JACKSON-TRIGGS ESTATE WINERY

NIAGARA, ONTARIO

KPMB ARCHITECTS

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JACKSON-TRIGGS WINERY
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QUICK FACTS

Building Name	Jackson-Triggs Niagara Estate Winery
City	Niagara-on-the-Lake, Ontario, Canada
Year of Construction	1999-2001
Architect	Kuwabara Payne McKenna Blumberg Architects
Consultants	Blackwell Engineering (structural); Keen Engineering (mechanical/sustainability); Carinci Burt Rogers (electrical); Janet Rosenberg &Associates (landscape); Suzanne Powadiuk Design (lighting); Merit Contractors of Niagara (contractor)
Program	Winery
Gross Area	4,000 m^2
Owner/User Group	Vincor International Inc. / Jackson-Triggs
Climate	Temperate, cold-humid
Special Site Conditions	Maximize the area of arable land
Aesthetics	Agrarian / industrial
Structural System	Concrete walls, columns, and barrel vaults below grade; steel columns supporting full-span wood trusses above grade
Mechanical System	radiant floor heating/cooling, multi-zone air handling units, fan-coil units
Special Construction	accommodate production of premium wines
Daylighting	East-west orientation; continuous clerestorey windows
Shading	5m overhang of roof on south,east and west facades
Acoustics	No special considerations
Ventilation	Operable windows and sliding oversize doors; displacement ventilation system is used for office, boardroom and lounge areas
Adaptability	None
User Controls	Operable windows and sliding oversize doors
Estimated LEED Rating	26/69 - Certified Status
Cost of Construction	+/- $9 million
Annual Maintenance	Estimated at $198 000
Special Circumstances	Building designed to highlight process of wine making to visitors

INTRODUCTION

"When Vincor began planning for the new winery, its Ontario wine production facilities were limited to a large warehouse-like space in Niagara Falls. The facility was unable to accommodate the production of super- and ultra- premium VQA wines, and its symbolic presence was far removed from the consumer.

Vincor's President and CEO Donald Triggs, a marketer at heart, envisioned a new state-of-the-art winery that would be capable of producing super- and ultra- premium VQA wines, feature a unique visitor experience that would bring people closer to the wine, and would be a recognizable home for the wine, strengthening the product's brand and providing the Jackson-Triggs label with a stronger identity."[1]

The architects of the new winery production and retail facility in Niagara-on-the-Lake, Ontario were given three environmental objectives: the building should be agrarian in nature, the building system should be just as conservative as the wine-making process, and CO_2 emissions should be minimized.[2]

From a distance, the building appears small in scale. Strickland, in On/Site magazine review, attributes this initial visual reading to the oversized cement board siding and the building's fit within the region's agricultural vernacular. Closer to the building, its true large scale can be fully appreciated, giving the building a more industrial reading.[3] The building is designed to support the production of premium wines, while illustrating the wine-making process to visitors. Sustainable and energy efficient design strategies have been employed in both the wine production systems and the building's construction and environmental control systems.

Figure 1 (Top): View of the breezeway entrance to the winery. Figure 2 (Bottom): Detail of the glulam and steel trusses that support the floating plane of the roof.

Figure 3 (Top): A view to the vineyards from the breezeway passage in the building.
Figure 4 (Below): Looking north towards the Winery from the southern grape fields.

SITE

The new home for the Jackson-Triggs Winery is located in the rustic wine region of southern Ontario, Niagara-on-the-Lake. The Estate Winery was sited to maximize the cultivated area of the vineyard. The siting places the grape processing equipment (located at the western end of the winery) central to the fields and takes advantage of the dense vegetation on the edge of Two Mile Creek at the east end of the building. The building lies parallel to the Niagara Escarpment and perpendicular to the north-south alignment of the vineyards, giving long views down rows of growing grapes and maximizing the south facing building area.[4]

Off of Old Niagara Stone Road (Highway 55), which encloses the vineyard on the northwest side, a drive curves through demonstration vineyards to the parking lot. A long axial walkway, flanked by a linear trough-like water feature and garden, leads to a large opening in the linear building – the Great Hall – which divides the two major program components of the building and provides views through it to vineyards to the south.[5]

The necessary rural location of the Winery does not promote environmentally sensitive modes of transportation since most visitors arrive by car and there is no public transport to the winery. However, there are many companies that provide bus tours to the Niagara wineries – about once a day, to the Jackson-Triggs Estate Winery – such as Niagara Air Bus, Wine Country Tours, Crush on Niagara Wine Tours, Elite Wine Tours and Niagara Wine Tours International. A tour bus, that takes passengers to specific desired locations, could be more efficient than public transit, which runs on general routes with or without passengers.

