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Green Value was initiated and led by RICS Canada but could only have been undertaken with the kind contribution and support of many others. They are:

Sponsors

- RICS Canada, RICS USA and RICS UK;
- BC Hydro;
- British Columbia Ministry of the Environment;
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I especially wish to thank our co-partners and sponsors, and others who contributed greatly to this project. Credit goes to you for understanding the need to translate between the environment and business, and to try to find a common language.

Some individuals' contributions merit special mention. They are Philip Smith of Royal LePage Advisors in Toronto who led the consulting team (this Technical Appendix is largely credited to Phil with the support of the team); Michael Chambers and Clare Barker of RICS in London, England for coordinating the European aspects and final completion; but above all, Orest Maslany whose unflappable contributions, vision and support repeatedly went well beyond the call of duty. This could not have been completed without you.

Green Value took two years from concept to completion and was intended to be the start of work on how sustainability can profitably form part of, and be integrated into, society. It is emphatically not the end of that work, which I hope will continue.

Chris Corps BSc MRICS
Victoria, British Columbia, Canada
16th October 2005.

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GREEN ON THE GRAND, KITCHENER, ONTARIO, CANADA

This two-storey office property was originally developed in 1995 and is located on the east side of Kitchener immediately adjacent to the Grand River. The property was originally developed at a time of high vacancies in the market after the recession of the early 1990s and the development of two major public sector buildings, Kitchener City Hall and the headquarters of the Regional Municipality of Waterloo which had driven the office vacancy rate in the downtown area up as high as 35%.

The developer, Ian Cook Construction, a home builder, and the lead tenant and project engineer, Enermodal Engineering, shared a common goal to build an environmentally state of the art building employing the latest in energy saving and environmentally friendly features.

The project was also a winner of the C-2000 project and thus able to secure significant funding ($400,000) to assist in the design and construction of the project. (The C-2000 Program for Advanced Commercial Buildings was a small demonstration program for high-performance buildings, developed and sponsored by the CANMET Energy Technology Centre (CETC) of Natural Resources Canada. The emphasis of the program was on energy performance and water conservation, but criteria was also developed for maintenance of site ecology and improved levels of indoor environmental quality.) Since its initial occupancy, the property has always enjoyed a high level of occupancy and is currently fully leased. Although there have been some challenges with the property from an operational standpoint overall both the landlord and the major tenant regard it as a success from investment, occupancy, environmental, social and marketing perspectives.

SUMMARY OF KEY BUILDING FACTS

Figure 1 is a description of the building's key Green features (based on a summary provided on the Advanced Buildings web site, www.advancedbuildings.org).

Site Design

Located on a height of land overlooking the Grand River, Green on the Grand has a southerly orientation for passive solar gains. The building shape (two off-set rectangles) maximizes daylight penetration into the building and gives most offices views of the Grand River. Five office suites are located on two storeys. The central core (where the rectangles overlap) houses stairways, elevators, washrooms and mechanical space.

Building Envelope and Structural Design

The building envelope for Green on the Grand is airtight and has insulation values three times those required by ASHRAE 90.1. Wood is the primary structural material because wood is a renewable resource; it is energy-efficient and it has low-embodied energy. Engineered wood products are dimensionally stable and are not manufactured with urea formaldehyde. Double-stud walls prevent thermal bridging and provide plenty of space for insulation. The building foundation is slab-on-grade, insulated to reduce heat loss and improve thermal comfort. Waterproofing of polyethylene eliminates the use of toxic tar in construction. The windows and doors at Green on the Grand are designed to have low heat loss, high daylight transmission and low solar heat gain.

- Building support structure and floor joists entirely of engineered wood products.
- Above-grade walls R32, below-grade walls R11, ceiling R57, windows R6.2.
- Exterior walls are wood, double-stud construction with blown-in cellulose insulation made from recycled newspapers; a 6mil polyethylene air/vapour barrier; and 50 mm expanded polystyrene insulation (EPS) coated with stucco.
- Foundation insulated with 50 mm EPS; 75 mm rigid fiberglass for drainage and insulation.
- Steeply-pitched roof with joists and trusses made from small-dimensional lumber. Cathedral ceilings insulated with 350 mm mineral-wool batts spun from 50% slag waste. Flat ceilings insulated with 450 mm blown cellulose.
- Triple-glazed windows with two low-e coatings, two argon gas-fills and two silicone edge-spacers. Outside lite of spectrally-selective glass. Frames of pultruded fiberglass lineals filled with polystyrene insulation. Most windows are fixed; 10% of window area is operable. Frames around entrance doors have a 13mm thermal break. Window to wall ratio is optimized at 30%.

Address	650 Riverbend Drive, Kitchener, Ontario, Canada
Gross Building Area	23,573 square feet (2,190 sq. m.)
Net Useable Area	20,452 square feet (1,900 sq. m.)
Completion	Mar-96
Owner/Developer/Construction Manager	Ian Cook Construction
Tenants	Enermodal Engineering, Hybrid Turkeys, MTE Consultants and Simon and Johnston Accountants (Summerfield NAI Commercial Real Estate were also original tenants and subsequently vacated)
Architects	Snider, Reichard, March
Mechanical and Electrical Engineers	JNE Consultants and Enermodal Engineering
Civil Engineers	MTE Consultants
Environmental/Energy Engineers:	Enermodal Engineering
Construction Costs	$2,500,000, including $180,000 for the land, equating to $106 per square foot ($1,142 per sq. m.)
Awards	Canadian C2000 Design Competition (1995), Designated Canada's contribution to International Energy Agency Task 21 (Daylighting) and Task 23 (Energy-Efficient Buildings), ASHRAE Technology Award, Division 2 (1997)
Grants	Approximately $400,000 for design and construction from C-2000 award.

Figure 1: Green on the Grand – Summary

Heating and Cooling

The design goal was to meet heating and cooling loads with the most environmentally-benign fuel available (natural gas) and with energy-efficient equipment. The building design uses radiant heating and cooling (rather than forced air systems) to achieve greater energy efficiency, lower motor power demand, superior occupant comfort, and zone temperature control. During the summer, the gas-fired chiller is less expensive to operate than an electrical air-conditioning system and does not contribute to peak electricity demand. Waste heat is sent to an attractive landscaping pond (and not a rooftop cooling tower) where the heat is lost through evaporation.

- Energy-efficient fans and pumps.
- Water-based radiant panels cover 30% of ceiling area; panels operate at 35°C in winter and at 13°C in summer.
- Condensation on radiant panels is eliminated by dehumidified ventilation air.
- Gas-fired absorption chiller/heater is 85% efficient.
- Landscaping pond (20m x 10m x 0.9m deep) evaporates heat from the chiller and eliminates the need for a cooling tower and CFCs. A waterfall increases effective pond surface and evaporation.

Ventilation and Air Quality

The ventilation system is independent of the heating/cooling system and supplies outdoor air to all offices. The main air-handling unit has two heat exchangers, two fans and a heating/cooling coil. Fresh air from the air-handling unit is delivered via displacement ventilation that places the air close to occupants.

- Displacement ventilation uses 100% outdoor air. Ventilation air is introduced at floor level, rises as it warms, and is exhausted at ceiling level. CO2 levels are typically 450 ppm in offices.
- Incoming ventilation air passes through a desiccant-coated energy recovery wheel, a cooling coil (in summer only) and a second heat exchanger before delivery.
- Ventilation system operates at full capacity 20 hours a day at two rates. The normal rate is 10L/S/person. The high flow rate is used when additional fresh air is needed or when free cooling is provided by outdoor air.
- Awarded ASHRAE Technology Award, Division 2 (1997)

Lighting and Daylighting

Green on the Grand demonstrates that offices can be attractively lit through the use of daylighting, energy-efficient light fixtures and task lighting. Electricity use for lighting is 50% lower than that typically used in offices.

- Large dormer windows, glazed entranceways and interior glass walls maximize light penetration to building interior. Windows placed to maximize lighting to interior but minimize glare and overheating.

- Summertime shading provided by fabric roller-blinds and horizontal blinds with slats that deflect light into building interior.
- Lighting plan emphasizes task lighting with compact fluorescents and halogen lights with parabolic reflectors.
- Most light fixtures have electronic dimmable ballasts in indirect/direct lighting fixtures controlled by photo and motion-sensitive controls.
- Parking lot lighting with high-pressure sodium lights.

Plumbing and Water Heating

Green on the Grand uses 30% less water than a conventional office building. This objective was met through the use of rainwater for landscape irrigation; the elimination of a cooling tower; and the use of conserving bathroom fixtures and dishwashers. Water heating is supplied by a high-efficiency, direct-vent, wall-mounted gas boiler connected to a small storage tank.

- The central location of washrooms eliminates the need for hot water recirculation and reduces hot water demand by about 20%.
- Water-conserving toilets (6 litre) and urinals with infra-red sensors that shut fixtures off when not in use.
- Shower heads with manual shut-off valves and infrared sensors.
- Cooling tower pond is filled by rainwater so no additional water is required. This pond conserves about 500 m3 of water per year.

Finishes and Furnishings

The plan for Green on the Grand emphasized indoor air quality. Designers identified interior finishes that do not off-gas VOCs or urea formaldehyde. Wise material selection along with a 100% outdoor air ventilation system means that occupants enjoy excellent air quality.

- Interior walls are covered with 100% recycled gypsum board. Some walls are finished with sisal wall coverings or cellulose-based textured wall coverings that do not require the use of toxic glues.
- Straw-filled interior wall panels are used as room dividers.
- Highly durable linoleum floors and baseboards are made from natural products, are low in embodied energy and do not off-gas.
- Some office suite doors are recycled from other buildings.
- VOC-free adhesives and paints are used throughout the building.
- Most furnishings are made from formaldehyde-free particleboard or from steel finished with powder-coat paint that is solvent-free.

Equipment and Appliances

Choices in office equipment and appliances are guided by a desire to reduce electricity demand and minimize the use of toxic materials.

- Priority is given to lap-top computers, laser printers and fax machines with low idling-power requirements and automatic switching to standby.
- Kitchen areas include energy-efficient dishwashers and refrigerators; the latter are CFC-free.

SUMMARY OF INTERVIEW

On December 15, 2004 we interviewed the owner, Ian Cook, President of Cook Homes and the lead tenant and engineer for the project, Steve Carpenter, President of Enermodal Engineering. Their responses to our survey can be summarized as follows:

General

Rationale for Building Green - At the time the building was constructed in 1995 the housing market had experienced one of its worst years since 1958. Ian Cook was a homebuilder and was able to acquire the site relatively inexpensively as there was an issue with site remediation which pre-dated the construction. The partnership with Enermodal provided a lead tenant and a willing partner with knowledge of new and innovative technologies, and the grant money available through the C2000 program provided the financial incentive to green the building.

Marketing - The green features of the project were one of the key differentiating factors in marketing a new office building in a market experiencing high vacancies. As a result the building was essentially fully leased to four tenants upon its completion, including an engineering firm, a consulting engineering firm, an accounting firm and the administrative offices of a turkey breeding firm.

Third Party Involvement - There is no (third party financing on the property. There was a third party leasing agent involved with the leasing initially but they did not have any specific knowledge of the green features. The project picked up a good deal of recognition after it had been completed and was fully leased. This subsequent recognition was useful to both the tenants and the developer but did not contribute to its initial success.

Green designation - The partnership between Ian Cook Construction and Enermodal created a good deal of goodwill which contributed directly to securing the award and grant monies. The biggest challenge related to the process itself and the very specific criteria the project had to meet.

Third party reports – several appraisals were completed for the owners, a post occupancy audit was completed in March 1998 for Enermodal and a tenant survey was completed. We were provided with an excerpt from the Tenant Satisfaction Survey by Enermodal as well as a booklet relating to the C2000 designation.

Environmental

Key Green features – The following is a list of the green features which have proven to be most financially and non-financially beneficial from the perspective of landlord or tenant, listed in order of benefit from most to least:

Building envelope – this represents a similar cost to conventional construction but yielded the biggest benefit from the standpoint of operating cost benefit.

Lighting – natural daylight workspaces represents significant benefit for occupants and reduces electricity consumption.

Ventilation– (the building has both natural and mechanical ventilation) better than the heating and cooling system, with a low cost and relatively high benefit

Lack of ambient noise – there is good quality sound in the office (although noise does carry through the floor).

Operable windows – this is a popular feature with the tenants. The only complaint is that not all the offices have operable windows.

Pond – this aesthetic feature is popular with the tenants but has created maintenance headaches for the landlord.

Mechanical system – this has created the biggest challenge for the owner. If they could reconfigure the building mechanical systems they would have it piped differently with a modular system, not centrally controlled, allowing for the varying loads associated with multi-tenant buildings (i.e., better zone control).

Importance of Green features in attracting tenants - The green features of the project were regarded as important by all four of the tenants in the building.

Non-Green Comparables – There are a number of potentially comparable buildings in the same business park, most of which have been developed in the last 10 years or so. Specifically, 508 Riverbend Drive (a multi-tenant building), and 30 Dupont were identified.

Other impacts on the environment – water conservation (with an estimated 72% reduction in potable water consumption over conventional office buildings), the location has a relatively low impact on the environment.

Environmental issues considered in developing project – all items including using less energy, resource efficient materials (recycled or salvaged), and less water, and improving the indoor air quality were all considered extremely important factors. The only item which was not applicable was a green roof.

Social

Reputation of owner/occupant/tenant – the project has received considerable press coverage to the benefit of both the owner/developer and the tenants. Honours include small business leader of the year and environmental company of the year. Enermodal has received national and international profile from the project and one of the other tenants, Hybrid, has owners based in the Netherlands who regularly visit the building. The impact has been measurable, particularly for Enermodal, based on the greater awareness of their services and the rapid expansion of their business. This is evidenced by them doubling up offices to accommodate the growth in staff. For Cook

Construction, the owner, their main business is building homes and the profile this project received has provided some welcome publicity and increased profile which has contributed to greater numbers of home sales and more awareness of Cook Homes.

Larger scale local/regional effects – locally the impact of the project on greening the local market has been modest. The only new green project which has been contemplated since the completion in 1996 of Green on the Grand is the Emergency Medical Services building for the Region of Waterloo. There has been no noticeable impact on government policies/standards or building practices as a result of this project. There has however been an increase in the expectations and knowledge of the community as a result of the project. By being the first green project in the region there is a sense that the project has raised the bar for future development. No other specific social/community impacts were noted.

Absenteeism, health issues and productivity levels – Enermodal provided information for the period from 2001 to 2004 as to the number of sick days as a proportion of their total hours worked. In every year the number of sick days was less than 1% of the total, shown in Figure 3.

	2001	*2002*	*2003*	*2004*
No. of Sick Days	204	264	242	155
Total No. of Days	29,762	27,780	29,596	34,056
% of Sick Days	0.69%	0.95%	0.82%	0.46%

Figure 3: Green on the Grand – Absenteeism

With regard to productivity and efficiency the breakdown is shown in Figure 2:

	2001	*2002*	*2003*	*2004*
Efficiency	67%	74%	84%	90%
Efficiency with Underage	80%	84%	94%	96%
Productivity	26%	32%	48%	100%
Effort	32%	38%	52%	105%

Figure 2: Green on the Grand – Productivity

As can be seen the level of efficiency, productivity and effort has grown every year for the last four years to the point where all of the key measures have essentially been maximized in 2004. Although a number of factors certainly contribute to these improvements the quality of the work environment would certainly be regarded as a positive influence. An abundance of daylight, low levels of absenteeism and the overall comfort and quality of the work environment are all regarded as key factors in contributing to the overall high levels of productivity and efficiency being experienced by Enermodal.

Ranking of social issues in developing the building – increasing corporate or civic image, increasing corporate or civic leadership in social/environmental responsibility and increasing employee morale were all regarded as important issues in developing the property. Reducing absenteeism, increasing productivity, improving employee health and improving indoor air quality were all regarded as somewhat unimportant factors in developing the property.

Financial

This is an investment property. The development of the property was based on the rents which could be achieved at the time in the market. The green features did not, in the opinion of the owner, contribute to higher rents being achieved however these items did assist in leasing up the space by creating a niche in the market and attracting tenants who might otherwise not have committed to the project.

Construction costs **-** As part of the C2000 package a comparison of costs between the Green on the Grand and conventional construction was provided. Overall construction costs, including land, leasehold improvements and design fees totaled $102.19 per square foot ($1,100 per sq. m.). Based on "hard" construction costs only (i.e. excluding land, tenant leasehold improvements, design fees, landscaping and site services) the total was $67.08 per square foot ($722 per sq. m.) compared to $66.70 per square foot ($718 per sq. m.) for conventional construction. Figure 4 provides an elemental breakdown and comparison of these costs.

Utility Costs **–** As part of the C2000 package a comparison of predicted utility costs between the Green on the Grand and conventional construction was provided. This demonstrated savings of 58% relative to conventional construction, which was prior to the significant increases in energy costs experienced in the last two years. Figure 5 is a summary of the predicted annual savings in utility costs based on each component:

Financial Indicators – according to the owner the following categories of items exceeded expectations (i.e. outperformed): rent, yield (rate of return), marketing success and level of absorption of space. Initial construction costs, operating costs and ongoing maintenance costs all exceeded expectations, but in a negative way (i.e. they were more expensive than expected). Tenant allowances and turnover of space met the original expectations. Neither of the two items which were ranked as having exceeded expectations by the greatest amount, rent and yield (rate of return), were, in the opinion of the owner, directly attributable to greening the building.

However with regards to the impact on the initial construction costs and ongoing maintenance costs the higher cost of these items was felt to be directly related to the greening of the building. Both of these latter two items were felt to have exceeded initial expectations, in terms of additional cost, by 11-20%. All other items, including marketing success, level of absorption, operating costs, tenant allowances, turnover of space etc. were all felt to fall

	Green on the Grand		*Typical Office*		*Means 1996*	
Component	*$/sq.m.*	*$/sq.ft.*	*$/sq.m.*	*$/sq.ft.*	*$/sq.m.*	*$/sq.ft.*
General Conditions	$39	$3.62	$50	$4.65	$62	$5.76
Excavation	$9	$0.84	$13	$1.21	$11	$1.02
Foundation	$54	$5.02	$49	$4.55	$23	$2.14
Building Shell	$105	$9.75	$192	$17.84	$99	$9.20
Windows & Doors	$44	$4.09	$76	$7.06	$12	$1.11
Roofing	$16	$1.49	$24	$2.23	$15	$1.39
Insulation	$17	$1.58	$27	$2.51	-	-
Exterior Walls	$40	$3.72	$38	$3.53	$179	$16.63
Miscellaneous Steel	$7	$0.65	$1	$0.09	-	-
Finishes	$16	$1.49	$90	$8.36	-	-
Mechanical	$209	$19.42	$90	$8.36	$179	$16.63
Electrical	$93	$8.64	$78	$7.25	$115	$10.68
Elevator	$25	$2.32	$32	$2.97	$37	$3.44
Contingency	$49	$4.55	$28	$2.60	-	$0.24
TOTALS	**$722 m2**	**$67.08/sf**	**$718 m2**	**$66.70/sf**	**$773 m2**	**$71.81/sf**

Figure 4: Green on the Grand – Cost Comparison

Component	*Green on the Grand*	*Typical New Office*	*% Savings*
Space Heating	$1,105	$2,715	59%
Space Cooling	$863	$1,874	54%
Water Heating	$86	$132	35%
Receptacle Loads	$2,796	$3,855	27%
Lighting	$1,978	$6,534	70%
Pumps/Fans	$855	$2,099	59%
Water/Sewer	$720	$2,610	72%
TOTAL COST	**$8,403**	**$19,819**	**58%**

Figure 5: Green on the Grand – Energy

in a range of 0-2% of initial expectations.

Barriers to Understanding Sustainability – two main items were identified. First, there is limited incentive to build a green building for an owner/investor as opposed to an owner occupant. A key issue here is that under a traditional net lease structure the energy efficiency and operating cost savings resulting from a green building all flow to the tenant, while the initial capital costs and ongoing responsibility for maintenance of building systems falls on the owner. There needs to be a better correlation of savings in energy costs and the benefit to the landlord. Second, there is a disconnect between the understanding of the benefits and the lack of understanding of the technologies. While the benefits are real, there is limited knowledge of the technologies required to realize the benefits of building green.

Relative Understanding of Sustainability – in the opinion of both the owner and the major tenant the level of understanding of sustainability (or green buildings) was greatest amongst architects and lenders and limited amongst developers, tenants and real estate brokers. Appraisers and planners were felt to have an understanding of sustainability.

Suggestions for making it easier to understand sustainability – the two key items which were identified were firstly the need to create a market and demand for the product, and secondly the need for economies of scale. In the context of this project the timing of the development in a very weak market meant that the green features helped the project "stand out" from competitive available space. The need for economies of scale has proven to be an issue because of the relatively small size of the property and the fact that the developer's main business is building homes.

As a result, the unique mechanical systems have proved challenging to manage and have resulted in a number of significant expenditures which are difficult to pass on to the tenants due to the impact on the operating costs. For example, an expenditure of $10,000 represents an additional cost of approximately $0.50 per square foot for this property. Clearly for a larger project it is easier to see the significant benefits associated with some of these energy saving technologies.

Tenant/Occupant ranking of the relative direct and indirect benefits of the project – the major tenant provided the following relative ranking of these five items:

1) Energy Consumption
2) Marketing and Promotion
3) Health
4) Productivity

5) Operating Costs

Requirement for an appraisal by the lender and the extent to which the appraisal took into account the green features– there was a requirement for an appraisal by the lender but no impact of the green features was reflected in the appraisal.

Ability to achieve lower insurance premiums – there was no ability to achieve lower insurance premiums as a result of the green features. If anything the insurance premiums are actually higher because of the boiler and the wood frame construction.

Ability to achieve lower financing costs - there was no ability to achieve lower mortgage financing costs as a result of the green features.

SAS BUILDING, TORONTO, ONTARIO, CANADA

SAS Institute (Canada) Inc. is developing a 115,000 square feet, eight-storey, office property with three levels of underground parking, on the north side of King Street a few blocks east of downtown Toronto's financial district for occupancy in late 2005. The property is budgeted to cost $30 million to construct and SAS will occupy 60,000 square feet, or 52% of the building with the balance of the space available for lease in the market.

SAS is currently located in leased accommodation in BCE Place, one of the premier office complexes in Toronto's downtown financial district. The property has applied for LEED certification and incorporates numerous green features.

SAS is the world's largest privately held software company. SAS Canada is a subsidiary of SAS Institute Inc. of Cary, North Carolina with over 9,000 employees in over 250 offices worldwide. SAS started its Canadian operations in 1988 and is headquartered in Toronto and employs over 200 people across the country in Quebec City, Montreal, Ottawa, Calgary and Vancouver. Major customers in Canada include Royal Bank Financial Group, Bell Canada, CIBC and Bank of Montreal.

SAS has a corporate philosophy to own rather than lease its National Office accommodation and the significant cost of renewing its lease at BCE Place was a key driver of the decision to relocate to less expensive accommodation. SAS also regards itself as a socially responsible company and a leader in innovative technologies. All these factors, as well as the difficulty of finding alternate suitable existing accommodation which met its requirements, all drove the decision to relocate and build a new Canadian headquarters.

SUMMARY OF KEY BUILDING FACTS

Figure 6 is a brief description of the property and the building's key Green features (based on a summary provided in the SAS Canada brochure on the property and the web site www.sas.com/280King).

