Why Green Buildings Matter

We as Canadians live in a predominately cold climate. We spend over 90 percent of our time inside buildings. Buildings affect the way we live, the way we work and the way we play. They affect us as individuals and as communities. But these buildings also have an environmental impact. They account for 37 percent of the total primary energy use in Canada, and roughly 30 percent of the total greenhouse gas emissions. They are therefore a large part of the problem, but can become a significant part of the solution.

Green buildings differ from conventional buildings by integrating environmental and social goals, with the result that their ecological footprint is reduced and they are healthier and more comfortable.

The worldwide green building movement is relatively young and Canada has been a seminal player in its launch. In 1996 planning began for the first major international green building conference (Green Building Challenge ’98) held in Vancouver, British Columbia. Interest in green buildings has been growing exponentially ever since. One indicator is the growth in membership in the Canada Green Building Council (CaGBC) since its founding in late 2002. In the summer of 2006, CaGBC had over 1200 member organizations, representing an average growth rate of about 10 percent per month.

Challenges still remain. One of which is bringing leading edge technological solutions into the market. There is no single technological answer for all buildings. The solutions, while currently available in the market, need to be more visible to the mainstream. Early exponents of green buildings have tended to view them primarily as a technical innovation challenge, while the mainstream needs to understand the impact on financial viability and the greater value which these buildings add to our communities and lives.

Why These Case Studies are Important

The buildings in this collection of case studies represent a cross section of recent examples from across Canada, of different scale, different building type and different ownership. These case studies do not contain every detail of each building but rather they focus on key innovative features (technological, or process related). They may include ways project teams have found solutions to significant barriers or how they have managed to become pioneers in a given market or region.

Cardel Place (Nose Creek Recreational Facility) – Calgary, Alberta:
This project is a highly successful first implementation of an aggressive city sustainability policy that contains green buildings as key commitments.

BC Cancer Agency, Cancer Research Centre – Vancouver, British Columbia:
A major Level 3 research lab that is built on time, under budget and which helps to attract discretionary funding for the agency is more than just a building, it is a strategic coup.

The Silva – Vancouver, British Columbia:
As the first green residential high rise in the country, the success of this project in overcoming technological, economic and regulatory barriers was critical to transforming this market.

Conclusion

The overall picture that emerges when these studies are viewed as a collection is that these green buildings are demonstrating green value in ways that go beyond the traditional measures of the real estate and construction industry. The value that they add is in ways that matter to people and communities as well as to buildings viewed solely as businesses.

1A Business Case for Green Buildings in Canada, March 2005, presented to Industry Canada; Luciuk, Trusty, Larsson, Charrette

The Buildings: Summary of Highlights

One highlight from each of the projects, moving from east to west, serves to give an idea of the value added to their organizations, region, market or community.

Port Hawkesbury Civic Centre – Port Hawkesbury, Nova Scotia:
Incorporating sustainability into the project became a rallying point for a small town and provided community cohesion.

Pavilions Lassonde, École Polytechnique – Montréal, Quebec:
These sustainable buildings lead by example to our future leaders, the engineering students they serve, and the institutional sector the buildings represent.

TOHU, la Cité des arts du cirque – Montréal, Quebec:
This building demonstrates environmental responsibility by example and through a formal program, the owners provide buildings sustainability awareness for the large number of people that pass through its doors.

Emergency Medical Services Fleet Centre – Cambridge, Ontario:
This public sector project demonstrates that solutions to the key sustainability challenges identified by the regional government can be found even in basic building types.

Radiance @ MintoGardens – Toronto, Ontario:
As a pioneering green residential high rise in the country’s largest city, this building demonstrates that green can be profitable.

Mountain Equipment Co-op (MEC) Store – Winnipeg, Manitoba:
This green retail store embodies the values of the organization and shows that green retail is not an oxymoron.

SC3 Workplace, Smith Carter Architects and Engineers Incorporated – Winnipeg, Manitoba:
The development and construction of their green headquarters was the catalyst for reinventing and marketing this architectural and engineering practice.
Innovation Feature: Reduced Impact from Materials Choices

Sustainability Challenge
The ecological impacts of different building materials vary widely because of the extensive network of extraction, processing, manufacturing and transportation steps required to produce them, incorporate them in the building, and eventually dispose of them. Use of regionally extracted and regionally manufactured building materials not only reduces ecological impacts but supports the local economy.

Innovative Feature Response
Most of the materials for the concrete, concrete block, asphalt and wood products were extracted and manufactured locally. In addition, steel, millwork, dashboard, root, gypsum board and insulation were manufactured locally. Some materials contained recycled content and certified wood was used. The project had an extensive construction waste diversion program.

Impact on Sustainability and Performance
Fifty-two percent of all materials were manufactured locally and 35 percent of those were also extracted locally. Post-consumer and post-industrial recycled content also accounted for 12 percent of the total value of the materials in the project. 63 percent of the wood was from Forest Stewardship Council (FSC) certified forests and 76 percent of construction waste was diverted from landfill.

Innovation Feature: Water Use Reduction

Sustainability Challenge
Only a small fraction (3 percent) of treated potable water supplied to Canadian buildings is used for human consumption, which means that we are withdrawing, treating and then degrading the quality of most of the water that passes through buildings before returning it to the environment. In a dry, down-slope climate and rapid growth economy like Calgary’s, which is already withdrawing nearly half of all its available water, water is a scarce resource.

Innovative Feature Response
Outside the building, landscaping uses drought-tolerant species which are irrigated with a high efficiency system supplied entirely from the stormwater retention pond. Inside the building, dual-flush toilets, waterless urinals, low-flow sensor activated faucets and low-flow touch-activated time limited shower heads are installed.

Impact on Sustainability and Performance
Landscaping water use is 65 percent less than the benchmark. Water use inside the building is 47 percent less than benchmark. These reductions cost less and demand thereby extending water supply and infrastructure capacity. In the complete project, this also reduces waste water generation which extends sewage treatment infrastructure capacity.

Innovation Feature: Green Housekeeping

Sustainability Challenge
The ecological impacts of buildings do not stop with their construction. How buildings are operated, maintained and cleaned can have negative consequences that may offset gains made by good design.

Innovative Feature Response
A green housekeeping program has been implemented in this building. All cleaning products used are non-toxic and biodegradable in accordance with the Green Seal GS-37 standard. All maintenance staff are trained in green housekeeping practices.

Impact on Sustainability and Performance
Environmentally benign cleaning products and practices not only reduce impact on local receiving waters but the low toxicity safeguards the health of the workers who use them and users of the facility.

Innovation Feature: Alternative Transportation Incentive Program

Sustainability Challenge
Vehicle use to commute to buildings can have as much environmental impact as the operation of the building itself, while changing people’s transportation habits in a predominantly car-oriented culture is difficult, particularly for a suburban site like this.

Innovative Feature Response
In addition to providing easy access to alternative transportation modes, this project has implemented an innovative incentive program to entice people out of their cars when traveling to the facility. The program is called the LEED Loyalty Reward Program and operates similar to retail customer loyalty programs. Points accumulated on each visit by alternative transportation can be redeemed for benefits at local businesses as well as for facility programs, admissions or passes and continuing education courses.

Impact on Sustainability and Performance
This is a unique program that provides direct and tangible rewards for alternative transportation choices, in addition to the intangibles usually cited. The program is a pilot that will serve as a model for other City-owned facilities.

What sets this project apart

• Sustainable site features
• Aggressive energy savings for building type
• Indoor Environmental Quality (IEQ): low Volatile Organic Compound (VOC) emissions, thermal comfort, daylight and views
• Reduced impacts from materials choices
• Water Use Reduction
• Green housekeeping
• Alternative Transportation Incentive Program

Project Summary
Calgary’s ecological footprint is 9.86 Ha per person, nearly five times the 1.9 Ha per person average that is thought to be sustainable for the world. The municipal government is determined to change this statistic and has begun to demonstrate its commitment to improving. City Council has declared protecting the environment as one of six official priorities on both the past and current 3-year strategic plans. Calgary was the first city in North America to become ISO (International Standards Organization) 14001 certified. Calgary was one of the first cities in Canada to adopt a sustainability policy for its own operations and was the first city to mandate that all new City-owned buildings be certified to a LEED (Leadership in Energy and Environmental Design) Silver level.

This project is one of three facilities to be developed in partnership between the City of Calgary and local recreation associations. The Nose Creek Recreation and Sports Association worked with the City to develop the program for this multi-purpose building, to include facilities supporting sports, recreation and wellness, a regional library and community centre. The facility is located on a site that is intended to reinforce complementary uses. There is a high school on the site now and a junior high school and a future light rail transit stop are planned.

The Association was involved at every step in setting the direction and supporting the environmental goals for the project. This building was the first to be completed under the City’s policy for sustainable building design, and it achieved a LEED Gold level of certification, well above the mandated Silver.