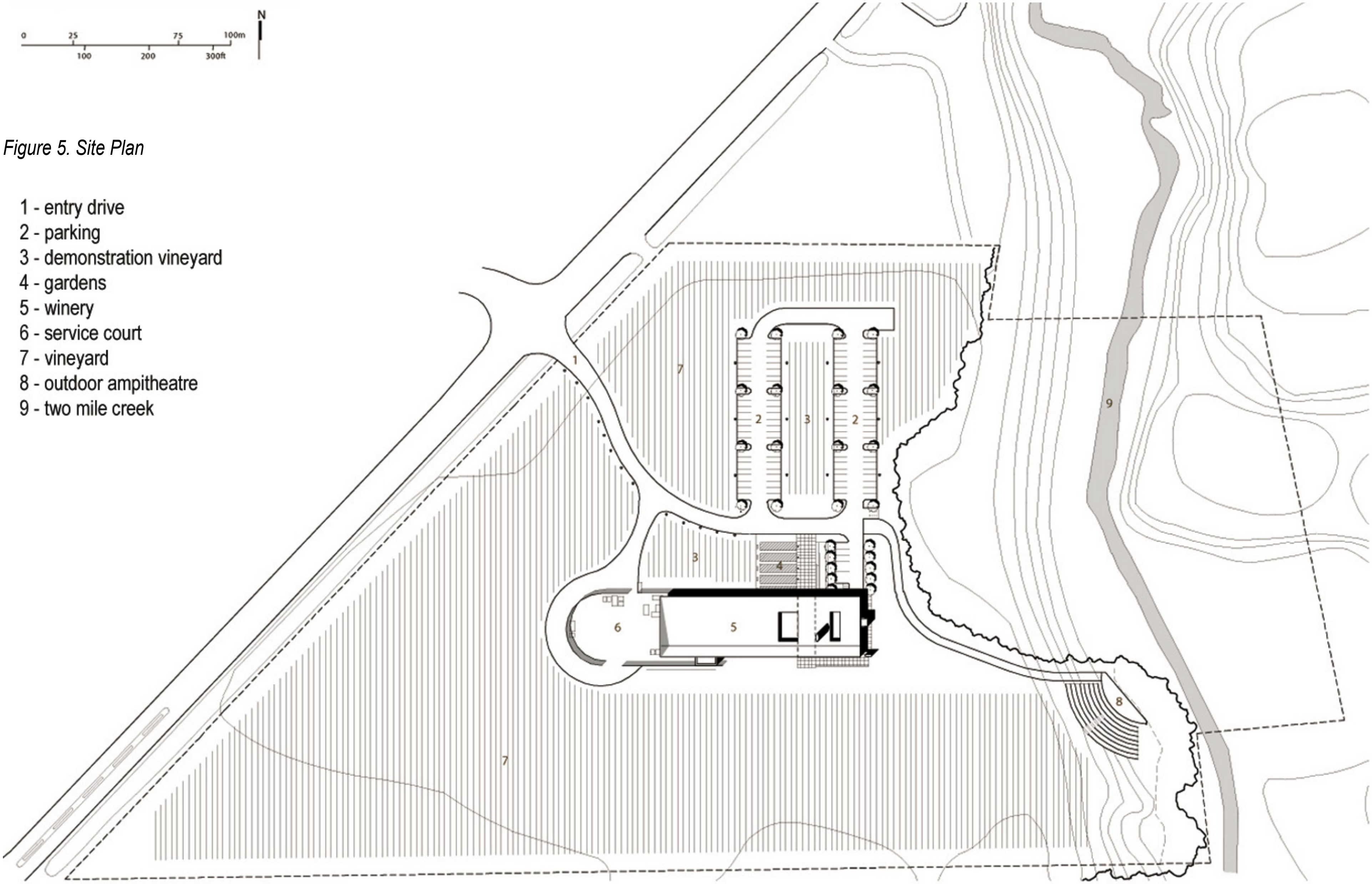


Figure 5. Site Plan

1 - entry drive
2 - parking
3 - demonstration vineyard
4 - gardens
5 - winery
6 - service court
7 - vineyard
8 - outdoor ampitheatre
9 - two mile creek

Figure 6 (Above Left): Main reception area divides the industrial and administrative areas. Figure 7 (Above Left): The outdoor cafe. Figure 8 (Below Left): Machinery used when grapes arrive from the field. Figure 9 (Below Right): The wine-tasting area.

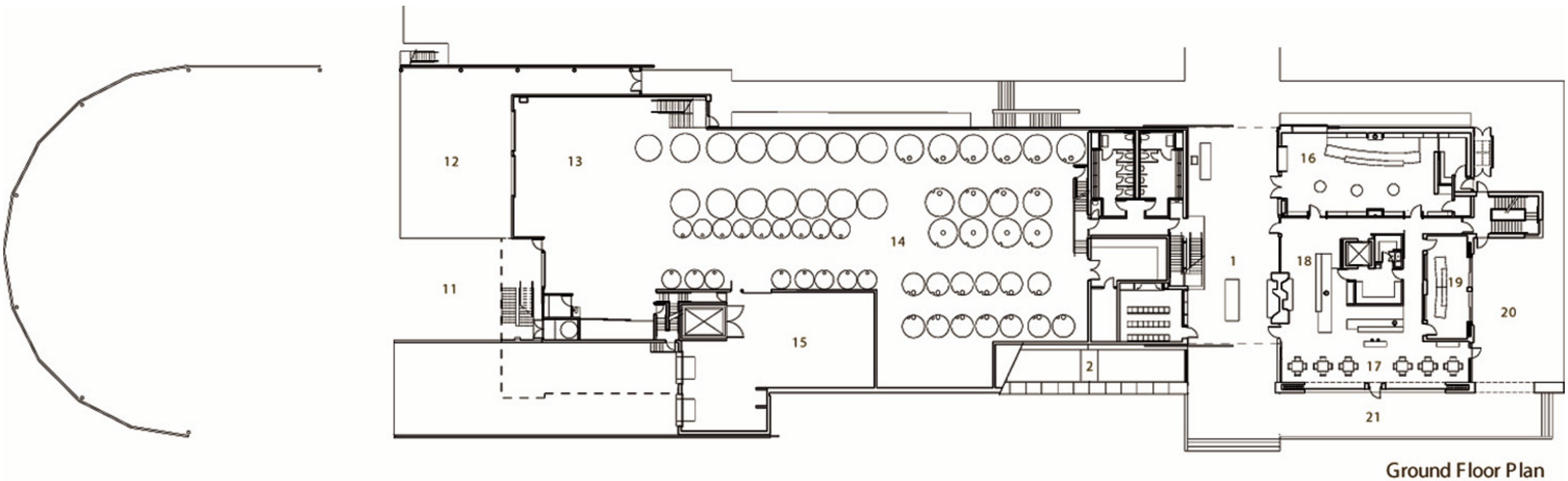
PROGRAMME

The two-storey, four thousand square meter (4,000m^2) winery is comprised of two main programmed components divided by a 'Great Hall', that are unified under one floating roof plane. The public area with tasting bars, a retail shop, entertaining spaces and administration areas occupy the eastern end of the building. The production area – including the fermentation tanks, storage and barrel cellars, which are all accessible to public as part of a tour – is situated at the western end of the building. The building occupancy is local retail (654m^2 or 19%), office (288m^2 or 8%) and industrial (2,509m^2 or 73%).[6]

The large, double height Great Hall acts as a link and buffer; it both divides and bridges the public and production areas. The full height oversize sliding doors, that open the hall and entrance court to the vineyards in mild weather, take advantage of the relatively temperate Niagara climate. This large open room provides immediate sensory connections to the vineyards: visually it is unobstructed by glazing reflections, breezes blow through the space, and the sounds and the smells of the grape growing process all filter through.

The more refined material selection and detailing of the public areas – "white marble counters that provide a neutral background against which to view the colour of the wine, oak millwood that refers to the barrels downstairs, earthy plaster finishes and polished concrete floors."[7] – is contrasted by the industrial appearance of the production areas.