- Eight floors above ground, including ground floor retail space and seven floors office space.
- The building is designed to respect the neighbourhood and pedestrian traffic. Building elevations facing King & Ontario Streets are designed to be as transparent as possible, reducing the mass of the building. The ground floor is recessed back from the sidewalk, providing pedestrians with a wider sidewalk area, and opening up the corner of King & Ontario Streets for better visibility for approaching vehicles.
- Top floors have a central atrium serving to bring natural light into the centre of the building, as well as opening up the entire top three floors to each other.
- Cast in place concrete structure uses a high percentage of recycled material in the concrete.
- Roof surface is covered with white membrane to reduce heat island effect in the neighbourhood and reduce solar heat gain in the building, which will reduce air conditioning energy costs.
- Three levels of underground parking provide a total of 80 parking spaces.
- Building design and specifications submitted for LEED (Leadership in Environmental and Energy Design) Certification. Potentially the first commercial building in Toronto to obtain this certification.
- Projected energy consumption of 30-50% less than a comparable building of typical design.
- All rainwater from the site is collected in tanks in the lower level of the building, and the collected water is treated and re-used to provide flushing of washroom fixtures.
- All office space is provided with full raised floors, complete with under-floor air distribution, saving energy costs and providing the highest possible levels of individual control of environment for each occupant.
- Latest technology elevator systems consume up to 50% less

Address	280 King Street East, Toronto, Ontario, Canada
Gross Building Area	115,000 square feet (10,219 sq. m.)
Net Useable Area	109,000 sq. ft.
Area Occupied	60,000 square feet (5,203 sq. m.) by SAS Institute (Canada) Inc.
Completion	Late 2005 (currently under construction)
Owner	SAS Institute (Canada) Inc.
Tenants	SAS Institute (Canada) Inc. (52% on top four floors), balance of space available for lease (54,000 square feet or 5,017 sq. m.)
Project Manager/General Contractor	Giffels Design Build
Architects	NORR Limited
Engineer	Mechanical: MCB, Electrical: Mulvey+Banani, LEED administrator with NORR
3rd Party Commissioning Agent	H & H Angus
Interior Design	Marshall Cummings
Leasing	Royal LePage Commercial Inc.
Construction Costs	$30,000,000, including $4,000,000 for the land, equating to $272
Awards	Applied for LEED certification. Estimated to be two points short of LEED silver designation based on existing Green
Grants	None identified

Figure 6: SAS Building – Summary

energy than traditional systems.

- Floor-to-ceiling glass walls on south and west walls are blue tinted with low-E glazing to allow natural sunlight transmission with reduced heat gain, also to reduce air conditioning energy costs.

SUMMARY OF INTERVIEW

On December 16, 2004 we interviewed a representative of the developer and owner/occupier, Jerry McDermott, Manager Real Estate Development, SAS Institute (Canada) Inc. His responses to our survey can be summarized as follows:

General

Rationale for Building Green – Initially SAS had not planned to develop a Green building. The key driver of the decision to relocate from BCE Place at the expiry of the lease was financial. At a projected $33 per square foot net rental rate and operating costs and realty taxes in excess of $25 per square foot considerable savings in annual occupancy costs were anticipated based on relocation outside the financial district. A downtown location was still considered the most convenient and desirable for both employees and clients. SAS also had a corporate philosophy to own rather than lease and a reputation as a socially responsible company and a leader in innovation.

It was the combination of all these factors and others which led to the decision to develop its own new Canadian headquarters on the east side of downtown Toronto which would incorporate energy saving features, abundant natural light, proximity to public transit and resource efficient building materials. It was only after the decision to proceed with construction and incorporate these features that there was a realization that this was effectively a "Green" building and that the existing features were only two points short of achieving a LEED silver designation. There was a recognition that it was easier for the project to be "Green" in the context of the urban environment as a result of the minimal site disturbance, access to public transit, relatively high density ratios and the ability to locally source building materials. The biggest initial challenge was educating the various trades and contractors involved in the construction on the specific implications of building Green on their day-to-day practices.

Third Party Involvement - There is no third party financing on the property. There is a third party leasing agent involved with the pre-leasing (Royal LePage Commercial Inc.). There is a LEED Accredited Professional or project manager working with NORR Architects and a third party commissioning agent (H & H Angus) is also involved.

Green designation – The project has registered for LEED certification.

Third party reports – no appraisals were completed for the property as no third party financing was required. No post occupancy audits have yet been completed as the project is not completed.. A financial model comparing the costs of renewal at BCE Place, the costs of third party leased accommodation, and the cost of developing and occupying a new building were all prepared by SAS and the net present value of the various options was used to determine the most favourable financial option.

Environmental

Key Green features – The following is a list of the Green features which are projected to be the most financially and non-

financially beneficial from the perspective of the owner/developer and tenant, listed in order of benefit from most to least:

- Quality of workspace – this was listed as the most important feature and all of the items listed below can be considered to contribute to this either directly or indirectly.

- Raised floor air conditioning system – under-floor air distribution saves energy costs and provides the highest level of individual control of the environment for each occupant.

- Daylighting – Full height Low-E glazing on the south and west sides, plus a sky-lit Atrium extending through the top three floors of the building bring natural daylight into interior zones, reducing lighting costs and solar heat gain, resulting in reduced operating costs.

- Energy consumption (particularly electricity) – 50% of the energy consumption is related to the lighting. Overall energy consumption is projected to be 30-50% less in this building compared to a comparable conventionally designed building.

- Water consumption – all rainwater from the site is collected in tanks in the lower level of the building, treated and re-used for flushing of washroom fixtures.

Costs were only tracked separately for these items from the perspective of construction costs. As the project is not yet complete there is no operating cost history. No breakdown of the construction costs was made available. Quality of the workspace and ongoing operating costs were listed as the two most important factors, which could not be achieved without many of the Green features which are being incorporated into the project. In terms of the relative benefit of these items the impact on the quality of the workspace environment and the bottom line impact were both listed as equally important.

Importance of Green features in attracting tenants – A high level of interest from prospective tenants has been expressed since the project became publicly known. The space marketing program which commenced in January has been very successful. Tenants have indicated that the unique “Green” aspects of the building, and the benefits financially (lower operating & energy costs) and to their staff (superior indoor air quality, lighting) as well as the location, were instrumental in their selection of this building .

Non-Green Comparables – Only one other new office building has been completed in downtown Toronto since 1995, the Maritime Life Tower at 2 Queen Street East, located closer to the financial district and representing a considerably larger project. This was completed in 2003 and would not be regarded as a direct comparable due to its larger size and superior location.

SAS did consider several other options prior to making its decision to construct a new office building for its Canadian Headquarters. These options included renewing its lease at BCE Place. However, at a projected net rent of $33 per square foot and operating and realty taxes of over $25 per square foot, a considerable increase in occupancy costs would have occurred. SAS also considered leasing space in other existing leased premises in less expensive buildings on University Avenue and King Street West as well as possible purchase of existing buildings in this area.

The decision to proceed with development of 280 King Street East was ultimately based on a comparative analysis of the relative costs of the respective options on a net present value basis. The ability for SAS to self-finance the project, the fact that the company has a preference to own rather than lease its real estate and that the project was consistent with the company's socially responsible and innovative culture, all further reinforced the financial decision.

Other impacts on the environment – four other items were specifically referenced.

- The heat island effect: the roof is covered with a white membrane to reduce the heat island effect and reduce solar heat gain. Previously the site was used as a paved surface parking lot.
- Rainwater collection: all stormwater run off is collected and re-used on-site.
- Densifying the neighborhood: the replacement of a surface parking lot with an eight storey office building also provides a catalyst to regenerate the neighbourhood. Replacing the surface parking surface with underground parking, removes polluting vehicles from the street and eliminated asphalt, impervious pavement surfaces which contributes to the urban heat island effect.
- Using less energy: many of the features already identified will result in significant energy savings.

Environmental issues considered in developing project – using less energy, using resource efficient materials, and improving the indoor air quality were all considered extremely important factors. Using less water was considered somewhat important. Using recycled or salvaged material was considered neutral and employing a green roof was considered somewhat unimportant in view of the alternate selected.

Social

Reputation of owner/occupant/tenant **–** the project has received considerable media coverage, to the benefit of SAS. This coverage includes recent articles in the Globe and Mail (national daily newspaper in Canada), Property magazine and a recent presentation at the Real Leasing Forum in Toronto. Knowledge of SAS has also increased significantly and there has been enhancement of SAS's brand as a result of all the positive publicity surrounding the project. It is too early to quantify the impact of this on the bottom line.

Larger scale local/regional effects – there has possibly been an impact of the project on greening the local market but this is hard to quantify in any tangible way. There has been no noticeable improvement in local government policies/standards, nor any increases in the baseline for standard business building practices - although it is still too early to identify the impact. There has been an increase in the expectations and knowledge of the community in terms of the immediate neighborhood. No other specific social/community impacts were noted.

Absenteeism, health issues and productivity levels – As SAS will not be occupying the property until after it is completed in late 2005 there is no information available yet related to these items.

Ranking of social issues in developing the building – Increasing productivity, improving employee health, improving indoor air quality and increasing employee morale were all

regarded as extremely important factors in developing the project. Reducing absenteeism rates, increasing corporate or civic image and increasing corporate or civic image in social/environmental responsibility were all regarded as somewhat important factors.

Financial

This is an owner-occupied property. The development of the property was based on a comparison of occupancy costs on a net present value basis, over a 10 year time horizon between: renewing SAS's lease in its existing premises, relocating to less expensive leased accommodation, and purchasing an existing building or developing a new building. Initially SAS was not planning to construct a Green building, however it was only after several of the design elements were incorporated that SAS recognized that they had already complied with many of the LEED requirements. Therefore the Green features were regarded as very important from the perspective of their contribution to lower operating costs and creating a quality workspace. These features did contribute to marginally higher construction costs, compared to conventional construction, and SAS is seeking premium net rents in the market, based on the unique Green features of the project. It remains to be seen whether SAS is able to achieve higher rents from third party tenants for these features (current firmed-up offers are reflecting higher than normal net effective rents). However the projected lower operating costs will contribute to making the property's overall gross occupancy costs more competitive.

Construction Costs – Total construction costs (including land, leasehold improvements and design fees) are estimated to be $30,000,000 or $272.72 per square foot ($2,936 per sq. m.). Based on "hard" construction costs only (i.e. excluding land, tenant leasehold improvements, design fees, landscaping and site services) the total was $208 per square foot ($2,239per sq. m.).

Operating Costs – no information was available relating to projected operating costs for the property.

Financial Indicators – as the project has not yet been completed it was considered premature to determine which financial indicators had exceeded or fallen short of SAS' expectations.

Barriers to Understanding Sustainability – none were identified with respect to the local community, however it was felt that although at the municipal government level there was an understanding of sustainability actual implementation of sustainable practices was still falling well short of the rhetoric – i.e. municipalities are *"talking the talk"* but not *"walking the walk"*.

Relative Understanding of Sustainability – in the opinion of SAS the level of understanding of sustainability (or green buildings) was greatest amongst architects and planners and limited at present amongst tenants. Appraisers, developers and brokers were felt to have limited understanding of the financial impact of sustainability. There are no lenders involved in this project.

Suggestions for making it easier to Understand Sustainability – look at the bottom line and only consider the direct incremental costs related to Sustainability versus the energy cost reduction.

Tenant/Occupant ranking of the relative direct and indirect benefits of the project – this could not be addressed as the tenant has not yet taken occupancy.

Requirement for an Appraisal by the Lender and the extent to which the Appraisal took into account the Green features – there was no requirement for an appraisal as there was no third party lender involved with the project.

Ability to achieve lower insurance premiums – this could not be addressed as the tenant has not yet taken occupancy.

Ability to achieve lower financing costs – there is no third party lender involved with the project.

2465 DON REID DRIVE, OTTAWA, ONTARIO, CANADA

In July 2003 The City of Ottawa began the process of selecting a private sector partner to develop a new facility for Ottawa Paramedic Services. Forum Leasehold Partners submitted a successful joint proposal with Aecon-Westeinde Alliance, who are responsible for the design and construction process, and Trammell Crow Company Canada, who are responsible for the property management. Forum's proposal was selected in January 2004 and subsequently entered into a 30-year lease with the City of Ottawa and is responsible for financing the $20 million construction costs of this 100,000 square feet project. The project is scheduled for completion in December 2005. The project will be LEED Certified.

SUMMARY OF KEY BUILDING FACTS

Figure 7 is a description of the building's key green features (based on information provided directly by Forum and on their web site, www.forum-flp.com as well as information from the contractor, Aecon-Westeinde Alliance Inc.).

SUMMARY OF GREEN FEATURES

General

The new Ottawa Paramedic Service headquarters building has been designed to qualify under two sustainable design evaluation programs. The first is the Commercial Building Incentive Program (CBIP) sponsored by Natural Resources Canada which requires a building to be at least 25% more energy efficient than that required by the National Model Energy Code for Canada. The second is the Leadership in Energy and Environmental

Design (LEED) program by the Canadian Green Building Council. This project will achieve a "Certified" level certification when completed.

Energy Efficiency

The following measures are being implemented in the project contributing to an energy use reduction of 30% when compared to a baseline building as per the National Model Energy Code and as modelled on EE4 software from Natural Resources Canada:

- Windows are specified as argon filled, low-E coating, high shading properties and with non-metallic warm-edge spacers;
- Lighting for the garage and stores areas are high efficiency T5 fluorescent with occupancy sensor switching;
- Occupancy sensors are provided in enclosed offices, meeting rooms, washrooms, utility rooms, washrooms, garage and decontamination area to control lighting;
- Low flow water fixtures reduce the amount of hot water consumed;
- Drain water heat recovery from the second floor washrooms and showers by means of a heat exchanger will pre-heat the cold water going to the showers;
- CO2 demand control sensors on the air handling unit serving the administration area reduces the amount of ventilation required when this area is not occupied in the evenings and during the nighttime;
- An energy recovery ventilator (ERV) and CO2 demand control sensors are provided on the air handling equipment serving the operations and support areas;
- The fit-up area of the garage is being designed to allow for future gas fired infrared heaters. This would allow the overall temperature in the garage area to be lowered. The provision of these heaters may be reconsidered near the completion of the project if funds are available;
- High efficiency condensing boilers are specified for space heating;
- High efficiency condensing boilers are specified for domestic hot water heating; and
- Comprehensive third party commissioning to ensure systems work and are operated as designed.

Environmental Initiatives

- At least 75% of construction waste will be diverted from landfills.
- Backfill and granulars are construction waste diverted from

Address	2465 Don Reid Drive, Ottawa, Ontario, Canada
Gross Building Area	100,000 square feet (9,290 sq. m.), with surface parking
Net Useable Area	Not available
Completion	Currently under construction with completion scheduled for
Land Owner	The City of Ottawa
Land Lessee and Developer	Forum Leasehold Partners Inc. (subject to a 30-year leasehold interest)
Property Manager	Trammell Crow Company Canada
Contractor	Aecon-Westeinde Alliance Inc.
Tenant	City of Ottawa
	(Ottawa Paramedics Services)
Architect	Griffith, Rankin and Cook
Mechanical and Electrical	Mec-Arc Mechanical
Construction Costs	$20,000,000, equating to $200 per square foot ($2,153 per sq. m.) based on the gross building area of 100,000 square feet. Hard costs are budgeted at $16 million with soft costs (permits,
Awards	LEED Certified (anticipated on completion)
Grants	None identified.

Figure 7: Don Reid Drive – Summary

other local construction projects. This consisted of ground up and graded asphalt and concrete in the order of magnitude of 20,000m² (100 dump trucks).

- Greater than 10% of construction materials will consist of more than 50% recycled content.
- Greater than 20% percent of building materials will be harvested and manufactured within 800km of the site.

Water Efficiency

- Low flow faucets and showerheads are specified at 6.8 l/min. This results in domestic water use reduction of greater than 30% when compared to the minimum standard of the plumbing code.
- Waterless urinals are specified.
- Landscape plantings are native species requiring no irrigation system. Hose bibs are provided for occasional waterings if required.

Indoor Environment

- Carbon dioxide monitoring in the ventilation system is provided to ensure fresh air.
- An indoor air quality plan will be implemented during construction to protect tradesmen and future occupants of the building.
- The building will be flushed for 2 weeks after construction stops and prior to occupancy with 100% outside air to remove any volatile organic compounds (VOC) from off gassing materials such as carpets, paints and adhesives.
- Materials with low emitting VOC's have been specified for paints, carpets, adhesives, sealants and millwork.
- Janitor rooms and rooms designated for the storage of chemicals are mechanically ventilated.
- Non-perimeter normally occupied rooms are provided with individual temperature and lighting controls.
- 90% of normally occupied interior spaces have views to the exterior.
- All furniture will be specified as "Greengard" certified. This program limits the amount of VOC containing materials.
- The property managers Trammel Crow have committed to a 2-year period utilizing green housekeeping practices.
- The facility has secure bike racks with showers and change rooms.

SUMMARY OF INTERVIEW

On January 13, 2005 we interviewed a senior representative of the developer and land lessee, Michael Sullivan, Director, Forum Leasehold Partners Inc. In addition on January 20, 2005 we also had a brief conversation with Robert Vaillancourt with the City of Ottawa to clarify certain issues from the tenant's perspective. Their responses to our survey can be summarized as follows:

General

Rationale for Building Green – The City of Ottawa developed a request for proposal (RFP) on behalf of one of its departments, the Ottawa Paramedic Services, who have an urgent need for a new custom-built facility. Previously the Province of Ontario had been responsible for funding these services which have now been downloaded onto the City. Their previous leased facility no longer met their custom requirements and the imminent lease expiry offered an opportunity to consider other options.

The tender envisaged a public-private partnership whereby the City would enter into a 30-year lease with a developer who would finance and construct the building based on specifications provided by the tenant. The rent would be derived through a pre-determined formula to provide an economic return to the developer as well as a custom-designed facility for the tenant. At the expiration of the 30 years the property reverts to the City.

The green features were driven by the occupant and requested in the RFP with a requirement for a LEED Certified building being specified. Subsequently when the financial impact of all these items was quantified in the construction budget certain green features were omitted when the financial bid was reengineered. A key objective was to attain a LEED designation and the LEED Certified designation was targeted once it became evident that there was insufficient budget and points to obtain a LEED Silver designation.

Third Party Involvement – Aecon-Westeinde Alliance Inc. were the general contractors. The City of Ottawa owns the land, with a reversionary interest in the land and building, Forum Leasehold Partners hold a 30-year leasehold interest and are financing and developing the project and Trammell Crow Company Canada are the property managers. Third party financing for the project (both construction and long term) has been arranged by Forum with a major Chartered Bank. The property will be 100% occupied by Ottawa Paramedic Services. The architects for the project are Griffith, Rankin and Cook.

Green designation - The project is targeting a LEED Certified designation and is only one point short of a LEED Silver designation. There were no real challenges identified in obtaining this designation, the requirements were detailed and clear and it was relatively easy to price. The decision to go green and apply for the LEED designation was strictly a financial one, from Forum's perspective. The general contractor identified the additional cost of LEED Certification and green features to be $230,000 with a payback of $60,000 anticipated as a result of an energy grant which is anticipated to be provided to the project. From the City's perspective they considered it important to show environmental leadership and believed that the 25% energy savings, which were mandated in LEED would provide a payback on the incremental costs within 5 years.

Third party reports – Forum was not aware of any appraisals having been required. An environmental audit was completed for the site.

Environmental

Key Green features – As the project is still under construction it is not yet possible to identify the financial and non-financial benefits of the green features.

The incremental costs of the green features required to obtain LEED Certification were estimated to be $230,000 (percentage of total cost on $20m = 1.2% "green premium") with a high

possibility of a $60,000 payback as a result of a grant related to the energy savings. It was also felt that the perception of the relative benefit of the green features related to the level of seniority of the decision maker, from the occupant's perspective. The more senior the decision maker the more concerned they were about the financial implications of the green features and less about the indirect, harder to quantify, benefits.

Green features you would not replace or add that were not included – not applicable from Forum's perspective as the green features were all driven by the end user and the City

Green features which assisted in attracting the user – the City of Ottawa required a green building based on the specifications set out in their request for proposals. This was therefore a pre-requisite to attracting the user.

Non-Green Comparables – there are no directly comparable buildings as this facility has been custom designed for the user and includes such specialized items as de-contamination bays.

Installing the green features were a requirement of the tenant in the design-build proposal process. At the end of the 30-year lease the facility reverts to the tenant.

Other impacts on the environment – no other impacts were identified.

Environmental issues considered in developing project – using less energy, using sustainable materials and indoor air quality were all regarded as somewhat important factors in developing the project. Using recycled materials and less water (recycled water is used for washing the ambulances) were all regarded as neutral. There is no green roof.

Social

Reputation of owner/occupant/tenant – there has been no measured effect, although Forum has generated some positive exposure which it has been able to use to improve its credibility with potential investment partners, the public sector and the real estate brokerage community. The City does not intend to actively promote the project until it has been completed and the LEED Certification has been received.

Larger scale local/regional effects – it is too early in the process to identify any noticeable impact of the project on greening the local community, local government policies/standards, standard business building practices and increases in the expectations and knowledge of the community. The most significant impact at this stage is the success of the public private partnership process. The only other general comment from the developer is that LEED Certification is an onerous and expensive process and requires a high level of commitment to complete. From the City's perspective they are now looking to adopt a policy of LEED Certified for all new buildings. This has not yet been implemented but the City plans to announce it in April 2005.

Absenteeism, health issues and productivity levels – as the project is not yet complete this data is not yet available.

Ranking of social issues in re-developing the building – none of these issues were applicable in developing the project from the perspective of Forum.

Financial

This is an investment property. From Forum's perspective the development of the property was based purely on the financial returns which could be achieved over the 30-year period of the lease.

Construction costs - Overall construction costs are budgeted to be $200 per square foot ($2,153 per sq. m.) based on the gross area of 100,000 square feet. Hard costs are $160 per square foot ($1,722 per sq. m.) and soft costs are $40 per square foot ($431 per sq. m.). According to the City there is a 3-5% premium on the construction costs associated with the green features. The cost of having the project LEED Certified is estimated by the City to be 1% of the construction costs. The rent to be paid by the tenant is calculated based on a pre-determined formula applied to the construction costs with adjustments based on the price of steel and the cost of financing.

Operating Costs – no information is available at the present time relating to estimated operating costs. However the tenant is anticipating a 25% reduction in utility costs, compared to conventional construction as a result of meeting the energy savings specified in order to achieve the LEED Certification.

Financial Indicators – according to Forum the following categories of items all met expectations – rent, yield (rate of return), marketing success and initial construction costs. However all of these items were essentially pre-determined through the design-build process and the very detailed specifications. Operating costs, ongoing maintenance costs, tenant allowances, turnover of space (vacancy) and reduction in internal fit out costs (churn) were not measurable at this stage of the project.

Barriers to Understanding Sustainability – cost is considered to be the one main barrier to incorporating sustainability practices in other projects.

Relative Understanding of Sustainability – in Forum's opinion the level of understanding of sustainability (or green buildings) was considered excellent among architects. Planners and developers were considered to have a good understanding. Tenants are considered to have an understanding (the level of understanding tends to depend on the level of seniority of the individual). Lenders have a limited understanding of sustainability. No appraisers were involved with this project.

Suggestions for making it easier to Understand Sustainability – two key items were identified to assist stakeholders in understanding the relative financial benefits of sustainability.

- List and price each item;
- Develop better data on actual savings resulting from sustainable practices (for this project 40% savings were anticipated from the electrical and mechanical systems).

Tenant/Occupant ranking of the relative direct and indirect benefits of the project – we were not provided with any information which would enable us to rank these items.

Requirement for an Appraisal by the Lender and the extent to which the Appraisal took into account the Green features – no appraisal had been required by Forum.

Ability to achieve lower insurance premiums – there was no ability to achieve lower insurance premiums as a result of the green features.

Ability to achieve lower financing costs - there was no ability to achieve lower mortgage financing costs as a result of the green features.

VANCOUVER ISLAND TECHNOLOGY PARK, VICTORIA, BRITISH COLUMBIA, CANADA

The Vancouver Island Technology Park (the VITP) is located 5 kilometres north of downtown Victoria on the southern tip of Vancouver Island. The site comprises a total of 35 acres (14.2 hectares), with a permitted density of 400,000 square feet, zoned for research, office and manufacturing. Phase 1 of the project was completed in 2001 and comprises 184,000 rentable square feet and is currently 95% occupied by 21 tenants representing a wide variety of businesses from high technology to biotechnology to environmental and research. The property was the first in Canada to achieve certification under the U.S. Green Building Council's LEED rating system with a LEED 2.0 Gold designation. The property also received a BOMA Earth Award and several other awards for its innovative green features.

Prior to the development of the technology park there was a hospital located on the site, which was built in 1969-71. The deconstruction of this facility and conversion to primarily office use resulted in considerable savings on recycled materials compared to new construction and diversion of most of the material away from landfills. At the time the project was initially planned and developed there was still significant activity in the high technology sector – which had cooled off considerably by the time the project was completed. As a result of several of the innovative green features, the park-like setting and the "clustering" effect of the businesses, the VITP was still able to attract tenants during a relatively depressed leasing market. The property was developed by a partnership of the British Columbia Buildings Corporation (BCBC) (a crown agency responsible for the British Columbia's real estate assets) and BuildGreen Developments Inc. At the time of the interview BCBC owned the property and was responsible for the leasing and management. The total construction costs were $8,347,000 or $45.36 per square foot ($488.30 per sq. m.). On March 29, 2005 the property was acquired by the University of Victoria for $20,200,000.