Key Project Details

Year of completion 2004
Type New construction
Setting Suburban
Total site area 55,700 m²
Total building area 17,940 m²
Floors above ground 2
Building use sports, recreation, wellness, regional library, meeting and event rooms, offices
Design occupancy 25 staff; 2,000 visitors per day
Certifications LEED Canada (Leadership in Energy and Environmental Design) – NC (New Construction) 2.1 Gold

Key Innovation Features Summary

• Sustainable site features
• Aggressive energy savings for building type
• Indoor Environmental Quality (IEQ): low Volatile Organic Compound (VOC) emissions, thermal comfort, daylight and views
• Reduced impacts from materials choices
• Water Use Reduction
• Green housekeeping
• Alternative Transportation Incentive Program
Project Team
Owner Contact: City of Calgary
Tenant: Nose Creek Recreation Association
Architects: Gables Gage Architects; Cameron Johnston Architecture
Mechanical: Hemisphere Engineering
Electrical: Stadler Ruhman and Associates
Civil: Kellam Berg Engineering and Surveys
Primary Green Consultant: Barry Johns Architecture
Landscape Architect: Carson McCulloch Associates Ltd
Energy analysis: Hemisphere Engineering
Contractor: PCL-Maxam

Innovation Feature: Sustainable Site Features

Sustainability Challenge
Development and construction processes are often destructive to local ecologies, especially if a previously undeveloped building site is chosen. In particular, storm water runoff from developed areas can impact water quality in receiving waters and disrupt aquatic life. A dry climate without heavy natural vegetation cover is especially vulnerable. Vehicle use to commute to buildings can have as much environmental impact as the operation of the building itself, while changing people’s transportation habits in a predominantly car-oriented culture is difficult, particularly for a suburban site like this.

Innovative Feature Response
The building is located on a site that has one existing building with complementary use and more are planned in future. This project has implemented a suite of site practices that minimize ecological impact, beginning with consolidating a number of community recreational uses in one building. The site is served by four existing bus lines and will be the location of a future stop on the light rail transit when it is extended. Dedicated space is provided for car pool vehicles and bicycle storage and showers are provided. More than half the site is undisturbed. All run-off is collected in an existing retention pond that is sized for all existing and future buildings. The roof has a high albedo (fraction of sunlight that is reflected) and the site lighting does not spill beyond the property.

Impact on Sustainability and Performance
This project has proven the feasibility of a number of innovative features and has thereby raised expectations for future development on this site. Multiple uses in one building reduce the number of trips required by families and those trips can easily be made via public transit or bicycle. Alternative transportation provisions allowed a 40 percent reduction in car parking, thus also saving first costs. The large retention pond virtually eliminates peak flows and treats the run-off water before releasing it to nearby Nose Creek, while providing habitat for wildlife. The roof reduces the urban heat-island effect while the lighting allows the project to be good neighbour while contributing to keeping the sky dark.

Innovation Feature: Aggressive Energy Savings for Building Type

Sustainability Challenge
The energy that buildings use for heating, lighting and cooling accounts for the majority of total life cycle environmental impacts of a typical Canadian building. Part of the impact is the upstream effects of the “primary” energy produced to allow site use, including greenhouse gases that contribute to climate change. Where the electricity grid is primarily supplied by coal-fired power plants, as it is in Alberta, the challenge is greater.

Innovative Feature Solution
The project pursued three main strategies to reduce impacts from energy consumption. The first was a number of measures that reduced demand, including an improved building envelope, extensive daylighting, and the use of displacement ventilation in the gymnasium. Secondly, the efficiency of the plant supplying the demand was increased by increasing part load efficiency of equipment such as variable speed drives, more efficient boilers, increased lighting efficiency, better controls and exhaust air heat recovery. Also implemented was thermal ice storage, heat reclaim from the refrigeration plant, and cogeneration with a 120 kW thermal / 60 kW electric gas fired micro-turbine. Thirdly, 50 percent of the electrical load for the building is supplied from green power.

Impact on Sustainability and Performance
The project uses 44 percent less energy than the national benchmark, Model National Energy Code for Buildings. Equipment sizes and therefore capital costs are reduced as a result of reduced demand. The micro-turbine functions as the lead boiler for the facility, powers space heating, pool water, domestic hot water and shaves peak heating demands for the pool and reduces demand costs.

Innovation Feature: Very high Indoor Environmental Quality (IEQ)

Sustainability Challenge
The World Health Organization states that most of a person’s daily exposure to many air pollutants comes through inhalation of indoor air. Canadians spend an average of 90 percent of their time indoors, where levels of pollutants may be two to five times, and occasionally more than 100 times, higher than outdoor levels. In a recreation and fitness facility, where activity, and therefore respiration levels, are generally higher than in most other buildings, indoor air and environmental quality are critical.

Innovative Feature Response
In addition to minimum steps such as banning smoking in the building and complying with building code ventilation requirements, additional strategies for improving indoor air quality included protection of materials and systems during construction and flushing the building with 100 percent outside air prior to occupancy. Low Volatile Organic Compounds (VOC) adhesives and carpets were used. The ventilation system control is based on active measurement of CO₂. In addition, all non-gym and arena areas have extensive glazing for daylight and views to outside.

Impact on Sustainability and Performance
Improved indoor air quality from the measures taken contribute directly to the health and comfort of the occupants. Although it is difficult to quantify the effects, the quality of the space that results from the daylighting and views is remarkable.

Innovative Feature: Stormwater retention pond

Innovative Feature Solution
The project pursued the retention pond virtually eliminates peak flows and treats the run-off water before releasing it to nearby Nose Creek, while providing habitat for wildlife. The roof reduces the urban heat-island effect while the lighting allows the project to be a good neighbour while contributing to keeping the sky dark.
The technical requirements of cleanliness, containment and control tend to drive the design of laboratories, often at the expense of other requirements. In this case, the sociology of collaboration, adaptability and high environmental performance were all achieved without compromising the technical requirements.

One quite remarkable but unexpected accomplishment was that the Foundation’s commitment to build a green building was also a key factor in attracting discretionary funding for the research. The resulting dividends. Finally, the building was opened on time and well under budget, a rarity for such a complex facility.

### Innovation Feature: Construction Waste Diversion and Recycled and Local Materials

**Sustainability Challenge**
Shipping construction and demolition waste to landfills not only creates problems for future generations but also, since many of the waste materials are capable of being re-used or recycled, squanders opportunities to reduce flows of virgin materials. In the greater Vancouver area, about 32 percent of the material in the landfill is demolition, land clearing and construction waste. The ecological impacts of different building materials vary widely because of the extensive network of extraction, processing, manufacturing and transportation steps required to produce them, incorporate them in the building, and eventually dispose of them.

**Innovative Feature Response**
Source separation of concrete, steel, other metals and cardboard was done on site. Large amounts of mixed waste and commingled waste were also collected on site and separated and recovered at recycling facilities off-site. Many products were selected that incorporated post industrial and post consumer recycled content, including steel for many different uses, gypsum board, insulation and miscellaneous wood products. All of the concrete, much of the steel, and significant fractions of other materials like glazing, formwork and masonry were manufactured and extracted locally.

### Impact on Sustainability and Performance

In total, 98.5 percent of all construction waste for the project was diverted from landfill, which is an exceptionally high proportion. Twenty-four percent of materials were manufactured and extracted locally, which is also a significant achievement in a region that is not a centre of manufacturing for building materials.

### Key Innovation Features Summary

#### What sets this project apart

- **Design for flexibility and collaboration**
- **Aggressive energy savings – 42 percent better than national benchmark**
- **Water Use Reduction**
- **Construction waste diversion and recycled and local materials**
- **Very high Indoor Environment Quality (IEQ)**

### Project Summary

The BC Cancer Research Centre is one of Canada’s largest cancer research facilities. The Centre is the research arm of the BC Cancer Agency, and is owned by the BC Cancer Foundation. The new building was built for researchers to carry out a variety of cancer research, with the goal of translating the research quickly into clinical applications.

Of the many objectives for this building, three are obvious drivers of the design. The first was the need and desire for collaboration between people and units, collaboration to connect the research into causes of cancer with ways of improving treatment, and to developing more effective ways of controlling and curing the disease. Secondly, researchers reconfigure their labs every nine months on average in response to where the research takes them, so flexibility of lab space is vital; Thirdly, scientists understand the connection between environmental degradation and human health, so they wanted to ensure that the new building did not adversely affect its occupants.

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**Key Project Details**

- **Year of completion**: 2005
- **Type**: New construction
- **Setting**: Urban
- **Total site area**: 14,500 m²
- **Total building area**: 21,800 m²
- **Floors above ground**: 15
- **Building use**: Level 2 and Level 3 laboratories, offices, meeting rooms
- **Design occupancy**: 600 staff
- **Certifications**: LEED Canada (Leadership in Energy and Environmental Design) – NC (New Construction) 1.0 Gold
**Innovation Feature:** Design for Flexibility

**Sustainability Challenge**
Reuse and rehabilitation of existing buildings that have changed fundamental use is a recognized way of minimizing environmental impacts from demolition and building with new materials. What is less well-recognized is that many building types, such as research labs, have inherently high rates of internal change because of their programs (reconfigured every nine months on average). Associated demolition and reconstruction can have high impacts but these can be mitigated by design.

**Innovative Feature Response**
This building was designed with interstitial service floors (a floor system in which a secondary floor is raised above the structural floor) devoted to the distribution of electrical and mechanical services. Clean rooms, Level 3 (Level of biosafety) labs and large autoclaves are located in the centre of the lab floorplates. Next to them are hallways or “ghost” corridors that lead from one functional lab to the next without intervening doors or walls. The lab bench areas are located on the perimeter at right angles to double height walls and windows.

**Impact on Sustainability and Performance**
Interstitial floors add almost no first costs but allow for faster and cheaper reconfiguration, with less material cost and waste, and minimal contamination during reconstruction. Maintenance is easier because services are accessible without going into the labs and frequency of decontamination is reduced because equipment is separate from the labs. Open hallways between different functioning labs promote greater social interaction and more serendipitous meetings, which are essential for collaboration.

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**Innovation Feature:** Aggressive Energy Savings for Building Type

**Sustainability Challenge**
The energy that buildings use for heating, lighting and cooling accounts for the majority of total life cycle environmental impacts of a typical Canadian building. This a particular challenge for laboratories that operate 24 hours a day, where technical requirements of meeting the laboratory processes frequently override all other considerations.