The Winery produces 105,000 cases per year, of super- and ultra- premium VQA (red and white), Sparkling Wines and Icewines. Chardonnay, Pinot Noir, Riesling vines are planted on-site and private growers supply other types of grapes.[8] The organization of the winery follows the process of winemaking.[9]



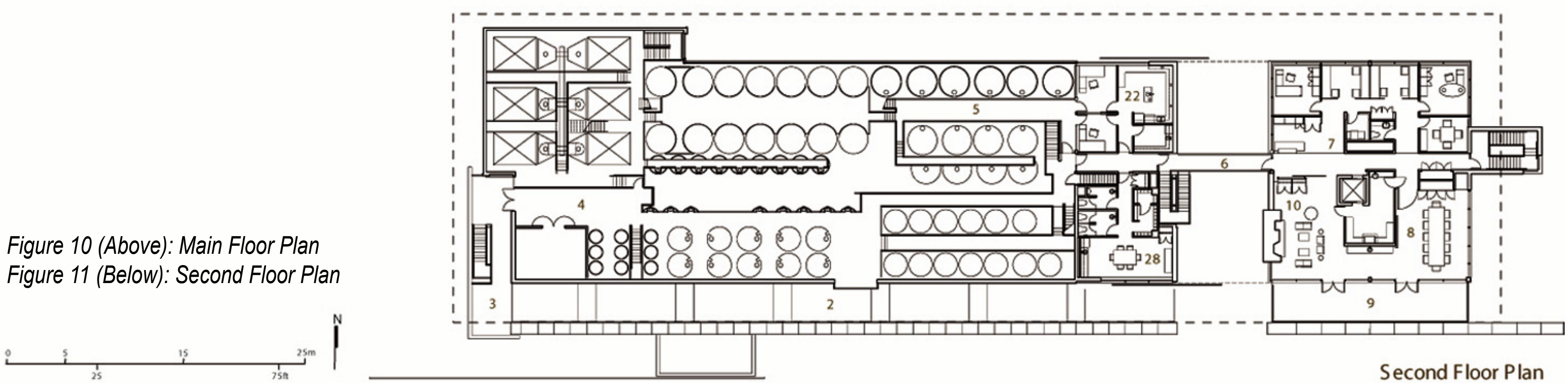
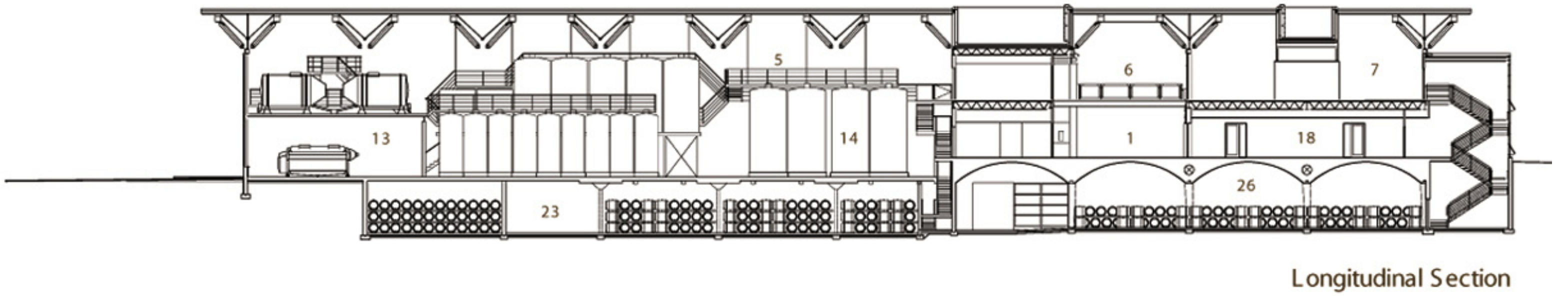
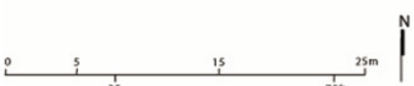


Figure 10 (Above): Main Floor Plan
Figure 11 (Below): Second Floor Plan



1 great hall
2 pedestrian ramp
3 viewing platform
4 pressing mezzanine
5 production catwalks
6 bridge
7 offices / administration
8 boardroom / dining
9 terrace
10 vip lounge & tasting
11 service court
12 crushing area
13 pressing area
14 fermentation area
15 storage
16 retail shop
17 tasting gallery
18 wine bar
19 tasting rooms
20 tasting terrace
21 café terrace
22 wine makers' offices / laboratory
23 finishing cellar
24 barrel washing
25 wine library
26 barrel cellar / cellar dining
27 unexcavated
28 staff lounge

Figure 12 (Above): East-West Section
Figure 13 (Below): Lower Level Plan



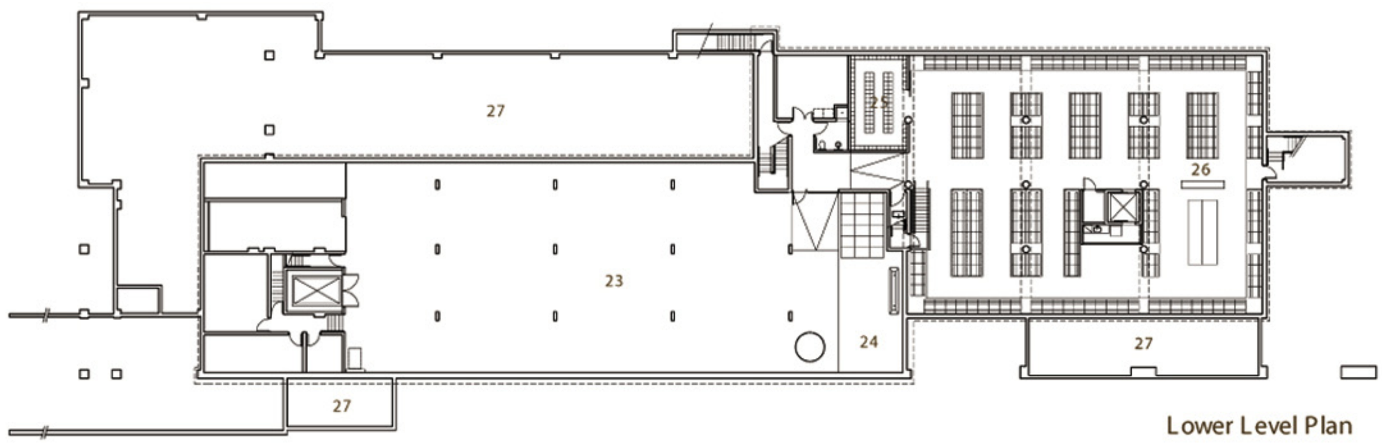
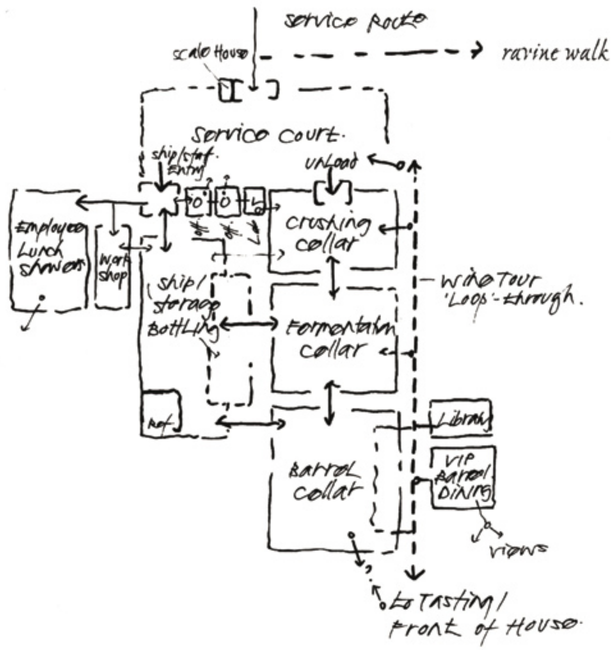
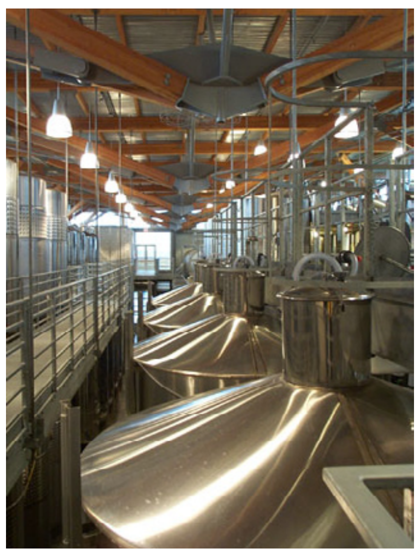