SUMMARY OF KEY BUILDING FACTS

Figure 8 is a description of the building's key green features (based on information provided directly by the British Columbia Buildings Corporation (BCBC) as well as information on the property on the Vancouver Island Technology Centre web site, www.vitp.ca).

Site/ Location

- The property is located in a campus-like rural setting with pathways and trails, a salmon spawning creek and access to protected wilderness areas and gardens in adjacent facilities. The parking lots are not paved but covered in gravel, which reduces run-off. There are no filters and separators as various swales and ponds on the site perform

the same function. Indigenous plants require virtually no maintenance which reduces operating costs.

- The property is located approximately five kilometres north of downtown Victoria and is bordered by the Interurban campus of Camosun College, the Forestry Research Centre, the Horticultural Centre of the Pacific and Layritz Park. It is also located midway between the University of Victoria and Royal Roads University. Downtown Victoria, the airport and ferry terminal (to access Vancouver, Port Washington and Seattle) are all located within a 30 minute drive.

Mechanical Equipment and Systems

- A water loop heat pump system has been installed at VITP in the north and south wings to provide heating and cooling to the space. This system is capable of recovering heat from zones requiring cooling and delivering it to zones requiring heating. In this manner, the run-time of the boiler system is reduced.

- The water loop heat pump system inherently avoids simultaneous heating and cooling within a zone.

- To save pumping costs, the water loop heat pump system has been designed to be variable flow instead of the conventional approach of constant flow.

- The original multizone air handler for the centre block has been retained to provide heating and cooling to the space. The system has been re-furbished and converted to a variable volume system to save energy costs.

- A digital control system has been installed at VITP to provide temperature control of tenant spaces and to allow coordination with the primary heating and cooling systems for the building. The heat pump controllers are mounted in the space and come with buttons to allow temperature setpoint adjustment and after-hours operation. The ambient space temperature is also displayed on a LCD screen.

- The digital control system will allow optimal start of each heat pump, thereby maximizing energy savings by keeping the zones in night setback as long as possible.

Address	4464 Markham Street, Victoria, British Columbia, Canada
Gross Building Area	184,000 rentable square feet (17,094 sq. m.) – Phase 1 (with an additional 235,000 square feet of available density for future
Net Useable Area	Not available
Completion	Original building constructed in 1969-71, with deconstruction
Owner/ Property Manager/	British Columbia Buildings Corporation (BCBC), recently
Developer	GreenBuild Developments Inc.
General Contractor	Campbell Construction
Tenants	Various (currently 95% leased to 21 companies)
Architects	Idealink Architecture and Bunting Coady Architects
Mechanical Engineers	Keen Engineering
Electrical Engineers	Robert Freundlich
Civil Engineers	First Team Engineering
Construction Costs	$8,347,000, equating to $45.36 per square foot ($488.30 per sq. m.) based on the gross building area of 165,000 square feet
Awards	LEED Gold Award, BOMA Earth Award, Greenways Developer's Award, Award for Excellence in Urban Development, 2002 Minister's Environmental Award, 2003 Award of Merit for Engineering Excellence and the 2003 Innovation Award for Sustainable Development – Spec
Grants	None identified.

Figure 8: Vancouver Island Tech Park – Summary

Lighting

- At VITP, the shape of the building maximizes daylight penetration into the interior. The type of window glazing that was used, allows more light than heat into the space. Additionally, the occupied floor space has a direct line of sight to windows on more than 90% of occupied space.

- As the property is located close to the Hertzberg Institute there is a requirement for subdued lighting resulting in reduced lighting both inside and outside the property.

Materials & Resources

During construction, the developer achieved a waste diversion from landfill sites of 98% with a savings of $20-$40 per square foot in savings resulting from the re-use of the base building materials of the previous structures on the site. Approximately $1,000,000 was saved based on using recycled materials.

Indoor Air Quality

- The base building HVAC (Heating, Ventilating, and Air Conditioning) systems were designed to meet or exceed ASHRAE Standard 62-1999, Ventilation for Acceptable Indoor Air Quality. This ASHRAE Standard is generally accepted as the design standard for indoor air quality.

- It is intended that most tenant spaces be fitted out with energy-efficient heat pump units, incorporating fresh air delivery to the units by connection into the base building fresh air system.

- In the base building, fresh outside air is ducted directly to each heat pump to ensure that the highest possible component of fresh air is delivered to the building occupants.

- Tenants are encouraged to use materials, finishes and systems which maintain the quality of fresh air established for the base buildings on the VITP Campus. Contract documents specify that paints, adhesives, sealants, carpet and composite wood products have low volatile organic compound (VOC) limits.

- The base building includes carbon dioxide sensors, to insure that sufficient fresh air is provided to different areas of the buildings.

- Gas boilers in series provide more flexibility in heating the facility, which results in lower energy costs.

Water Efficiency

Water use reduction strategies were incorporated for the VITP base building, including: electronic faucets, waterless urinals, low flow toilets and showers.

Transportation

- Employees of the tenants located at VITP are actively encouraged to use transit, carpooling and bicycles in order to both reduce harmful emissions to the environment as well as lowering operating costs by reducing reliance on parking. Bicycle racks are provided at the property.

SUMMARY OF INTERVIEW

On January 18th and 19th, 2005 we interviewed two senior representatives of the developer/owner and property manager, Dale Gann and Greg Sikora who at the time were, respectively, Manager, Business Development and Marketing and Manager, Real Estate & Leasing, for British Columbia Buildings Corporation ("BCBC"). Their responses to our survey can be summarized as follows:

General

Rationale for Building Green – the existing facility on the site, a 30-year old hospital, was surplus to local requirements and an opportunity was seen to create an innovative work environment based on its park-like setting. At the time the technology park was conceived, the high-technology boom was approaching its peak. A consulting study completed on technology parks around the world had identified the need for an inviting work environment to attract businesses and their employees, based on the long hours expected in this industry. In addition these employees were also found to be well-paid and well-trained, resulting in significant economic development benefits for the local community if these companies and their employees could be attracted.

At the time BCBC had also made a commitment to sustainable practices and this project could therefore fulfill several objectives, which were all complimentary. There were two major hurdles identified at the time the project was developed. The first, was the perceived incremental costs of building green, although these were offset by the use of recycled materials and the lower operating costs over the life-cycle of the project which could be demonstrated to offset any incremental capital costs. The second hurdle involved the permitting process with the local municipality, which was overcome by demonstrating the benefits of green construction as they related to reduced environmental impacts on items like the Salmon Creeks which run through the property.

Third Party Involvement – BCBC developed the project in conjunction with BuildGreen Developments. Campbell Construction was the general contractor. BCBC was also responsible for the leasing and management of the property. The architects for the project were Idealink Architecture and Bunting Coady Architects. There is no third party financing on the property, which was financed by BCBC.

Green designation - The project has received a LEED Gold designation, BOMA Earth Award, Greenways Developer's Award, Award for Excellence in Urban Development, 2002 Minister's Environmental Award, 2003 Award of Merit for Engineering Excellence and the 2003 Innovation Award for Sustainable Development – Special Recognition.

Third party reports – an appraisal was reportedly prepared but was not available to review. No post occupancy evaluations were available to review. One of the tenants, E-traffic Solutions, reportedly experienced a 30% productivity gain.

Environmental

Key Green features – The following is a list of the green features which have proven to be most financially and non-financially beneficial from the perspective of the owner/developer, listed in order of benefit from most to least:

Air quality – the cleaner air in the facility as a result of the low VOC materials and the HVAC system has benefited the tenants in terms of higher levels of productivity.

Park-like Setting – this campus type property has a drainage system which relies on swales and ponds rather than filters and separators. The parking lots are covered in grass and gravel rather than paving. There are indigenous plants on the site which do not require ongoing maintenance, unlike the usual landscaping found in office park settings. There is also a creek which is used by spawning salmon and benefits from the lack of run-off and other contaminants on the site.

Lighting – there is subdued lighting on the property both on the interior and exterior. The proximity to the Hertzberg Institute necessitates this reduced lighting. The abundance of natural light has also benefited the tenants in terms of higher levels of satisfaction and productivity.

Heating and cooling – the property is serviced by an oversized ground source heat pump system in the space which allows for considerable flexibility in directing the heating and cooling of the building. Gas boilers in series are also easier to manage, save on energy costs and also provide flexibility.

Water usage – lower water usage as a result of the indigenous plants and waterless urinals has resulted in a 30% reduction in operating costs compared to conventional buildings.

Recycled materials – the property was not completely rebuilt. However, 98% of the materials used in the renovation contained recycled content.. Only those base building systems which were required to adapt to individual tenant's needs were completely rebuilt.

From the landlord's perspective the positive impact of the green features on the tenants' productivity was the most important factor, because of the objective of promoting economic development and sustainable practices. However the ability to demonstrate operating cost savings and meet the budget for the project were also key factors. If the landlord was not a provincial crown agency the direct financial benefits would likely have been the most important factor.

Green features you would not replace or add that were not included – four items were identified. First, BCBC would have liked to have had the funding to ensure that all of the interior finishes met the LEED Commercial Interiors (LEED-CI) standards rather than leaving this up to the tenants to implement. Second. they would have liked to have gone further with the HVAC system by generating further energy savings. This would have included items such as operable windows. Third, they would like to consider including a green roof. Finally they would like to have tried to take the project to a LEED Platinum level.

Green features which assisted in attracting the user – the lighting and the HVAC system (and air quality) all had an extremely important impact in attracting the tenants to the project. The site features (including the park-like setting) had a neutral impact in attracting tenants. The media attention, particularly relating to the site and the LEED Gold designation, all had a positive impact in terms of the free advertising for the project.

Non-Green Comparables – two office buildings in the Victoria area were identified as being of a similar size and also competing for the same types of tenants. The Gateway Building at Keating Crossroads was formerly occupied by JDS Uniphase (a high technology company) and constructed in 1999/2000. 4000 Seymour Street was a 10-15 year old building which was formerly

occupied by the provincial government and subsequently marketed to high technology companies. These buildings had comparable net rents, but the lower operating costs at VITP (because of the reduction in water consumption and the greater energy efficiency as a result of the heat pump) resulted in lower gross rents which helped the marketing of the project, enabling the leasing of the project to outperform the market.

Other impacts on the environment – only one item was identified. Transportation was another key green benefit of the project. Many of the tenants car pool and plug-ins are also provided for hybrid cars, both of which help reduce harmful emissions into the environment.

Environmental issues considered in developing the project – using less energy, using sustainable materials (in the business centre) and indoor air quality were regarded as extremely important factors. Using recycled or salvaged material and using less water were regarded as somewhat important. There was no green roof.

Social

Reputation of owner/occupant/tenant – there have been a number of impacts of the project which have had a positive impact on the reputations of the owner, developer and tenants. The project has received considerable positive coverage, especially in local newspapers and trade journals when it was awarded LEED Gold. VITP was the first project in Canada to receive any type of LEED certification……The sustainability aspects of the project have been one of the key differentiators between VITP and its competitors and its ability to attract tenants.

The VITP has also been published in a book highlighting the top 10 technology parks in the world. The project is regarded as the "flagship" case study in the BCBC portfolio and clients are toured through the project to demonstrate green buildings. BCBC's marketing staff has also discovered that high performance green buildings are a significant source of new business (e.g. the Interior Health Authority). BCBC also now has a technical value division which focuses on sustainable practices.

The Canada Green Building Council was a tenant in the property for two years and as a result VITP has also served a useful purpose as a showcase for LEED in Canada. There is a technology development centre in the property which acts as an incubator for new businesses. In terms of bottom line impact there are several examples, both direct and indirect. MDS Metro, one of the tenants, referenced in a press release the positive impact of the project in contributing to a healthy, happy workforce. E-traffic Solutions claimed to have seen a 30% improvement in productivity within 7-8 months of moving into the project. Compugen, who were previously located in a downtown Class A building, has also found that their employees prefer the new working environment. Reportedly, all of the tenants frequently use the walking trails for impromptu meetings, leading to a unique business culture and frequent exchange of ideas. The project has also drawn other attention and positive publicity from the likes of David Suzuki, who has visited the site.

Larger scale local/regional effects – locally the impact of the project on "greening" the local market has been reflected in the significant number of companies in the environmental technologies business who are interested in locating at VITP. The proximity to the Hertzberg Institute and clustering effect of other tenants in the same business lines has also contributed to this trend. This has resulted in the creation of high-paying jobs and a

well-educated workforce which has provided significant economic development benefits to the local community. High profile visits by both the Provincial and Federal Government Environment Ministers have also helped raise the profile of the project at the local, regional and national level.

Two other significant green projects have also subsequently been announced in the area. The University of Victoria Medical Sciences Building for teaching doctors is targeting a LEED Gold designation. The winning tender for the Dockside Development in Victoria, which is a large mixed-use project with 18 buildings, was recently selected by the City of Victoria largely because of its sustainable features, over a conventional development which did not include the same green features. In terms of the owner, since the development of VITP, LEED is now an integral part of the critique when BCBC is developing a building. This also means that BCBC's suppliers (including contractors) have to change their business practices in order to comply with these requirements.

Absenteeism, health issues and productivity levels - no information was available from the owners relating to these items. However, as stated above, one of the tenants claims to have seen a 30% productivity increase since locating at VITP. Although the owners have no way of quantifying the impact of the project on these three items, they did indicate that the tenants are generally very happy working in the property.

Ranking of social issues in developing the building – improving employee health, improving indoor air quality and increasing corporate or civic image were all regarded as extremely important issues in developing the property. Increasing productivity, increasing employee morale and increasing corporate or civic leadership in social/environmental responsibility were all regarded as somewhat important factors in developing the property. As no data was available no assessment of reducing absenteeism rates could be made.

Financial

This is an investment property. The development of the property was based on three main factors:

- the economic development benefits of the project for the local community;
- creating increased awareness of LEED (and sustainable practices); and
- achieving market rents and savings in operating costs.

Construction costs - Overall construction costs totaled $45.36 per square foot ($488.33 per sq. m.) based on the gross area of 184,000 square feet.

Operating Costs – no specific information was available as to current operating costs, however the project has been able to achieve savings in water and energy consumption which have resulted in lower operating costs compared to other conventional properties.

Financial Indicators – according to the owner, the following categories of items exceeded expectations (i.e. outperformed) – marketing success, turnover of space (vacancy) and reduction in internal fit-out costs (churn). Rent, yield (rate of return), level of absorption of space/units, operating costs and ongoing maintenance costs all partially exceeded expectations (i.e. outperformed). Initial construction costs met expectations. Tenant

allowances only partially met expectations as the cost of these was higher than expected.

In order of relative importance from a financial perspective, marketing success and level of absorption were the two most significant items. Marketing success and level of absorption of space were felt to have exceeded expectations by 21-50%, reduction in internal fit-out costs (churn) was felt to have exceeded expectations by 11-20%, rent, operating costs, ongoing maintenance cost and turnover of space (vacancy) were all felt to have exceeded expectations by 6-10%. Yield (rate of return) exceeded expectations 3-5% and tenant allowances also exceeded expectations by 3-5% (but in a negative way – i.e. they were higher than expected). Initial construction costs met expectations within a range of 0-2%. The excess performance was considered to be due to the green features.

Barriers to Understanding Sustainability – two items were identified. First, the lack of familiarity of the market to sustainable practices and the benefits, and second, the lack of knowledgeable construction companies specifically as it relates to sustainability.

Relative Understanding of Sustainability – in the opinion of the owner the level of understanding of sustainability (or green buildings) was considered excellent as it relates to the developer of VITP but developers in general were felt to have a limited understanding. Architects were considered to have a good understanding. Planners and tenants were considered to have an understanding and lenders, appraisers, planners and real estate brokers were felt to have a limited understanding of sustainability.

Suggestions for making it easier to Understand Sustainability – two key items were identified to assist stakeholders in understanding the relative financial benefits of sustainability.

- good planning at the beginning of the project - getting the project team together to understand the impacts on the life cycle of the property and the interdependence of the various components;

- working more closely with the end user of the space – gaining a better understanding of the impact of green buildings on the productivity of the occupants (i.e. better post occupancy audits, understanding the impact of the project on attracting and retaining employees etc.).

Tenant/Occupant ranking of the relative direct and indirect benefits of the project– the major tenant provided the following relative ranking of these five items:

1) Productivity

2) Health

3) Marketing and promotion

4) Operating costs

5) Energy Consumption

Requirement for an Appraisal by the Lender and the extent to which the Appraisal took into account the Green features – the project was self-financed. An appraisal was completed but it did not really take into account the green features, although the lower operating costs were taken into account.

Ability to achieve lower insurance premiums – there was no information available for the owner to address this issue.

Ability to achieve lower financing costs - there was no third party financing for the property.

260 TOWNSEND STREET, SAN FRANCISCO, CALIFORNIA, USA

This seven-storey office property with three indoor parking levels was originally developed in 1984 and is located on the periphery of downtown San Francisco. The property was originally developed for another tenant who occupied the building for 16 years. When the property was acquired by Swinerton in 2002 it was 90% vacant and there were a number of items of deferred maintenance including contaminated ductwork. Swinerton is a large contractor and construction management company and saw this property as an opportunity to achieve multiple objectives including creating value, providing accommodation for its employees and, perhaps most importantly, serving as an educational centre for its clients and suppliers (i.e. to show them how to build green).

The project is LEED-EB (LEED for Existing Buildings) Gold Certified. The cost premium and savings were tracked for each green item during construction, with the total incremental cost estimated at $107,547 or $1.13 per square foot based on the gross area (including the indoor parking).

SUMMARY OF KEY BUILDING FACTS

Figure 9 is a description of the building's key green features (based on information provided directly by Swinerton as well as information on the property on the Swinerton web site, www.swinertongreen.com).

Site/ Location

The property is located in an urban renewal zone – a part of the China Basin area of San Francisco, which is undergoing a dramatic renaissance, and is located within ¼ mile of two municipal railway lines and ½ block from the CalTrain station.

Green Roof and Rooftop Terraces

On the garden terraces, large areas were landscaped with native plants that significantly reduce storm run-off and solar heat island gains. To replace the main roof of the facility, dozens of "Energy Star" certified roofs for high albedo (reduced heat island effect) and low emissivity (the relative power of a surface to emit heat by radiation) were explored; however none met the high-traffic resistance criteria. Swinerton then turned to the 3M Company and convinced them to add a white, high albedo admixture to their elastomeric roofing product for a trial at 260 Townsend.

3M is currently conducting reflectivity and emissivity testing in accordance with ASTM tests E903 and 408 respectively. Once results are final, 3M hopes to achieve an Energy Star rating for this new product and then make it commercially available for the building industry. Special light fixtures were selected for 260

Townsend to reduce the amount of light pollution leaving the site; low impact fertilizers and pesticides are also being used.

Water Efficiency

The old plumbing fixtures, which consumed five gallons per flush, were replaced with high-efficiency models that use only 1.5 gallons. Continuous metering for both building and site water consumption installed, which displays digitally through the Building Management System.

Energy & Atmosphere

Design decisions enabled Swinerton to exceed California Energy Code Title 24 by over 12% on a 20-year old building. An Emcor state-of-the-art, fully digital building management system (BMS) with dedicated Internet website access continuously monitors temperature, CO2 and humidity, enables the building to maximize outside air and run the HVAC system to meet actual rather than anticipated demand, thus saving over 30% on utility bills. New high-efficiency light fixtures with motion sensors were also installed.

Materials & Resources

During construction, Swinerton achieved a waste diversion from landfill sites of 85%. The ongoing waste diversion rate of recyclable materials is at approximately 70%. Great care was devoted to the selection of materials with maximum recycled content and a minimum of volatile organic compounds (VOCs). Vinyl was replaced with linoleum; no VOC paints and adhesives were used. The wood selected for the doors is from a Forest Stewardship Council (FSC) certified forest. The carpeting contains a high percentage of recycled content and, in certain areas, Blue Ridge carpet by Savant was used, which can be recycled back into carpet.

Indoor Air Quality

The building is 100% non-smoking and all vendors are required to use low impact fertilizers, cleaners and pest control products. The interiors of 260 Townsend are laid out so that over 90% of the workstations receive direct or indirect sunlight. Glass partitions and low height wall dividers also provide exterior views to over 75% of the occupants.

To further promote greener commuting, Swinerton installed secure bicycle storage, new showers, and designated hybrid and vanpool parking. Swinerton offers the use of an electric car with

Address	260 Townsend Street, San Francisco, California, USA
Gross Building Area	66,947 square feet (6,220 sq. m.), with 25,330 square feet (2,353 sq. m.) of rooftop terraces and 28,179 square feet (2,618 sq. m.)
Net Useable Area	Not available
Completion	1986, renovated and upgraded with Green features in 2002
Owner/ Construction Manager /Contractor/	Swinerton Family of Companies/ Swinerton Builders (acquired and renovated in 2002)
Tenants	Swinerton Family of Companies
Architects	IA Architects
Mechanical and Electrical	Glumac
Construction Costs	$5,357,122, equating to $56.32 per square foot ($606.19 per sq. m.) based on the gross building area of 95,126 square feet (including the indoor parking area of 28,179 square feet)
Awards	Accepted into USGBC LEED-EB Pilot Program in February 2002, awarded LEED-EB Gold Certification by USGBC in November 2004, CORY Award – 1st Place for Occupant Recycling, Transportation award from City of San Francisco
Grants	None identified.

Figure 9: 260 Townsend St – Summary

a range of up to 30 miles and a top speed of 25 miles per hour to all employees during business hours.

SUMMARY OF INTERVIEW

On December 23, 2004 we interviewed a senior representative of the developer/owner/occupier, William Krill, Operations Manager and Green Building Chairman, Swinerton Builders. His responses to our survey can be summarized as follows:

General

Rationale for Building Green – sustainability and building green are some of the core beliefs of the owner/occupant and builder and very much a part of the Swinerton culture. The project provided an opportunity to meet a number of objectives in terms of both meeting Swinerton's own office accommodation needs and providing a demonstration project to clients to physically illustrate how sustainable practices (building green) could be successfully incorporated into the project.

The major hurdle was the cost and as a result Swinerton tracked the so-called Green Premium as it related to every item in the project. At the time the project was acquired it needed a major overhaul and was 90% vacant and subject to environmental contamination (in the ductwork).

Third Party Involvement – Swinerton were the general contractors and own and manage the building and are also the major tenant. The architects for the project were IA Architects and Glumac were responsible for the mechanical and electrical design. There is no third party financing on the property, which was financed by Swinerton.

Green designation - The project received a LEED-EB (Existing Building) Gold certification in July 2004, and a 1st place CORY Award for occupant recycling and a transportation award from the City of San Francisco. The actual/perceived benefits include the direct return on investment from the building management systems and the mechanical systems, the productivity savings resulting from the air quality in the building and the indirect benefits from using the building as a knowledge and educational tool. The main challenges in obtaining the LEED-EB Gold designation related to both the amount of documentation required and how to organize it.

Third party reports – no third party reports have been commissioned relating to the property. One year of operating performance data is required, and no appraisal was conducted as there was no third party lender. However throughout the course of the construction Swinerton tracked all costs in order to be able to assess any premiums for green features.

Environmental

Key Green features – The following is a list of the green features which have proven to be most financially and non-financially beneficial from the perspective of the owner/occupant, listed in order of benefit from most to least:

Building Management System – the premium cost of this item was tracked at $37,000. The building management system and mechanical upgrades were expected to result in a 20-30% improvement in energy usage.

Low Volatile Organic Compounds (VOCs) in building materials – a premium was paid for better air quality (e.g. no (VCT) vinyl tile in the cafeteria, no VOC paint and low VOC carpet). The owners

speculate that the results of better indoor air quality are at least partly reflected in both higher productivity and higher occupant satisfaction.

FSC Wood – there is paneling on the 7th floor and laminated doors.

Daylighting/ views – this was inherent in the original design. The private offices have glass partitions and the workstations have half height walls to allow for more natural light.

Other – the 3rd party certification, the level of attention, the visibility of the building, and the educational displays in the building are thought to have had an impact on the employees' moods, performance and morale.

A detailed breakdown of the premium capital costs, annual savings and return on investment was prepared by Swinerton and is attached as an Addendum to this interview and case study.