**Innovative Feature Solution**
Exterior walls, roofs and windows have improved thermal performance over the national benchmark. Lighting power density is reduced from the benchmark and is controlled by occupancy and daylight sensors. A high-efficiency chiller with a heat recovery condenser is installed and major fans and pumps are variable speed. Space cooling in the office areas is via chilled slab. Other features include an integrated make-up air supply system serving all fresh air demands, with pre-heat from a glycol loop recovering heat from fume hood exhausts. Fume hood ventilation volume is controlled by sash position.

**Impact on Sustainability and Performance**
The project design was projected to use 42 percent less energy than the national benchmark, the Model National Energy Code for Buildings. In particular, heating energy was projected to be 85 percent less than benchmark. Although a full cycle of seasonal operations has not yet been completed, early indications are that actual building performance is better than projected.

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**Innovation Feature:** Water Use Reduction

**Sustainability Challenge**
Since only a small fraction (3 percent) of treated potable water supplied to Canadian buildings is used for human consumption, it means that we are withdrawing, treating and then degrading the quality of most of the water that passes through buildings before returning it to the environment. In a dense urban environment, any landscaping tends to be created, artificial ecosystems. In addition, Vancouver has a reputation for being a wet climate, but the summer months are in fact extremely dry.

**Innovative Feature Response**
Landscaping water use was reduced by custom growing medium design, use of high-efficiency irrigation and automated management responding to actual water needs. Inside the building, waterless urinals, dual-flush toilets and low-flow faucets were installed.

**Impact on Sustainability and Performance**
Landscaping water use was reduced by 76 percent over the baseline and inside water uses was reduced by 43 percent.

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**Project Team**
- **Owner Contact**: BC Cancer Agency
- **Architect**: Henriquez Partners + IBI Group
- **Mechanical**: Keen Engineering Co. Ltd.
- **Electrical**: R.A. Duff & Associates Inc.
- **Geotechnical**: GeoPacific Consultants Ltd.
- **Primary Green Consultant**: Keen Engineering Co. Ltd.
- **Energy Analysis**: Keen Engineering Co. Ltd.
- **Landscape Architect**: Durante Kreuk Ltd.
- **Contractor**: LEDCOR Construction
Impact on Sustainability and Performance
The low VOC materials, along with daylighting and operable windows contribute to the quality of the indoor environment. During the certification process, the third party verification revealed that, although the mechanical ventilation system was built as designed, it initially failed the pressurization test because of the vacuum created by the stack effect. The source of failure turned out to be the gaps at the bottom of the common area exit doors that were too wide, preventing positive pressure from being created, but this was easily remedied.

Innovation Feature: Materials Use / Construction Waste diversion
Sustainability Challenge
The ecological impacts of different building materials vary widely because of the extensive network of extraction, processing, manufacturing and transportation steps required to produce them, incorporate them in the building, and eventually dispose of them. Use of regionally extracted and regionally manufactured building materials not only reduces ecological impacts but supports the local economy. In the greater Vancouver area, about 32 percent of the material in the landfill is demolition, land clearing and construction waste.

Innovative Feature Response
Asphalt and concrete were ground and reprocessed during demolition and glue-lam beams were sold for re-use. The excavation material became structural fill for another project.

Impact on Sustainability and Performance
A demolition and construction waste diversion rate of 83 percent was achieved. Fifty-seven percent of all materials were manufactured locally and 50 percent of those were also extracted locally.

What sets this project apart
• Market pioneer/role model
• Urban redevelopment/stormwater management
• Water use reduction
• Significant energy savings for building type
• High Indoor Environmental Quality (IEQ)
• Materials use/Construction Waste diversion

Multi-unit residential building (MURB) construction is a very competitive market in Canada. Awareness of environmental issues in this market has historically been low and discussion of them has been virtually absent from the marketing discourse. The building type also faces different technical challenges from those in commercial and institutional sectors, and the market does not have the same level of experience in developing solutions. Pioneering green projects in any market face major challenges, but these were compounded in this case by the late start to greening the project. This late start meant that many of the gains achieved were without benefit from an integrated design process. Some of the elements that should have made economic sense could not be included because the design was too far along to change.

In this context, one of the most important aspects of this project is that it was the first MURB project in Canada to explicitly tackle these issues and to seek the credibility of third party verification (LEED®) for environmental performance. The project nonetheless achieved great success measured several ways; a smooth rezoning process with the city, capital cost within 1.7 percent of market standard, good sales and reasonable environmental performance. The project left one other legacy – the experience of this project informed the development of a LEED application guide for MURBs for Canada, to enable easier future green MURBs.

Key Project Details
Year of completion 2005
Type New construction
Setting Urban
Total site area 1,785 m²
Total building area 8,188 m²
Floors above ground 16
Building use residential condominium, commercial office, retail, health care
Design occupancy 67 suites (about 100 people)
Certiﬁcations LEED Canada (Leadership in Energy and Environmental Design) – NC (New Construction) 2.1 Certified

Innovative Feature Response
A demolition and construction waste diversion rate of 83 percent was achieved. Fifty-seven percent of all materials were manufactured locally and 50 percent of those were also extracted locally.

Innovation Feature: Energy Savings For Building Type
Sustainability Challenge
The energy that buildings use for heating, lighting and cooling accounts for the majority of total life cycle environmental impacts of a typical Canadian building, both directly, and indirectly via impacts from upstream primary energy production. MURBs also face different technical challenges from commercial and institutional buildings, neither does the market have the same level of experience in developing solutions. The national benchmark energy code is frequently not achieved in common practice in this area where there is a market expectation of high glazing ratios.

Innovative Feature Response
A number of strategies that might have been employed had the green objectives been incorporated earlier in the project were not possible. The single biggest contribution comes from a reduction in space heating due to better building envelope, including smaller windows than market standard and better performing glazing. More efficient fixed lights and cooling equipment were also provided.

Impact on Sustainability and Performance
The project uses 14 percent less energy than the ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc.) 90.1 standard referenced in this version of LEED. Although this is a modest gain, it was achieved within the payback horizons set for the project.

Innovation Feature: High IEQ Through Ventilation Effectiveness
Sustainability Challenge
Maintaining health and comfort in a building’s indoor environment while safeguarding the building envelope and using minimal energy is a challenge for every building. For historic financial and other market failure reasons, existing market practices for some building types lag far behind what is known to be desirable and technically possible. This is especially true in the case of ventilation for MURB construction, where neither existing practices or technologies were adequate. In addition, a prerequisite for LEED certification is minimizing the effects of second-hand tobacco smoke. An outright ban on smoking in the building is not practical as it could be seen as infringing on the rights of the occupants, so technical solutions are therefore required.

Innovative Feature Solution
All of the paint, adhesives, sealants and carpets installed are low Volatile Organic Compound (VOC). Windows are operable. To deal with second-hand smoke, each residential unit was treated as a contained smoking room while installing a positive pressurization system for the lobby and hallways.

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Innovation Feature: Market Pioneer and Role Model

Sustainability Challenge
In a market-based society, capital is a scarce resource. Allocation of capital to projects that provide a good rate of return, as well as achieve ecological objectives, is important for moving society towards sustainability. Many decisions that affect rate of return are not strictly design decisions but are taken well ahead of the design process, and in turn influence the technical aspects of design for sustainability. Pioneering green projects in any market face major challenges with zoning, risk perception and marketability. Successful solutions in these areas do as much to advance sustainability as do clever technical innovations. While green buildings have a significant foothold in institutional and commercial projects, this project was the first green residential high-rise building in Canada, and so faced all of these challenges.

Innovative Feature Response
The City and the developer worked collaboratively to negotiate three density transfers in exchange for the project’s ability to deliver on sustainability objectives outlined in the City’s Official Community Plan and related Sustainable Development Guidelines. The City viewed this as a pilot project for the Guidelines. The green features of the project were featured in marketing materials as a way of differentiating the project. VanCity Credit Union, who espoused sustainability, offered buyers into the project a tailor-made ‘green mortgage’, as a result of the intended LEED certification.

Impact on Sustainability and Performance
Overall potable water use was designed to use 41 percent less than the benchmark. These reductions reduce costs, demand thereby extending water supply, infrastructure capacity, and sewage treatment infrastructure capacity. A four month post-occupancy evaluation confirmed that the project in fact is performing as designed.

Innovation Feature: Urban Redevelopment and Stormwater Management

Sustainability Challenge
Increasing density in an area extends the use of existing infrastructure and avoids developing Greenfield land. Car use to commute to buildings can have as much environmental impact as the operation of the building itself. Development and construction processes are often destructive to local ecologies, especially if a previously undeveloped building site is chosen. Storm water runoff from developed areas can impact water quality in receiving waters and disrupt aquatic life. In this location, stormwater run-off goes almost directly to a nearby creek that is a salmon and trout spawning stream.

Innovative Feature Response
This project is located on a previously developed site, which was the home of a cinder block building and a parking lot. The site is in a central location with proximity to public transit, multiple essential services within walking distance and includes onsite health facilities. Secure bicycle storage is provided. A green roof is installed over the parking area to reduce stormwater run-off.

Impact on Sustainability and Performance
Multiple environmental objectives are achieved by building on a previously developed urban site. Greenfield development has been avoided. Downtown density is increased. Reliance on existing viable alternative transportation options encourages people to avoid car use. The green roof filters the run-off water, reduces the rate and quantity by 27 percent over the previous completely impervious condition, reduces the urban heat-island effect and provides an amenity to residents.

Innovation Feature: Water Use Reduction

Sustainability Challenge
Only a small fraction (3 percent) of treated potable water supplied to Canadian buildings is used for human consumption, which means that we are withdrawing, treating and then degrading the quality of most of the water that passes through buildings before returning it to the environment. Consumption of potable water is an especially topical issue in this area after a number of dry years decreased levels of local reservoirs and prompted significant watering restrictions.