Figure 14 (Above): The retail area sells wines not available elsewhere. Figure 15 (Below): The barrel cellar is integral in the wine aging process, but also in the appreciation of the facility and wine-making process.

Figure 16 (Above): Schematic of the wine-making process integrated into the planning of spaces for efficiency. Figure 17 (Below Left): Detail of the bridge between the administration and production area. Figure 18 (Below Right): View into the production area of the winery.





At the western end of the building, trucks deliver fruit to a large service area for crushing. The winery's crushing capacity is 1,300 tonnes per year. Juice is pumped up to second level fermentation tanks, which can hold a combined capacity of one million litres. Gravity – instead of the typical method of pumping that could harm young wine – is used for processing the wine. The repetition of the stainless steel tanks, the steel catwalk systems and the extensive piping give the production area an industrial look.[10]

The storage and barrel cellars are below the production areas. Below grade, a cool and consistent temperature is maintained for the 1,600 barrels, through the heat sink effect from surrounding earth. "Poured-in-place concrete barrel vaults on tapering concrete columns create an updated version of traditional caves, and carefully integrated low lighting accentuates the warmth of French oak barrels against the earthy grey of concrete and river stone. A fundamental part of the winery tour, the cellars need to be evocative as well as functional, and the strategy here is an effective one."[11]

SUSTAINABLE DESIGN

Natural building materials that are indigenous to the region have been used in the winery, including white oak and Algonquin stone. Most selected materials are naturally finished, such as wood, stone, concrete and stainless steel. Materials like hollow metal doors and frames, which are usually painted, have only been sealed. The exposure of raw building materials displays a composition of varied textures and finishes, from highly polished to coarse and patina.[12] "Cement-board exterior cladding and rubble stone walls contribute further to the building's rustic, agrarian quality, but the detailing and composition are unmistakably high design."[13] 95% of interior finish materials are low VOC and 30% of the solid construction waste will not be sent to a solid waste facility.[14]

The database of the Sustainable Building Information System compares each building to a 'benchmark' type. Since a winery is highly specialized it was difficult to find a suitable benchmarking facility. The benchmark type was selected to "accommodate the functions of a utilitarian architecture more commonly found in light industrial parks or farm buildings, where production space is typically located adjacent to appointed office and administration spaces but not necessarily in the same building."[15]

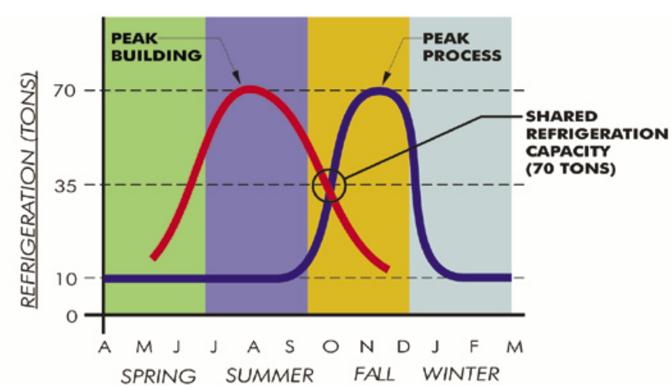
"The [Jackson-Triggs Winery] appears to have marginally higher embodied energy consumption compared to the benchmark building. This can be explained by the use of architectural elements such as the extensive clerestory glazing and the lightweight metal roof. On the other hand, the high quality architectural solution, as compared to its industrial park archetype, has been achieved at only a marginally higher cost to the environment due to the embodied effects of the building structure and envelope."[16]

The Sustainable Building Information System charts: the annual consumption of delivered energy to the winery at 1,672 MJ/m^2 (benchmark 2,424 MJ/m^2), the annualized embodied energy for structure and building envelope at 68 MJ/m^2 (benchmark 52 MJ/m^2), total of annualized embodied energy and annual delivered energy at 1,741 MJ/m^2 (benchmark 2,476 MJ/m^2), and the annual total of primary non-renewable fuels used on-site for generation of electricity at 1,839 MJ/m^2 (benchmark 2,683 MJ/m^2).[17] While the embodied energy of construction materials is high for the Jackson-Triggs Winery, the total embodied and delivered energy – as well as the primary non-renewable fuels used on-site for generation of electricity – were both significantly lower than the benchmark design.

Table 1. Sustainable Building Information System Partial Analysis

Other General Building Data	Bmark	Design	Units	Design/ Bmark
Not applicable	0	0	m2	
Total net floor area for Local Retail	654	654	m2	
Total net floor area for Office	288	288	m2	
Total net floor area for Industrial	2,509	2,509	m2	
Surface area to volume ratio above grade	0%	68%	percent	0.00
Average window to wall ratio	0%	75%	percent	0.00
Overall glazing SHGC	0.80	0.60	ratio	0.75
Overall window STC in wall exposed to most noise	27.50	30.00	ratio	1.09
Overall window U-value	2.80	1.89	W/m2 * OC	0.68
Overall exterior roof U-value	0.33	0.19	W/m2 * OC	0.57
Overall exterior solid wall U-value	0.33	0.00	W/m2 * OC	0.00
Overall exterior solid wall RSI-value	3.03	0.00	m2 * OC/W	0.00
Average reflectance of horizontal roof surfaces and hard-paved site areas	0.32	0.90	number	2.80
The vertical angle measured from the building line on the ground of the nearest adjacent property to the roof line of the case-study building is (0 to 90 degrees):	0	0	degrees	0.00
Estimated percent of the southerly facing building façade of an adjacent property south of the case-study building, that is shaded by it at 12 noon on Summer Soltice.	0%	0%	percent	0.00
Estimated Daylight Factor	2.0%	4.5%	percent	2.25
Predicted minimum relative humidity during heating season	28.6%	30.0%	percent	1.05
Predicted maximum relative humidity during cooling season	76.3%	80.0%	percent	1.05
Percentage of net floor area of the building that is mechanically ventilated and cooled.	100.0%	100.0%	percent	1.00
Ratio of openable window area or other controllable openings to all net primary area in naturally ventilated areas	NA	9.0%	percent	

Figure 19 (Right): Double-duty refridgeration process helped to reduce both building and process energy loads. Source: Keen Engineering.



