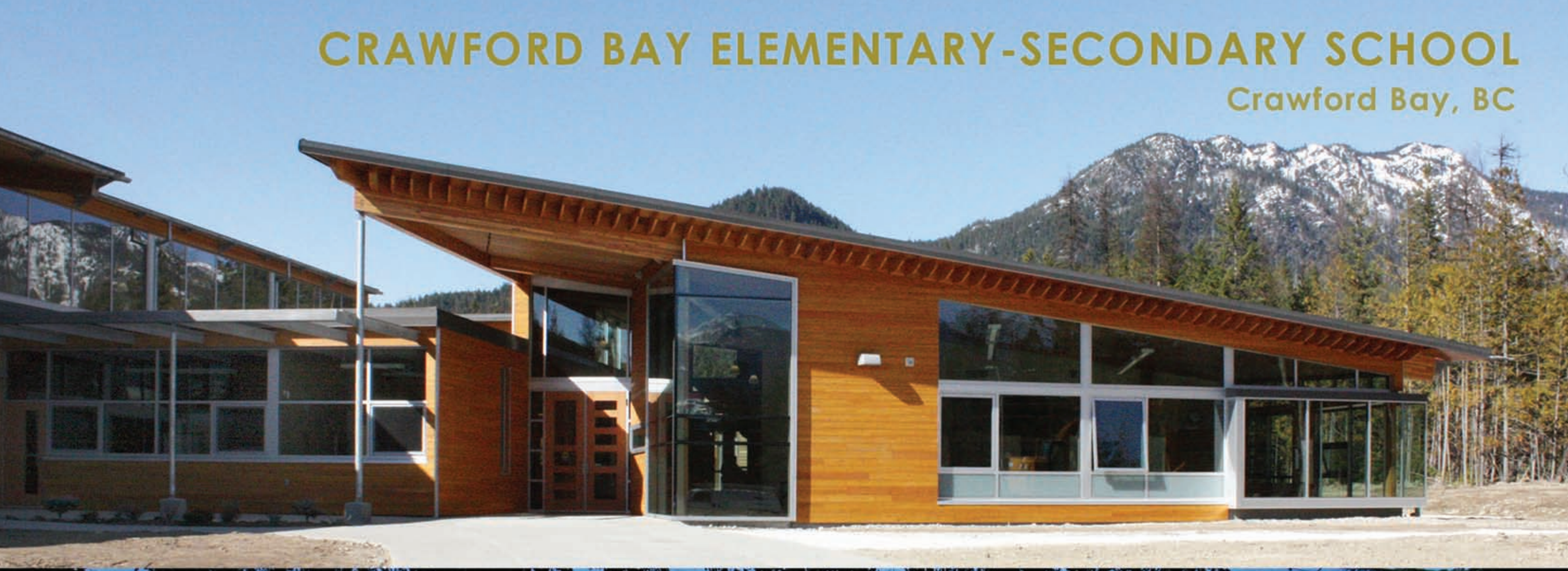
CRAWFORD BAY ELEMENTARY-SECONDARY SCHOOL

Crawford Bay, BC



RICHMOND CHRISTIAN SCHOOL

Richmond, BC

Canadian Wood Council
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Project of the Canadian Wood Council

Crawford Bay Elementary-Secondary School

Richmond Christian School

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Crawford Bay Elementary-Secondary School, Crawford Bay, BC

Introduction

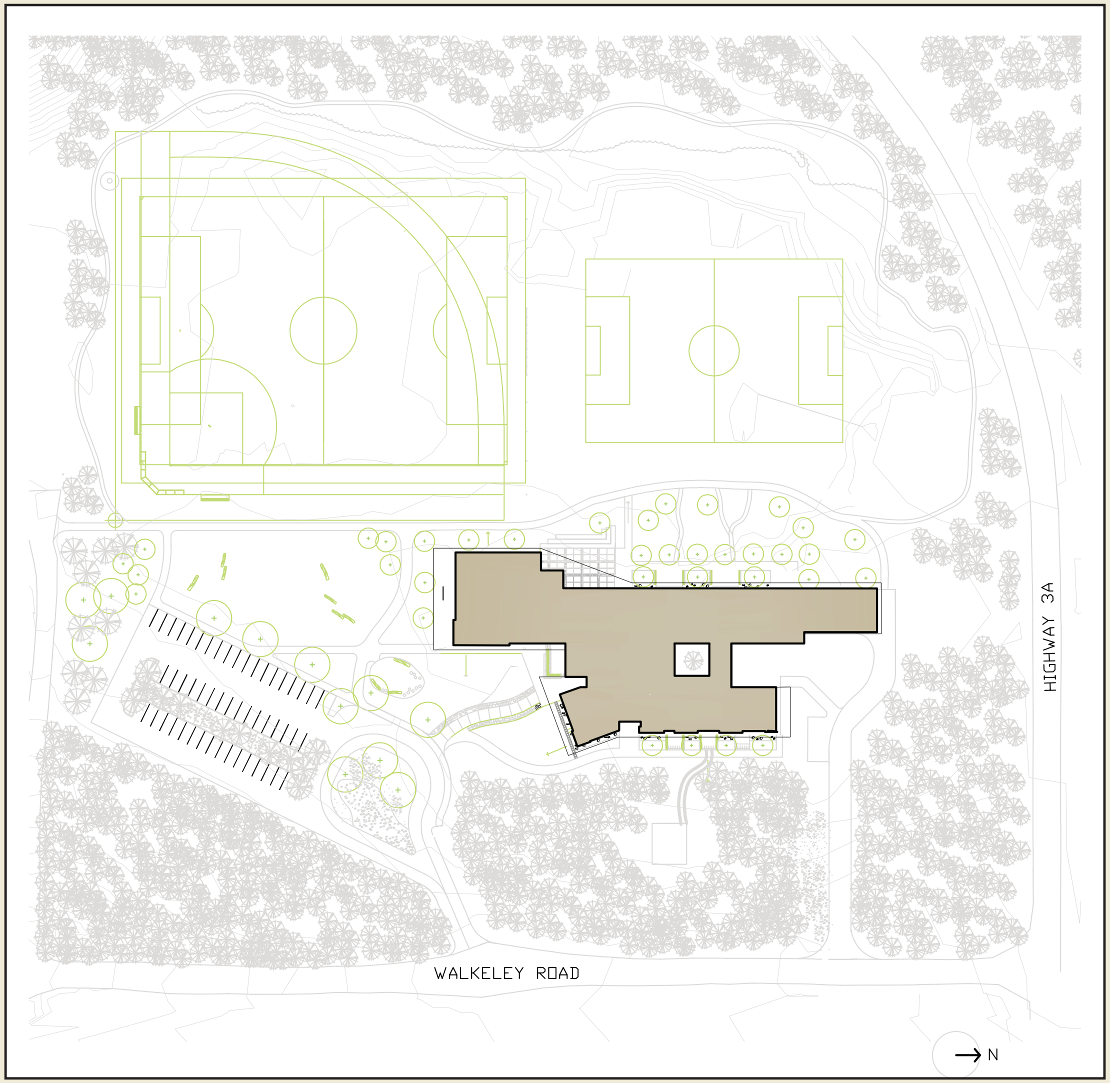
Crawford Bay is a small and remote community on the east shore of Kootenay Lake in the southern interior of British Columbia. A community of about 500 people, it is one of several such communities collectively known as the East Shore communities.

