from roof.
- **Reducing light pollution**
  Containing interior lighting within the building and limiting exterior lighting to avoid uplighting or light spillage beyond property lines.

CONSTRUCTION

- **Various erosion and sedimentation control measures ensured that soil was protected and construction activities caused no stormwater pollution and/or dust generation.**
- **84% of project construction waste was recycled and as a result was diverted from the landfill.**
- **Indoor Air Quality during construction**
  Measures during construction included protecting heating, ventilation, and air-conditioning equipment (HVAC) and ducting systems against dust; offgassing and pollutants; protecting absorptive materials against moisture and mold; comprehensive housekeeping during construction; scheduling construction activities to prevent pollution of the absorptive materials and minimizing and containing various sources of indoor air pollution (from off-gassing materials to dust-generating construction activities).
- **The building was flushed by 100% fresh air for an extended period of time before occupancy to ensure any pollutants or chemicals resulting from construction activities would be removed from interior spaces.**

SUSTAINABILITY LEADERSHIP

The City of Richmond has taken extra steps to ensure the Steveston Fire Hall project becomes an exercise in truly sustainable design, construction and operation of a public building.

- The project included the expansion of the previous fire hall site which inevitably included a landmark heritage house built in 1922. The City of Richmond facilitated the complete salvage of the McKinney house and its relocation to a new privately-owned location. In doing so, the project:
  - contributed to the cultural and heritage values of the community (social sustainability)
  - extended the life of a building and potentially helping reduce the need for building a house from scratch (environmental sustainability)
  - diverted a significant amount of waste from landfill (environmental sustainability)
  - saved the City (taxpayers' money) the demolition, removal and waste disposal costs (economic sustainability)
- **Green Housekeeping Plan**
  The plan ensures that not only through the construction of the facility but also during its operation, the users' exposure to chemicals in cleaning and janitorial products will be minimized.
- **Education Program**
  A Sustainability Education Program developed by the City of Richmond becomes a tool to share and transfer to building users and the public the experience and knowledge gained throughout the project. As part of this program, the City offers tours of the facility.

Pine Beetle Wood

Pine beetle wood has been extensively used in the Steveston Fire Hall No. 2. In fact, the unique design of the project decking consists of solid wood panels made up of stacks of dimensional lumber (2-by-4) entirely sourced from pine beetle wood. The BC Ministry of Forests and Range estimates that as of 2009 the cumulative area of provincial Crown forest affected to some degree by mountain pine beetle infestation was about 16.3 million hectares. If harvested promptly, the infested wood could still be used for construction and structural purposes.

Green Roof

More than half of the roof of Steveston Fire Hall No. 2 is a green roof. The green roof helps reduce the run-off from the roof by working like a sponge to absorb and hold the water. Green roofs also help reduce what is called Heat Island Effect. Heat Island Effect happens in cities and urban environments where dark surfaces of roads, parking lots, roofs, etc. absorb much more heat than the surrounding countryside; thus, creating "heat islands" in cities. The vegetated surface of green roofs significantly reduces the heat absorption.

Windows & Natural Daylight

Almost all regularly occupied rooms in the Fire Hall No.2 have windows. Windows have three essential functions all of which contribute to the user's health and comfort. Windows provide (1) access to fresh air, (2) views and (3) daylight. In addition to its health benefits, daylight reduces the need for electric light and as such, reduces energy consumption.