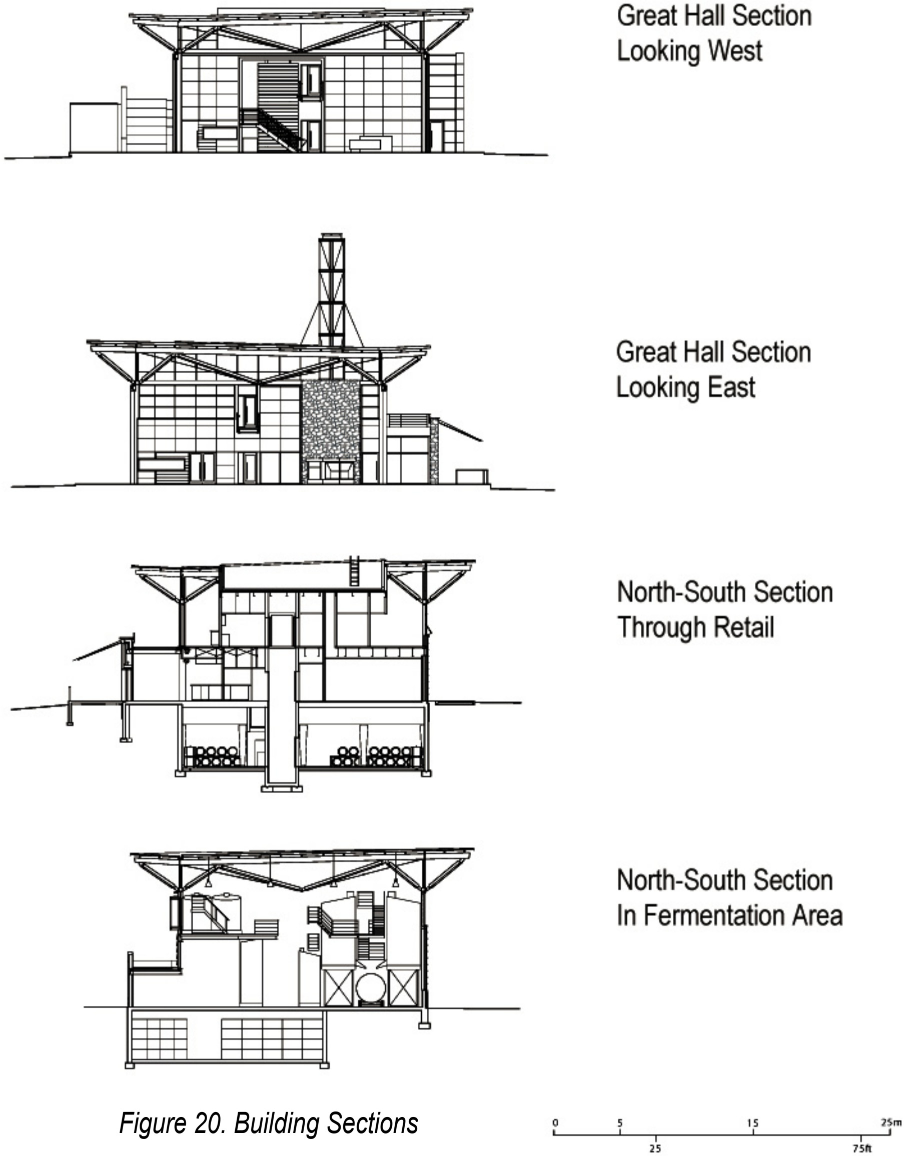


Figure 20. Building Sections

The winery also employs grey water re-use systems and water conservation methods to reduce water consumption. The Sustainable Building Information System charts: annual potable water consumption for all building uses per unit area 3.5 m^3/m^2 (benchmark 44.4 m^3/m^2), annual potable water consumption for all building uses 113 m^3/occupant (benchmark 1,427 m^3/occupant), annual greywater and rainwater use for all building uses 7.5 m^3/occupant (benchmark 0 m^3/occupant), sanitary waste water not leaving site 0.23 m^3/m^2 (benchmark 0 m^3/m^2), and storm water not leaving site 0.42 m^3/m^2 (benchmark same m^3/m^2).[18]

"The building achieves excellent water economies, through water conservation measures. For example, using the force of gravity avoids the need of large quantities of water to be pumped for processes such as cleaning the vats."[19] Water used for cleaning runs into linear drains in the production area. It is treated for PH before leaving the winery.

Storm water management minimizes site impact: an on-site water collection system discharges rainwater and site drainage to 'Soak Away' pits.

A lower reflectance on horizontal surfaces (such as roofs) and hard-paved site areas reduces heat islands (thermal gradient differences between developed and undeveloped areas) which minimize the impact on microclimate and human and wildlife habitat.[20] The average reflectance of horizontal surfaces and hard-paved site areas at the winery is 0.90 (the benchmark was 0.32).[21] The heat islands created by the tar and gravel roof, and the hard surfaced parking and entry court, are compensated for by the fields around the building which occupy the majority of the site.

ENVIRONMENTAL CONTROLS

The building uses energy conservative systems, as well as materials and components to reduce supplemental heating and cooling loads.

An east-west building orientation and five to one floor plate ratio, maximizes south-facing passive solar gain and day lighting. The daylight factor is 4.5% (compared to the benchmark of 2.0%).[22] The abundance of natural light reduces the reliance on artificial illumination systems, lowering cooling loads and electrical energy costs. The roof that overhangs five meters on the south, west, and east shades the building and minimizes direct solar heat gain, and cooling energy loads.[23]

Operable (motorized at the clerestory position) windows in all areas encourage natural ventilation during shoulder (Spring and Fall) seasons to reduce the reliance on building heating and cooling systems. Windows are connected to the HVAC control system, turning the system off in locations where windows are open. Air is circulated with ceiling fans and a displacement ventilation system is used for office, boardroom and lounge areas where high ceilings allow stratification, providing energy reductions and improvement in indoor air quality. Marco Polo in Canadian Architect attests to “the cool temperature in the naturally ventilated production areas on a hot July day.”[24]