Innovative Feature Response
Outside the building, landscaping uses drought-tolerant species which eliminates the need for a permanent irrigation system. Inside the building, dual-flush toilets, low-flow faucets and low-flow shower heads are installed. Efficient appliances in the form of front load washers and dishwashers were provided.

Impact on Sustainability and Performance
Overall potable water use was designed to use 41 percent less than the benchmark. These reductions reduce costs, demand thereby extending water supply, infrastructure capacity, and sewage treatment infrastructure capacity. A four month post-occupancy evaluation confirmed that the project in fact is performing as designed.
Port Hawkesbury Civic Centre - Arena
Port Hawkesbury, Nova Scotia

What sets this project apart

- Urban redevelopment
- Innovative daylighting for building type
- Aggressive energy savings for building type
- Green operations

Project Summary

Port Hawkesbury is a stable town of about 4,000 residents on the Cape Breton Island side of the Strait of Canso separating the island from Nova Scotia, that needed to replace an aging and inefficient ice arena.

The new Civic Centre, through its location and its mix of facilities, brings together activities that make it a focal point for the community. The building incorporates an ice arena, a 500-seat conference facility, meeting space, performance space, gallery and retail space for local arts and crafts, municipal services facilities, a fitness centre, racquetball courts, and a walking track. The location near the commercial district and high school promote accessibility.

The ice arena is the first in North America to use engineered natural daylight to illuminate the ice surface, which provides multiple benefits. The building also incorporates a number of other green building features.

Innovation Feature:

- Green Operations

Sustainability Challenge

The ecological impacts of buildings do not stop with their construction. How buildings are operated, maintained and cleaned can have negative consequences that may offset gains made by good design.

Innovative Feature Response

All cleaning products used are non-toxic and biodegradable. The centre has a full kitchen and has invested in dishes and linens for the use of caterers who service events at the centre. Coffee mugs for the meeting rooms were commissioned from a local potter. Surplus food from events is donated to the local food bank. Bottles and cans are recycled by people with mental disabilities as part of a recycling depot day program run by the local Regional Occupational Centre. The centre uses laptops computers that typically have lower-voltage processors, passive cooling, more aggressive power-saving settings and liquid crystal displays (LCD) compared to desktops computers. The center has a policy favouring all electronic communications over paper. The Centre is also completely covered by a wireless network accessible to events and arena attendees.

Impact on Sustainability and Performance

Environmentally benign cleaning products not only reduce impact on local receiving waters but the low toxicity safeguards the health of the workers who use them. Using linens and dishes for catering reduces waste and the embodied energy use associated with disposables. Operating energy is reduced through the use of laptops and both embodied energy (paper) and operating energy (printing) is saved by not printing out communications. Access to the wireless network further reduces the need for paper-based information exchange.

Key Project Details

- Year of completion 2004
- Type New construction
- Setting Small Town
- Total site area 9,020 m²
- Total building area 22,663 m²
- Floors above ground 3
- Building use Ice arena, Recreation, Assembly, Restaurant, Retail, Community
- Design occupancy 22 full time staff, 1,000 people at arena events, 2,800 visitors per week
- Certifications Commercial Building Incentive Program (CBIP) qualified
Innovation Feature:  

Innovative Daylighting for Building Type

Sustainability Challenge
Sunlight is the most efficient (lumens per watt) source of lighting known. Frequently, when we attempt to incorporate daylight in buildings, we not only have more than enough lumens, but we also have too many watts, which leads to unwanted heat and glare control issues. This is a particular challenge for an ice arena, where unwanted heat and glare not only soften the ice, but adds directly to the energy use for ice-making.

Innovative Feature Solution
The arena incorporates a 1.3 m high sloped perimeter clerestory with a proprietary glazing system called Solera, from Advanced Glazings Ltd. This is a North American first for this type of building. Electric lights in the centre of the arena are turned off during the day.

Impact on Sustainability and Performance
This design provides multiple benefits. The combination of using occupancy sensors to control lights in unoccupied areas together with turning the electric lights off during the day in the arena reduces lighting energy use by an estimated 45 percent. Further energy is saved due to the efficiency of the daylight, compared to electric lighting, which reduces the heat gain and therefore the energy that is required for ice-making. The average quality of daylight is also higher compared to electric light.

Innovation Feature:  

Aggressive Energy Savings for Building Type

Sustainability Challenge
The energy that buildings use for heating, lighting and cooling accounts for the majority of total life cycle environmental impacts of a typical Canadian building. Part of the impact is the upstream effects of the “primary” energy produced to allow site use, including greenhouse gases that contribute to climate change.

Innovative Feature Response
A number of technologies, in addition to the daylighting, were employed to reduce energy consumption. These include high-efficiency lighting for other areas of the building, improved thermal insulation in the building envelope, radiant heating to allow reduced air temperatures and automated control systems. Close attention was paid to the overall efficiency of the mechanical systems, and in particular to the refrigeration plant for ice-making. Specific strategies included low-friction piping, modular equipment for better part-load efficiencies and installation of a proprietary “Ice Kube” system that uses thermal cold storage under the rink slab, geothermal storage in the ground under the parking area, and heat recovery for space and domestic water heating. Other features include water to water heat pumps to provide preheat to the domestic and Zamboni hot water, heat recovery on exhaust air and a dehumidification unit that can extract heat from earth loop to heat the ice shed or cool air and reject heat to the earth.

Impact on Sustainability and Performance
The project uses 42 percent less energy than the national benchmark, the Model National Energy Code for Buildings. The piping design reduced pumping power by 90 percent. Greenhouse gas intensity (kg of CO₂ per m²) is 73 percent less than the facility it replaces.

Sustainability Challenge
The development of open space away from urban cores and other existing development may reduce a property’s first cost, but this development paradigm has far-reaching negative consequences for the environment and the community. Prime agricultural land is lost and previously developed urban sites fall into disuse and decay. Utility, transportation and community support infrastructure must also be developed to support the people who utilize new buildings. These infrastructure requirements increase the development’s impact far beyond the initial project scope.

Innovative Feature Response
Prior to beginning the project, the Town of Port Hawkesbury held a one-day municipal planning workshop, focused on sustainable energy and the community, which was attended by politicians and citizens as well as municipal staff and experts. The project site chosen is located on a previously abandoned elementary school in close proximity to the downtown core and the local high school. Parking area is limited. Additionally, it is fully accessible by wheelchair users, including preferred seating for them in the arena.

Impact on Sustainability and Performance
The community engagement workshop generated significant awareness and support at all levels for a more sustainable direction for the project. By choosing this site, the project has rejuvenated an area of the town which was already connected to the municipal infrastructure. This promotes walking and cycling, and reduces the need for car access, which was recognized by limiting the parking area. Minimal new infrastructure was needed to service the building. The project has, by its location, promoted inclusiveness, reinforced healthy community living patterns and reduced future downstream negative impacts.

Innovation Feature:  

Urban Redevelopment

Sustainability Challenge
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Innovation Feature: Reduced Impact from Materials Choices

Sustainability Challenge
The ecological impacts of building materials vary widely because of the extensive network of extraction, processing, manufacturing and transportation steps required to process, and eventually dispose of them.

Innovative Feature Response
A significant fraction of the materials for this project were not only manufactured locally but were also extracted locally, reducing the embodied transportation impacts. All of the materials for the concrete structure were sourced locally, and to mitigate the resulting negative greenhouse gas impacts, some of the cement was replaced with silica fumes and fly ash. Some rapidly renewable materials were used in the interior fit-up.

Impact on Sustainability and Performance
Forty-four percent of all materials were manufactured locally and 50 percent of those were also extracted locally. Post-consumer and post-industrial recycled content also accounted for 12.6 percent of the total value of the materials in the project.

Innovation Feature: Construction Waste Diversion

Sustainability Challenge
Shipping construction and demolition waste to landfills not only creates problems for future generations but, since many of the waste materials are capable of being re-used or recycled, it squanders opportunities to reduce flows of virgin materials. In addition, there is the challenge of introducing a best practice from elsewhere into this region, where tipping fees are low and construction waste diversion was very uncommon prior to this project.

Innovative Feature Response
Source separation of materials was done on site. Where no local markets existed for some materials, these were shipped to the nearest available recycling market.

Impact on Sustainability and Performance
Eighty-two percent of all construction waste was diverted from landfill.

What sets this project apart

Key Innovation Features Summary

• Urban/brownfield redevelopment and alternative transportation
• Aggressive energy savings – 60 percent better than national benchmark
• Major reduction in greenhouse gas emissions (GHGs) from operating energy
• Aggressive water use reduction/storm water management
• Reduced impact from materials choices
• Aggressive construction waste diversion

Project Summary
The Pavilions Lassonde are two new buildings housing combined classrooms, a library, IT labs, offices and a student café for the engineering program at the École Polytechnique de Montréal.

The environmental challenges society faces today will be solved in part by future engineers who are currently in school. With students, actions speak louder than words. École Polytechnique saw an opportunity with these buildings to teach solutions by example, by immersing students in a new space that demonstrates advanced energy efficiency, greenhouse gas reduction and improved environmental performance.

These additional project goals faced two significant hurdles. First, the goals had to be met within the usual government-funded budgetary constraints imposed on any university building – there was no extra money for the environmental goals. Secondly, because it was the first project to attempt to deliver a large-scale green university building in the province of Quebec, there was no institutional or organizational experience with doing so. In this context, the resulting environmental performance is all the more impressive.