Historically, the area has relied heavily on logging for employment but, since the 1960s at least, has also been home to grassroots environmentalists and, more recently, to highly educated ex-urbanites who form part of a 'back to the land' movement. There is also a strong artisan community with a broad range of skills in carving, weaving, ironwork and other arts.

The village of Crawford Bay has been home to a one-room school house since 1946, and the need to replace this aging facility provided the impetus for this project. A feasibility study quickly determined that rehabilitation and expansion of the existing building was not cost effective, nor could the existing site readily accommodate a new structure and the required ancillary facilities such as playing fields and parking lots. Accordingly, a new site was selected and design of the new school commenced in 2004.

Crawford Bay Elementary-Secondary School

Crawford Bay, BC

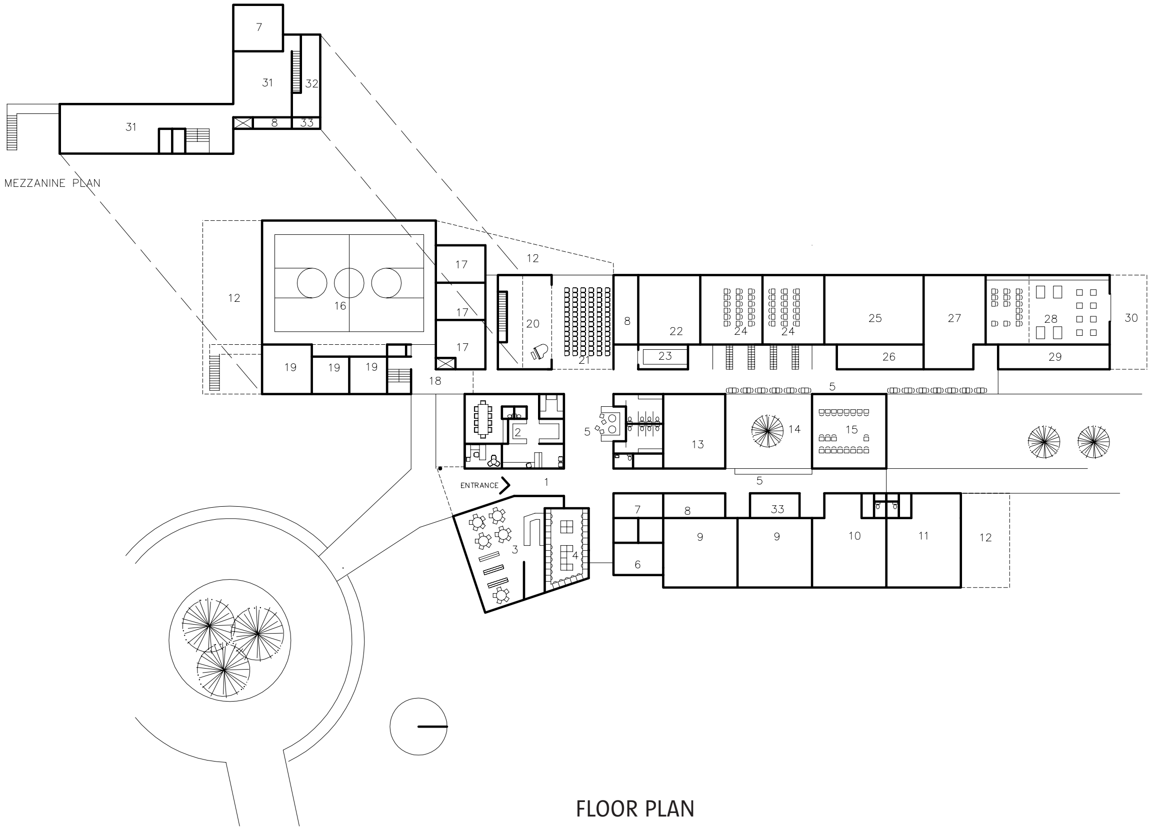


SITE PLAN

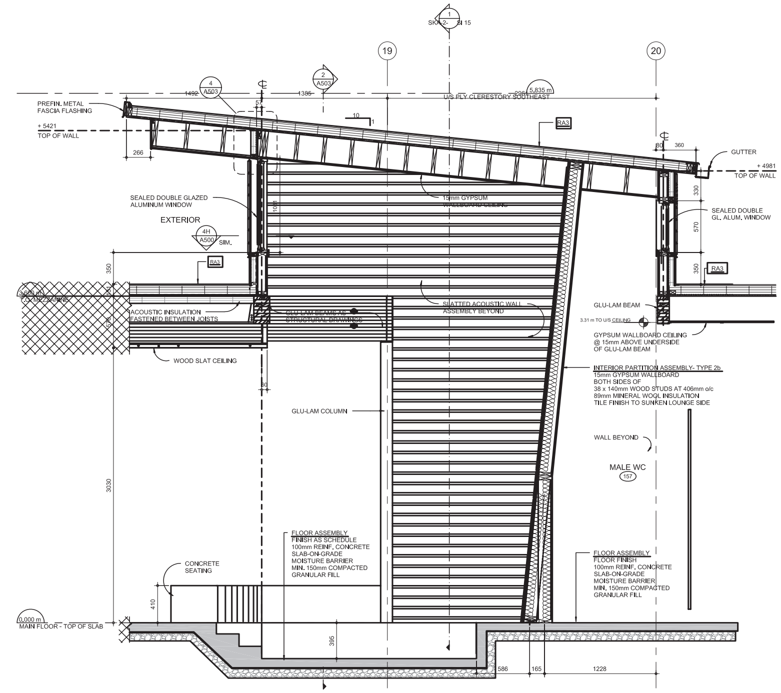
Architectural Design Approach

Design objectives for the project were formulated through a process of consultation with the community, and included:

- Create a healthy, sustainable environment for learning and working, with emphasis placed on the use of natural materials, natural light, fresh air, energy and water conservation and durability.
- Integrate school and community by creating a welcoming facility that uses local materials and labour, and incorporates art and other products made by local artisans.
- Recognize the unique qualities of a small, rural kindergarten to Grade 12 school, providing opportunities for interaction between students of all ages, as well as between students and staff.