Heating and cooling is divided into individual control zones, including north, south, east and west facades, as well as individual program zoned areas, to maximize energy conservation. A radiant floor system, forced air and fan coil units condition zoned spaces in the building on a scheduled control system. Concrete radiant floor heating and concrete cooling, between the basement barrel storage and the fermentation area above, use concrete mass for storage

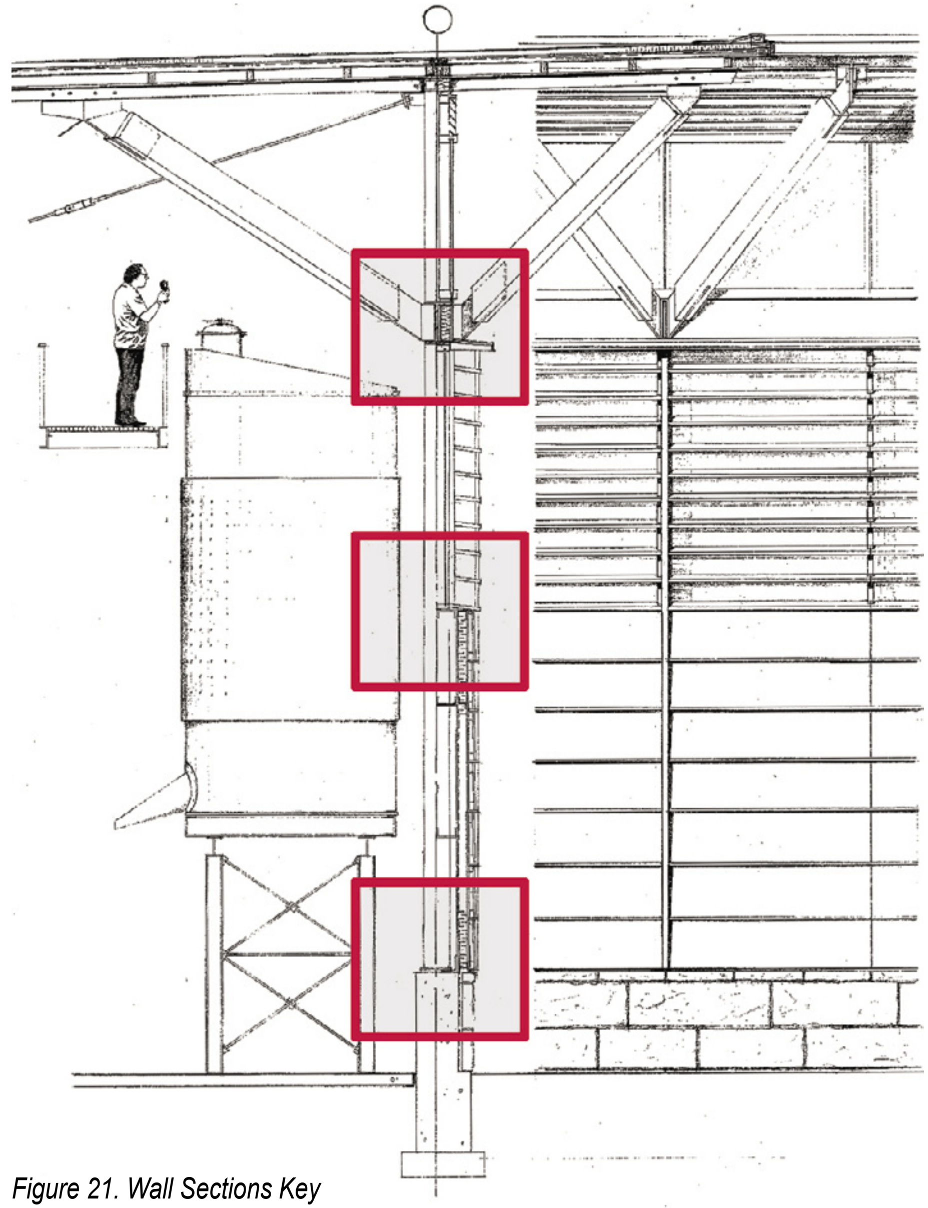


Figure 21. Wall Sections Key

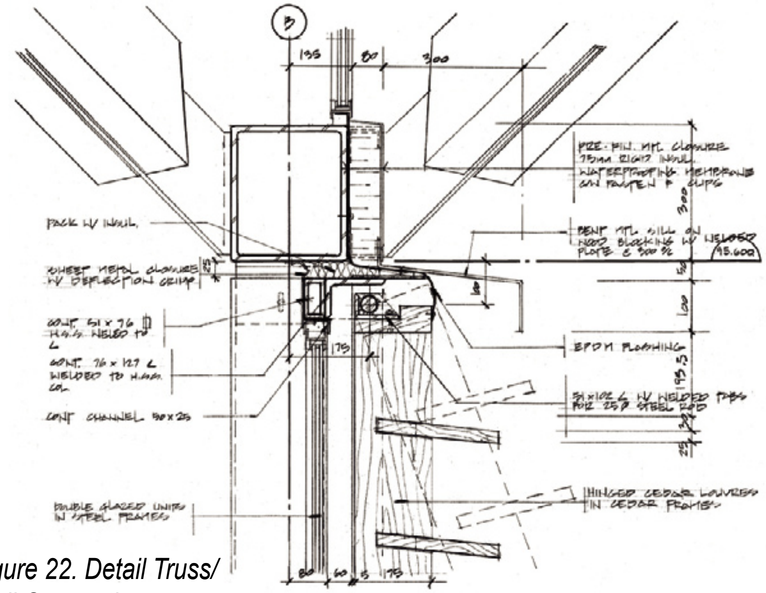


Figure 22. Detail Truss/ Wall Connection

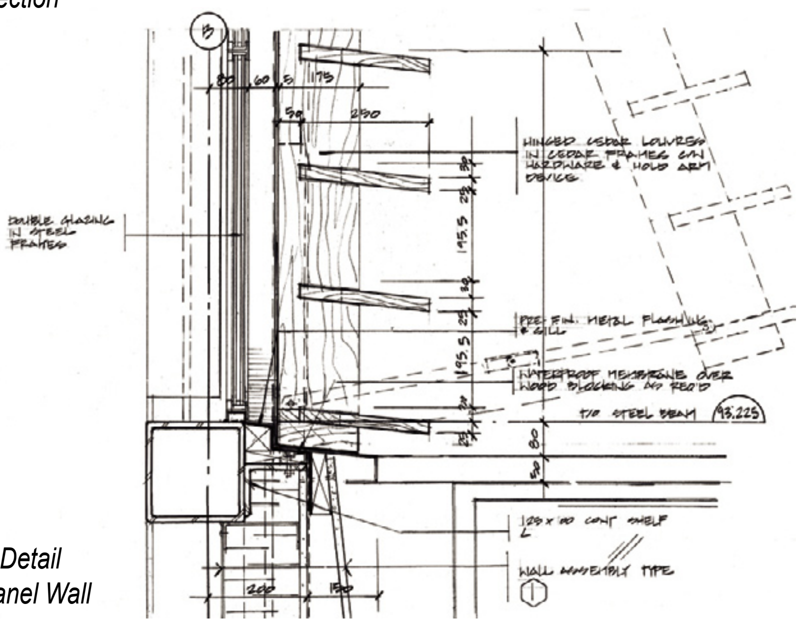


Figure 23. Detail Window/Panel Wall

and thermal flywheel effect. The multi-zoned air-handling unit uses air-to-air heat exchangers for the pre-heating of fresh air for the building.[25] High efficiency motors are used on equipment, such as fans and pumps, throughout the building. A direct digital control system is used to automatically schedule and monitor equipment to maximize energy conservation. Energy consumption is estimated at 60-70% of ASHRAE 90.1.