Green features you would not replace or add that were not included – three items were identified. First, the bamboo flooring on the 7th floor which Swinerton wanted to include but the architect elected not to. Second, water conservation, as it related to the waterless urinals. The San Francisco plumbing department indicated at the time that the waterless urinals did not comply with the code and therefore they weren't included. Third, the grey water/stormwater collection on-site which was not allowed by the San Francisco building code and would otherwise have been included.

Green features which assisted in attracting the user – the building management system, the CO_2 monitoring and low VOC materials (air quality) all had an extremely important impact in attracting the user to the project.

Non-Green Comparables – there are three mid-rise office buildings with a similar level of occupancy which were identified as being comparable. These are 333 Bush, 50 Freemont and 100 Pine Street, all in San Francisco. Based on the Energy Star ranking, for combined gas and electricity consumption, these properties ranked as follows:

- 50 Fremont – 63.0 KBTUs per square foot per annum;
- 333 Bush – 70.5 KBTUs per square foot per annum; and
- 100 Pine Street – 87.9 KBTUs per square foot per annum.

260 Townsend has an Energy Star ranking of 51.1 KBTUs per square foot per annum, which is considerably less than all three of the comparable properties.

The green features have all clearly helped Swinerton in the marketing of its business.

Other impacts on the environment – three items were identified. First, recycling efforts in the building, with 88% of construction waste diverted from landfills. Second, ongoing occupant recycling efforts, with 65% continuous occupant recycling in the building. Third, the LEED-EB program requires the reduction of usage of mercury in lamps and as a result only those lamps with the lowest mercury content were utilized.

Environmental issues considered important in developing project – using less energy, and indoor air quality were regarded as "extremely important", while using sustainable materials and

recycled or salvaged material were regarded as "important". Using less water was regarded as "neutral". The only item which was considered unimportant was use of a green roof.

Social

***Reputation of owner/occupant/tenant* –** the opportunity to network with and educate staff and clients both during and after construction has benefited Swinerton's business. The project has received considerable exposure in the media and the local community. Every month Swinerton hosts the US Green Buildings Council (USGBC) Big Users Group, which also provides further awareness within this group and the green building industry in general and marketing opportunities. In terms of impacts on the bottom line it is harder to quantify, however there have been at least three direct referrals to Swinerton through the USGBC as well as some project opportunities. In addition, in the last two years Swinerton has signed contracts for approximately $500 million of new projects using LEED, compared to only approximately $100 million of LEED projects prior. This increase in contracts coincides directly with the acquisition and redevelopment of 260 Townsend.

Larger scale local/regional effects – locally the impact of the project on greening the local market has been reflected in the level of third party interest through articles in Interior Design Magazine and BOMA. There has been a significant impact on government policies/standards and building practices as a result of this project, with the City of San Francisco looking to implement LEED Silver for all projects over 5,000 square feet (as of September 2004). A former Swinerton employee, Mark Palmer, was heavily involved in this LEED Silver initiative.

Absenteeism, health issues and productivity levels – Swinerton looked at these issues both pre- and post occupancy. Previously the company had been located in a 25-story high-rise office building with a very deep floor plate which provided no gathering space for employees. Now the newly renovated building has a large outside terrace which can accommodate up to 200 people. This improvement has encouraged more staff get-togethers, which in turn has improved communication, the flow of ideas, and ultimately the level of productivity of the company.

Ranking of social issues in re-developing the building – increasing productivity, improving employee health and improving indoor air quality were all regarded as "extremely important" issues in re-developing the property. Reducing absenteeism, increasing employee morale, increasing corporate or civic image and increasing corporate or civic leadership in social/environmental responsibility were all regarded as "somewhat important" factors in developing the property.

Financial

This is an owner occupied property. The development of the property was based on three main factors:

- the direct return from the energy savings;
- improved productivity of the occupants; and
- the business development and marketing benefits from building Green.

***Construction costs* -** Overall construction costs totaled $56.32 per square foot ($606 per sq. m.) based on the gross area of 95,126 square feet (including 28,179 square feet of indoor

parking area). The green items incorporated in the project were processed separately to determine their premium cost over conventional construction. These items resulted in an estimated additional capital expenditure of $107,547 ($1.13 per square foot or $12.16 per sq. m.) or 2.01% over the entire project cost. A summary of those items is shown in the table above and also in the complete breakdown provided by Swinerton and attached as Addendum A.

Operating Costs – given the fact that the building renovation was only recently completed, it is difficult at this stage to quantify the level of operating costs savings which can be attributed to the green features. However as part of the original exercise of tracking the green premium on the construction costs the annual savings (and payback) associated with these items was also estimated. On this basis the annual operating cost savings would amount to $28,535, resulting in a payback of just under 4 years. The estimated annual savings for each item are set out in Figure 10.

Financial Indicators – according to the owner the following categories of items partially exceeded expectations (i.e. outperformed): operating costs, ongoing maintenance costs and reduction in internal fit out costs (as a result of the flexibility of the modular furniture). Initial construction costs met expectations. Rent, yield (rate of return), marketing success, level of absorption of space, tenant allowances and turnover of space (vacancy) were not applicable as this is an owner occupied property.

In order of relative importance from a financial perspective these items would rank as follows: operating costs, maintenance costs, reduction in internal fit out costs (churn) and construction costs. Operating costs and ongoing maintenance costs were felt to have exceeded initial expectations, in terms of savings, by 11-20%. Initial construction costs and reduction in internal fit out costs were felt to have met

CREDIT NO.	CRITERIA	INTENT AND REQUIREMENT	TOTAL LEED Points	Prem. Cost - Total	% of Project	Cost Per Sq. Ft. of Gross Floor Area	Savings/ year	Return on Investment (%)
Credit 4.4	Transportation	Designated carpool/vanpool parking for serving 5% of occupants	1	$1,500.00	0.0%	$0.02	$0	NA
Prereq.	Water Efficient Landscaping	Protect natural habitat, waterways and water supply from pollutants carried by building discharge water.	0	$160.00	0.0%	$0.00	$0	NA
Pre-req: 1	Building Systems Commissioning	Verify and ensure that fundamental building elements and systems are designed, installed and calibrated to operate as intended through best practice commissioning procedures.	—	$1,500.00	0.0%	$0.02	$1,400	1.1
Pre-req: 2	Minimum Energy Performance	establish minimum building energy efficiency	—	$3,600.00	0.1%	$0.04	$2,657	1.4
Credit 1.1	Optimize Energy Performance	Beat ASHRAE by 10%	2	$5,500.00	0.1%	$0.06	$3,163	1.7
Credit 1.2	Optimize Energy Performance	Beat ASHRAE by 20%	2	$5,500.00	0.1%	$0.06	$3,163	1.7
Credit 3.1	Commissioning	Continous Commissioning	1	$1,500.00	0.0%	$0.02	$2,300	0.7
Credit 5.1	Measurement and Verification	Continous metering for lighting, electric meters, water risers & outdoor irrigation systems	1	$15,000.00	0.3%	$0.16	$8,626	1.7
Credit 5.2	Measurement and Verification	Continous metering for chiller efficiency, cooling load, economizer & boiler	1	$5,500.00	0.1%	$0.06	$3,163	1.7
Credit 5.3	Measurement and Verification	Continous metering for process energy, motor loads, VFD & air pressure	1	$5,500.00	0.1%	$0.06	$3,163	1.7
Credit 2	Construction Waste Management	Recycle and/or salvage at least 75% (by weight) of any construction, demolition waste	1	$2,500.00	0.0%	$0.03	$0	NA
Credit 4	Recycled content	Specify recycled matls for 50% of any building materials	1	$8,600.00	0.2%	$0.09	$0	NA
Credit 7	Certifieed wood-millwork	Use a minimum of **50%** of wood-based materials certified in accordance with the Forest Steward Council guidelines for wood building components including framing, flooring finishes, furnishings, and non-rented temporary construction applications such as brac	1	$7,300.00	0.1%	$0.08	$0	NA
Credit 7	Certifieed wood-doors	Use a minimum of **50%** of wood-based materials certified in accordance with the Forest Steward Council guidelines for wood building components including framing, flooring finishes, furnishings, and non-rented temporary construction applications such as brac	0	$8,600.00	0.2%	$0.09	$0	NA
Pre-requisite 1	Minimum IAQ Performance	Air performance	—	$890.00	0.0%	$0.01	$0	NA
Credit 1	Carbon Dioxide Monitoring	Install a permanent carbon dioxide (CO2) monitoring system	1	$8,700.00	0.2%	$0.09	$900	9.7
Credit 2	Increase Ventilation Effectiveness	For mechanically ventilated buildings, design ventilation systems that result in greater air change effectiveness	1	$2,600.00	0.0%	$0.03	$0	NA
Credit 3	Construction IAQ Management Plan	Develop and implement an Indoor Air Quality Management Plan	1	$1,200.00	0.0%	$0.01	$0	NA
Credit 5.1	Green housekeeping	Entryway filtration systems; grills, grates, mats	1	$1,500.00	0.0%	$0.02	$0	NA
Credit 5.4	Green housekeeping	Low impact cleaning solution program	1	$1,200.00	0.0%	$0.01	$0	NA
Credit 5.6	Green housekeeping	Low impact pest program	1	$1,200.00	0.0%	$0.01	$0	NA
Credit 7.1	Thermal comfort	ASHRAE Standfard 55-1192	1	$3,300.00	0.1%	$0.03	$0	NA
Credit 7.2	Thermal comfort	temperature and humidity monitoring system	1	$3,997.00	0.1%	$0.04	$0	NA
Credit 8.1	Daylighting	Provide line of sight to vision for 40% of total space	1	$500.00	0.0%	$0.01	$0	NA
Credit 8.2	Daylighting	Provide line of sight to vision for 80% of total space	1	$500.00	0.0%	$0.01	$0	NA
Credit 8.3	Daylighting	Daylight factor of 2% to 65% of spaces	1	$500.00	0.0%	$0.01	$0	NA
Credit 9	IAQ practices	Meet ASHRAE 62-1999	1	$2,500.00	0.0%	$0.03	$0	NA
Credit 1	Innovation in Design	Low VOC's		$6,700.00	0.1%	$0.07	$0	NA
			24	$107,547.00	2.0%	$1.13	$28,535.12	3.8

Figure 10: 260 Townsend St. – LEED® Cost Assessment

expectations within a range of 0-2%. The excess performance was mainly considered to be due to green features, although some other factors did contribute.

Barriers to Understanding Sustainability – one main item was identified, specifically the planning and building codes in the City of San Francisco. The local codes were not considered to be very flexible in relation to a number of the green features which were originally contemplated for the project. For example with regard to the photovoltaic panels the building codes were only recently changed to accommodate such technology. Since the project was completed there has already been evidence that the City's understanding and adoption of green practices is changing.

Relative Understanding of Sustainability – in the opinion of the owner/occupier the level of understanding of sustainability (or green buildings) was considered good among architects. Planners and tenants were considered to have an understanding and lenders, appraisers, planners and real estate brokers were felt to have a limited understanding of sustainability.

Suggestions for making it easier to Understand Sustainability – four key items were identified to assist stakeholders in understanding the relative financial benefits of sustainability.

- Visiting 260 Townsend to see how sustainable practices have been put into place;
- Conferences explaining how to understand and implement sustainable practices;
- Involvement of local utility companies to train stakeholders on energy saving technologies;
- Ongoing training and education for all stakeholders on sustainable practices.

Tenant/Occupant ranking of the relative direct and indirect benefits of the project – the major tenant provided the following relative ranking of these five items:

1) Energy Consumption
2) Productivity
3) Health
4) Marketing and Promotion
5) Operating Costs

Requirement for an Appraisal by the Lender and the extent to which the Appraisal took into account the Green features – there was no requirement for an appraisal as the project was self-financed by the developer/owner.

Ability to achieve lower insurance premiums – there was no ability to achieve lower insurance premiums as a result of the green features.

Ability to achieve lower financing costs - there was no ability to achieve lower mortgage financing costs as a result of the green features.

PHILLIPS ECO-ENTERPRISE CENTRE, MINNEAPOLIS, MINNESOTA

This office industrial office property was completed in 1999 and comprises 64,000 square feet split into approximately one-third offices and two-thirds industrial space. The property is located in Minneapolis in an ethnically diverse neighborhood which had been experiencing a high level of crime and high unemployment. The property was developed on a site that was originally planned for a solid waste transfer station and, as such, one of the project's primary motivations was to demonstrate that that this inner-city location warranted a higher and better use. The property was developed by Mr. Corey Brinkema, on behalf of the non-profit Green Institute. This was the first speculatively built Green business centre in the U.S. and required 50% pre-leasing in order to secure debt financing for the project.

There are now 18 tenants leasing space in the development, many of which are in the energy and environmental industry, which have created over 100 new jobs in a relatively depressed neighbourhood. The property consumes 40% less energy than a conventional project of a similar size and program, and the combined economic return to the tenants and owner resulting from the performance enhancements included in the design have resulted in an estimated savings of $60,000 per annum or a 39% return on investment and 2.5 year payback. The property has received a number of regional, national, and international distinctions based on its environmental and energy conservation features and other unique innovations.

SUMMARY OF KEY BUILDING FACTS

Figure 11 is a description of the building's key Green features (based on a summary provided on the Trillium Planning and Development web site, www.trilliumplan.com).

Occupant Health

- Active day-lighting systems
- Indirect artificial lighting
- Low-emission coatings
- Multiple zone climate control
- Air quality sensors and controls
- Operable windows

Energy Efficiency

- Geo-Exchange heat pump system
- Air-to-air energy recovery system
- Energy management system
- Ground source hot water system

Efficient Construction

- Local sourcing of over 90% of all materials
- Salvaged brick façade
- Salvaged steel superstructure
- Salvaged wood & millwork
- Salvaged fixtures and flooring
- Fly ash substituted in concrete panels
- Recycled and recyclable carpet tiles
- Linoleum flooring
- Recycled glass tiles
- Recyclable carpet
- Millwork from agricultural byproducts
- Polished concrete block interior
- 79% construction waste reuse/recycling

Other Strategies

- 100% on-site storm water retention
- Green roof with native landscaping
- 1/2 acre prairie restoration
- Brownfields redevelopment with contamination abatement

Address	2801-21st Avenue South, Minneapolis, Minnesota, USA
Gross Building Area	64,000 square feet (5,946 sq. m.)
Net Useable Area	Not available
Completion	Aug-99
Owner	The Green Institute (non-profit organization)
Developer	Mr. Corey Brinkema
General Contractor/Construction	Kraus-Anderson Construction Company
Tenants	18 tenants
Architects & Engineers	LHB Engineers & Architects
Construction Costs	$5,800,000 including $200,000 for the land, equating to $90 per
Awards	The American Institute of Architects Top Ten in Environmentally Responsible Design (2000), the Environmental Protection Agency's Energy Star Award (2000); the Minnesota Environmental Initiative Award (2001), the Minnesota Council of Consulting Engineers'
Grants	Approximately $1,500,000 in equity funding was received from the State of Minnesota and $200,000 for architectural work and other items received from the Federal Government.

Figure 11: Phillips Eco Enterprise Centre – Summary

- 35 kilowatt photovoltaic system

SUMMARY OF INTERVIEW

On December 20, 2004 we interviewed the developer, Corey Brinkema, now Principal of Trillium Planning & Development. His responses to our survey can be summarized as follows:

General

Rationale for Building Green – The site had originally been slated for the development by the local County of a large solid waste transfer station. This use was challenged by the local community and never received approval to proceed. As a result the County was challenged to find an alternate use for the site which would create jobs in the local community. Given that this community was one of the poorest and most crime-challenged in the State of Minnesota this represented a significant challenge. The concept for the project came from the Green Institute, a non-profit organization which started in the business of re-using building materials and subsequently moved into the property development business. The project was conceived in 1993, the first grant monies were received in 1995 and the project was completed in 1999. The focus of the project was to recruit companies in the energy and environmental industries to create jobs in the local community. The Green aspects of the project were intended partly to attract these types of organizations.

Marketing - The project has been well received by the market and was able to achieve 40% pre-leasing and 75% absorption within the first year and full occupancy within two years. Net lease rates of 5-10% above market levels were achieved. The Green features of the project were one of the key differentiating factors in marketing the project, although it is interesting to note that after initially using a third party leasing agent the real success of the marketing plan occurred after the developer assumed leasing responsibilities with direct marketing to companies in the energy and environmental sectors.

Third Party Involvement – The State of Minnesota provided $1,500,000 in equity funding for the project. The Green Institute is the owner/developer, Kraus-Anderson Construction Company were the general contractors and construction managers and LHB Engineers and Architects were the architects and engineers. Third party leasing was provided by Welsh Companies.

Green designation – The project did not apply for LEED certification, although it was a part of the original LEED pilot process, as it was felt to be too time consuming and costly. However based on the Green features adopted, the developer believes it would have achieved sufficient points for a LEED Gold certification. As stated in the fact sheet above the project has received the following awards:

- City Business magazine's Best in Real Estate (1998);
- The National Award for Environmental Sustainability from the President's Council for Sustainable Development and ReNew America (1998);
- The American Institute of Architects Top Ten in Environmentally Responsible Design (2000);
- The Environmental Protection Agency's Energy Star Award (2000);
- The Minnesota Environmental Initiative Award (2001);

- The Minnesota Council of Consulting Engineers' Grand Award (2001);

- The Bremen Partnership Award from Germany's Bremen Initiative (2001).

Third party reports – two appraisals were completed for the property, including one for refinancing (as the owners were seeking low interest government financing). The only area where the lender would consider any incremental value based on the Green features related to energy efficiency. The lower projected operating costs resulting from the energy efficient features incorporated into the building in part contributed to the 5-10% net rental premium which the property was able to achieve compared to comparable conventional projects presented in the appraisal. Herzog and Associates completed a post occupancy survey for the building which provided two main conclusions: firstly the building systems resulted in a 35% more energy efficient building than a typical high-efficiency furnace and, secondly, the building orientation, day-lighting, and the energy exchanges resulted in 40% total lower energy usage.

Environmental

Key Green features – Figure 12 is a list of the Green features which have proven to be most financially and non-financially beneficial from the perspective of landlord or tenant, listed in order of benefit from most to least:

Daylighting systems – this was particularly important in the warehouse area where skylights were used with sun tracking mirrors to reflect the sunlight, resulting in up to 10 times more Lumens during the morning and the late afternoon compared with passive skylights.

Ground Source Heat Pump system – shallow bedrock required the installation of more wells around the property, resulting in higher upfront costs and a longer payback – initially estimated at 7 years. Actual payback has been more rapid (3-4 years) due to spikes in natural gas costs for comparable projects. Heat pump system runs entirely on low-cost electricity.

30 kilowatt Photovoltaic system – four years after the project's commissioning, the owner installed 30 kilowatt photovoltaic array on the building's warehouse roof. This array constitutes the largest single solar energy installation in the region.

Reuse of building materials – 60% of the steel joists in the warehouse, and the office building's bricks were from salvaged sources. There were some subsequent construction challenges relating to the steel joists in the warehouse area.

Site design – shallow depressions were created around the building, and limited paving allows for 100% of the storm water runoff to be handled on-site.

In terms of occupant health, day-lighting was considered to be the most important Green feature followed by operable windows. The occupant health features were estimated to have produced a 3% productivity gain resulting in a 3-year payback and a return on initial capital investment of approximately 30%. The Ground Source Heat Pump was estimated to have had a 3-4 year payback and the native landscaping an immediate savings based on the fact that no irrigation system needed to be installed and little ongoing maintenance is required. The table above, prepared by Corey Brinkema of Trillium Planning and Development, the project developer, summarizes the relative incremental costs and payback estimated for each of the Green features identified:

Overall the building was designed to be flexible and adaptable to the needs of different tenants. This proved to be worthwhile given the subsequent mix of tenants and range of space requirements. Design features such as the common corridor in the warehouse are examples of these types of innovations.

Green features that would not be replaced or added that were not included - at the time the project was developed there was no renewable energy but this feature was subsequently added. An electrical connection has also been added for a wind turbine. The developer indicated that they would not reuse structural steel again as they had to re-weld every connection of the steel joists as otherwise the contractor would not have warranted the construction.

. The developer would have liked to have further evaluated passive solar design techniques, however a complete southerly

PEEC Green Building Characteristic	Developer Capital Cost Differential (1)	Resulting Annual Return to Tenants (2)	Resulting Annual Return to Developer (2)	Combined Developer & Tenant Payback (Years)	Combined Developer & Tenant IRR (3)
Sum of Occupant Health Features	$ 144,000	$ 43,000		3.3	30%
Ground-source heat pump	$ 48,000	$ 6,500		7.4	12%
Air-to-air energy recovery system	$ 6,000	$ 700		8.6	10%
Efficient lighting and controls	$ 10,000	$ 3,500		2.9	35%
Energy management system	$ 36,000	$ 4,000		9	9%
Salvaged material installations	$ (20,000)	None		Immediate	NA
Native landscaping	$ (55,000)	$ 3,500		Immediate	NA
Active skylights - energy (4)	$ 90,000	$ 5,000		18	1%
Lease premiums	$ 169,000	$ (39,700)	$ 39,700	4.3	23%
Totals	$ 169,000	$ 26,500	$ 39,700	2.6	39%

1. Capital cost differential is the incremental increase (+) or decrease (-) in construction costs from current code-required building practices.
2. Annual return is the estimated average savings to owner and tenants due to improved worker output, decreased utility bills and prevented facility maintenance.
3. Internal rate of return is the implied return in percent based upon the capital cost differential, annual savings, and a 20-year holding period.
4. Skylight costs are included in Occupant Health features; this calculation evaluates this feature based upon energy savings alone.

Figure 12: Phillips Eco Enterprise Centre – Green Value Analysis

orientation would have resulted in facing the loading docks of dated shopping centre . The developer considers the green roof, which cost $50,000, a luxury that could have been omitted without compromising the property's stormwater retention capabilities. The demonstration attributes and marketing cache of the green roof though have been very positive.

Importance of Green features in attracting tenants – the comprehensive nature of green building techniques and the clustering of the tenants (mostly in the environmental and energy business) were all regarded as extremely important in the marketing of the project. Day-lighting was regarded as the most important feature, the ground source heat pump system and the indirect electrical lighting were regarded as somewhat important, and the recycling of building materials was regarded as neutral. Noise (as a result of the open space design) and the noise resulting from the ground source heat pump fans were both regarded as negative aspects of the Green features. Overall the Green features did assist in attracting tenants to the project.

Non-Green Comparables – at the project's opening in 1999, average net lease rates for non-green comparables in adjacent neighborhoods and Twin Cities suburbs were $4.00 (warehouse finish) and $8.00 per square foot (office finish). Opening leases at the PEEC were slightly higher: $4.50 and $9.00, respectively. The PEEC's dedicated office space initially leased at $12.00 to $14.00 per square foot versus $11 to $12 for non-green comparables. The market was relatively balanced in 1999 when the project was completed but weakened in 2000 as a result of a substantial increase in supply both from new developments and space vacated as a result of the high tech "bust" in 2000. The day-lighting in the project and the common areas/loading docks and entrances all assisted in the marketing. Companies who were not doing as much shipping and receiving were able to benefit from the space savings of shared loading facilities facilitated by the common corridor through the warehouse section of the building.

Other impacts on the environment – no other impacts other than those already mentioned.

Environmental issues considered in developing project – all items including occupant health, using less energy and other resources, sustainable materials, recycled or salvaged materials, native landscaping and green roof were all considered extremely important factors.

Social

Reputation of owner/occupant/tenant – there has been a positive impact of the project on the reputations of the owner, developer and the tenants. Specifically in regards to the owners (The Green Institute) there has been a change in the perception of this organization both at the state and national level, as evidenced by the recent award of a $2 million grant to do the design work for a nearby Biomass energy project.

Measurable effects of this on the bottom line, sales or service – there are more non-profit organizations in the building than the owner/developer would like. There is no directly quantifiable measure on the bottom line but a 3% productivity improvement has been estimated. A survey of four of the initial tenants provided very positive feedback on the property. Only one tenant, may not be as positive as the other tenants.

Larger scale local/regional effects – the project has had a very positive effect on the local neighbourhood based on the job creation and pride in the development. In terms of local

government policies/standards there has been a change in the local storm water policy effective January 1, 2005, with costs reduced for projects that incorporate on-site storm water management plans. The project has played some role in increasing the baseline for standard business building practices, although this is hard to quantify. The biggest impact of the project has been on the expectations and knowledge level of the community. Two examples of this include firstly that the State of Minnesota has since enacted its own version of LEED (for details see www.sustainabledesignguide.umn.edu). Secondly, over 90% of the people involved in working on the development of public sector buildings in the local region have looked at the Phillips Eco-Enterprise Centre as an example of how to adopt Green practices. The project has also been a huge source of civic pride in the neighbourhood.