FLOOR PLAN



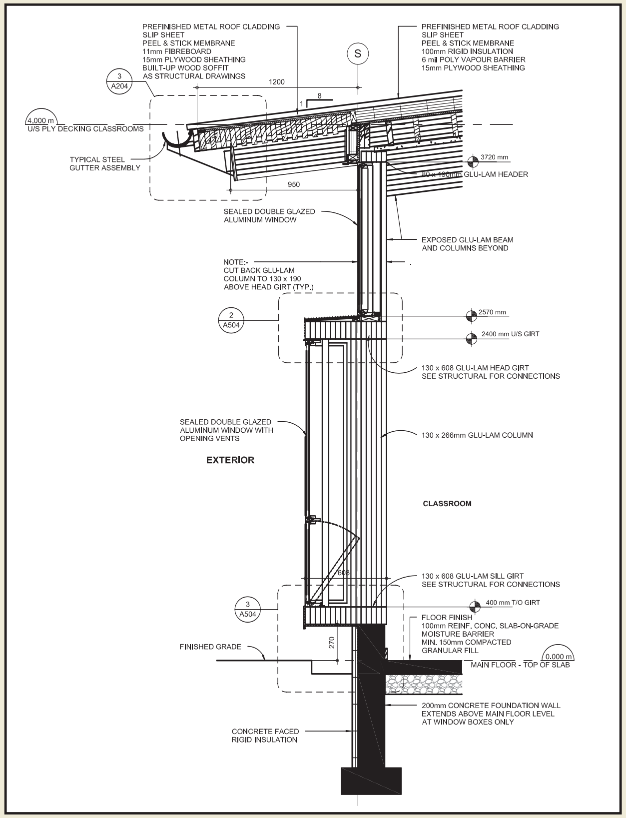
CROSS SECTION - SUNKEN LOUNGE

- Design in harmony with nature, respecting the site, conserving vegetation and water, considering solar orientation and views, and integrating building and site.

The basic plan organization is straightforward: two single-loaded parallel corridors that serve the educational and communal spaces of the school. One north-south wing contains the elementary classrooms, the other the secondary classrooms. Between them is a courtyard and at the south end of the building, they are connected by the third main program element containing the gymnasium, library and other common spaces.

In a small community, the school is the heart of social and recreational activity and the construction of a new school is an event of great significance. This is underscored by the fact that the local residents raised an astounding $850,000 to add a preschool, fitness centre and other community facilities to the program.


EXIT



TYPICAL WINDOW BOX SECTION

Structure

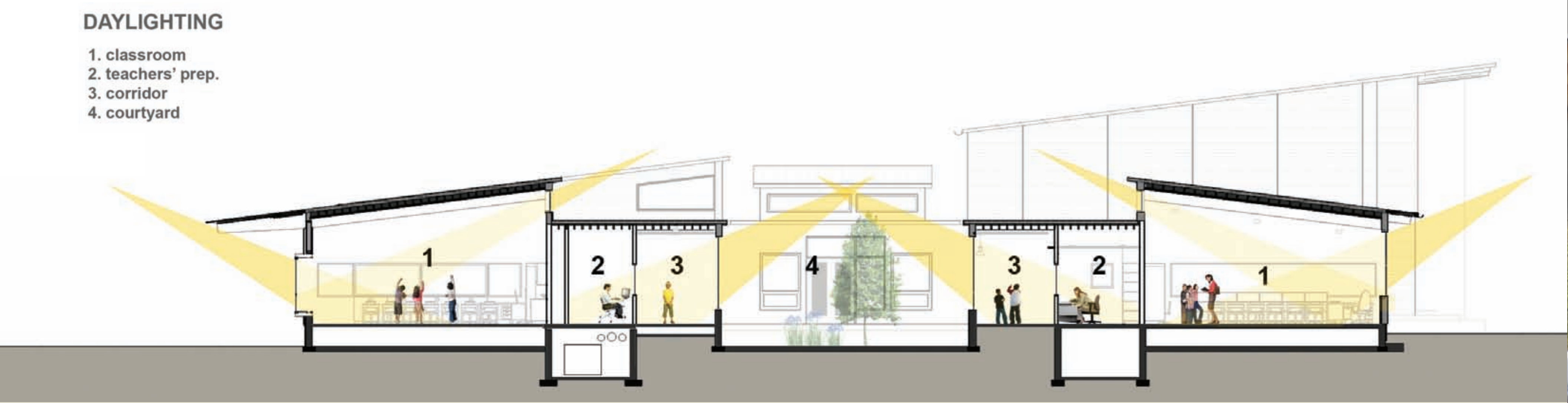
In recognition of the historic importance of forestry to the local community, the building is designed as an all-wood structure, using native local species as much as possible. The geometry is simple and repetitive, based on a 3-metre (10-foot) grid; a deliberate strategy to ensure construction could be accomplished using local labour and expertise. In fact, Sam Anderson, the general contractor, used the project as a skills training program for youth in the community.