CONSTRUCTION

The building uses a structural system of concrete floors, walls, columns and barrel vaults to grade, and steel columns supporting full-span wood trusses above grade. The continuous plane of the roof, clad in unfinished steel deck-

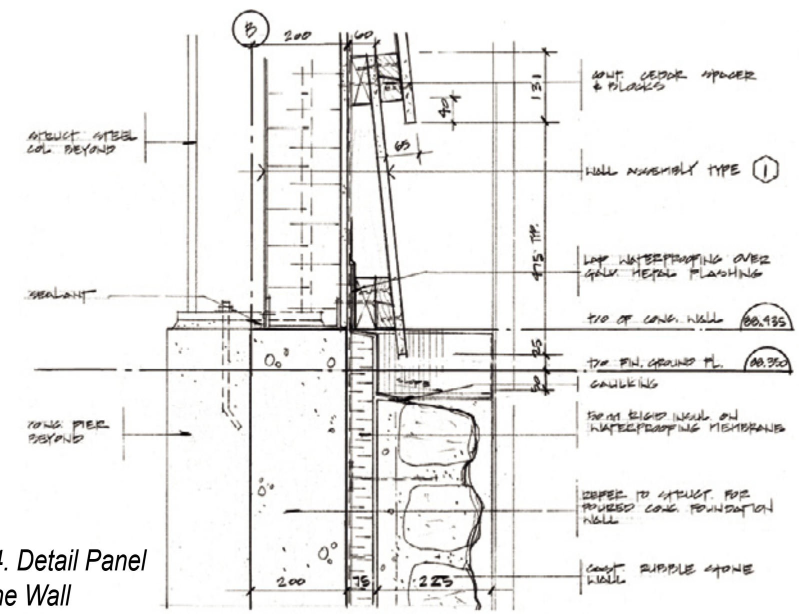


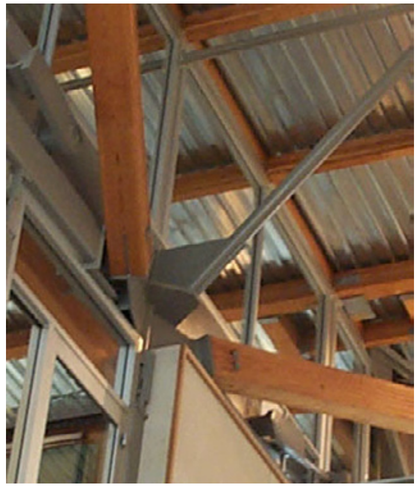
Figure 24. Detail Panel Wall/Stone Wall

ing, acts as a unifying element for the building and promotes the typology of the industrial shed. It is supported by the wood trusses, and floats above a continuous clerestory window. Below the clerestory, the exterior walls are clad with cement board siding with a rubble stone wall base. The overall window U-value is 1.89 (the benchmark was 2.80), and the overall roof U-value is 0.19 (the bench mark was 0.33).[26]

INTEGRATION OF SYSTEMS

The design maximizes the use of equipment for dual purposes to minimize the use of embodied energy: the building uses the commercial heating and ventilation equipment for the Carbon Dioxide emergency exhaust systems; motorized

Figures 25 and 26: Details of the production area architecture and wine process.



Figures 27, 28, and 29 (Above Left, Above Right, and Below Left, respectively): Details of the steel and glulam trusses. Figure 30 (Below Right): Detail of barrel cellar.

operable windows are used for relief air and moisture, as well as make up for carbon dioxide exhaust ventilation; refrigeration equipment is used for the process cooling of the wine-making tanks and provides chilled water for the HVAC air handling equipment, saving the purchase of a (40) forty-tonne commercial chiller.

The building uses ozone-friendly (non-ozone depleting) refrigerants. The generation of domestic water off central boilers is used rather than a separate water heater; minimizing materials and increasing boiler efficiency.

The natural and mechanical environmental control systems (described above) are integrated into the design. The more significant integration of systems for the Winery is the incorporation of the winemaking process with the architecture.

“When Rob Scapin [a master winemaker] joined the team, he brought ideas about technology that would help achieve the goals of a gravity-fed winery, minimizing the harmful mechanical manipulation of young wine by designing the building around the process. This was accomplished with the architect by bringing the equipment to the wine rather than the more traditional other way around. An example of how this was achieved was by elevating the red wine fermentation tanks and rolling the tank presses along railways beneath the tanks, and by letting the sinks flow by gravity into the press instead of pumping. However, the design of winemaking technology that could accommodate these processes was simply not available in Canada. Some equipment came from abroad, and the parts that weren’t commercially available were designed by the architect in close collaboration with the winemaker. This customization of the equipment is one of the features that make this facility unique, and the end result was a process that would yield a premium wine product.”[27]

The use of gravity in the production spaces, which accounts for a majority of the building, exemplifies energy-efficiency by eliminating the typical and energy consuming pumping processes of winemaking. Juices flow below grade into a finishing cellar, where the surrounding earth helps to maintain a stable, cool and humid environment – ideal for the aging of wine – through a heat sink effect. Low energy evaporative drying is used to remove excess moisture produced in the fermentation cellar. “The design of the building is completely consistent with the way the wine is made, and the wine follows a linear, logical process through the building. One of the central goals of both client and architect was to make the process as visible as possible, so that visitors to the winery literally flow along with the wine, thus gaining a meaningful comprehension and aesthetic impression of the process.”[28]

COSTING

Costing information is taken from the Sustainable Building Information System database, which uses a US dollar currency. An exchange rate of 1.5 CAD = 1 USD is assumed for the costing of this project.