Absenteeism, health issues and productivity levels – no definitive data was available to address these issues. The anecdotal evidence points towards improved health and productivity.

Ranking of social issues in developing the building – increasing productivity, improving employee health and increasing corporate or civic image were all regarded as very important issues in developing the property. Reducing absenteeism, improving indoor air quality, increasing employee morale and increasing corporate or civic leadership in social/environmental responsibility were all regarded as important issues.

Financial

This is an investment property. The development of the property was based on a minimum level of 50% pre-leasing and the rents which could be achieved at the time in the market, to ensure sufficient debt service coverage, in order to secure the third party financing. The original objectives of the project were job creation and urban regeneration but the project still had to be financially viable and would not have proceeded without sufficient levels of pre-leasing, rents and financing commitments. The Green features did, in the opinion of the developer, contribute to higher rents being achieved and a shorter lease-up period and the ability to target a specific group of tenants.

Construction costs – According to the developer the constructions costs were approximately 3% higher than they would have been for conventional construction. However the rates of return are similar due to the higher rental rates achieved. The total construction costs were in the $100 per square foot ($1,074 per sq. m.) range for the office portion of the building and $50-$60 per square foot ($538 - $646 per sq. m.) for the industrial/warehouse portion of the building.

Operating Costs – overall energy consumption is 40% less than a similar conventional building, resulting in lower operating costs.

Rental Rates - net rental rates achieved were $12 - $14.00 per square foot per annum for premium office space, and $4.50 and $9.00 per square foot for warehouse and warehouse office spaces, respectively. These figures represent a 5-10% premium over the market for conventional buildings.

Level of Absorption - the project was completely leased in two years not three, as expected.

Financial Indicators – according to the owner the following categories of items exceeded expectations (i.e., outperformed) – yield (rate of return), marketing success, level of absorption of

space and turnover of space (vacancy). Initial construction costs, ongoing maintenance costs and internal fit-out costs (churn) all slightly exceeded expectations, but in a negative way (i.e., they were more expensive than expected). Rents, operating costs and tenant allowances all met the original expectations. Marketing success, the level of absorption of space and the level of the rental rates achieved were all felt to have been directly linked to the Green features of the project. The higher ongoing maintenance costs were also felt to relate to the Green features of the project (mainly because of the heat pump system). Yield (rate of return) was regarded as the item which exceeded expectations by the greatest amount, 21-50%, followed by marketing success, level of absorption and reduction in internal fit-out costs (churn) at 11-20% and rent at 6-10%. Operating costs, tenant allowances and turnover of space (vacancy) have all have met expectations (i.e., within 0-2%). Ongoing maintenance costs were higher than expected by 6-10% and initial construction costs also exceeded original expectations by 3-5%.

Barriers to Understanding Sustainability – three main items were identified. Firstly the developer was less knowledgeable of sustainable building practices at the time. Secondly there were fewer resources to work with at that time, especially research on sustainable practices. Thirdly with the benefit of current knowledge the project could have been completed in less time and for lower cost. Essentially the key point here is that with greater knowledge of sustainable practices and their implications the whole development process involving Green buildings becomes easier. Lack of knowledge is still regarded as a significant barrier.

Relative Understanding of Sustainability – in the opinion of the developer the level of understanding of sustainability (or Green buildings) was greatest amongst the owner/developer and the architect, followed by the general contractor. Tenants were felt to have a limited understanding and lenders, appraisers and real estate brokers were felt to have no understanding of sustainability.

Suggestions for making it easier to Understand Sustainability – the three key items which were identified were firstly the need to quantify better the post occupancy benefits of the Green features, secondly to complete more follow up analysis (for this project the developer and owner simply had no remaining funding to complete this analysis). Finally there is a need for the various stakeholders to see the benefits of adopting sustainable practices in investment properties as well as owner occupied properties (many of the Green projects completed to date in Canada and the U.S. are owner occupied).

Tenant/Occupant ranking of the relative direct and indirect benefits of the project – the major tenant provided the following relative ranking of these three items:

1) Occupant health and productivity

2) Marketing and branding (ability to showcase the property to customers)

3) Energy consumption (significant energy savings for tenants)

Requirement for an Appraisal by the Lender and the extent to which the Appraisal took into account the Green features – There was a requirement for an appraisal by the lender. The only impact of the Green features which was reflected in the appraisal related to the impact on the operating costs of the lower energy consumption. Initially the appraisal did not reflect the higher rents

which were being achieved in the building, i.e. $11.00 per square foot in the market compared to $12-$14.00 per square foot in the building. Two leases had already been signed prior to the date of the appraisal but it was only after evidence was presented to the appraiser proving the higher rents could be justified in the market that this was reflected in the appraisal.

Ability to achieve lower insurance premiums – there was no ability to achieve lower insurance premiums as a result of the green features.

Ability to achieve lower financing costs - there was no ability to achieve lower mortgage financing costs as a result of the green features and in fact the significant pre-leasing requirement necessitated significant marketing efforts. The developer's perception is that there is actually less risk for the lender as a result of the Green features, which reduce operating costs, potentially extend the useful life of the building and result in higher occupancy levels all of which improves the quality of the income stream, the residual value and the overall level of security of the financing.

MOUNTAIN EQUIPMENT CO-OP STORE, MONTREAL, QUEBEC, CANADA

The Mountain Equipment Co-Op ("MEC") store is a two storey, 48,438 square feet (4,500 square metre) retail outlet, located in the Marche Central Shopping complex in the heart of the City of Montréal, adjacent to Highway 40 and Highway 15 on Boulevard de l'Acadie. It was opened in May 2003.

MEC is a consumer co-operative, and Canada's leading supplier of quality outdoor gear and clothing, with more than 1.8 million members across Canada and around the world. One of MEC's stated goals is to *"reduce the ecological impact of running our business while increasing the positive impact we have on people and communities"*. The project mandate given to the design team included a stringent set of environmental objectives.

- The Montréal store was the third MEC store to comply with the environmental and energy performance objectives of Natural Resources Canada's C2000 standard and the first in Québec. The landlord owns the building and the land; MEC acted as developer (and reduced their lease rate by doing it that way). Landlord put $60 per square foot into the building. The total project cost was $6 million or $123.87 per square foot or $1,333 per square metre.

SUMMARY OF KEY BUILDING FACTS

Figure 13 is a description of the building's key green features (based on information provided directly by Mountain Equipment Co-Op from a publication prepared by the architect, MTF Architects, entitled "Sustainability features Report" dated November 2004, the MEC web site www.mec.ca and the results of the interview).

Energy

- Geothermal heating and cooling in a radiant slab; modeled at 50% below MNECB; actual 69.2% below (first year operations data); approximately 10 year payback on system. Energy costs of a standard building of this type about $150k/year; MEC pays $50k/year. and the project has a heat recovery ventilator ("HRV"). A technology that recovers waste heat and reuses it.

- Mechanical systems placed in a basement, building on 2 levels – to reduce footprint (especially within the big box context).

Water

- Roof rainwater storage in an underground cistern (45,000 litres); supplies 75% of sewage conveyance water; waterless urinals and low-flush toilets. Payback was not of interest,, as the system was installed under informal standards of good practice.

- Overall potable water reduction (for all process water uses) is over 50%.

- Stormwater from parking lot collected, channeled into an underground storage pipe for reinfiltration into ground.

Sustainable Sites

Located in an area with a lot of big box development, but relatively close to the Metro, and to 2 bus lines. It was located there because of proximity to public transit. It was the only site large enough to accommodate parking/site requirements, cheaper than downtown, at a congruence of 2 major highways, nowhere downtown that would meet their needs.

- Chose deciduous trees for shading in summer months. Native plants used in landscape, as well as reused fill/boulders from the excavation. Cistern (rain) water used for temporary irrigation for plant establishment, after it was established they should survive with no irrigation.

Indoor Environmental Quality

- Naturally assisted ventilation: ventilation air drawn from channels in the basement, moves up through chimney's throughout the building; curved roof helps to create stack effect. System chosen in part to ensure that ventilation air wasn't being taken from ground level, to prevent polluted highway-side air from getting into the building.

- CO_2 sensors control ventilation air flows.

- Daylighting through interior design (including windows at high point in roof, and a 2nd storey with large space in the centre to allow light down to 1st level) and windows. Artificial lighting on daylight sensors.

- Operable windows in staff room (beyond some venting windows at roof peak) for sound attenuation and for protection of indoor air quality.

- Solar hot water pre-heat, Photovoltaic (PV) array to run pumps, used for irrigation. There are some solar panels located on the roof.

Address	8989 Boulevard de l'Acadie, Montréal, Québec, Canada
Gross Building Area	48,438 square feet (4,500 sq. m.). The Marche Central complex comprises 1 million square feet with 50 retail units on 98 acres
Net Useable Area	Not available
Completion	May-03
Owner	British Columbia Investment Management Corporation (recently acquired the property from Fiducie immobilière MCM)
Property and Asset Manager	Bentall Capital Management
Developer	Mountain Equipment Co-Op
General Contractor	Brocollini Construction
Tenants	Mountain Equipment Co-Op
Architects	MTF Architects (Studio MMA, Atelier d'architecture, Lyse M. Tremblay, Architecte and Duschenes & Fish Architectes)
Energy/Mechanical/ Electrical	Pageau Morel and Associates
Structural	Sala, Deslauriers, Kadonoff, Leconte, Brisebois, Blais
Civil Engineers	Vinci Consultants Inc.
Construction Costs	$6,000,000, equating to $123.87 per square foot ($1,333 per sq. m.) based on the gross building area of 48,438 square feet
Awards	Natural Resources Canada C-2000 designation. Did not try for LEED designation, but did use LEED as a guide.
Grants	None identified.

Figure 13: Mountain Equipment Co-Op – Summary

Materials and Waste Management

- Building designed to be deconstructed – component pieces of the structure and façade can be taken down and reused on another site in the future; not all materials (masonry) – limited by bylaws on what they could do here.
- Architect focused on specifications for materials with recycled content, low embodied energy.
- 27% fly ash in concrete. In Québec fly ash is considered a premium product because it has to be imported.
- 65% construction waste recycled (very high for the region; practices being showcased by the City).
- R30 walls (using insulation from old shredded newspapers) and R40 roof.
- Interior spaces designed for easy deconstruction, movement and reassembly – to limit waste through interior space redesign. Overall reduction in the use of materials for interior finishing (exposed concrete, exposed ceiling).
- Reused wood from Seagram's in ceiling and stairs.
- Went green because it is a MEC policy item. As a co-op this decision would have been made by the members/board. The environmental policy of MEC was established upon their incorporation, about 30 years ago. Have completed two other green projects to date, in Ottawa and Winnipeg.

SUMMARY OF INTERVIEW

On December 13, 2004 we interviewed Marie-Eve Allaire, Director of Social and Environmental Responsibility, Mountain Equipment Co-Op based in Montréal and completed a tour of the property and on January 13, 2005 we interviewed Corin Flood, Facilities Development Manager, Mountain Equipment Co-Op, based in Victoria, to complete the remainder of the interview. Their responses to our survey can be summarized as follows:

General

Rationale for Building Green – going green is MEC policy and the company has an 11 year old policy that called for elimination of ozone depleting substances in buildings; the policy was rewritten several year later to be more broad in reach. Sustainability and building green is part of the company's core philosophy. Two successful projects in Ottawa and Winnipeg had already been completed using sustainable practices. Significant energy savings were identified, resulting in lower operating costs. MEC also took on responsibility for the development as they felt no third party could deliver the type of building they were looking for.

Third Party Involvement – no third party lenders were involved. The Marche Central property recently changed hands and is now owned by BCIMC and managed by Bentall. The MEC retail store was developed by MEC who worked with local design firms, construction firms, architects and engineers (including MTF Architects and Brocollini Construction).

Green designation - The project earned a Natural Resources Canada C-2000 designation. MEC did not try for a LEED designation but did use LEED as a guide and did prepare their

own internal analysis on LEED performance. On this basis MEC believes it was built to LEED standards.

Two main concerns were raised with regard to LEED. First, it was perceived as a process that would take a long time to complete and second, it was felt that LEED distorts the design process and MEC didn't want the design team to design for points. The design team was not motivated to pursue a LEED designation after the project completion although MEC did offer to pay half the costs.

Third party reports – no third party reports were prepared, with the exception of the Sustainability Features Report, referenced above. No appraisal was required as the value of the project is based on the lease rate and the "face rate" is below the value of the building. The lease term runs for 15 years.

Environmental

Key green features – The following is a list of the green features which have proven to be most financially and non-financially beneficial from the perspective of the developer/tenant, listed in order of benefit from most to least:

Energy efficiency – 69.2% below the Canadian Model National Energy Code for Buildings (MNECB), based on the first year's operating data. Energy costs are estimated to be only $50,000 per annum for MEC compared to $150,000 per annum for a comparable conventional building.

Photovoltaic panel – two PV panels power the circulation pump for the solar domestic water system and the irrigation system.

Financial cost of PV panel – the up-front capital costs associated with the PV panel, relative to the energy savings benefits were considered to be difficult to justify based on a strict financial payback.

Overall green building story – this generated positive publicity for the project.

Cistern to feed toilets/irrigation – this commodity was not valued correctly (in terms of the initial cost versus the benefits).

Stormwater management – this was designed to go beyond the municipal requirements to accommodate a 100-year event with no discharge to the sewage system.

High fly-ash concrete – 27% fly-ash in concrete. Due to the cost premium of this product in Québec there was a financial penalty associated with this as it related to incorporating this material into the project.

From the tenant's perspective energy efficiency was the most important green feature based on its financial payback. The photovoltaic panel and the whole green building story with the resulting positive media and credibility for the project and MEC was also beneficial. MEC also had a $100,000 communications budget which was used to pay for media publicity for the project.

Overall the costs of the green features weren't tracked separately, as the overall concept was to design green systems not individual pieces. It was very difficult to break out the relative costs of individual items. The fabric of the building changes in response to green building requirements and they can't be added in later.

Green features you would not replace or add that were not included – MEC has learned that costing analysis is difficult and

that winter is not the best time to build (based on cost and other logistical challenges). Most issues affecting the building construction were external to its design such as 15% per annum cost escalations, the additional time and cost required to look at approaches to commissioning the building (there were very few comparable projects which could be considered at the time). There were also challenges associated with the development model that requires speedy design/build to generate income as soon as possible. This often means opening a building which isn't finished (from MEC's perspective) with building systems not in line and commissioned. This market issue matched with the complex building systems and controls made for a very difficult start up. In MEC's view it is important to take the time to build the knowledge about how to get the building to work effectively.

Green features which assisted in attracting the user – as this was a design build project developed by the end user all of the green features were custom designed to accommodate the tenant's requirements.

Non-Green Comparables – there are various other two storey retail buildings on the Marche Central site with a parking deck underneath. No financial data was available for these buildings. No other buildings were considered to be good comparables as most retail properties do not have two stories.

Other impacts on the environment – two other items were identified. Based on MEC's design, Canadian Tire (who were developing a site across the street), redesigned their project under pressure from the local municipality. The only impact of MEC's project on the Marche Central site was aesthetics. Overall it was not felt by MEC that the owner took any leadership in the incorporation of sustainable practices in the development of the rest of the Marche Central site.

Environmental issues considered in developing project – using less energy, using sustainable materials, using recycled or salvaged material and using less water were regarded as extremely important factors. Indoor air quality was considered a somewhat important factor. With this type of building and function indoor air quality is not a big issue, although it is more of an issue with the work areas. Green roof was considered as neutral. Although this item gets a lot of positive press, the cost and maintenance associated with the additional structure, irrigation, growing medium is not seen as that positive from a green building perspective.

Social

Reputation of developer/tenant – MEC isn't marketing the fact that this is a green building, but corporately they are building green because they believe it is the right thing to do. Many members don't know that it is a "green building". MEC's Montréal representatives have taken the position of touring curious visitors around the project, and this has also been done with some members, but more so with other design professionals. MEC already has the reputation of being quite green and have already won a number of architectural/design awards for the project. Reputational management is core to MEC and therefore necessary. It is also reflected in the underlying value of the company.

Tracking the effect on the bottom line hasn't been important to MEC corporately (in terms of building green projects) and therefore it hasn't been a priority. The project won a Montréal interior design competition (People's Choice Award) as people liked what they saw. MEC feels that if you build an environment that people like/feel comfortable in they tend to stay in it longer. For example a few days after opening a number of breast feeding

mothers were observed on the 2nd floor, and this was taken as an indication as to how comfortable people feel in the building.

Larger scale local/regional effects – locally the impact of the project on "greening" the local market has been reflected in four areas:

- First, one of the goals of this project was to provide an example of good building practice in the region to encourage others to do it. However MEC is not tracking such developments;
- Second, the Canadian Tire example described above;
- Third, there are no buildings of similar type that have been built that they know of; and
- Finally other building types have been catalyzed by MEC's work (supplier of sunglasses who got excited about what MEC was doing who eventually built their own green building with some initial guidance from MEC).Manitoba Hydro is building a huge new green building in downtown Winnipeg, MEC met with executives to talk about green building process, linked some consultants to this hydro project; worked with another group in Montréal who were trying to develop a site and participated in their charettes – can't disclose the details on this project.

In terms of the impact of the project on improving local government policies/standard two areas were identified:

- First, the City has been very interested in this project, and may have offered some tax relief (likely around water infrastructure reductions). Another project in Montréal was recently in touch with MEC to find out how they went about negotiating the tax reduction, so there are some other owners/developers interested in their process; and
- Second, the green roof on the Toronto MEC store probably had the most profound impact on this the City's attitude – there was no comparable impact in Montreal.

In terms of the increase in expectations and knowledge of the community, one main area was identified:

- The new store gives people an example to follow. MEC has to show it has changed its own practices if it expects others to follow suit. There is a lot of "guilt money", with people having the money to make better choices but being frustrated by their lack of choice.

Absenteeism, health issues and productivity levels – MEC doesn't have any statistics. This is a brand new store with new staff and these measures are not directly relevant for this building/use type, and it is not very people intense. On an average day there are only about 30 staff in a 45,000 square foot building.

Ranking of social issues in developing the building – increasing corporate or civic leadership in social/environmental responsibility were both regarded as extremely important issues in developing the property. Increasing employee morale was regarded as a neutral issue in developing the project. Reducing absenteeism rates and increasing productivity were not regarded as important factors in developing the property. Improving employee health and improving air quality were not addressed.

Financial

This is an investment property. MEC spends 3% of its revenue on the facility (which is also their spending target). They look for the least expensive way to obtain the building product that they want. Staffing represents 14% of the revenue and therefore in comparison the real estate costs are fairly minor. This project didn't fit into the typical owner/leaseholder development model. The reason for doing it this way was to avoid the development profit which meant a lower cost product could be provided and they also felt that a developer wouldn't build it the way they wanted. MEC also benefits because the building costs less to run. The rent is driven by the created value on the site and what the market will bear and then it is a negotiation between the landlord and the tenant. MEC doesn't measure the rate of return on the real estate investment; instead they measure the rate of return on the business with real estate being a small part of it. The real driver of building green is the corporate ethic/organizational importance, not the financial aspects.

Construction costs - Overall construction costs totaled $123.87 per square foot ($1,333 per sq. m.) based on the gross area of 48,438 square feet.

Operating Costs – the annual energy costs for the first full year of operations were estimated to be $52,347, a savings of $99,865 compared to a conventional building. No information was available for the balance of the operating costs.

Financial Indicators – according to the developer/tenant the following categories of items met expectations – operating costs and ongoing maintenance costs (although it is still too early to tell). Initial construction costs were not met as they were higher than expected. The yield (rate of return) and marketing success (in relationship to offering/organization not the building) did not meet expectations. Rent, level of absorption of space, tenant allowances and turnover of space (vacancy) and reduction in internal fit out costs (churn) were not applicable. Reduced operating costs were also a very important item and was all attributed to the green features. The initial construction costs were regarded as a very important item, but the green features were not the reason for the cost overruns.

Barriers to Understanding Sustainability – it was written into the offer to lease and MEC were happy with that.

Relative Understanding of Sustainability – in the opinion of the owner/occupier the level of understanding of sustainability (or green buildings) was considered good among architects and planners. Developers were considered to have no understanding. No opinion was rendered on the level of understanding of lenders, appraisers and real estate brokers.

Suggestions for making it easier to Understand Sustainability – four items were identified:

- developers deliver to the market what they perceive the market wants; the market generally is quite ignorant to green building. People need to demand better buildings. On the other hand consumers can only buy what they are offered – so where does change get inserted?
- accurate pricing of materials/systems/resources – as long as market pricing is distorted people will continue to make choices based on current (inaccurate) pricing;
- the consumer needs education; and

- it is not designers that need education; it is easy to select from the large number of designers who care about environmental design, and are excited about working for someone who is open to these concepts.

Tenant/Occupant ranking of the relative direct and indirect benefits of the project – energy consumption and operating costs were considered to be the most important items.

Requirement for an Appraisal by the Lender and the extent to which the Appraisal took into account the green features – there was no requirement for an appraisal.

Ability to achieve lower insurance premiums – no information was available to address this item.

Ability to achieve lower financing costs – there was no information available relating to the financing.

THE SOLAIRE, NEW YORK, NEW YORK, USA

This 27-storey residential apartment property has 293 units and comprises 357,000 square feet with an on-site parking garage. The Solaire is located in Battery Park City on the west side of New York City's financial district and directly adjacent to the site of the former World Trade Centre. The property was completed in August 2003, after a nine-month delay in construction as a result of the terrorist attacks on the World Trade Centre. The Solaire is the first building to be designed in accordance with new environmental guidelines instituted in 2000 by the Battery Park City Authority (BPCA), the government entity that has overseen the development of Battery Park City since 1969.

The property is designated as LEED Gold by the US Green Building Council (USGBC and was developed by a joint venture of the Albanese Organization Inc. and Northwestern Mutual Life Company. Numerous green features were incorporated, many of which were required to meet BPCA's design guidelines. The building was designed to consume 35% less energy, reduce peak demand for electricity by 65% and require 35% less potable water than a conventional, high-rise residential building. The project cost a total of $116 million to build, including hard and soft costs, equating to $325 per square foot ($3,498 per sq. m.) or $395,904 per unit.

SUMMARY OF KEY BUILDING FACTS

Figure 14 is a description of the building's key green features (based on information on the USGBC web site, and the web site for the property).

Site/Location

- The building is located at 20 River Terrace (on the Hudson River) at the corner of Murray Street in Battery Park City.
- Within the Tribeca neighbourhood, close to the subway, a short walk from the Chambers Street station.

Building Systems

- Integrated array of photovoltaic panels.
- Advanced HVAC system, fueled by natural gas and free of ozone-depleting CFC refrigerants.
- Multi-level humidification and ventilation systems supply filtered fresh air to each unit.
- Daylighting was maximized and balanced with the thermal envelope.

- High-performance casement windows were used throughout.
- All units include programmable digital thermostats, Energy Star fixtures and a master on-off switch.
- Common areas include occupancy sensors and daylight sensors to further optimize energy use.
- On-site black water treatment and re-use system supplies the cooling tower and the building's toilets with water.
- A stormwater catchment system provides irrigation to both a rooftop garden and a green roof.

Recycled Materials

- 66.8% of the materials (by cost) were manufactured within a 500-mile radius of the site and 19% contain recycled content.
- More than 93% of the construction waste for the project was recycled.

Air Quality

- Advanced central air-filtration system.
- In-building 24-hour air quality monitoring system.
- Vapour and air barrier minimizes random air-infiltration.
- 24/7 exhaust in every bath and kitchen.
- Building materials and paints are free of formaldehyde, with low or no off-gassing.
- 24-hour carbon monoxide monitoring in parking garage.

Water Quality

- Central water-filtration system for entire building.
- Refrigerators that provide doubly filtered drinking water and ice.