The post and beam frame is made up of a combination of Douglas fir glulam, spruce/pine/fir (SPF) glulam and solid timber elements, with solid-sawn rafters. In-filled between the post and beam elements is light frame construction that is non-load-bearing and hence easy to reconfigure if the need arises. The exterior walls include windows with deep box-like frames also constructed from glulam material. Although the glulam components for the project were fabricated several hundred kilometers away in Penticton, much of the material used in their manufacture came from local forests and mills.

The roof overhangs (which require no in-sulation) were prefabricated on site as stacked plank components – approximately 1.2 metres (4 feet) in width and spanning the 3 metres (10 feet) between the glulam beams. This

system has the advantage of providing both structure and finish in a single operation, and is entirely compatible with the remainder of the structure and the plywood roof sheathing.

Exterior detailing, including the substantial roof overhangs, is designed to protect wood components from exposure to weather and so improve durability. The scupper detail, which uses a steel channel to cantilever beyond the roof edge and discharge rainwater directly into a gravel bed, features a dual purpose bracket that both supports the channel and protects the end grain of the glulam roof beam.



Environmental Strategies

To ensure a healthy and stimulating environment, the building features large expanses of glass to bring natural light and views to all occupied spaces including the gymnasium. The glazing is oriented for optimal solar exposure, protected by overhangs to reduce glare and prevent overheating in summer, and shaded by deciduous trees that filter sunlight in summer and allow full solar penetration in winter. Operable windows at low level around the perimeter of the building work in combination with operable clerestories to create a chimney effect that facilitates natural ventilation.

Crawford Bay is sufficiently remote that it has no service infrastructure other than electricity. Thus the school has no main water supply, and no piped connection for the disposal and treatment of waste water. All water used by the school comes from wells drilled to subterranean aquifers. In addition to supplying daily needs, this water also feeds a separate 20,000 litre (4,400 gallon) storage tank used for fire fighting and the building's sprinkler system. A fire pump draws the water from the storage tank and creates the pressure for the system.

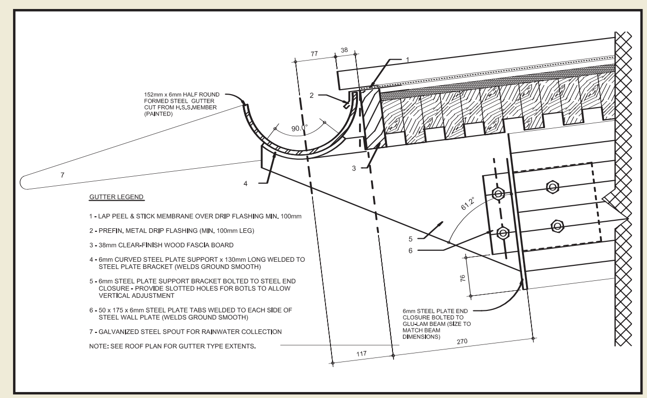
Sewage effluent from the school is treated to tertiary standards. This process culminates in six constructed wetland zones where natural vegetation and wood cellular fibre remove any remaining nutrients from the liquid, which then percolates back into the ground. The school uses site ecology as a teaching tool, including sustainable silviculture, a composting program and an organic worm farm.

Rain water is collected through rain water troughs and scuppers at roof eaves, directed into gravel and garden catchment zones, and used to irrigate landscaping. Excess water is collected by a sub-surface collection system and stored in a cistern for irrigation of playing fields. The water system, which includes water-efficient, low-flush toilets and urinals and infra-red water taps, is designed to achieve a reduction of at least 20% over baseline calculation.

The main energy source for the heating system is a closed-loop geo-exchange system that includes 9,000 metres of horizontal piping laid beneath the playing fields, and a series of heat pumps placed along a "Utilidor" beneath the floor slab of the school. A propane-fired back-up system is only used for peak loads during the coldest times in the winter.

Occupant comfort and a healthy environment for learning were of paramount importance in the design for this school. All materials used in the building are LEED (Leadership in Energy and Environmental Design) compliant in conformance with the IEQ credits for low emitting materials. Floor finishes are linoleum, polished concrete, rubber, porcelain tile, and maple hardwood for the gymnasium. Wall finishes are low VOC (volatile organic compounds) paints on drywall, larch wood slats over mineral wool acoustic insulation, low VOC MDF (medium density fibreboard) board and some Tectum acoustic panels. Ceilings are Tectum panels, exposed wood structure and larch wood slatted panels. Sealants and finishes are non-toxic and low VOC.

The majority of structural and finishing products are wood-based and/or include a recycled content. As much as possible, locally/regionally manufactured and or harvested products were sourced. As Crawford Bay is a logging and lumber-producing community, the majority of the wood products used in the structure and finishing products, including the larch exterior siding and wood slats used throughout the school, were locally grown, harvested and milled.