The total construction cost of the Winery was $9 million CAD or $6 million USD. The predicted annual energy costs were $150,000 CAD or $100,000 USD (the benchmark being $300,000 CAD, or $200,000 USD). The predicted annual maintenance costs were $198,000 CAD or $132,000 USD (benchmark costs were estimated at $180,000 CAD, or $120,000 USD). The construction cost, excluding land, was $2,610 CAD, or $1,739USD, per m^2 (the same as the benchmark), and the predicted total annual operating and maintenance costs were $100 CAD or $67 USD per m^2 (the benchmark costs were $140 CAD, or $93 USD per m^2).[29]

Table 1. LEED GREEN BUILDING RATING SYSTEM 2.1

Project Checklist	
Sustainable Sites	**5**/14 Possible Points
Water Efficiency	**2**/5 Possible Points
Energy & Atmosphere	**6**/17 Possible Points
Materials & Resources	**0**/13 Possible Points
Indoor Environment Quality	**14**/15 Possible Points
Innovation & Design Process	**2**/5 Possible Points
Project Totals	**29**/69 Possible Points
Jackson-Triggs Winery Result	**Certified Status**

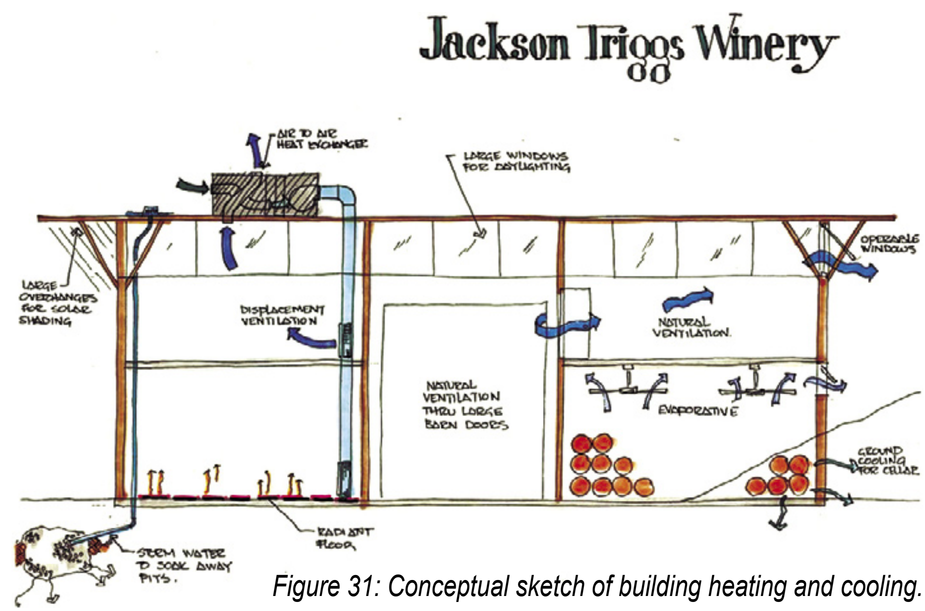


Figure 31: Conceptual sketch of building heating and cooling.

The predicated energy costs of the winery were half of the benchmark's, but the maintenance costs were predicted to be slightly higher for the winery. Together the operating and maintenance costs were predicted to be approximately two thirds of the benchmark's.

LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN

Since the Jackson-Triggs Winery is touted as exemplary of "sustainable" architecture, a preliminary LEED rating was conducted for the building, as a means of trying to quantify how sustainable the building actually is. Overall, the building receives only a "certified" rating, achieving a total of twenty-nine (29) of a possible sixty-nine (69) points. Although this rating might seem disappointing, many points were unachievable due to the heavily industrial nature of the building and its rural setting.

In the "Sustainable Sites" category, the building receives only five (5) points because of its necessary rural location. Despite its location that also negates any possible points for alternative transportation, the building scores well for reduced site disturbance, storm water management and the reduction of roof heat-island effects.

Because the building uses grey-water, the building receives two (2) points in the "Water Efficiency" category for reducing the use of potable water for plumbing fixtures and wastewater conveyance. Points for reduced water consumption for irrigation were unachievable because of the needs of the grapes.

Figure 32: Front entrance and view through the building to the vineyards beyond.

In terms of “Energy and Atmosphere,” the Winery scores six (6) points. An impressive five (5) points were achieved for saving 35% on delivered energy and on-site use of non-renewable fuels versus the benchmark, and reducing energy consumption by 60-70% over ASHRAE 90.1. An additional point was earned in this category for renewable energy.

Disappointingly, the building does not get any points for “Materials and Resources” since there was no proof of resource reuse, or materials with recycled content or that were locally produced used in construction. This is quite unfortunate because the points in this category are quite easily achieved, although they require heavy documentation to prove so. This is also unfortunate because of all of the care that went into selecting materials with low-embodied energy.

The sensitivity of the winemaking process requires a controlled environment, so the Winery does well in the “Indoor Environment Quality” category. The only point lost in this category is for access to views and day light for 90% of all regularly occupied spaces – attributed to the needs of the wine making process again.

In the final category of “Innovation and Design,” the winery could receive an additional two (2) points. First, one (1) point could be earned for the detailed calculations performed by the design team to determine the embodied energy of the building materials used in the project. Second, another point could be earned for the innovative use of gravity flow in the winemaking process that eliminated the need for pumps, and thereby reduced the building’s process energy loads. Overall, despite the “low” LEED score, the “sustainable” features used in the Winery make it a “green” building.

CONCLUSION

The Jackson-Triggs Estate Winery is a highly specialized building type. Of the initial design objectives set out for the architect – the building should be agrarian in nature, the building systems should be just as conservative as the wine-making process, and CO2 emissions should be minimized – only the third implies a singular ‘sustainable’ objective for the design. However, the winery does embody other sustainable attributes, the most innovative of which are integrated into the winemaking process. “The energy performance of the building is also exceptional due to the integration of natural lighting, which reduces the electrical load, as well as innovative industrial practices such as use of gravity to move the wine from vessel to vessel as it is processed. This not only saves energy but improves wine quality as well.”[30]

Following the opening of the new Estate Winery in 2001, Jackson-Triggs has been awarded ‘Best Canadian Winery’ and ‘Best Icewine’ Worldwide at Vinitaly 2002 in Verona, and has received a host of Gold awards for its Niagara-on-the-Lake wines in both national and international competitions. The new winery has had a large impact on sales and has drawn far more visitors than expected.[31] ”The architecture of the winery has successfully married the science of wine-making process with the art of marketing.”[32]

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IMAGE CREDIT

Images used in this document have been borrowed from the following sources:

1. Canadian Architect Article: Figures 3, 6 and 8.
2. Professor Terri Meyer Boake: Figure 30 and the Quick Facts image.
3. KEEN Engineering: Figures 19 and 31.
4. KPMB Architects: Figures 4, 7, 9, 10, 11, 12, 13, 14, 15, 16, 20, 21, 22, 23, 24, 26, and 32, including all building plans and sections.
5. Diana Saragosa: Figures 1, 2, 17, 18, 25, 27, 28, and 29.