Energy

- Energy-conserving building design is 35% more energy-efficient than code requires, resulting in a 67% lower

Address	20 River Terrace, New York, New York, USA
Gross Building Area	357,000 square feet (33,100 sq. m.)
Net Useable Area	Not available
Number of Units	293
Completion	Aug-03
Owners	Albanese Organization Inc. and Northwestern Mutual Life
Tenants	Individuals (578 people)
Architects	Schuman, Lichtenstein, Claman, Efron Architects
Design Architects	Cesar Pelli and Associates Architects
General Contractor	Turner Construction Company
Mechanical Consultant	Cosentini Associates
Structural Consultant	The Cantor Seinuk Group
Construction Costs	$116,000,000, equating to $325 per square foot ($3,498 per sq. m.)
Awards	USGBC LEED-NC, v-2 – Level: Gold (41 points), Green
Grants	$3,200,000 over 5 years through a New York State Green Building tax credit and $560,000 from the New York State Energy Research and Development Authority, who administer funds for

Figure 14: The Solaire – Summary

electricity demand during peak hours.

- Lower electric bills for residents.
- Photovoltaic (PV) panels convert sunlight to electricity and generate 5% of the building's energy at peak loading.
- Computerized building management system and environmentally responsible operating and maintenance practices.

Additional Features

- 33% more sheetrock between apartments provides extra soundproofing and fire barriers.
- Resident-use, pesticide-free rooftop garden provides natural insulation for building.
- Rainwater storage and reserve for roof garden irrigation.
- In-building wastewater treatment system re-supplies treated wastewater and make-up water for central air conditioning.
- In-building bicycle storage area.

SUMMARY OF INTERVIEW

On January 14, 2004 we interviewed a senior representative of the developer/owner, Martin Dettling, Vice President, The Albanese Organizations. His responses to our survey can be summarized as follows:

General

Rationale for Building Green – Battery Park City Authority is a public benefit organization created and operated by the State of New York. BPCA owns a 92-acre site at the southwestern tip of Manhattan and has a mandate to promote sustainable development on its lands. BPCA established its Residential Environmental Guidelines in 2000 and tendered for development proposals for the site based on entering into a ground lease with the successful proponent. The Albanese Organizations together with its equity partner, Northwestern Mutual Life Company, successfully won the tender to develop the project.

Approximately 75% of the green features which were incorporated in the design of The Solaire were as a direct result of the BPCA's Environmental Guidelines. However the developer also wanted to develop a better building incorporating higher quality materials and systems which was also healthier for the occupants. The main initial hurdle was the reaction of the market to the Green features, as many of the systems which were incorporated had not yet been proven. Throughout the design and development there was a need for a constant balance between feasibility, performance and sustainability.

Third Party Involvement – Albanese Organizations was the developer, with North Western Mutual as their equity partner. Turner Construction was the general contractor and Cesar Pelli and Associates were the design architects and Schuman, Lichtenstein, Claman, Efron Architects were the architects. Third party financing for the project was provided by Fleet National Bank through the liberty bond program.

Green designations, awards and grants - The project received a LEED-NC (New Construction) Gold certification and a level 2.0

rating through the Green Building Challenge. The project received two grants including $3,200,000 over 5 years through a New York State Green Building tax credit and $560,000 from the New York State Energy Research and Development Authority, who administer funds for public utilities.

The main challenge in obtaining the designations and grants related to the cost of consultants to administer these programs and manage the process for the developer. While it was recognized that these grants helped offset costs, it was also necessary to retain professional assistance to prepare and administer the applications and compliance with the requirements.

Third party reports – no third party post-occupancy reports have been commissioned relating to the property. However the owners operate "Building Link", a web-based property management system and the results of the tenant questionnaire have been very positive as they relate to this building. Although third party financing was provided through liberty bonds administered by Fleet National Bank the developer is not aware whether or not a third party appraisal was prepared for the property.

Environmental

Key Green features – The following is a list of the green features which have proven to be most financially and non-financially beneficial from the perspective of the owner/occupant, listed in order of benefit from most to least:

Energy efficiency – the photovoltaic (PV) panels and the bulkhead have a very long payback period of over 50 years compared to the usual 3-5 years which is considered reasonable for other features. The variable frequency drives which pump hot and chilled water through the building have a reasonable payback period. The other energy efficient feature is the gas fired cooling with the double effect absorption chiller.

Indoor air quality – the mechanical ventilation and low VOC content has resulted in better indoor air quality in the building which has led to the project being able to achieve a very positive public perception and premium rents in the market.

On-site wastewater treatment plant – the collection of stormwater, its treatment and reuse in the building does not provide a reasonable payback to the owners. Since the project was developed, and as a result of lobbying efforts, the local Water Board now provides a reduced water rate if savings of over 25% water usage can be demonstrated.

Lighting – there is energy efficient lighting throughout the project as well as occupancy sensors to control the lighting.

Overall the energy efficiency features provided the most significant payback, especially as a result of the financial incentives (grants) that were received and the overall reduction in energy costs. Indoor air quality was the second most significant item as a result of both the intangible marketing benefit for the project and the 5% premium which was achieved in the rents.

Green features you would not replace or add that were not included – two items were identified and have been addressed in another building adjacent to The Solaire, which is being built by the same developer. First, there was no room in the mechanical room to add heat recovery ventilators, which would otherwise have been added. Second, the ventilation systems in The Solaire worked better than expected. This raised the question as to how much ventilation is actually required and the ability to manage

this. The lessons learned are now being applied in other projects. This in comparison to typical buildings new "tighter" building envelopes without mechanical ventilation, the exhaust systems are less effective.

Green features which assisted in attracting the user – the indoor air quality had an extremely important impact in attracting the tenants to the project, energy efficiency and the green roof (which was also treated as an amenity) had a somewhat important impact and the water efficiency had a neutral impact.

Non-Green Comparables – no specific comparable projects were identified. The Solaire was able to achieve higher rental rates (5% higher than market) primarily as a result of the indoor air quality.

The green features have clearly helped the owner/developer in the marketing of the project.

Other impacts on the environment – one other item was identified. The financial incentives available do not address some of the community benefits of the project. Specifically the use of a natural gas chiller in the project reduces the peak electric loads experienced in New York in the summer months, when older, less efficient power plants have to be brought on line to meet peak demand. The positive impact of a project like The Solaire which does not add to the peak load clearly provides a benefit to the community but it is hard to quantify from a financial perspective.

Environmental issues considered in developing project – using less energy, using sustainable materials, using recycled or salvaged material, using less water, installing green roofs and improving indoor air quality were all regarded as extremely important. All of these items were required as a result of the environmental guidelines issued by BPCA.

Social

Reputation of owner/occupant/tenant – a number of examples were identified which demonstrated the benefits to the owner. In previous projects there had been an interest in exploring energy efficient strategies but as a result of this project the real benefits of employing these strategies had been realized and demonstrated. The Albanese Organizations have received significant attention through the USGBC New York chapter as a result of this project. There have been very positive articles about the project written in the New York Times and also coverage on the Discovery Channel. All of this free publicity has clearly benefited the owners and the project. There have been a number of measurable effects on the bottom line including the following factors:

- This was the first new building constructed after the World Trade Centre attacks, which created a positive message in the market and with the local community;
- The project was leased up in only six months;
- Operating expenses were reduced, relative to conventional buildings;
- This project achieved 5% higher rental rates than comparable conventional projects (partly because the electricity and water rates were lower for the occupants);

- Lower electricity costs were achieved as a result of the efficient use of gas cooling as well as reduced rates charged by the local utility company.

Larger scale local/regional effects – locally the impact of the project on greening the local market has been reflected in the increase in the number of developers who are now prepared to respond to BPCA's proposal calls. The next request for proposal issued after the one for The Solaire attracted twice as many bidders which is indicative of the higher level of understanding of building green. The initial RFP only attracted limited interest from the development community. In terms of impact on local government, the Department of Buildings Sustainability Committee is currently re-writing the building code to address many of the green practices which were adopted in The Solaire. The local community has received the project very well and this has certainly contributed to an overall improvement in construction practices.

Absenteeism, health issues and productivity levels – as this property is occupied by individual residents, business data on absenteeism and productivity was not applicable. In regards to health issues there was some anecdotal evidence that the project's indoor air quality benefits the occupants. Specifically one family's daughter had been having asthma attacks and had never slept properly prior to moving into The Solaire and has subsequently slept soundly.

Ranking of social issues in re-developing the building – improving indoor air quality, increasing corporate or civic image and increasing corporate or civic leadership in social/environmental responsibility were all regarded as extremely important factors in developing the property. Reducing absenteeism, increasing productivity, improving employee health and increasing employee morale were not applicable as this is a residential building.

Financial

This is an investment property. The project started with a financial pro-forma which did not anticipate the premium on the rental rates that was achieved. The initial construction costs were $116 million based on $76 million of hard costs and $40 million of soft costs. Rents achieved averaged $50 per square foot.

Construction costs - Overall construction costs totaled $325 per square foot ($3,498 per sq. m.) based on the gross area of 357,000 square feet or $395,904 per unit. Any incremental costs associated with the green features were not tracked separately as most of these items were requirements in the tender issued by the BPCA.

Operating costs– no specific data was available relating to operating costs. However the reduced energy consumption has resulted in lower operating costs.

Financial indicators – in terms of level of importance, from a financial perspective, the owners/developers ranked the following items in order of priority: rent, marketing success, yield (rate of return), level of absorption, construction costs and operating costs. Rent and yield (rate of return) were both considered to have exceeded expectations (i.e. outperformed) by 3-5%. The excess performance was considered to be at least 50% related to the green features, although some other factors did contribute. The primary benefit was the positive publicity for the project.

Barriers to understanding sustainability – two items were identified, specifically the sharp learning curve for the Albanese

Organization and its consultants and the significant level of education required to understand the benefits and implications of sustainability.

Relative understanding of sustainability – in the opinion of the owner/occupier the level of understanding of sustainability (or Green buildings) was considered good among architects, planners developers, consultants and brokers. Lenders and tenants were considered to have an understanding of sustainability.

Suggestions for making it easier to understand sustainability – two key items were identified to assist stakeholders in understanding the relative financial benefits of sustainability.

- Make the commitment to build green first and then determine how to implement the measures most cost effectively;
- Give options to the tenants as the market is shifting and developers need to be able to respond to changing perceptions.

Tenant/Occupant ranking of the relative direct and indirect benefits of the project – the major tenant provided the following relative ranking of these four items:

1) Indoor air quality/health
2) Energy
3) Operating costs
4) Marketing and Promotion (only from the perspective of the owner/developer)

Requirement for an appraisal by the lender and the extent to which the appraisal took into account the green features – the owner/developer was not aware as to whether or not the lender required an appraisal.

Ability to achieve lower insurance premiums – there was no evidence that lower insurance premiums could be achieved.

Ability to achieve lower financing costs – lower financing costs were achieved through the liberty bond program, however this was not because of the green features.

CRANBERRY COMMONS, 4272 ALBERT STREET, NORTH BURNABY, BRITISH COLUMBIA, CANADA

Cranberry Commons is a co-housing community comprising 22 units and 26,662 square feet, including one, two and three bedroom apartments, three-story townhouses and two-story stacked townhouses with loft units above. There are also 38 parking stalls on site. Cranberry Commons is located within a block of a busy commercial street with a wide variety of amenities as well as being in close proximity to public transit and a half hour bus ride from downtown Vancouver, reducing reliance on automobiles.

The project was completed in October 2001 and was developed by Cranberry Commons Co-housing Development Consulting, a company created by the future homeowners for the purpose of developing a co-housing community. These future owners acted as developer, financing the project and directing the design and development. Each household owns their individual strata title with common ownership of the land and common area amenities.

Aside from its social focus, Cranberry Commons is like other co-housing groups, with respect for the environment being one of its highest values. Members have attempted to incorporate sustainability into every aspect of the community design, from site selection through to the installation of solar panels on the roof.

The project cost a total of $5,317,750 to build, including hard and soft costs, equating to $239 per square foot ($2,572.60 per sq. m.) or $241,698 per unit.

SUMMARY OF KEY BUILDING FACTS

Figure 15 is a description of the building's key green features (based on information provided by the developer/owner and on the Cranberry Commons web site).

Site/Location

- Located on a 0.46-acre site in North Burnaby, British Columbia, close to commercial stores and other amenities.
- Close to public transit and within a half hour bus ride of downtown Vancouver.

Energy and Water Conservation

- The property uses a centrally located, commercial grade high efficiency boiler for domestic hot water and space heating combined with an in-floor radiant heat distribution system increases both energy efficiency and occupant

comfort. The extra cost of the in-floor system was made more palatable by the anticipation of a warm floor under bare feet, avoiding the dust and noise issues associated with a forced air or electrical heating systems, and the $3,500/year savings in energy costs for the project.

- Compact fluorescent lighting is located throughout the property in appropriate locations, such as the numerous porch lights, and by maximizing the halogen lighting within the units, there is a savings of almost $1,000/year. Compact fluorescents use 75% less electricity than normal incandescent lights and the extra capital costs for fixtures and bulbs is balanced against the fact that these lights last ten times longer.

- With the support of the Canadian government's Renewable Energy Deployment Initiative and the BC provincial government's Renewable Energy Technology Program, solar hot-water panels were installed, which offset the domestic hot water load by 50%. Low flow toilets and showerheads reduce the requirement for potable water significantly.

- Landscaping employs native plantings, which require lower maintenance and water use and enhance the local natural ecosystem. Rain barrels located near planted areas such as the common garden further reduce potable water demands.

Materials

- The use of high volume fly-ash concrete in the parkade and building slab reduced the greenhouse gas emissions associated with the production of cement by up to 50% while providing a constructive use for a waste product from burning coal. The production of cement in the Vancouver region results in almost 50% as much CO2 emissions as all the personal automobiles combined.

- About 10% of the wood used for the buildings were reclaimed timbers. There were a few challenges using this

Address	4272 Albert Street, North Burnaby, British Columbia
Gross Building Area	26,662 square feet (2,476.96 sq. m.)
Net Useable Area	22,248 square feet (2,066.89 sq. m.), excluding common areas
Number of Units	22 (1 bachelor, 5 one bedroom, 4 two bedroom and 12 three
Completion	Oct-01
Owners	Cranberry Commons Co-housing Development Corporation
Managers	Co-housing Development Consulting
Tenants	Individuals
Architects	Birmingham & wood
Construction Manager	Artian Construction (no longer in business)
Mechanical Consultant	Keen Engineering
Structural Consultant	Chui-Sandys-Wunsch Consulting Structural Engineers
Electrical Consultant	Falcon Engineering
Civil Engineer	Reid Crowther & Partners Ltd.
Landscape Consultant	Vagelatos Associates
Code Consultant	Protection Engineering
Geotechnical Consultant	Centennial Geotechnical
Acoustic Consultant	BKL Consultants Ltd.
Building Envelope	Aqua-Thermal Consultant (1999) Ltd.
Sustainability Consultants	Resource Rethinking Building
Co-housing Consultant	CDC Co-housing Development Consulting
Construction Financing	North Shore Credit Union
Appraiser	Fred Lee and Associates Ltd.
Quantity Surveyor	Ramsey Ferguson Consultants Inc.
Strata Management (partial	Ascent Real Estate Management
Construction Costs	$5,317,750, equating to $239 per square foot ($2,572.60 per sq. m.)
Awards	2002 City of Burnaby Environmental Award planning and
Grants	REDI grant covered about 10% of the cost for a total of $3800

Figure 15: Cranberry Commons – Summary

material - it was difficult to obtain a good supply, and the cost to de-nail the wood on site was expensive.

- While the cost of "eco-shakes" or long life metal roofing systems proved to be more than the budget could manage, the use of long-life asphalt shingles extend the expected time to replacement from 25 to 40 years.

Waste Reduction and Behavioural Alternatives

- Construction site recycling was mandated in the construction contracts to minimize materials sent to landfill. The following items were sorted on site and recycled: cardboard, clean dimensional timber and palette wood, concrete, scrap metal, drywall, and paint (to hazardous waste depot).

- Shared composters near landscaped areas and designated community recycling bins located near the project garbage facility make it easy for community members to engage in these behaviours. Sharing resources and bulk purchasing are easier because the extensive common facilities shared by the community support the social fabric, which makes the sharing of resources a daily reality. Although all of the homes are equipped with connections for private washers and dryers, there is also a shared laundry in the common house. More than 50% of the residents have chosen to share the laundry facilities. In addition, there are a number of people who are sharing cars and other equipment such as canoes and kayaks. About 1/3 of the 38 parking stalls are never used because of the reduced number of vehicles. Sharing reduces the impact on the environment by lowering production needs for consumer products.

- The parkade has lots of secure bicycle storage.

- To facilitate work-at-home and telecommuting arrangements, all units are equipped with two runs of CAT5 wiring. The community also shares a local area network and a high-speed Internet connection similar to that found in most offices making it easier for residents to work at home.

SUMMARY OF INTERVIEW

On January 7, 2005 we interviewed a senior representative of the developer who is also a resident and member, Ronaye Matthew of Co-housing Development Consulting. Her responses to our survey can be summarized as follows:

General

Rationale for Building Green – The profile of residents/members ranges from young couples in their 20's to a woman in her 80's. There are not many teenagers in the project and not much ethnic diversity. There is diversity in self-awareness and maturity. Going green aligns with the overall philosophy of trying to do something that is creating a better world: it's about stewardship. If there is a real focus on building green, then there are costs associated with that. This project was interested in focusing on social sustainability (seen as a green building feature as well) – based on the amount of common amenity space. Shared spaces (by larger groups) tends to be more expensive in this project because they wanted to make these very nice, elegant, higher-end finished spaces that people want to be in. The common spaces are viewed as a shared asset. Extra money and effort went into the design and construction of the circulation spaces. Design that balances privacy and community is quite complex and more expensive.

The owner/developer has been working with an appraiser who has a good understanding of the concept and how to value the common asset spaces in the appraisals.

- Some of the key hurdles were as follows. The site was zoned for townhouses, meaning the floor space ratio (FSR) of common spaces was included in the total; there were challenges with the design (financial requirements) of an intergenerational community. The City of Burnaby relaxed the FSR requirements, had to work at this – if they wouldn't have done this it would have made the project quite a bit more expensive. Common amenity spaces were taken out of the FSR right away, it was the circulation spaces that were difficult. There were issues with one level apartments on the main floor (good for seniors) with 2 story townhouses above (kid friendly), but this is functionally backwards. The final design has one-level units on the upper floors (requiring elevators and more circulation space, thus higher FSR) and townhouses for families with ground level access.

- The property has way more parking than is functionally required – with 38 spaces when there is only a need for 21. The project tried to trade some additional environmental features as a trade but the City wouldn't go for that. There are 55% fewer vehicle trips/day at Cranberry Commons and 35% fewer trips at Windsong. There is a car sharing, bike and bus culture in the project. There is also quite a bit of awareness in residents around responsible living.

- Finding the site was a big hurdle – co-housing is in competition with standard development and therefore it is necessary to be able to compete with a sophisticated land purchaser. There was an interesting fusion of a City of Burnaby redevelopment of the street, but this parcel of land was privately owned. Once the key site had been purchased from the private owner, the City of Burnaby was willing to sell adjacent lots to the co-housing group.

- Building the group was very difficult and it also happened during a slow building market – when there was a reduced willingness to take risks.

Third Party Involvement – The owner was the co-housing development company and the unit owners became the shareholders in the company. Birmingham and Wood were the architects, and there were a number of engineers. North Shore Credit Union provided the construction loan, a mortgage broker arranged financing for mortgaging individual units (mostly through TD Canada Trust at competitive rates); Artian Management was the Construction Manager; marketing and sales were completed through the co-housing group. Assent Property Management was hired to do partial management for the strata once the development was completed (prepare financial statements, pay invoices, manage bookkeeping). The project is partially managed by the residents who are responsible for managing the janitorial staff for cleaning common areas, with the members doing the landscaping (cut grass, weeding, etc.) and managing general maintenance of the property.

Green designations, awards and grants – a REDI grant was received – the approved grant was for a higher amount than what was eventually paid out. It was very difficult to actually get the funds once the solar panels had been installed – it took about a year (past the time that the solar panels were operational) for the government to pay out. The developer believed they would have received more money than they did (and likely wouldn't have included them if they knew the subsidy would be so small).

Some people in the community were more willing to contribute more dollars into green building – as individuals really wanted to see some additional green building features so therefore they contributed additional money during development (which was non-recoverable at sale).

LEED was not on the radar at the time the project was completed; and wasn't a priority. There was an interest in green building, but it was not felt at that time that certification was important. The design work was completed in 1999 and not a lot was known about green building or LEED at the time. The group hired Chesterman Properties (now ReSource Rethinking Building) to prepare a report with recommendations and had energy studies completed. Those environmental features that were included were chosen based on this report. The features were selected according to desirability, perceived long term benefits and cost.

Third party reports – a series of third party reports were provided to us including a copy of the construction budget, income and expense pro-formas, appraisals for the units, floor plans and specifications for the property.

Environmental

Key Green features – The following is a list of the green features which have proven to be most financially and non-financially beneficial from the perspective of the owner/occupant, listed in order of benefit from most to least:

In-floor radiant heat - was considered more energy efficient, but had a higher capital cost and a long payback. The in-floor radiant heating was installed for both for efficiency and occupant comfort.

Solar panels – there was a significant cost premium associated with this feature, however the benefit is in having an identifiable green building feature.

High fly-ash content – non-financial benefit of contributing to reduced green house gas emissions was significant particularly because there was not added cost to do this.

Durability - Building has excellent rain-screen technology – the intention was to build a durable, long-lasting building as a green building strategy.

Recycled hardwood flooring – this feature was an upgrade and chosen by many residents/owners in the project. It adds to the beauty and comfort of the homes.

More for higher grade, longer lasting roofing.

Reused lumber (cost premium for de-nailing) was used for structural members, i.e. floor joists.

Most of the green features were integrated into the design and therefore could not easily be separated out.

Overall there is nothing that they are sorry that they did. They are glad that they installed the solar panels which have provided more of a "feel-good" environmentally responsible benefit. The same comment applies with the lumber reuse. Overall the building quality is higher and these features are all things that will pay off over the very long-term. They haven't spent very much money on maintenance, as the durable design has been a large factor in this regard. The type of people buying into the project are all people who care about green building, co-housing, community, with a sense of global responsibility. Right at the

front entry way is an environmental award from the City of Burnaby. Green building helps to further build the community and has become a big piece of the marketing presentation for the project. People are willing to pay more for the common spaces. There are also some lifestyle and learning benefits of common spaces (the common space is used for a Non-Violent Communication practice group and members of co-housing can use the common space for free, for meetings, events, etc.). They don't currently allow access to that space to the general public because no one in the project has taken on that responsibility.

Sharing resources is a big challenge. It is hard enough to do this within the community without extending the resources out to the broader community. Co-housing is about learning skills about how to share. There is a shared woodworking shop in the building for use by the residents; the tools are owned by one person that shares them with other community members. There is also courtyard space and a reading room. There is at least one shared meal/week (about 60% of the community participate).

Green features you would not replace or add that were not included – no items were identified.

Green features which assisted in attracting the user – solar panels attracted the highest profile, in-floor radiant heat was also a key feature from a comfort standpoint and durability/rain-screen was also identified as a key green feature which helped attract the user.

Non-Green Comparables – no specific comparable projects were identified as too many features in this project differed from other residential projects.

Other impacts on the environment – Design/considerations were driven by members of the co-housing group. An individual can have a lot of impact on the design. In general people would like to live more sustainably and would if they could, it's just that they don't know what they want. Co-housing can be more innovative because the end users of the product are involved in the design. More standard development (housing) tends to be more conservative because of risk analysis, selling what we already know will sell. In co-housing there are people who are willing to give up (partially) personal economic gains for environmental and social gains – it is quite a process to recognize those gains and learn to deal with them (cooperatively). People who seem to get the most benefit out of co-housing are elders and children. Co-housing design values children's safety. Elders also don't lose their sense of meaning – it is a stimulated, purposeful environment for seniors. As a result, many returns are intangible – personal development, learning how to share resources, investment in future generations, learning, communications, active learning in day-to-day life, investment in the community. The tangible returns are less. Children really benefit by being more active, more social, and watching less television, etc.

Environmental issues considered in developing project – using less energy, using sustainable materials and using less water were all regarded as somewhat important factors in developing the project. Indoor air quality was regarded as neutral. Using recycled or salvaged material was regarded as somewhat unimportant. Green roofs were regarded as not being important.

Social

Reputation of owner/occupant/tenant – this item was not considered applicable to Cranberry Commons.

Larger scale local/regional effects – the setbacks are closer to the street front when there is more internal courtyard space. FSR (see above) set a precedent with this project and provided an opportunity for someone else with similar challenges to point to the precedent. Every new co-housing project allows another group to build on the experiences of the group before. The City of Burnaby is fairly progressive on water issues. This project has paved the way for other co-housing projects in BC and across country (including in Ontario and the Yukon).