As a first of its kind in Montréal, the project’s success goes beyond what can be easily measured; it has built capacity within the university to deliver green buildings; has enhanced the process of building capability within the buildings industry in the Montréal area to deliver green buildings; and, has demonstrated to a key funding agency that green buildings are not an unaffordable luxury. It provides an ongoing example to the public that environmental solutions are becoming mainstream.

The greatest benefit, which may not be apparent for years or decades, is to educate, future engineers about ways to find creative and cost-effective solutions to the challenges they will face in practice.
Innovation Feature: Urban and Brownfield Redevelopment

Sustainability Challenge
Development and construction processes are often destructive to local ecologies, especially if a previously undeveloped building site is chosen. Frequently, past practices have contaminated the land, further threatening the environment. Car use to commute to buildings can have as much environmental impact as the operation of the building itself, while changing people’s transportation habits in a predominantly car-oriented culture is difficult.

Innovative Feature Response
The site for this project was part of the larger École Polytechnique de Montréal campus. The site has hydrocarbons resulting from asphalt fill materials and naturally occurring copper in excess of regulations, which required clean-up. The buildings are linked by an underground tunnel under a roadway for cyclists. Car pool vehicles are given priority access to parking and electric vehicle charging stations are provided.

Impact on Sustainability and Performance
By cleaning up and building on a previously developed urban brownfield site the project accomplished multiple environmental objectives. Greenfield development has been avoided and the land is no longer contaminated. Provision of several different, viable and convenient alternative transportation options to the automobile encourages students, staff and visitors to make environmentally responsible commuting choices.

Innovation Feature: Aggressive Energy Savings and GHG Reduction

Sustainability Challenge
The energy that buildings use for heating, lighting and cooling accounts for the majority of total life cycle environmental impacts of a typical Canadian building. Part of the impact is the upstream effects of the “primary” energy produced to allow site use, including greenhouse gases that contribute to climate change.

Innovative Feature Solution
This project has employed a broad suite of energy reduction strategies, including: reflective and vegetative roofs to reduce solar gain, heat recovery exhaust fans, heat recovery from chillers to provide any needed reheat, CO₂ control of ventilation air, occupancy sensors to turn off lights and air-conditioning when not needed, locking out electric lighting when daylight is sufficient, variable speed electric motors and automated control systems to constantly optimize air and fluid supply temperatures. Waste heat is recovered from the boiler flue gases of the existing buildings to heat the building.

Impact on Sustainability and Performance
The project uses 60 percent less energy than the national benchmark, the Model National Energy Code for Buildings. The waste heat recovery from boiler flue gases reduces primary energy consumption and greenhouse gas production by two thirds.

Innovation Feature: Storm Water Management and Water Use Reduction

Sustainability Challenge
Development and construction processes are often destructive to local ecology and in particular, storm water runoff from developed areas can impact water quality in receiving waters and disrupt aquatic life. Since only a small fraction (3 percent) of treated potable water supplied to Canadian buildings is used for human consumption, it means that we are withdrawing, treating and then degrading the quality of most of the water that passes through buildings before returning it to the environment.

Innovative Feature Response
Water use reduction strategies start with the use of indigenous plants for landscaping. The soil and the green roof areas slow the flow and absorb part of the storm water and the remainder is collected in an underground water reservoir that stores water for re-use in the sanitation system, which uses dual-flush toilets, infra-red sensors and low-flow faucets.

Impact on Sustainability and Performance
There is a 92 percent reduction in the consumption of drinking water for sewage conveyance, 47 percent less potable water use overall and a 39 percent decrease in the rate and quantity of storm water runoff.
Innovation Feature:
Reduced Impact from Materials Choices and Management

Sustainability Challenge
The ecological impacts of different building materials vary widely because of the extensive network of extraction, processing, manufacturing and transportation steps required to produce them, incorporate them in the building, and eventually dispose of them. Use of regionally extracted and regionally manufactured building materials not only reduces ecological impacts but supports the local economy.

Innovative Feature Response
Post-consumer and post-industrial recycled content was high in the steel, millwork, carpet and gypsum board used in the building. All of the steel including decking, cladding, rebar, plate, liners, purlins and miscellaneous steel, was manufactured locally, as was all of the concrete used in the building. A high fraction of those building materials were also extracted locally. The project had an extensive construction waste diversion program based on source separation.

Impact on Sustainability and Performance
Forty percent of all materials were manufactured locally and 80 percent of those were also extracted locally. Post-consumer and post-industrial recycled content also accounted for 25 percent of the total value of the materials in the project, which is exemplary. Seventy-six percent of construction waste was diverted from landfill.

Innovation Feature:
Sites/Storm Water Management

Sustainability Challenge
Development and construction processes are often destructive to local ecology and in particular, peak and untreated storm water runoff from developed areas can impact water quality in receiving waters and disrupt aquatic life.

Innovative Feature Response
The chosen site is one that was previously developed but over half of the site was left undeveloped and planted with native species. The cistern collects not quite half of the roof rainwater, with excess going to grassy swales that also convey surface stormwater to a filtration basin, before finally being discharged to existing storm sewers.

Impact on Sustainability and Performance
The combined technologies provide multiple, reinforcing benefits. The cistern, swales and filtration basin reduce not only the peak flow and total quantity of stormwater discharged to the existing storm sewer system but also clean the water. Combined, the systems remove 91 percent of total suspended solids and 83 percent of total phosphorus from the discharged water. Existing storm sewer connections did not need to be upgraded.

Project Summary
This building is a fleet supply centre and administration offices for the Region of Waterloo’s publicly-owned and operated ambulances, which operate 24 hours a day, 7 days a week. The building has three main subcomponents: an administration area, a vehicle fleet area and a crew support area.

The Region of Waterloo in southern Ontario is not far from the major urban centres of Toronto and Hamilton. The Region has a mix of rural areas and small cities that are facing infrastructure pressures resulting from rapid growth. The Region’s strategic plan responds to these pressures with plans for public transit, wastewater treatment and water system capacity improvements. In addition, one entire focus area of the plan is devoted to protecting and enhancing the environment.

In this context, ambitious environmental goals were set for the project. It was intended as both a pilot for new technologies and design processes, and as a demonstration prototype for other similar buildings. One specific goal was to reduce operating energy consumption by more than half. Other goals included exploring the use of renewable energy, co-generation, and waste heat recovery.

What sets this project apart
Key Innovation Features Summary

- Aggressive energy savings – 60 percent better than national benchmark
- Very high Indoor Environmental Quality (IEQ)
- Water use reduction
- Reduced impact from materials management
- Sites generally/Storm Water Management

The proposed micro-turbine for co-generation and emergency back-up power proved to be too expensive and was not incorporated, but the heat recovery and the photovoltaics helped the project achieve exemplary energy performance of over 60 percent reduction. The project was the first in Ontario to be certified to LEED Canada (Leadership in Energy and Environmental Design) – NC (New Construction) achieving Gold. The building has achieved its larger goal of demonstrating the feasibility and benefits of green building technologies for this building type. Following this demonstrated success, the Region of Waterloo mandated LEED Silver as a requirement for its future projects.

Key Project Details

Year of completion 2004
Type New construction
Setting Rural
Total site area 11,100 m²
Total building area 1,737 m²
Floors above ground 1
Building use ambulance fleet service centre, offices, crew support
Design occupancy 29 staff at peak periods
Certiﬁcations LEED Canada (Leadership in Energy and Environmental Design) NC (New Construction) 1.0 Gold, Commercial Building Incentive Program (CBIP) qualiﬁed
Innovation Feature: Aggressive Energy Savings

Sustainability Challenge
The energy that buildings use for heating, lighting and cooling accounts for the majority of total life cycle environmental impacts of a typical Canadian building. Part of the impact is the upstream effects of the “primary” energy produced to allow site use, including greenhouse gases that contribute to climate change. The particular challenge faced by this building type in a cold climate is the 24 hour operation and the need to accommodate running vehicles indoors.

Innovative Feature Solution
The building employed a number of technologies for reducing energy consumption, beginning with improved thermal performance of the exterior envelope and lighting power density nearly half the national benchmark. Other technologies include more efficient electric motors, heat recovery on exhaust air, demand controlled ventilation in administration and crew support areas, liquid desiccant dehumidification and cooling, modulating condensing boilers, radiant heating and a photovoltaic system to supply part of the electricity.

Impact on Sustainability and Performance
Space heating energy was reduced by 68 percent, space cooling energy by 98 percent and fan energy by 65 percent. The photovoltaics supply 10 percent of the building’s energy needs. This is exemplary performance.

Innovation Feature: Very high Indoor Environmental Quality (IEQ)

Sustainability Challenge
The World Health Organization states that most of a person’s daily exposure to many air pollutants comes through inhalation of indoor air. Canadians spend an average of 90 percent of their time indoors. Vehicles inside a facility contribute additional pollution sources. Good indoor environmental quality, more than some other environmental issues, depends not just on good design, but on key activities during construction and on critical operational control once occupied.

Innovative Feature Response
Design strategies included use of entryway grills, dedicated exhaust for photocopiers, enthalpy heat recovery ventilation, low Volatile Organic Compound (VOC) adhesives, paints and carpets, and provision of additional operational zones and control sensors. Materials and systems were protected during construction and air quality was tested prior to occupancy. No smoking is allowed in the building and active measurement of CO₂ controls the ventilation system in the admin and crew areas based on demand. These areas are both supplied by a displacement ventilation system. A displacement ventilation system, controlled by carbon monoxide and nitrous oxides levels, is also used in the garage area, which may be the first application of these combined technologies in North America. All regularly occupied spaces in the building’s perimeter have operable windows and lighting controls.