GUTTER DETAIL

Durability and Demountability

The anticipated service life of this building is a minimum of 50 years. The regular grid of post and beam glulam structure allows ultimate flexibility for future changes in use, as all interior partitions are non-load bearing and can easily be modified and relocated.

Furthermore, bolted connections of the timber superstructure allow the entire building skeleton to be disassembled and relocated, or components thereof to be reused.

As a school building, ease of maintenance and longevity requires a robustness of finishes. The corridor walls are designed to withstand a higher than usual wear and tear as can be expected in a school environment. MDF panelling is used on lower surfaces, capped by a solid wood chair rail, while upper regions of the walls are finished with slats of larch wood, spaced and backed by acoustic insulation for an attractive finish and functional acoustic treatment.

Corridor floors are concrete that has been finished by a local craftsman to a finely polished surface resembling terrazzo. Thus they are virtually maintenance-free, requiring only wet mopping (no wax required). Classroom floors are finished with linoleum that contains only natural products.

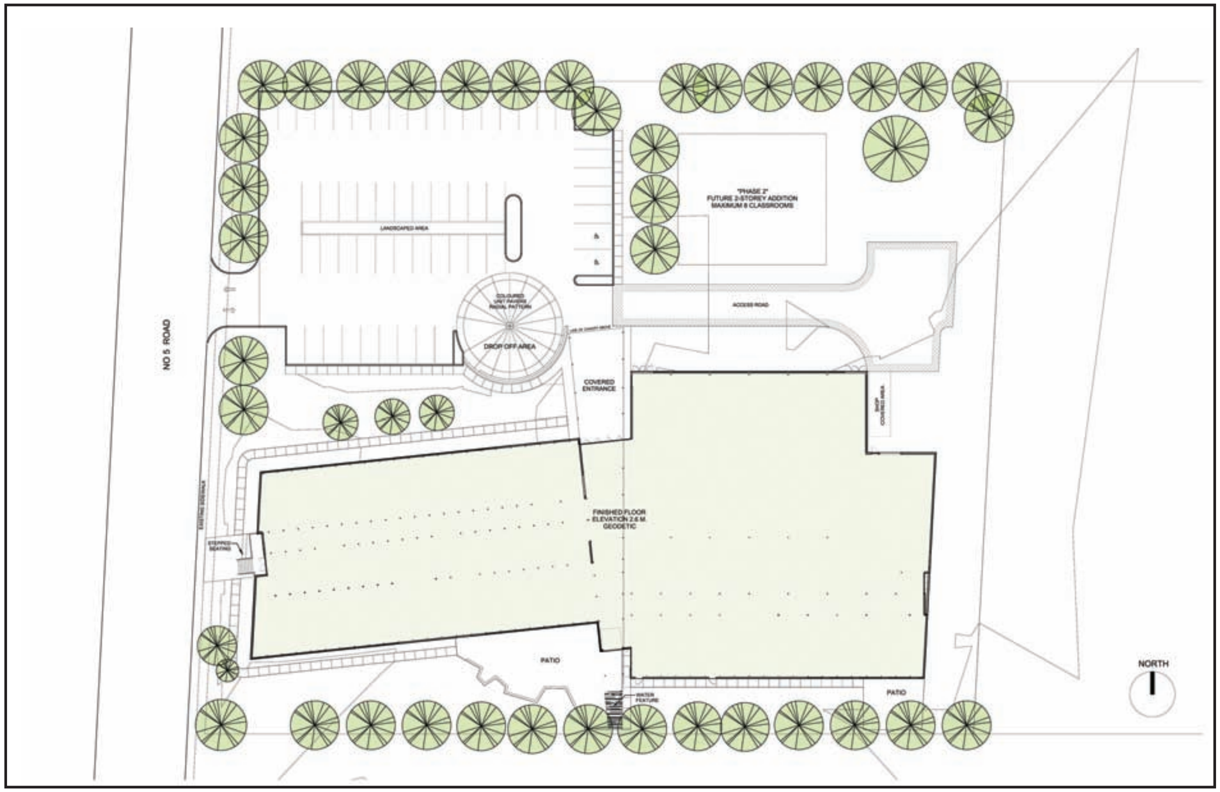
Conclusion

In its blending of the environmental, economic and social aspects of sustainable design, Crawford Bay School can be seen as the quintessential community project. The use of local materials – particularly wood – and labour has provided not only economic benefit to the community during the construction process, but has fostered a long-term sense of ownership and commitment to what has become the social and recreational heart of the surrounding area.

Richmond Christian School

Richmond, BC

Richmond Christian School, Richmond, BC



SITE PLAN

Introduction

Richmond Christian School (RCS) was founded in 1957 and operated as an independent elementary school for 35 years before merging with the nearby Seacliff Christian School in 1992. From that point Richmond Christian School has offered an expanded K-12 program, with the original RCS building becoming the elementary campus, while the Seacliff facility - known as the Woodward Building - on No. 5 Road in south Richmond, becoming the high school campus.

In the early 2000s, increasing enrolment created the need for additional space and a new building was commissioned for the No. 5 Road campus. Opening in the spring of 2008, the new 38,000 ft^2 (3500 m^2) single storey structure has become the high school, while the existing Woodward Building now houses the middle school.