In terms of other social/community impacts a number of items were identified. The developer did quite a bit of public education during the public hearing stage. As a result there was no community opposition to the project. Traffic along their street is a problem and the immediate neighbours are aware of how well organized Cranberry Commons is as an organizing body (petitions, etc.), making it very easy to get the whole Cranberry Commons community to comment as a large group on regional issues. There has been a lot of response in the community on political issues, e.g. a family was sponsored at Christmas. Cranberry Commons has been quite active as a body in the larger community.

Absenteeism, health issues and productivity levels – this item was not considered applicable to Cranberry Commons.

Ranking of social issues in developing the project – none of the social issues listed in our survey were considered relevant in developing the project. Many of these issues related to the business environment and are either irrelevant or harder to track when dealing with a residential property.

Financial

This is an owner occupied property. In general properties increase in value over time in line with the market. With this project they are a percentage above market and want to remain there. Protecting the assets of the people who live there is the key. Essentially they have determined that Cranberry Commons is 15-20% above market for similar square footage. This value increment is attributed to the social and environmental features and addressed as an overall package.

Construction costs **-** Overall construction costs were $5,317,750, including hard and soft costs, equating to $239 per square foot ($2,572.60 per sq. m.) or $241,698 per unit. Any incremental costs associated with the green features were not tracked separately.

Operating Costs **–** operating cost data was provided for the project for 2002 and 2003 and year to date financial data up to July 31, 2004. Operating costs increased from $1,702 per unit in 2002 to $1,906 in 2003 and are budgeted to be $1,936 for 2004. This represents annual increases of 12% and 1% respectively.

Financial Indicators – the owners/developers felt that yield (rate of return), marketing success, operating and ongoing maintenance costs have all exceeded expectations. Turnover of space (rate of resale) was felt to have partially exceeded expectations. Sale prices and level of absorption of units were both felt to have met expectations. Initial construction costs were felt to have not met expectations. Tenant allowances and reduction in internal fit out costs (churn) were not considered to be applicable.

While all of the green features are felt to have contributed to the financial performance of the property the sale price, ongoing operating and maintenance costs and turnover of space (rate of resale) were all felt to be the most important items. Marketing success, level of absorption of space, ongoing maintenance costs and turnover of space (vacancy) were all considered to have exceeded expectations (i.e. outperformed) by 11-20%. Initial construction costs were all considered to have exceeded expectations (i.e. underperformed, with costs higher than expected) by 11-20%. Operating costs were considered to have exceeded expectations (i.e. outperformed) by 6-10%. Yield (rate of return) was considered to have exceeded expectations by 3-5%.

Values did not increase as much as conventional development (costs were higher to start with), but they did increase somewhat in relation to the general market. It is difficult to compare, but the percentage above market is believed to now be slightly higher than at construction completion. The excess performance was considered to be directly attributable to the greening of the property.

Barriers to Understanding Sustainability –There are many factors that impact sustainability, however, the issue is very complex and they don't have a sense that there is a clear understanding (even among the professionals) of the alternatives and the impact of making certain choices. Many of the green building decisions that were made at Cranberry Commons were intuition-based rather than on hard data or information.

Relative Understanding of Sustainability – in the opinion of the owner/occupier the level of understanding of sustainability (or green buildings) was considered limited among all professional disciplines including lenders, architects, appraisers, planners, developers and tenants. With tenants the level of understanding is mixed but generally considered to be quite low.

Suggestions for making it easier to Understand Sustainability – More information needs to become available. Members of the group wanted to adopt sustainable practices but the consultants didn't have much too offer. Finally the project ended up hiring resources to educate the tenants about the possibilities.

Tenant/Occupant ranking of the relative direct and indirect benefits of the project – the interviewee addressed this question as both a resident in the project and a representative of the developer with the following relative ranking:

1) Overall living environment – as a tenant the interviewee has a high level of satisfaction in the overall living environment, with no desire to move, and ranks this as the highest priority. There appears to be somewhat lower turnover here – 18% (4 re-sales) in just over three years - than in other developments in this area. However, they have not seen the statistics, so they don't know if this is an accurate assessment. Also, because of the low turnover, values remain constant.

2) Energy consumption and operating costs – they have not compared the energy consumption, operating or maintenance costs of Cranberry Commons with others, so they don't know what (if any) financial benefits have resulted from including green building features – however overall costs have generally exceeded expectations in that they have been lower than anticipated. Generally, they find the cost of living in this location affordable (in part because it is such a "walkable" neighbourhood with many amenities).

3) Marketing and Promotion (only from the perspective of the owner/developer) - marketing, promotion and re-sale costs have been very low – the website and personal connection have been the means for generating all the re-sales. Homes have sold on average within 60 days. This has been an unexpected benefit.

Requirement for an Appraisal by the Lender and the extent to which the Appraisal took into account the Green features – an appraisal was required and the co-housing aspect was taken into account but not the other green features.

Ability to achieve lower insurance premiums – there was no evidence that lower insurance premiums could be achieved.

Ability to achieve lower financing costs – there was no evidence that lower financing costs were achieved.

ADAM JOSEPH LEWIS CENTRE FOR ENVIRONMENTAL STUDIES, OBERLIN COLLEGE, OBERLIN, OHIO, U.S.A.

This two-storey educational facility was originally developed in 1998 and is located on the Oberlin College Campus in Oberlin, Ohio. The Environmental Studies Program had been accommodated in inadequate facilities on the campus. The program was growing rapidly and there was a requirement for additional space. It was felt that a new building which incorporated numerous Green features, which were also prominently addressed in the curriculum, would attract students, faculty and the local community and become a focal point for the academic program.

The Environmental Studies Program was required to raise its own funding for the project, which was achieved through a Cleveland based family foundation and an insurance company, and was developed in an underutilized portion of the campus (and therefore served as a catalyst to regenerate activity in this part of the campus). The building incorporates numerous innovative technologies and energy saving features which have resulted in energy savings of 63% compared to a conventional building. As such it is seen as a living laboratory not only for the students enrolled in the Environmental Studies Program but also for the thousands of visitors who have toured and studied the building.

SUMMARY OF KEY BUILDING FACTS

Figure 16 is a description of the building's key Green features (based on a summary provided on the Oberlin College web site, www.oberlin.edu/envs/ajlc/).

Mechanical System

- Geothermal Wells: Heating and cooling is derived from closed loop geothermal wells. Water circulates through closed-loop pipes to water source heat pumps located in each space throughout the building. In addition, two larger heat pumps serve the ventilation needs for the main building and the auditorium.
- Each heat pump is controlled individually, allowing the unit to either reject or extract heat from the circulating water as needed. This reduces energy use by enabling simultaneous heating and cooling within the building.
- Loop water temperature is between 30° and 105° Fahrenheit. When the water temperature gets warmer than 105°, it is circulated in to wells to reject the excess heat. When cooler than 30°, it is supplemented by a small electric boiler.

- Atrium heating is provided through radiant coils under the concrete slab.
- Fresh Air: 100% fresh air for ventilation is provided in all occupied spaces. Return air is passed through a heat recovery unit before it is exhausted.
- Raised Floor: A raised floor is employed at the first floor workspaces and on the entire second floor, providing plenum space for ducted ventilation air delivery and return, and electrical, data, and communication wiring.

Living Machine

- Natural wastewater treatment system, powered by sunlight; serves as a research and teaching tool.
- Designed to handle 2,400 gallons per day, the Living Machine is a resilient system due to its mechanical simplicity and biological complexity.
- Replicates and accelerates the natural purification processes of ponds and marshes.
- Diverse communities of bacteria, algae, micro-organisms, plants, trees, snails, and fish form whole ecologies in tanks and living bio-filters.
- Recycles water for non-potable “greywater” use throughout the building.

Solar Design

- Photovoltaic Panels: 3,700 sf photovoltaic (PV) array on the main south-facing curved roof will provide electrical energy for the building.

Address	122 Elm Street, Oberlin, Ohio 44074, U.S.A.
Gross Building Area	13,600 square feet (1,263 sq. m.)
Net Useable Area	Not available
Completion	1998
Owner/Occupier	Oberlin College (Environmental Studies Program)
Facility Manager	Aramark
General Contractor	Mosser Construction
Architects	William McDonough & Partners
Energy Analysis	Steven Winter Associates, Rocy Mountain Institute
Structural and MEP	Lev Zetlin Associates
Landscaping	Andropogon Associates
Civil Engineering	CT Consultants
Lighting	Clanton & Associates
Daylighting	Loisos/Ubbelohde
Specifications	Heller Metzger
Acoustics	Shen Milson & Wilke
Indoor Air Quality	Hal Levin
Estimating	Vermeulens, Hammond Construction
Living Machine	Living Technologies
Construction Costs	$4,800,000 including $400,000 for the Living Machine (wastewater treatment) and $500,000 for the Photovoltaic System, both items not normally found in a conventional building project, equating to $353 per square foot ($3,799 per sq. m.)
Awards	Pre-dated LEED. Currently working towards a LEED certification. Existing building features would suggest a designation close to LEED Platinum. American Architecture Award, 1999; AIA Honor Award, 1999; AIA Top Ten Green
Grants	None identified.

Figure 16: Adam Joseph Lewis Centre – Summary

- Anticipated advancements in PV efficiencies should meet or exceed the building energy demand (64,000 kwh) within five years. Roof attachment detail allows for upgrades as advancements are made in PV technology.
- Sun Plaza: The Sun Plaza maps the solar year; shadows cast by a gnomon are marked in the Sun Plaza form.
- Building Orientation: Building is elongated along the east-west axis to optimise passive solar performance.
- Daylighting: Daylighting is provided for all interior spaces, reducing lighting loads.
- Direct solar gain is collected through south-facing glass in the Atrium and Workspaces.
- Thermal Mass: Thermal mass in concrete floors and exposed interior masonry walls retains and re-radiates heat.
- A vine-covered trellis provides shading on the south elevation.

Energy Efficiency

- Natural Ventilation: Building orientation takes advantage of prevailing breezes. Operable windows located in all occupied spaces allows for natural ventilation. Atrium ventilation introduces air at low levels and exhausts air at clerestory, using natural convective air flows.
- R-30 to R-40 roof assemblies.
- Energy efficient wall design: R-21 masonry cavity-walls, featuring pressure-equalized rain-screen assemblies, with air barrier construction.
- Integrated building controls: advanced, central building controls for mechanical, security, fire, and Living Machine systems.
- Energy efficient lighting design: 0.9 watts/sf connected lighting load.
- Glazing to represent the most advanced in thermal insulation and shading.

Indoor Air Quality

- Low-VOC materials, paints, and adhesives are specified throughout the building.
- Exposed ceiling structure eliminates inaccessible ceiling plenums.
- Construction procedures: careful review of product submittals, proper ventilation during construction, construction sequencing to limit exposure of materials to toxins.
- Complete HVAC testing, balancing, and commissioning before occupancy.
- Maintenance protocol to establish green cleaning products and practices after building occupancy.

Material Selection

- Durable, low-maintenance materials are used throughout, including: exterior walls (brick), interior walls (stained concrete masonry units), and steel structure.
- Materials containing recycled content are used throughout, including: steel (framing), aluminium (roof, windows and curtain wall frames), ceramic tiles (restrooms), toil partitions.
- Certified Forest Products: All wood is supplied from certified well-managed forests, as determined by standards and specification language endorsed by the Forest Stewardship Council (FSC). The certified status of the forest of origin will be verified, as well as the chain of custody from the forest through manufacturing and fabrication. This includes the wood roof decking structure, glued-laminated beams, plywood and wood framing members, and veneered wood panels.
- Products of Service™: The raised floor and carpeting are leased to the College by Interface (the manufacturer). The College gains the services of the floor and carpet, without the liabilities of the ownership. Interface retains ownership of the floor and carpet, which will allow reuse or recycling of the components when their service life is complete.

Landscape

- Indigenous Landscape: A microcosm of the hardwood forests common to Northern Ohio.
- Aquatic Landscape: A pond and wetland retains, processes, and cleanses stormwater and runoff from adjacent areas.
- Social Landscape: The Sun Plaza, North Plaza, paths, and walks provide places for gathering, circulation, learning, and leisure.
- Food Growing Landscape: Orchards and gardens provide a working landscape where students can learn about growing food and fundamental ecological processes.

SUMMARY OF INTERVIEW

On December 20, 2004 we interviewed a representative of the owner/occupier, Cheryl Wolfe-Cragin of the Environmental Studies Program at Oberlin College. Her responses to our survey can be summarized as follows:

General

Rationale for Building Green – Previously the Environmental Studies Program was located in the basement of another building on the Oberlin College Campus. This building had asbestos insulation on the pipes, coal fires electricity and no natural light and was therefore fundamentally contradictory to the content of the department's program. In addition there was insufficient room for expansion.

The idea for a new building started to gain momentum after the appointment of a new Program Director, David Orr in August 1990. The program subsequently expanded from 25 majors to 100 majors. A new facility for the Environmental Studies Program was not incorporated on the Campus Master Plan and, as such,

funding for a new building had to be raised by the program directly. This was a major hurdle and it was only after significant capital contributions from the Lewis family Foundation of Cleveland and the Progressive Insurance Company that construction could proceed. The intent of the building was to be a living laboratory where students, faculty and the local community could become educated on green practices and which could accommodate a rapidly growing educational program.

Third Party Involvement – All financing for the property was achieved through donations, with the major contributions provided by the Lewis family Foundation and the Progressive Insurance Company. A significant number of specialist professionals were engaged in the project to coordinate the implementation of various green features (i.e., living machine system) in the project. The property is owner-occupied but is managed by a third party facility manger, Aramark. William McDonough was the architect and Mosser Construction was the General Contractor.

Green designation – The building does not currently have a LEED certification, as it pre-dated the LEED program. However the existing building is working towards a LEED designation and is expected to achieve LEED Gold or Platinum certification.

Third party reports – two official commissioning reports were completed for the building, as no third party financing was required and no appraisals were completed.

Environmental

Key Green features – The following is a list of the Green features which have proven to be most financially and non-financially beneficial from the perspective of landlord or tenant, listed in order of greatest benefit to least:

Solar Panels – 3,700 square feet of Photovoltaic array on the south facing curved roof provides electrical energy for the building and cost $500,000 to install. The PV panels result in electrical savings of 60% and have the additional benefits of being able to sell additional power to the grid in the summer months as well as avoid the generation of harmful environmental impacts associated with conventional power sources.

Living Machine wastewater treatment system – this natural wastewater treatment system is powered by sunlight and is designed to handle 2,400 gallons of waste water a day which is naturally treated and reused for non-potable “gray water” use throughout the building. The Living Machine eliminates the need for off-site treatment of wastewater as 80% of the water is recycled. With 70-80% of water usage typically being required to flush toilets, the use of nearly all “greywater” for this purpose significantly reduces the building’s water consumption.

Geothermal heating and cooling – closed-loop geothermal wells provide heating and cooling in the building, through closed-loop pipes to water source heat pumps located throughout the building.

Natural landscaping – a pond and wetland retains, processes and cleanses stormwater and runoff from the site and ? adjacent areas. It also provides a pleasant environment, an indigenous landscape (featuring local hardwood forests) and orchards and gardens where students can learn about growing food and ecological processes.

Green features that would not be included or that would be added - if the project was developed again today two items would have been addressed differently. Firstly less technical and less complicated systems would have been included.. Secondly more of a mix of fresh and re-circulated air would have been included. The 100% fresh air for ventilation is creating a challenge for the building systems to handle the recycling of this air. One other significant challenge has been in finding an engineer who understands how the systems are designed and also knows how to operate and maintain the closed loop ground water system.

Importance of Green features in attracting tenants - the PV array and Living Machine would be regarded as extremely important by the owner/occupier. The Geothermal heating and cooling system would be regarded as somewhat important and the natural landscaping would be regarded as neutral.

Non-Green Comparables – most of the other buildings on the Campus are much older. The Community College Campus is of a similar age. The Environmental Studies Building uses 33% of the electricity used by the other buildings on campus. It is a very popular building and the atrium/auditorium is booked most evenings because of the amount of natural daylight in the facility.

Other impacts on the environment – avoidance of Greenhouse Gas (GHG) emissions, saving water and the use of native plants.

Environmental issues considered in developing project – all items including using less energy and water, and improving indoor air quality were all considered extremely important factors. Using sustainable materials, and recycled or salvaged material (such as classroom chairs and the aluminum in the roof) were all considered somewhat important factors. Green Roofs were not applicable to this project.

Social

Reputation of owner/occupant/tenant – Oberlin College has become known as having one of the best? Strongest? environmental studies programs in the U.S.A. and there has been a significant increase in the number of students who have enrolled in the program, since the development of the new building. In addition there have been articles about the project in Time magazine and a profile on ABC News. In fact there has been so much media attention focused on the project that a full time staff person now has responsibility for dealing with these enquiries. There are also tours of the property all the time by interested parties, which has significantly raised the local, regional, national and international profile of both the Environmental Studies Program and Oberlin College.

Other measurable effects - these include a significant increase in the number of majors, an increase in the number of students who are now interested in taking the Environmental Studies courses and the very significant utilization of the building

Larger scale local/regional effects – while it is hard to quantify the direct impact of the project on greening the local market there are a number of indirect examples. In terms of the overall building market in the area one of the recent graduates from the program was involved in setting up a non-profit corporation, the Cleveland Green Building Foundation, which is focused on the greening of Cleveland. Many of the students have also been involved in assisting the local city council on environmental related issues. Many architectural firms and development officers have also toured the property and considered it as a case study for other Green projects.

Another direct example is the case of Wal-Mart, who were looking to open a store just outside Oberlin and agreed to a number of changes in their development plans and building practices to mitigate some of the environmental impact of the project. The President of Oberlin College agreed to set up an environmental policy advisory committee, which addressed five key areas of environmental policy for the campus. This policy was adopted in March 2004. Another example of the community impact of the project is that a number of students purchased one block in downtown Oberlin (a former car dealership), and have incorporated creative financing and Green design principles into their plans for the project. It is very likely that this project would never have been contemplated before the new Environmental Studies building was developed. It is interesting to note that there was some criticism of this project before any third party verification and validation was received.

Absenteeism, health issues and productivity levels – no definitive data on this issue could be provided, however there is some indication that the students are staying more alert. There was also a case where a student with a medical condition was able to work in this building in spite of experiencing considerable adverse effects from off-gassing of materials in other conventional buildings.

Ranking of social issues in developing the building – improving indoor air quality, increasing employee morale, increasing corporate or civic image and increasing corporate or civic leadership in social/environmental responsibility were all regarded as extremely important issues in developing the property. Reducing absenteeism, increasing productivity and improving employee (and student) health were all regarded as somewhat important factors in developing the property.

Financial

This is an owner-occupied property. The development of the property was based on the need for a new facility to house the Environmental Studies Program. The financial performance of the property was not the primary driver of the development, although the lower energy consumption did result in operational cost savings, compared to conventional construction. The increase in the number of graduate students that could be accommodated, the lower maintenance and long-term operating costs and the integral role of the facility itself and its systems in the teaching program were the primary reasons for the development.

Construction costs - As stated earlier the total construction costs for the project were $4,800,000 or $353 per square foot ($3,799 per sq. m.). No direct comparison with conventional construction costs was available, however if the Living Machine and Photovoltaic array were not included in the construction costs (two of the key Green features) the total costs would have been reduced by $900,000 (19%) or $66.18 per square foot ($712 per sq. m.) to $287 per square foot ($3,089 per sq. m.). ***Operating Costs –*** No specific financial information was available to breakdown the operating costs, however the building incorporates energy saving features and innovative technologies which have resulted in energy savings of 63% compared to a conventional building.

Financial Indicators – a number of financial indicators such as rent, yield (rate of return), marketing success, level of absorption, tenant allowances and turnover of space (vacancy) were not relevant as this is an owner occupied facility and is not an investment property. Reduction in internal fit-out costs was also largely irrelevant, however it is interesting to note that more departments are using the space in the building and the property

is being utilized twice as much as was initially anticipated, creating greater demands on the building systems and management of the facility.

Operating costs exceeded expectations, in a positive way, with greater savings than anticipated. Initial construction costs and ongoing maintenance costs met expectations. From a financial perspective the building is performing best in terms of its lower than expected operating costs. Maintenance is requiring more time and effort and original construction costs were all fully funded by various grants. On a percentage basis operating costs were estimated to have exceeded expectations by coming in 3-5% less than anticipated, maintenance costs were 3-5% higher than expected and initial construction costs were essentially in line with initial expectations. The relevant excess/under-performance were all felt to be directly attributable to the greening of the building.

Barriers to Understanding Sustainability – two main items were identified. Firstly this is a high performance building and as such it requires very specialized knowledge to operate. It was felt that the lack of qualified engineers knowledgeable of these types of building systems is a barrier to greater adoption of sustainable practices. Secondly the computer controls for these systems require a high level of knowledge of the programming requirements and understanding of the logic of the systems and what they are designed to do. There is also limited knowledge of these technologies.

Relative Understanding of Sustainability – in the opinion of the owner/occupier the level of understanding of sustainability (or Green buildings) was excellent amongst architects and the tenants (or occupier) in this case. Planners and developers/contractors were felt to have a good understanding (which increased to an excellent understanding after the project was completed). Developers, tenants and real estate brokers were felt to have a limited understanding. No lenders, appraisers or real estate brokers were involved with the project.

Suggestions for making it easier to Understand Sustainability – four key items were identified which were felt to potentially make it easier for stakeholders to understand sustainability. The first item was, the creation of a web site with real time data on the benefits of building Green. Second, involved experiencing a Green building (particularly in terms of the natural daylight and indoor air quality in this project). Third, required creating an awareness that a building can generate its own electricity (this project generates 58% of its own electricity). Finally was the need for a media “blitz”, promoting the benefits of sustainability.

Tenant/Occupant ranking of the relative direct and indirect benefits of the project – the owner/occupier provided the following relative ranking of these four items:

1) Marketing and promotion
2) Energy consumption
3) Health and productivity
4) Operating Costs

Requirement for an Appraisal by the Lender and the extent to which the Appraisal took into account the Green features – there was no requirement for an appraisal as there was no third party lender involved in financing this project. It is interesting to note that there was a willingness to expend more initial capital

funds based on the future payback from lower operating costs and the other indirect benefits noted earlier.

Ability to achieve lower insurance premiums – there was no ability to achieve lower insurance premiums as there is a blanket policy in place for the entire campus.

Ability to achieve lower financing costs – as already stated there is no third party financing in place. There is a perception that if a future Green project was built on the Campus it might be easier to raise the financing and Oberlin College's overall ability to raise financing may have been enhanced by this project. However, there is no empirical evidence to support this view at the present time.

C.K. CHOI BUILDING FOR THE INSTITUTE OF ASIAN RESEARCH & THE LIU CENTRE FOR THE STUDY OF GLOBAL ISSUES, UNIVERSITY OF BRITISH COLUMBIA, VANCOUVER, BRITISH COLUMBIA, CANADA

The C.K. Choi Building for the Institute of Asian Research ("C.K. Choi Building") and the Liu Centre for the Study of Global Issues ("The Liu Centre") are two green buildings located close together in a grove of trees on the campus of the University of British Columbia in Vancouver British Columbia. The campus is on a promontory extending westward into the Strait of Georgia, situated between Vancouver Island and mainland British Columbia.

The C.K. Choi Building is a 30,000 square feet educational building completed in 1996 and located at the University of British Columbia. The building has five research centers, focusing on China, Japan, Korea, South East Asia, and India. It has a full-time occupancy of about 100 people (with a maximum capacity of about 175).

The Liu Centre is a notable environmental project at the University of British Columbia, established as a policy and conference centre dedicated to the critical cross disciplinary issues of our time, such as global environment change, population growth and immigration. The 18,800 square feet Liu Centre was completed in September 2000 with a construction budget of $3.1 million. It has a full time occupancy of about 37 people.

SUMMARY OF KEY BUILDING FACTS – THE C.K. CHOI BUILDING

Figure 17 is a description of The C.K. Choi Building's key Green features (based on a summary provided by the University of British Columbia and information on the building on the following web site, http://www.iar.ubc.ca/choibuilding/matsuzaki.html).