Impact on Sustainability and Performance
Improved indoor air quality from the measures taken contribute directly to the health and comfort of the occupants. Effectiveness of displacement ventilation systems is higher than mixing systems, providing better air quality in the garage while minimizing energy use and operating costs. Operable windows and views to the outside contribute to higher satisfaction with the indoor environment.

Innovation Feature: Water Use Reduction

Sustainability Challenge
Only a small fraction (3 percent) of treated potable water supplied to Canadian buildings is used for human consumption, which means that we are withdrawing, treating and then degrading the quality of most of the water that passes through buildings before returning it to the environment. Since deferring expansion of the future water supply is one of the Region’s key goals, demand reductions are important.

Innovative Feature Response
Outside the building, landscaping uses native plant species, eliminating the need for permanent irrigation. Inside the building, dual-flush toilets, waterless urinals and low-flow faucets are provided. A water-efficient clothes washer is used for crew laundry. Stormwater is collected in a cistern, which supplies the toilets, is used for vehicle washing and provides initial watering to get exterior plants established.

Impact on Sustainability and Performance
The amount of potable water used for sewage conveyance has been reduced by 90 percent. The total amount of potable water used in this building is reduced by 69 percent, which is exemplary. These reductions reduce costs and demand thereby extending water supply and infrastructure capacity. Waste water reduction also extends sewage treatment infrastructure capacity.
Mountain Equipment Co-op (MEC) Store
Winnipeg, Manitoba

Innovation Feature:
Aggressive Energy Savings

Sustainability Challenge
The energy that buildings use for heating, lighting and cooling accounts for the majority of total life cycle environmental impacts of a typical Canadian building. Part of the impact is the upstream effects of the “primary” energy produced to allow site use, including greenhouse gases that contribute to climate change.

Innovative Feature Solution
Exterior wall assemblies have twice the thermal performance of the national benchmark while the roof is nearly two and half times better. Custom high performance windows were made locally. Lighting power density is less than half the benchmark. Make-up air for the building is provided by an enthalpy recovery ventilation unit with an overall effectiveness of 72 percent. Heating and cooling are both provided by radiant systems in the floors and suspended from the ceilings, respectively.

Impact on Sustainability and Performance
The project design was projected to use 53.9 percent less energy than the national benchmark, the Model National Energy Code for Buildings. Actual performance since completion is better, at 55.8 percent, than projections. The project was certified under the Canadian Federal Government’s C-2000 program for the country’s most energy efficient buildings. The electrical peak load was kept low enough that the existing service, unusual for a retail store, did not require upgrading.

Innovation Feature:
Urban Redevelopment and Alternative Transportation

Sustainability Challenge
Development and construction processes are often destructive to local ecologies, especially if a previously undeveloped building site is chosen. Car use to commute to buildings can have as much environmental impact as the operation of the building itself. Locating a destination building, such as a popular retail outlet, in an existing downtown serves to maintain the viability of the core.

Innovative Feature Response
The site for this project is near the center of the downtown core. A total of 22 public transit bus lines run past the front door, 23 more are located within one block, bicycle racks have been installed close to the building entrances for customers and showers have been provided for staff. MEC provides bus passes for its staff at the store. No parking is provided for the building, with the exception of one stall reserved for handicapped visitors.

Impact on Sustainability and Performance
By building on a previously developed urban site the project accomplished multiple environmental objectives. Greenfield development has been avoided. Downtown revitalization is enhanced. Reliance on existing viable alternative transportation options encourages customers and staff to avoid car use and reduces downtown traffic congestion.

What sets this project apart
Key Innovation Features Summary

• Integrated Design and Construction Management Process
• Aggressive deconstruction and materials re-use
• Green Roof/Water Use Reduction/ Storm Water Management
• Aggressive energy savings – 60 percent better than national benchmark
• Urban redevelopment and alternative transportation

Project Summary
Mountain Equipment Co-op (MEC), a retail co-operative, is Canada’s largest supplier of outdoor equipment and has more than two million members in 192 countries. It sells its products via the internet and a phone/mail order service, as well as through retail stores across Canada.

MEC, as articulated in its Vision, Mission and Values, is very committed to social and environmental leadership. One of the most tangible demonstrations of these practices is through their building program, which has been building progressively greener buildings for the past ten years. Each store that it opens has improved environmental performance over the previous store.

The building development strategy for the Winnipeg store was based on explicit goals to retain, reuse, design, build and implement systems that reduce waste and energy consumption. Central to putting the strategy in place was the acquisition of a downtown site that had existing buildings that were viewed as a resource for the new building, not a problem to be removed. The project participated in a rigorous national green building demonstration program called C-2000, and the completed store was certified to a LEED (Leadership in Energy and Environmental Design) Gold level. The project also supported the City of Winnipeg’s plans to revitalize the downtown core by increasing density and providing amenities that attract people downtown.
Innovation Feature:
**Integrated Design and Construction Management Process**

Sustainability Challenge
Although building-related sustainability principles are universal, each project presents unique challenges due to variables like region, climate, site, client and market. Understanding and responding to those challenges in a way that captures the synergies that are possible requires an integrated, inclusive and collaborative approach to the design process.

Innovative Feature Response
Both the client and the design team were committed to a collaborative integrated process. Besides the architects and engineers, the project core design team included the client, a construction manager, a cost consultant, an energy simulation consultant and a representative from the federal government’s C-2000 program. A wider group of expertise was brought in as needed. This included both specific building technical areas and others such as experts in social interaction in the downtown core. Six intensive working sessions lasting two or three days each were held to develop a robust concept design, while the team remained open to new ideas well into construction.

Impact on Sustainability and Performance
Several decisions and creative ideas that were key to achieving exemplary performance resulted from the process, starting with the decision to deconstruct rather than demolish existing buildings. The building design was modified partway through deconstruction to accommodate and incorporate found materials. Use of non-traditional and disadvantaged labour sources reduced costs, provided needed work experience and benefited the community.

Innovation Feature:
**Aggressive Deconstruction and Materials Re-use**

Sustainability Challenge
Use of salvaged and refurbished materials in new building projects extends the life of materials and can reduce overall first costs of construction materials. Use of salvaged materials can also add character to the building and can be used effectively as architectural details.

Innovative Feature Response
One of the three existing buildings on the site was re-furbished and re-used and the other two were carefully deconstructed instead of being demolished. The reclaimed materials were inventoried, sorted and cleaned and the design of the new building was based on these materials. Materials reclaimed included Douglas fir timber columns, beams and joists, wood sheathing, framing and flooring, steel beams, cast iron columns, brick and local limestone.

Impact on Sustainability and Performance
Ninety-seven percent of the existing building materials were re-used. Use of reclaimed materials diverted nearly 4,000 tonnes from landfill, which reduced the projects total design and construction cost to less than $10-15 per m², reduced the embodied greenhouse gases by 729 tonnes and enhanced the retail aesthetic of the building. Avoiding the use of virgin materials reduced the transportation-related impacts from shipping of materials. The project also benefited the community in novel ways. For example, about three times as much brick was recovered from deconstruction than the project needed. The extras were given to the local Habitat for Humanity group who cleaned them with volunteer labour and sold them back cheaply to the project, while using proceeds from the sale of the remainder to fund their organization.

Innovation Feature:
**Water Use Reduction/Green Roof/Storm Water Management**

Sustainability Challenge
Development and construction processes are often destructive to local ecology and in particular, storm water runoff from developed areas can impact water quality in receiving waters and disrupt aquatic life. Since only a small fraction (3 percent) of treated potable water supplied to Canadian buildings is used for human consumption, it means that we are withdrawing, treating and then degrading the quality of most of the water that passes through buildings before returning it to the environment. In addition, dealing with peak storm water flows increases infrastructure costs, a particularly acute issue in Winnipeg where the City faces a $750 million upgrade cost to reduce combined sewer overflows.

Innovative Feature Response
Several technologies are combined. Composting toilets replaced flush toilets. Storm water from the green roof is collected in two 5700 L storage tanks. Collected, stored water is used to irrigate the roof, via a solar photo-voltaic (PV) powered pump, with the flow being proportional to the solar heat gain on the roof. “Compost tea” from the toilets is used to fertilize the roof.

Impact on Sustainability and Performance
The combined technologies provide multiple, reinforcing benefits. The green roof absorbs some of the storm water, cleans the runoff and virtually eliminates peak flows to the combined sewer, which addresses the city’s infrastructure issue. The re-used water not only irrigates the plants on the roof but provides self-regulating evaporative cooling because of the solar photo-voltaic (PV) irrigation pump, which reduces the air-conditioning load. Combined, these technologies provide over 72 percent water savings and reduce waste water generation by 51 percent. There is no sewage discharge from the building and the existing combined sewer connection does not need to be upgraded for the remaining stormwater.

Impact on Community
The project not only benefited the community in novel ways, but also opened the dialogue with the community in novel ways. For example, about three times as much brick was recovered from deconstruction than the project needed. The extras were given to the local Habitat for Humanity group who cleaned them with volunteer labour and sold them back cheaply to the project, while using proceeds from the sale of the remainder to fund their organization.
For more information on:

**Innovation Feature:**

- Ice Storage Cooling

**Sustainability Challenge:**
Buildings with highly variable occupancies frequently place strains on both the building systems and on the public infrastructure required to service the resulting peak loads. In this project, the peak occupancy during performances is over thirty-five times that of normal daily occupancy.

**Innovative Feature Response:**
To accommodate the enormous differences in peak cooling demand between times when there are no performances and when the theatre is full, an ice storage system accumulates up to 10,000 kg of ice. The ice storage tray is visible to visitors through a window in the floor of the reception area.