Architectural Design Approach

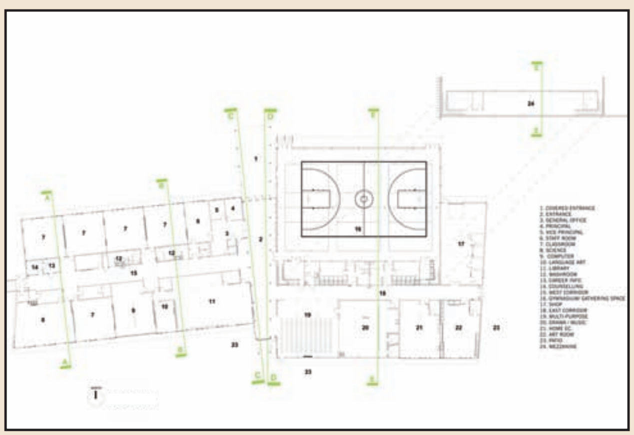
The new building is located to the west of the Woodward Building, between it and No. 5 Road. Rather than adopting the conventional solution, which would have been to orient the building parallel to the main road, it is instead arranged perpendicularly and is entered from the north. This enables the new building to relate more closely to the Woodward Building, creating a campus-like quality, as well as improving solar orientation by elongating the east-west axis. A pedestrian path connects the old and new buildings.

The decision to build a single storey structure was partly economic and partly programmatic. The greater part of the program is made up of a gymnasium, multi-purpose room, drama studio, home economics room, library and tech shops – all of which ideally needed to be located at ground level. This left only seven classrooms that could have been organized in a two-storey block – but this would have incurred disproportionate extra costs for stairs and elevators. A two-storey classroom block will be added in a later phase.

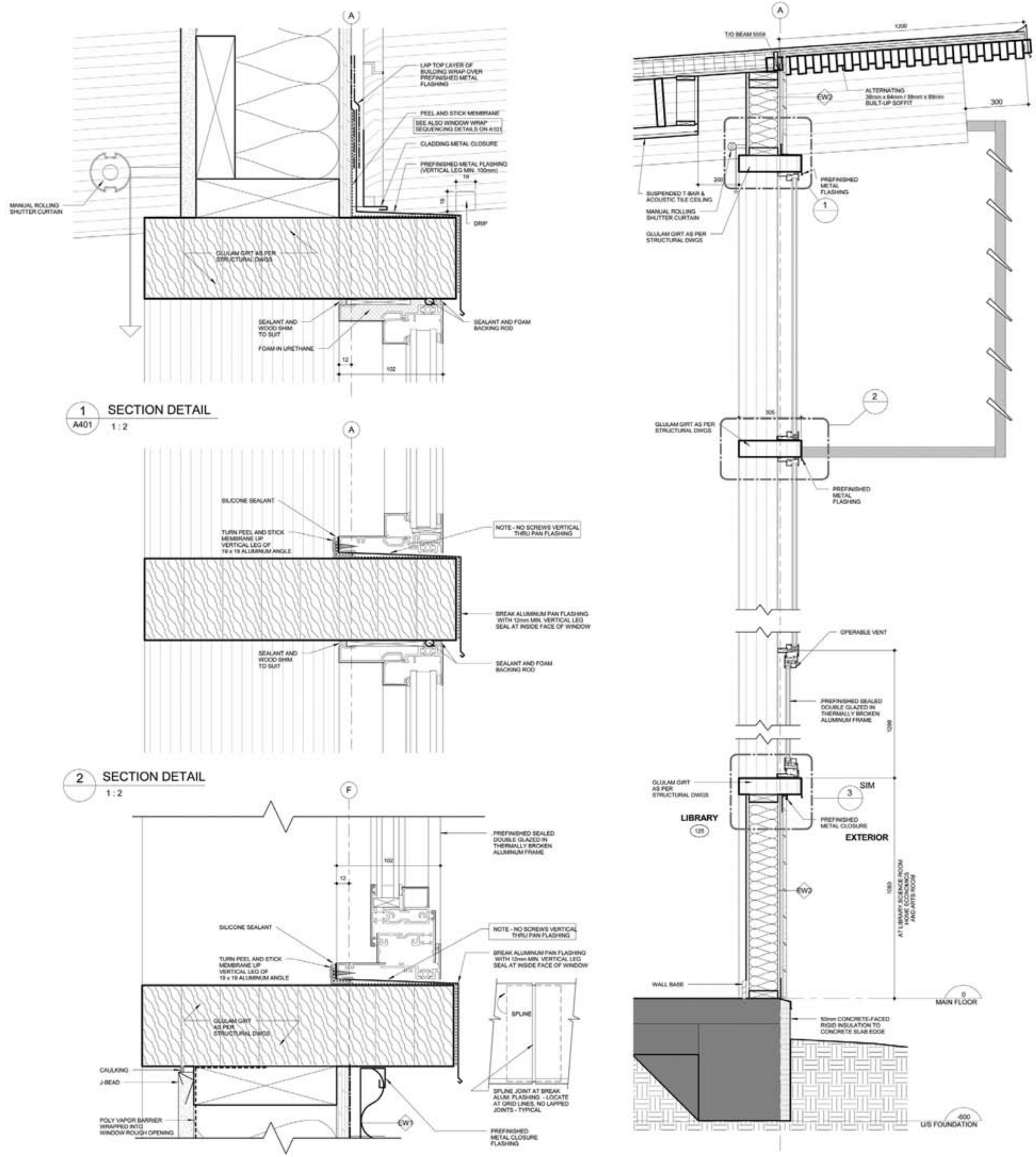
The plan is organized into two wings, placed either side of the north-south entrance and circulation axis. The west wing is turned a few degrees off grid, with the result that the central circulation spine tapers in plan from north to south. The taper is repeated in section, so that the expansive scale of the entrance canopy reduces first to that of a generous foyer, then further to that of a more intimate corridor before terminating at the entrance to the gym. This forced perspective adds drama to the experience of the building.

The single storey solution has the added advantage of increasing the opportunities for introducing daylight to the interior spaces, and this opportunity has been beautifully exploited through the introduction of 'light trenches' along the length of the entrance foyer and corridors.

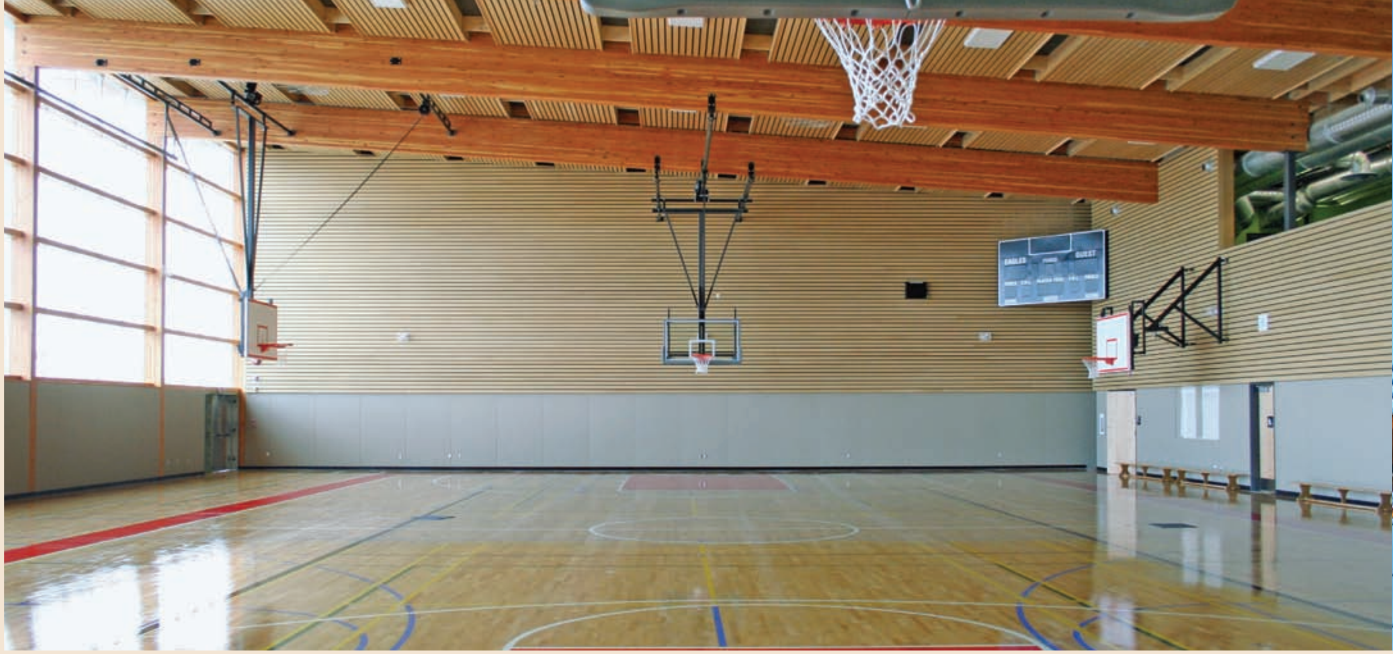
Daylight has also been introduced into the gymnasium to a degree rarely seen before in Canada. A vast north-facing window wall brings bright and even daylight into the entire space without hot spots or glare. The light, combined with the material quality of the space, makes the gymnasium a suitable venue for a variety of school and outside functions.



FLOOR PLAN



TYPICAL SECTIONS



Structure

The design of the building structure was driven by two objectives: economy and a desire to create a non-institutional environment that would be visually warm and welcoming. The solution was a simple post and beam system on a 4.2-metre (14-foot) grid, made up of a combination of Douglas fir and spruce/pine/fir (SPF) glulam elements with solid-sawn rafters. The structure is fully exposed in some of the larger spaces, notably the gymnasium, but only partially exposed in the classroom areas where suspended ceilings have been used.

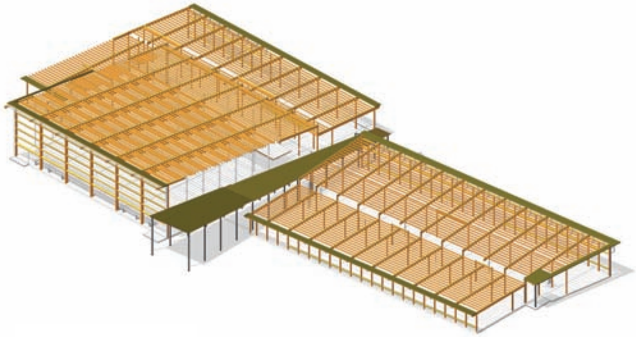
In the gymnasium, the north-facing exterior wall is fully glazed above an 8-foot (2.4-metre) datum level. Here the glulam columns are connected by glulam transom beams that resist the wind forces acting on the curtain wall, so reducing the required depth of the extruded aluminum mullions. The ceiling beams are exposed and between them are prefabricated 5/8 inch (15mm) thick slatted medium density fibreboard (MDF) panels with acoustic insulation behind. A similar finish is used on the interior walls, where the MDF is fastened directly to 2″x2″ (38x38mm) strapping on 24 inch (600mm) centres.

In the classroom areas, only the glulam columns are exposed. As in the gymnasium, glulam transom beams are used to resist wind forces,

although in this case the glazing system fits between the beams rather than running past them on the exterior as the curtain wall does. The face of the glulam transom beams, thus exposed on the exterior of the building, is protected by a flashing. Internally, the lowest beam forms a window sill that is deep enough for students to sit on.

Around the edge of the building, the roof eaves are constructed using solid 2″x3″ and 2″x4″ lumber nailed side by side on edge. This nailed plank system is both self-supporting and self-finished, spanning between the roof beams and cantilevering beyond the beam ends. Finished off with a zinc gutter, this detail creates a crisp and elegant edge to the roof. The warmth of the wood soffits is highlighted by exterior uplighters.

A similar construction technique is used for the roof of the entrance canopy, foyer and circulation spine, which appears to float above the slender steel portal frames that support it. Here the nailed planks are alternately 2″x4″ and 2″x6″, giving the soffit a visual texture and good acoustic properties.