**Impact on Sustainability and Performance:**
The ice storage system allows the air conditioning size to be reduced by 90 percent of the system that would be required if no storage was employed. The peak electricity demand on the public grid with this system is reduced from 100 to 10 kW.

**Innovation Feature:**

- Greenhouse Gas Neutral Heating Source

**Sustainability Challenge:**
The environmental impacts from energy that buildings use for heating are due not only to their direct energy use, or “site” energy; but as well to the upstream effects of the “primary” energy produced to allow site use, including greenhouse gases that contribute to climate change. Landfills are another contributor because of the release of methane, which has a global warming potential approximately twenty-three times that of CO₂.

**Innovative Feature Response:**
A nearby municipally owned power plant generates electricity by burning captured methane produced from a closed landfill. Cooling of the generation process rejects “waste” heat to the condenser water, which is pumped to the building via an underground water loop to provide heating.

**Impact on Sustainability and Performance:**
Utilization of the waste heat from the co-generation plant that burns landfill methane that was previously vented to atmosphere avoids the need to burn primary energy directly. The system eliminates over 135 tonnes of greenhouse gas emissions each year from the building.

**What sets this project apart**

- Previously developed land, Brownfield site
- Delivering public environmental education of the Saint-Michel Environmental Complex, including tours of pavilion
- On-site stormwater retention and treatment
- Ice storage cooling system to reduce equipment costs and peak electricity demand
- Greenhouse gas neutral heating source
- Natural/hybrid ventilation system

**Key Innovation Features Summary**

- Natural/Hybrid Ventilation System
- Cooling of the generation process rejects “waste” heat to the condenser water via underground intake ducts 2 m in diameter and 60 m long, with displacement ventilation in the theatre. The ventilation is driven by stack effect alone at times of low load (less than 10°C outside) and assisted by fans during periods of high load. Extensive computer modeling was carried out by Concordia University to confirm the viability of this approach.

**Project Summary**

**TOHU, la Cité des arts du cirque,** is the home of a non-profit organization founded by En Piste (the national association of circus arts professionals, companies and institutions), the National Circus School (École nationale de cirque) and Cirque du Soleil.

TOHU is about more than supporting the circus arts industry. Much of the project value is rooted in social benefits and context—local culture, employment, and economic development.

TOHU is influenced by its location in the Saint-Michel Environmental Complex (CESM), the second-largest urban landfill site in North America and the focus of a 192-hectare rehabilitation project undertaken by the City of Montreal. TOHU’s neighbours, the co-generation facility operated by Gazmont, and the recovery centre for recycled materials, are part of the CESM. TOHU occupies the southeast sector of the CESM, and serves as the CESM’s welcome centre and the rallying point for the activities that take place at the site.

**Key Project Details**

- **Year of completion:** 2004
- **Type:** New construction
- **Setting:** Suburban
- **Total site area:** 27,530 m²
- **Total building area:** 4,965 m²
- **Floors above ground:** 2
- **Building use:** Circus training, performance venue, administrative office
- **Design occupancy:** 1,742 people with a full theatre and gallery plus about 15,000 on the grounds for outdoor performances; about 22 full-time staff during non-performance times
- **Certiﬁcations:** C2000, CBIP (Commercial Building Incentive Program), PowerSmart, LEED Canada (Leadership in Energy and Environmental Design) – NC (New Construction) Gold
Innovation Feature: Rehabilitation of Brownfield Site

Sustainability Challenge
Development and construction processes are often destructive to local ecologies, especially if a previously undeveloped building site is chosen.

Innovative Feature Response
This project chose a site that had seen three previous industrial uses with activities that left it as a brownfield site. The building site is part of a larger site complex that had been a limestone quarry since the early 20th century and was turned into a landfill site in the early 1970s. In 1988, the City of Montreal acquired the landfill site and surrounding areas and turned it into a waste sorting and elimination center. Eventually, the site became the Saint-Michel Environmental Complex and, “the focus of the most extensive environmental rehabilitation project ever undertaken by the City.”

Impact on Sustainability and Performance
By choosing a brownfield site and committing to the larger rehabilitation goals of the Saint-Michel Environmental Complex, the project now contributes to the rehabilitation of the local ecology rather than the degradation of it.

Innovation Feature: Public Education

Sustainability Challenge
Public awareness is low for both the negative impact of standard processes of development and construction and of the potential positive impacts of improved processes. Demand for better ways building is not increasing as quickly as it should.

Innovative Feature Solution
This project has taken over the responsibility of delivering the cultural and educational programming for the entire Saint-Michel Environmental Complex, and for demonstrating the value of incorporating sustainable design principles and innovative methods of heating, cooling, ventilating, and construction.

Impact on Sustainability and Performance
Raised public awareness of improved development and building processes contributes to increased demand for such processes. This educational program also increases goodwill and public support for the non-profit organization and its programs.

Innovation Feature: On-site Storm water Treatment

Sustainability Challenge
Development and construction processes are often destructive to local ecology and in particular, storm water runoff from developed areas can impact water quality in receiving waters and disrupt aquatic life.

Innovative Feature Response
All runoff water from the buildings and grounds is channeled into landscaped basins bordering the administrative area of the building. These basins, which are planted with indigenous vegetation, receive and retain rainwater from the roof and paved areas and then release it gradually to flow into the City of Montréal storm sewers via surface runoff. Some of the buildings are equipped with green roofs.

Impact on Sustainability and Performance
Runoff water is treated by the plants in the landscaped basins, resulting in enhanced quality of the water that eventually flows into the municipal storm system. The landscaped basins delay and reduce peak storm water flows, thereby eliminating the need to construct a traditional underground retention system of concrete ducts.

- Total Suspended Solids: 80 percent + removed
- Total Phosphorus: 40 percent + removed
- Design return period for storm water Retention basins: 100 years

Project Team
- Owner Contact: Jacques Charest, Cité des arts du cirque
- Mechanical: Martin Roy et associés
- Civil: Vinci Consultants Inc.
- Energy analysis: Martin Roy et associés
- Airflow simulation: Andreas Athienitis, Université Concordia
- Contractor: Construction Vergo Inc.

Site Plan showing building site in context of Saint-Michel Environmental Complex. Photo: Project conception team presentation.

View of ice storage through glass floor in main entrance. Photo: Project conception team presentation.

Looking out main entrance with view of rainwater treatment. Photo: Alex Zimmerman

View of TOHU flag at front entrance. Photo: Alex Zimmerman

Rainwater capture and treatment basin alongside main entrance. Photo: Alex Zimmerman

Main staircase showing recycled steel panels from old bumper car ride. Photo: Alex Zimmerman

Schematic of natural ventilation flows

Schematic of hybrid ventilation concept. Photo: Project conception team presentation.

View of ice storage through glass floor in main entrance. Photo: Project conception team presentation.
Innovation Feature: Significant Energy Savings for Building Type

Sustainability Challenge
The energy that buildings use for heating, lighting and cooling accounts for the majority of total life cycle environmental impacts of a typical Canadian building, both directly, and indirectly via impacts from upstream primary energy production. MURBs also face different technical challenges from commercial and institutional buildings, neither does the market have the same level of experience in developing solutions. The national benchmark energy code is frequently not achieved in common practice.

Innovative Feature Response
A number of strategies were employed. The single biggest contribution comes from a reduction in space heating due to better building envelope, more efficient central equipment such as condensing boilers and heat recovery on suite exhaust air. More efficient fixed lights, fans and cooling equipment were provided. Automated control of central equipment and better control strategies, including increased occupant control, also contribute to reductions.

Impact on Sustainability and Performance
The project uses 33 percent less energy than the national benchmark Model National Energy Code for Buildings. About two thirds of the reduction is achieved by reducing space heating energy.

Innovation Feature: Residential Waste Diversion Infrastructure

Sustainability Challenge
The ecological impacts of all materials vary widely because of the extensive network of extraction, processing, manufacturing and transportation steps required to process and eventually dispose of them. Recycling of residential waste materials greatly reduces these impacts. Most people are inclined to recycle their waste materials as long as the process is not inconvenient or costly, which is it in most MURBs, due to the lack of facilities. The average waste diversion rate in Toronto in the multi-residential sector is only 12 percent, which is likely typical of most Canadian cities.

Innovative Feature Response
The City of Toronto employs a commingled recyclables program, in which paper, metals, glass and other recyclables can be mixed together in the same bin for collection. Recycling of residential waste materials greatly reduces these impacts. Most people are inclined to recycle their waste materials as long as the process is not inconvenient or costly, which is it in most MURBs, due to the lack of facilities. The average waste diversion rate in Toronto in the multi-residential sector is only 12 percent, which is likely typical of most Canadian cities.

Impact on Sustainability and Performance
The project delivery team now has experience and capability to deliver more green buildings. The media coverage lead to requests for presentations to local industry groups. The project delivery team has used their experience to develop, fund and deliver an environmental education curriculum for the local elementary school.

Project Summary
Minto is an integrated development, construction and management company with Canadian operations in Toronto and Ottawa, and currently manages more than 23,000 residential rental units. They have made a commitment to improving the environmental performance of its projects, which is demonstrated by its formation of a dedicated team of experts that works exclusively on energy and environmental management initiatives, called Minto Energy Management. This team has been instrumental in finding innovative natural resource management solutions that make good environmental, business, and operational sense.

What sets this project apart
- Urban redevelopment and alternative transportation
- High Indoor Environmental Quality (IEQ) through ventilation effectiveness
- Occupant empowerment for reduced resource use
- Significant energy savings for building type (34.5 percent better than national benchmark)
- Waste diversion infrastructure
- Market transformation through education
Innovation Feature: **Urban Redevelopment and Alternative Transportation**

**Sustainability Challenge**
Development and construction processes are often destructive to local ecologies, especially if a previously undeveloped building site is chosen. Frequently, past practices have contaminated the land, further threatening the environment. Vehicle use to commute to buildings can have as much environmental impact as the operation of the building itself, while changing people’s transportation habits in a predominantly car-oriented culture is difficult.