ISOMETRIC VIEW - STRUCTURAL

Environmental Strategies

Although this building did not go through formal green building registration processes such as Green Globe and LEED, it nonetheless incorporates many design strategies consistent with these evaluation systems.

Building orientation takes maximum advantage of passive solar radiation and glazing is sized and positioned to maximize daylight and views. Windows are operable to facilitate natural ventilation.

The choice of wood for the structure also has environmental benefits. Wood is a local material with low embodied energy and, when obtained from sustainably managed forests, helps reduce atmospheric carbon dioxide.

Interior finishes were chosen for durability and low VOC (volatile organic compounds) emissions. These include both the solid wood and MDF material, which are clear sealed.

The mechanical system is highly efficient, employing heat pumps that use a variable refrigerant flow system new to North America. This system, which enables excess heat generated in one zone of the building to be transferred and used to heat other cooler zones, replaces the traditional on/off control system with one that operates on an infinitely variable sliding scale.

Conclusion

Richmond Christian School is an eloquent example of how straightforward post and beam construction, strategically and sensitively handled, can produce buildings of poetic simplicity and elegance. The detailed design demonstrates an understanding of the inherent properties of wood, its strengths and limitations. The nailed plank roof and eave systems are both self-finished and self-supporting while the gutter and flashing details acknowledge the need to protect the material from weather in exposed locations. The result is a building that is not only elegant but economical, durable and environmentally responsible.

APPENDICES

Code Brief

The governing code is the British Columbia Building Code (BCBC). The building is classified A2 (assembly) major occupancy and contains a public kindergarten to Grade 12 school under a single tenancy. All other uses contained within the building are considered subsidiary occupancies within the major occupancy.

The building is considered combustible construction, one storey plus mezzanine, slab-on-grade with partial crawlspace, and is fully outfitted with sprinklers.

Floor assemblies and mezzanines are required to be fire separations and, where they are of combustible construction, have a fire resistance rating of not less than 45 minutes.

Load-bearing walls, columns and arches supporting an assembly are required to have a fire resistance rating of 45 minutes.

Project Credits

	Address	City	Prov.	PC	Phone	Website
Client School District #8 Kootenay Lake	570 Johnstone Road	Nelson	BC	V1L 6J2	250 352 6681	www.sd8.bc.ca
Architect KMBR Architects Planners Inc.	1788 8th Avenue West	Vancouver	BC	V6J 1V6	604 732 3361	www.kmbr.com
Structural Engineer Fast + Epp Structural Engineers	201-1672 1st Avenue West	Vancouver	BC	V6J 1G1	604 731 7412	www.fastepp.com
Mechanical Engineer Poole & Associates Mechanical Engineering Ltd.	107-2293 Leckie Road	Kelowna	BC	V1X 6Y5	250 762 6116	
Electrical Engineer Falcon Engineering Ltd.	210-1715 Dickson Ave.	Kelowna	BC	V1Y 9G6	250 762 9993	www.falcon.ca
Landscape Architects Maruyama & Associates	615 Stamps Landing	Vancouver	BC	V5Z 3Z1	604 874 9967	
Construction Manager School District #8	570 Johnstone Road	Nelson	BC	V1L 6J2	250 352 6681	www.sd8.bc.ca

Commissioning Agent R.A. Bruce & Associates	5603 38B Ave NW	Edmonton	AB	T6L1W2	780 462 6909	
Photography Brandi Abele, Witmar Abele, KMBR	1788 8th Avenue West	Vancouver	BC	V6J 1V6	604 732 3361	www.kmbr.com

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APPENDICES

Code Brief

The governing code is the British Columbia Building Code (BCBC). The building is classified as a Group A - Assembly - Division 2 major occupancy. The building contains a public school under a single tenancy. All other uses contained within the building are considered subsidiary occupancies within the major occupancy.

The building is of combustible and heavy timber construction; building height is one storey (plus mezzanine). The building is fully outfitted with sprinklers.

Load-bearing walls, columns and arches supporting an assembly are required to have a fire resistance rating of 45 minutes.

Project Credits

	Address	City	Prov.	PC	Phone	Website
Client Richmond Christian School	10260 No. 5 Road	Richmond	BC	V7A 4E5	604 274 1122	www.richmondchristian.ca
Architects KMBR Architects Planners Inc.	1788 8th Avenue West	Vancouver	BC	V6J 1V6	604 732 3361	www.kmbr.com
Allen + Maurer Architects	2843 Arawana Place	Naramata	BC	V0H 1N0	250 276 4106	www.allenmaurer.com
Structural Engineer Fast + Epp Structural Engineers	201-1672 1st Avenue West	Vancouver	BC	V6J 1G1	604 731 7412	www.fastepp.com
Mechanical Engineer Cobalt Engineering	305-625 Howe Street	Vancouver	BC	V6C 2T6	604 687 1800	www.cobaltengineering.com
Electrical Engineer Acumen Consulting Engineers	One Innovation Place, Suite 650-2700 Production Way	Burnaby	BC	V5A 4X1	604 525 4601	www.engineering-acumen.com
Civil Engineer Matson Peck Topliss Engineering	Suite 210-8171 Cook Road	Richmond	BC	V7A 5H7	604 270 9331	www.mpt.bc.ca
Landscape Architects Maruyama & Associates	615 Stamps Landing	Vancouver	BC	V5Z 3Z1	604 681 0548	
Construction Manager Companion Construction Ltd.	4211 Vanguard Road	Richmond	BC	V1Z 1G1	604-271-1609	www.companionconstruction.com
Photography Robert Stefanovic	2843 Arawana Place	Naramata	BC	V0H 1N0	250 276 4106	www.iana-architect.ca
Photography Florian Maurer	2843 Arawana Place	Naramata	BC	V0H 1N0	250 276 4106	www.iana-architect.ca

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