**Innovative Feature Response**
The site for this project had seen numerous past uses, some of which had left contamination that required clean up. The site is in a dense neighbourhood with a wide range of amenities, near the corner of one of the city’s busiest intersections, in close proximity (90 m) to a subway station serving two major lines and within walking distance of several bus stops. Secure bicycle storage has been provided for more than a third of residents. An agreement with a car-sharing cooperative has stationed a new hybrid vehicle on site that is dedicated to the residents of the project. More open space has been provided than pre-development and the non-roof areas reduce the urban heat-island effect.

**Impact on Sustainability and Performance**
The land is no longer contaminated, greenfield development has been avoided and no new urban infrastructure was required, with attendant cost savings and avoidance of resource consumption. There are four different, viable and convenient alternative transportation options to the automobile that encourages residents and visitors to make environmentally responsible commuting choices. Restoration of open space with vegetation provides a pocket of green space which also reduces the urban heat-island effect.

Innovation Feature: **High Indoor Environmental Quality (IEQ) Through Ventilation Effectiveness**

**Sustainability Challenge**
Maintaining health and comfort in a building’s indoor environment while safeguarding the building envelope and using minimal energy is a challenge for every building. For historic financial and other market failure reasons, existing market practices for some building types lag far behind what is known to be desirable and technically possible. This is especially true in the case of ventilation for MURB construction, where neither existing practices or technologies were adequate.

**Innovative Feature Solution**
The project worked with equipment manufacturers to develop new, cost-effective technology that provides controlled ventilation to individual dwelling units. The units that were developed are known as vertical stacked fan coils with integral plate-type heat recovery ventilator (HRV) cores. The HRV section extracts heat from air exhausted from the bathrooms to pre-heat outside ventilation air before introducing it to the dwelling unit.

**Impact on Sustainability and Performance**
The vertical stacked fan coils with HRV provide greatly improved ventilation performance, and therefore health benefits, over conventional practice while keeping first costs in check and minimizing additional energy use. Deployment of these units are also a market-shifting technological advance.

Innovation Feature: **Occupant Empowerment for Reduced Resource Use**

**Sustainability Challenge**
In residential buildings, addressing the sustainability challenge depends on sociological factors as much as purely technical ones, because variability in occupant behaviour affects resource use much more so than in commercial and institutional buildings where many resource-consuming systems are beyond the control of occupants. MURBs do not commonly provide unit-specific information nor do they commonly provide sufficient control to allow residents to significantly affect resource use.

**Innovative Feature Response**
In addition to designing efficient systems for common areas and services, this project has assumed that occupants will be motivated to do the right thing with respect to reducing resource consumption, as long as they are given appropriate information and tools. Three major utilities, hot water use, cold water use and electricity are metered separately for each suite in this project and billing is handled by a third-party billing service. Also provided is an “all-off” switch located at the entrance of each suite that allows residents to turn off all fixed suite lights as they leave the suite.

**Impact on Sustainability and Performance**
The project demonstrates a 55 percent reduction in water use compared to buildings without meters. The combination of meters and the “all-off” switch reduces electricity use by an estimated 10 percent. There is also the intangible benefit of allowing people to demonstrate environmental values in a market where it has traditionally been difficult, which is likely to lead to spin-off effects in other areas of their lives.
**Innovation Feature:** Significant Energy Savings

**Sustainability Challenge:**
The energy that buildings use for heating, lighting and cooling accounts for the majority of total life cycle environmental impacts of a typical Canadian building. Part of the impact is the upstream effects of the "primary" energy produced to allow site use, including greenhouse gases that contribute to climate change.

**Innovative Feature Solution:**
The resulting building is not only environmentally advanced, but has been a key strategic asset in reinventing the firm’s work in large and complex projects which require an integrated approach to design. Their clients have included containment laboratories, large government entities and corporations who seek to maximize the effectiveness of their workforce. In all cases, they have recognized the power of the building to profoundly affect what goes on within it.

**Impact on Sustainability and Performance:**
The project design is projected to use 55 percent less energy than the national benchmark, the Model National Energy Code for Buildings and saves about $43,000 per year in operating costs. Cooling energy costs were virtually eliminated. The project was certified under the Canadian Federal Government’s C-2000 program for the country’s most energy efficient buildings.

**Innovative Feature Response:**
Indoor environmental quality strategies on this project focused on air quality, daylight and views. A radon control system was installed under the slab. Construction phase activities included planning and control of contaminant sources, sealing of air delivery systems and good housekeeping practices. Interior materials choices focused on leaving materials in their natural state wherever possible and on using low Volatile Organic Compound (VOC) adhesives, paints and carpets. No smoking is allowed in the building. The studio space has very high windows and no partitions. Operable windows are provided at low level and motorized blinds at high level.

**Impact on Sustainability and Performance:**
Improved indoor air quality from the measures taken contribute directly to the health and comfort of the occupants. Over 95 percent of all spaces in the building have daylight and view access directly to the outside. The main view from the studio space is a natural one of the grove of spruce trees. Control over indoor air flow via the in-floor diffusers, operable windows and motorized blinds increase occupant satisfaction with the thermal comfort.

**Sustainability Challenge:**
The World Health Organization states that most of a person’s daily exposure to many air pollutants comes through inhalation of indoor air. Canadians spend an average of 90 percent of their time indoors. Ensuring that indoor environmental quality is high while also keeping capital cost of equipment and operating costs reasonable is a significant challenge. In addition, naturally occurring radon in the soil adds an additional risk.

**Innovative Feature Response:**
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**Innovation Feature:**

*Serious Play*

**Sustainability Challenge**

Green buildings must prove to be financially viable as well as environmentally sound if they are to become mainstream and contribute to lessening the sustainability crisis facing humanity. Traditional measures of a buildings’ value frequently fail to capture the full range of benefits offered by a green building and how they add value.

**Innovative Feature Response**

The building is not only a technological response to environmental challenges but incorporates solutions that directly address organizational design and collaborative work.

These combined ideas are captured in the notion of “Serious Play”, that became a catalyst not only for the building design process, but also for change in Smith Carter’s organizational design, management structure, employee empowerment and knowledge transfer.

The resulting building is not primarily about efficiency, but effectiveness, and in Smith Carter’s words, “how the physical workplace design can support business processes and in turn encourage behaviours that will reinforce who the company is.”

In this context, traditional measures of value for the project, for example space per employee, which actually doubled, do not apply.

**Impact on Sustainability and Performance**

The single biggest impact is the positive contribution of the new green building to the overall robust financial picture of the company. Quantifiable financial measures attributable to the building include consolidation of space, attraction and retention of key staff members and an overall Net Present Value of $30 million, which is three times what the building, fit-up and Information Technology (IT) systems cost. Harder to monetize, but still quantifiable positive measures include a 75 percent value increase in employee satisfaction, 50 percent increase in unsolicited media articles about the company and twenty unsolicited tours of the new building in one year, compared to no tours of the old facilities in the previous twenty years.

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**Innovation Feature:**

Intentional Integrated Design Process (IDP)

**Sustainability Challenge**

Architectural and engineering design has largely become a commoditized service. The widespread assumption is that there is no difference between one provider and the next, and that therefore the lowest cost service is the best value. In this context, risk minimization and linear, repetitive project delivery processes are paramount and there is little room for the innovation required to find solutions to environmental challenges.

**Innovative Feature Solution**

The program was intentionally not completed in any detail before design commenced, and the budget was based on return-on-investment criteria for the business as a whole, with the building as a catalyst, not just a container. Key decision-makers attended all meetings. As a combined practice, Smith Carter was able to compose the core project design team using internal resources. Very early on the core team reached outside the firm for a peer review of their proposed schematic design by experts in energy, materials, water, geothermal technology and others. Integrated design meetings were held frequently to accommodate the deadline imposed by the sale of the old building.

**Impact on Sustainability and Performance**

The return-on-investment success measure and flexible program allowed for exploration of a wider range of schemes, including the chosen scheme. The established relationship and increased trust of the core project team resulted in integrated decision-making, and allowed team members to informally share and test ideas, which shortened the design cycle time. Two key decisions resulting directly from the IDP process, which favourably impacted sustainability performance, were the siting of the building and the decision to use a geothermal system.

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**Innovation Feature:**

Ecological Site Enhancement

**Sustainability Challenge**

Development and construction processes are often destructive to local ecology and in particular, storm water runoff from developed areas can impact water quality in receiving waters and disrupt aquatic life. Frequently it is difficult to meet these challenges while realizing an adequate rate of return. In this case, the shape of the site plus the requirement to retain 150 existing trees, covering about a third of the site, had deterred previous buyers.

**Innovative Feature Response**

Prior to development, the site had been an ecologically barren lawn, except for the trees. The building was sited to retain the trees and use them as a visual and weather buffer. The building is not primarily about efficiency, but effectiveness, and in Smith Carter’s words, “how the physical workplace design can support business processes and in turn encourage behaviours that will reinforce who the company is.”

Impact on Sustainability and Performance

At 61 percent, nearly twice the site area than before development, is undisturbed forest or restored habitat. Runoff water is treated by the plants in the meadow and retention pond, resulting in enhanced quality of the water that eventually flows into the municipal storm system. The grove of trees provides a walking path for staff and community residents. Site restoration promotes biodiversity by providing habitat for bats, wood ducks, owls and other species. Geese have also taken up residence on the site.