Energy Usage

Based on a Building Simulation Energy Study, this 30,000 sq. ft. office building exceeds its ASHRAE 90.1 prototype building by 57%. The total electrical savings are 191,603 kWh per year. For this achievement, B.C. Hydro provided a $44,121 incentive to the Owner under the New Building Design Program. The final energy report prepared prior to construction predicted that the building would use just 10% less energy than an ASHRAE 90.1 building

Some of the key energy savings features include: retaining an existing stand of trees along the 300 foot western edge of the building to reduce cooling loads; utilizing building forms that enhance internal stack effects to provide air change through natural ventilation and localized fans (no large mechanical air handling system); utilizing building forms that enhance daylighting to reduce reliance on electric lighting and reduce cooling loads; incorporating daylight sensors and occupancy sensors to minimize unnecessary use of lights; incorporating high efficiency luminaries with lower ambient lighting levels and task lights where appropriate; exceeding the R-values suggested under ASHRAE 90.1 for walls, ceiling and glazing; careful attention to detailing and construction methodology to minimize heat loss through thermal breaks etc.; utilizing waste heat in an existing steam vault adjacent the site to preheat domestic water.

Water Conservation

Significant water savings are realized through a series of features. Composting toilets installed in this project do not require potable water for flushing. City water is generally only required for the low flow lavatory faucets (spring loaded to further reduce waste) and kitchen sinks. Irrigation of site planting material is provided solely from collected rain water (stored in an 8,000 gallon subsurface cistern) and recycled gray water from the building. Projected water usage is approximately 300 gallons per day.

Waste Management

Sanitary waste is eliminated through the use of the composting toilets. Waste from sinks is processed on site through a subsurface gray water recycling system and then used for irrigation. This combination eliminates the sanitary connection for this project. A comprehensive waste management plan was implemented during construction, and allowed more than one half of the waste generated on site to be diverted from the landfill. Significant use of reused and recycled materials and products (60% of primary wood structure, 100% of exterior brick cladding) addressed waste management and diversion of material from landfills.

Address	1855 West Mall, Vancouver, BC, V6T 1Z2, Canada
Gross Building Area	29,321 square feet (2,724 sq. m.)
Net Useable Area	25,495 square feet (2,369 sq. m.)
Completion	Oct-96
Owner/Occupier	University of British Columbia (Institute of Asian Research)
Facility Manager	University of British Columbia
General Contractor	Haebler Construction
Architects	Matsuzaki Wright Architects
Structural Engineers	Read Jones Christofferson
Mechanical Engineers	Keen Engineering
Electrical Engineers	Robert Freundlich and Associates
Landscape Architects	Cornelia Hahn Oberlander
Construction Costs	$4,400,000, equating to $150 per square foot ($1,615 per sq. m.)
Awards	Pre-dated LEED. Received BC Hydro Energy Smart Award; 1996 British Columbia Earth Award, Building Owners and Managers Association; 1997 Building Award of Excellence, Consulting Engineers of British Columbia; 1998 "Lieutenant Governor of B.C." Award of Excellence, Architectural Institute of British Columbia (Matsuzaki Wright Architects); 1998 Award for Innovation Excellence, Architectural Institute of British Columbia; 2000 Earth Day Top Ten Award, American Institute of Architects Committee on the Environment
Grants	$44,000 received through the BC Hydro Power Smart *"New*

Figure 17: CK Choi Building – Summary

Ozone-Depleting Substances

In addition to being free of CFCs as required under provincial regulations, efforts were made on this project to select systems and products that minimize impact on the ozone layer. For example, rigid insulations are expanded boards foamed with pentane (not ozone depleting) versus extruded boards expanded with an HCFC, and natural ventilation eliminates the need for refrigerated coolants. The significant amount of reused and recycled materials in this project also greatly reduces the use of fossil fuels (otherwise required to extract, transport and process new raw materials) and thus reduces carbon dioxide (CO_2) emissions, the largest single component of current greenhouse gas emissions.

Indoor Air Quality

Three strategies were taken to ensure good indoor air quality. Material selection was carefully reviewed. For example, all millwork is constructed from formaldehyde-free medite, all finishes are solvent-free, low VOC (volatile organic compound), carpet is laid with a tack strip method versus adhesives. Construction sequencing was specified to ensure flushing of the building during drywall installation and finishing, painting, caulking, and during the installation of carpets. Because human activity and everyday operations add CO_2 and VOCs to buildings, the natural ventilation system in the building was designed to provide 20 cfm per person of 100% fresh air at all times. In addition, copy machine areas are direct-vented. Being continually flushed, the building does not experience peaks and valleys in internal air quality often found in traditional mechanized systems that operate with reduced air changes during low occupancy hours.

Building Waste Management

The C.K. Choi Building incorporates a comprehensive approach to management of building waste and surface water on site. Graywater is collected in the building and directed to an exterior subsurface graywater recycling area. The graywater recycling trench contains plant material and in turn, microbial plant life known for their capacity to neutralize bacteria in the graywater. The recycled graywater is then used for site irrigation. A subsurface holding tank is incorporated for storage of rainwater collected from the roof area. This water is used for summer irrigation of the site and to ensure that the plant life in the graywater trench is never left dry. This design results in no city service connection for graywater waste from the building and no use of city water for site irrigation. The addition of composting toilets to this system allows this building to be "off grid" for sanitary waste.

Environmental Management

The first step in environmental management was to enhance the ambient conditions of the existing site. Existing trees were retained for their capacity to remove CO_2 from the air and the shade they provide on the west elevation. The building replaces an existing parking lot and the dynamic building form capitalizes on the benefits of the different climatic conditions at each orientation. The second step involved in designing a building that minimizes consumption and impact on the environment. The total operating energy savings for this project are 50% greater than what is achieved under the new Energy By-Law of Vancouver. An energy meter enables the building owner and users to monitor actual energy use in the building and make adjustments in operations as necessary.

Tenant Awareness Program

Part of the commissioning process of this project includes educating users about building features and items over which they have control. For example the building has operable windows and user control over heat in work spaces. Understanding the way the stack effect for ventilation works or the operation of daylight and occupancy sensors, enables the users to participate in energy efficient operations and ensure that good IAQ is maintained.

SUMMARY OF KEY BUILDING FACTS – THE LIU CENTRE

Figure 18 is a description of the building's key Green features (based on a summary provided in a property brochure prepared by Architectura, with Arthur Erickson).

Site Location and Landscaping

The Liu Centre is located at the edge of a second growth forest, which provides cooling shade and beautiful views. The centre has two distinct components, a seminar wing with public spaces for receptions, expositions, and conferences and an office wing, for more private research-related functions. The two wings are connected by a glazed lobby, with two courtyards – one a formal entry and the other providing space for outdoor events.

The building was integrated into the natural environment by:

- Using the site of the previous Pan-Hellenic House building and parking lot to minimize the impact on the forest.
- Positioning the building to protect a rare, large-specimen Katsura tree at the entry courtyard.
- Creating a stone garden with views from three main rooms.
- Preserving existing trees on the site and avoiding damage to tree roots.
- Restricting use of heavy machinery to avoid excessive soil compaction.
- Using native plants such as ferns and wild grasses to restore the forest floor and minimize irrigation requirements.

Building Design Features

Choices of building materials and systems for the Liu Centre were evaluated based on durability, efficiency, embodied energy, environmental impact, contribution to a healthy environment and economic feasibility using a 40-year life cycle cost analysis.

- Minimal building width to maximize day lighting of the interiors.
- Exposed building systems – concrete floors, timber and concrete ceilings, cable trays, sprinklers and mechanical ducts – to minimize the amount of interior finishing required.

- Free span structures for layout flexibility.
- Natural ventilation systems to minimize energy consumption, capital and operating costs.
- High-performance, low-E, argon-filled curtain wall system for the office component.
- Covered bicycle stalls and on-site shower facilities with separate entrance to promote sustainable commuting.

Materials

- High quality salvaged materials – bricks, pavers, glulams and structural decking – were collected from recently demolished buildings at UBC and elsewhere.
- The quantity of concrete and cement was minimized by using pre-cast plants and poured-in-place frames with high fly ash content (made possible through a partnership by CanMet and GVRD).
- Green furniture – board room chairs made from recycled pop bottles – and carpet were selected from suppliers with high environmental standards and practices.
- Non toxic paints and adhesives.

Energy Systems

- Low energy lighting fixtures with room sensors.
- Ultra low-flush toilet fixtures.
- Waste management system for construction and operation.
- Electrical load sharing with neighbouring buildings to avoid building a new substation.
- Air-to-air heat exchanges for the seminar room.
- Displacement ventilation in the case room which eliminated a ventilation duct system.

Other sustainable features which were evaluated but not implemented due to low cost benefit returns were collecting rainwater for toilet flushing, composting toilets, creating a roof-top

Address	6476 NW Marine Drive, Vancouver, BC, V6T 1Z2, Canada
Gross Building Area	18,800 square feet (1,746.56 sq. m.)
Net Useable Area	Not available
Completion	Sep-00
Owner/Occupier	University of British Columbia (The Liu Centre for the Study of
Facility Manager	University of British Columbia
General Contractor	Haebler Construction Inc.
Architects	Architectura (Planning Architecture Solutions Inc.), in collaboration
Structural Engineering	Bush Bolman & Partners
Landscaping	Cornelia Oberlander Landscape Architects
Mechanical Engineers	Keen Engineering Co. Ltd.
Electrical Engineers	Robert Freundlich & Associates
Construction Costs	$3,100,000, equating to $165 per square foot ($1,774.92 per sq. m.)
Awards	Pre-dated LEED;
	Earth Day Award from the American Association of Architects; 2001 Lieutenant Governor General Award, Architectural Institute of British Columbia; 2001 Innovation Award, Architectural Institute of British Columbia; 2001 Award of Merit, Consulting Engineers
Grants	None identified.

Figure 18: The Liu Centre – Summary

garden and using photovoltaic solar panels to generate electricity.

SUMMARY OF INTERVIEW

On December 23, 2004 we interviewed two representatives of the owner/occupier, Jorge Marques, Energy Manager, University of British Columbia Land & Building Services and Freda Pagani, Director, Sustainability for the University of British Columbia. Their responses to our survey which simultaneously covered The C.K. Choi and Liu buildings can be summarized as follows:

General

Rationale for Building Green – The C.K. Choi Building had been previously planned as part of the University of British Columbia's (UBC) 10-year, $500 million capital expansion program. This program also made a commitment to develop a demonstration Green building. It was only after UBC was convinced that there would be no incremental costs associated with going Green that the project proceeded, based on the same budget as for a conventionally constructed building.

There was still a perception at the time that the building would somehow be sub-standard due to the incorporation of such items as used building materials and concerns about meeting local building codes. There were a number of environmental advocates who acted as "Champions" for the project including key staff members such as Freda Pagani, and students in the Environmental Studies Program.

Key objectives were determined at the outset of the project to not only ensure that the timeline and budget was met but also ensure that targets were met for resource and energy use. The development of the Liu Centre proved to be easier to rationalize after all the positive media coverage of The C.K. Choi Building. In addition the on-time and on-budget development of The C.K. Choi Building had also demonstrated that a Green building could be successfully developed without any incremental costs but also provide significant positive benefits in terms of both publicity and cost savings for UBC.

Third Party Involvement – The C.K. Choi Building was 50% funded by the British Columbia Government and 50% private donor funded. UBC was the developer and owner of both properties. A significant number of specialist professionals were involved in the development of the project. The property is owner-occupied and is also managed by UBC. Matsuzaki Wright Architects were the architects for The C.K. Choi Building. Architectura, in collaboration with Arthur Erickson were the architects for the Liu Centre.

Green Designation – The C.K. Choi Building received a BOMA Earth Award (1996) and the BC Hydro Energy Smart Award, but does not currently have LEED certification, as it pre-dated the LEED program. The C.K. Choi Building was also listed as one of its top ten buildings by the American Society of Architects. The Liu Centre received a BOMA Earth Award (2002). The key challenges in seeking these designations (i.e., LEED, BREEAM, Green Globes etc.) related to the cost and time involved as well as the exercise of collating all the data.

Third party reports – Keen Engineering completed a post occupancy evaluation of both buildings and several articles and profiles of both buildings have appeared in numerous industry publications, including the Green Development Book prepared by the Rocky Mountain Institute (which details over 200 case studies). A post-occupancy evaluation of The C.K. Choi Building

was also completed by two UBC architecture students in 1998. No third party appraisals were prepared.

Environmental

Key Green features – The following is a list of the Green features which have proven to be most financially and non-financially beneficial from the perspective of landlord or tenant, listed in order of benefit from most to least:

The C.K. Choi Building

Reused Materials – approximately 50% of the construction materials utilized were reused, recycled or recyclable.

Indoor air quality – the decision was made to incorporate high indoor air quality in the building at the expense of energy savings.

Composting toilets – the incorporation of this item, which cost more to build, resulted in significant infrastructure savings for UBC.

Standalone utility system – normally the development of this building would have required an upgrade to the sewer system as the system had reached capacity, necessitating an additional infrastructure cost in the hundreds of thousands of dollars. This was not required, saving costs that would have been attributed to both the building and the sewer system.

For The C.K. Choi Building the energy savings would be regarded as the most important benefit, with a 69% reduction in electricity use from ASHRAE 90.1, although these electricity savings would not be as significant as compared to some more recently constructed Green buildings and are partially offset by the higher heating energy usage compared to a typical building. The second most important benefit would be the composting toilets, with the primary benefit being the savings in potable water consumption.

The Liu Centre

High volume fly ash concrete **–** the quantity of concrete and cement was minimized by using pre-cast planks and poured-in-place frames with high fly ash content. The high volume fly ash concrete, used in the project, had a 50% fly-ash replacement rate.

Naturally ventilated building – natural ventilation systems minimize energy consumption, capital and operating costs. *Reused materials* – high quality salvaged material including bricks, pavers, glulam beams and structural decking were collected from recently demolished buildings at UBC and elsewhere. Furniture and carpets were also selected based on reused/recycled materials.

Minimalist approach to design of finishes – the overall approach was based on functional design with life-cycle criteria for material and system selection, use of recycled and salvaged materials, and abundant natural light.

Deconstruction of existing building on the site – 92% of the building materials from the previous structures on the site were reused and therefore diverted from landfills. Although it costs more to deconstruct than demolish an existing building the savings generated from the reuse of the building materials more than offset the increased deconstruction costs resulting in a net benefit of $20,000 to the project.

For the Liu Centre the primary benefit would be regarded as the reuse of building materials and recyclables.

Green features that would not be included or that would be added – if the projects were to have been developed again today three items would have been addressed differently. Firstly they would have liked to have added renewable energy, which was too expensive at the time (and still is today, to some extent). However over the longer term this might have provided a significant benefit. Secondly there have been challenges associated with the acoustics of a naturally ventilated building, which requires extra care and attention to manage. Finally a geothermal/geoexchange, ground source heat pump system would have been added.

Importance of Green features in attracting users – overall the users enjoy being in both buildings. The natural ventilation and quality of light were considered to be extremely important by the owner/occupier. The composting toilets were considered to be neutral, and there was some initial reluctance on the part of the users to use these facilities, due to a lack of familiarity with the technology.

Non-Green Comparables – The C.K. Choi Building has been consistently compared to the Jack Bell Building (another building located on the campus). This facility had stucco exterior finishes compared to brick for The C.K. Choi Building and cost $125 per square foot to construct compared to $150 per square foot for The C.K. Choi Building. The Jack Bell Building had a more restricted budget which contributed to the lower construction costs. No specific comparables were identified for The Liu Centre, which cost 10% more to construct than the CK Choi Building, although it was completed four years later.

Other impacts on the environment – no other environmental impacts of the project were identified.

Environmental issues considered in developing project – all items including using less energy, using sustainable materials, using recycled or salvaged material, using less water and indoor air quality were all considered extremely important factors. Green Roofs were not applicable to these projects, although they had been initially proposed. It was generally felt that, due to the temperate climate in the Lower Mainland, and significant rainfall, there is limited benefit, except from the perspective of storm water retention — relative to the additional maintenance required.

Social

Reputation of owner/occupant/tenant – there has been a positive change in the reputation of UBC which has resulted from the positive publicity that these two projects have received in the media not just within Canada but also internationally. There have been numerous different groups who have toured the facilities since their opening and this has also contributed to the positive reputation and awareness of UBC.

Other measurable effects - these include the quality of the students enrolling, some positive feedback resulting from the development of the two projects identified in a recent survey of the students and a broader awareness on the reputation of the campus.

Larger scale local/regional effects – in terms of the overall building market in the area the impact of the of the two buildings has been indirect and related primarily to the critical mass contributed to the campus by the two Green buildings. The Greater Vancouver Regional District has adopted the same

program for managing construction waste as that used by the Liu Centre, which was used as a demonstration project in order that the GVRD could implement 10 other projects. There is also now a growing expectation on the part of the community that UBC will complete further Green projects, as well as the expectation that the development community and other government agencies will also complete Green projects. Other social/community impacts include indoor air quality, which is important for the users of the buildings. One user had an allergic reaction to the building and it was discovered that a joint had not been properly caulked and mould was discovered. Once the gap was caulked the problem went away. The key point here is that this problem would probably not have been discovered and addressed in a conventional building.

Absenteeism, health issues and productivity levels – no definitive data on this issue could be provided, especially because there is relatively frequent turnover of staff as a result of the faculty being funded on a project by project basis.

Ranking of social issues in developing the building – improving employee (and student) health, improving indoor air quality, increasing employee morale, and increasing corporate or civic leadership in social/environmental responsibility were all regarded as extremely important issues in developing the property. Increasing corporate or civic image, reducing absenteeism and increasing productivity were all regarded as neutral factors in developing the property (none of the last two items are being tracked).

Financial

Both The C.K. Choi Building and The Liu Centre are owner-occupied properties. The C.K. Choi Building was intended to provide an educational facility to house the Institute for Asian Studies and the development of The Liu Centre was based on the need for a new facility to house the Centre for Global Studies. The financial performance of the property was not the primary driver of the development, but the adoption of Green features in The C.K. Choi Building was based on maintaining a budget which would not exceed the original proposed budget for the project, excluding the Green features. A similar approach was taken with The Liu Centre, but by this point the benefits of building Green had already been demonstrated to UBC. Whilst The C.K. Choi Building was built at the same capital costs as a conventional project it also provided the financial benefits of lower energy consumption. Overall operational and maintenance costs were lower than for a conventional building, although the composting toilets actually increased the maintenance costs. For The C.K. Choi Building it was an easier deconstruction and reuse exercise and there was a 100-year life expectancy based on the structural components. The buildings were designed with long-term flexibility in mind in order to adapt to future requirements.

Construction costs - As stated earlier the total construction cost for The C.K. Choi Building was $4,400,000 or $150 per square foot ($1,615 per sq. m.). The total construction cost for the Liu Centre was $3,100,000, equating to $165 per square foot ($1,774.92 per sq. m.). No direct comparison with conventional construction costs was available, however the Jack Bell Building was constructed for $125 per square foot ($1,346 per sq. m.), approximately 17% less than The C.K. Choi Building, but based on a much more restricted budget. It is also interesting to note that The C.K. Choi Building design team did not approach the design in terms of green vs. non-green design: the building features were determined as desired and then fit into a predetermined budget.

Operating Costs – No specific financial information was available to break down the operating costs, however one of the original design goals was that The C.K. Choi Building should only use 65% as much energy as a comparable building compliant with AHRAE 90.1 and the actual reduction in electricity consumption was 69% compared to this standard. Based on the post occupancy audit the overall annual energy costs for The C.K. Choi Building were determined to be 49% less than the costs for the ASHRAE 90.1 prototype building, representing an annual savings of approximately $7,000.

Financial Indicators – a number of financial indicators such as rent, yield (rate of return), marketing success, level of absorption, tenant allowances and turnover of space (vacancy) were not relevant as this is an owner occupied facility and is not an investment property. Operating costs met expectations, even though initial expectations were high for operating cost reductions. Initial construction costs exceeded expectations, as the design team was able to do a lot with a limited budget. Ongoing maintenance costs also met expectations, which were also high with the anticipation of savings in annual maintenance costs. Reduction in internal fit-out costs did not meet expectations as initially the graduate students were given workstations and subsequently UBC had to add walls and doors, resulting in unexpected additional costs.

From a financial perspective, in order of relative importance, the buildings are performing best in terms of their initial construction costs (which came in the same as the original budget without the Green features), lower operating costs, lower maintenance costs and finally fit-out costs (which were higher than expected). Operating costs and initial construction costs were estimated to have met expectations within a range of 0-2% (although operating costs fell 35% below ASHRAE standards), ongoing maintenance costs were 3-5% higher than expected and internal fit-out costs fell short of expectations by 0-2% (although this was a one time expenditure and not a recurring cost). The relevant excess/under-performance were all felt to be directly attributable to the greening of the buildings.

Barriers to Understanding Sustainability – three main items were identified. Firstly there is the perception that it costs more to build Green compared to conventional construction. Secondly there is a lack of understanding of the value which building green can contribute. Thirdly it is difficult for people to understand how they can contribute to solving a global problem (i.e., how can building Green make a difference?). Although it is impossible to quantify there is a perception that buildings like The C.K. Choi Building do provide some level of “inspiration” to those looking to make a difference in solving issues such as global warming.

Relative Understanding of Sustainability – in the opinion of the owner/occupier the level of understanding of sustainability (or Green buildings) was excellent amongst architects, planners and engineers. Developers and users (tenants) were felt to have a limited understanding. No lenders, appraisers or real estate brokers were involved with the project.

Suggestions for making it easier to Understand Sustainability – two key items were identified which were felt to potentially make it easier for stakeholders to understand sustainability. Firstly the need for an awareness campaign to provide information to users/tenants of the financial and non-financial impacts of sustainability. Secondly The Liu Centre has prepared a manual which it has provided to all its occupants. This type of approach could be used elsewhere to heighten awareness of Green features and familiarize people with these technologies.

Tenant/Occupant ranking of the relative direct and indirect benefits of the project – the owner/occupier provided the following relative ranking of these four items:

1) Marketing and promotion

2) Health

3) Energy consumption

4) Operating Costs

Requirement for an Appraisal by the Lender and the extent to which the Appraisal took into account the Green features – there was no requirement for an appraisal as there was no third party lender involved in financing this project.

Ability to achieve lower insurance premiums – there was no ability to achieve lower insurance premiums as there is a blanket policy in place for the entire campus. It is interesting to note that the building insurance costs may actually have increased as the replacement costs for these two buildings are likely to be higher than for conventionally constructed buildings (and they do not experience the same level of depreciation).

Ability to achieve lower financing costs – as already stated there is no third party financing in place. However one of the donors was a Buddhist and appreciated the Green features incorporated into the project.

DTZ Research

April 2005

The Value of Green Buildings
A Study for the RICS

EXECUTIVE SUMMARY AND COMMENTARY

Background and approach

- DTZ Research was commissioned to undertake a study examining the value of green building standards in England as part of an international report for the Royal Institution of Chartered Surveyors (RICS) in Canada and the UK. English Partnerships (EP) has sponsored this DTZ Research Study.

- The research examined the relationship between green buildings and market value through a case study approach. Six residential developments located in the South, Midlands and North of England were identified, three of which were designed and built to BRE EcoHomes 'Very Good' building standards and three developed to current building regulations.

- Key data was gathered to enable a comparison in terms of the additional construction cost of including green features and end sale prices. An interview was conducted with a representative from each development and developers' attitudes and opinions with regard to EcoHomes standards were assessed.

Limitations

- The study was constrained by the following limitations:

- Access to key financial data was severely limited. For an accurate assessment of the costs associated with each scheme a detailed development appraisal is required.

- There was a general lack of comparability between the EcoHomes and the non-EcoHomes schemes in each region. For example, it is not possible to compare accurately a scheme consisting of 228 units with a scheme of 22 units. A direct comparison loses credibility because of differences in economies of scale, housing mix, affordable housing provision and Section 106 agreements.

- It was not possible to compare end user prices (house prices) on a like-for-like basis because of a lack of specific information relating to each transaction. It was especially difficult to obtain data for each unit on a development because of phasing, slow conveyancing and the complexity involved in matching development plots with actual address data.

- Therefore, an average price for completed housing transactions was obtained from the Land Registry or direct from the developer and used as the basis to determine the average sale price on a £ per sq ft basis.

- There was a general lack of willingness by developers to be involved in research associated with EcoHomes because of other work commitments and the time already spent on undertaking EcoHomes standards.

- The views of house-buyers were not collated during this study. The reference in this summary to consumer preferences is therefore anecdotal, but is a commonly held view amongst the developers that were interviewed.

Key commentary and findings - Valuation issues

- **Valuation practice** - Where there is an initial cost for green features and payback over time, the comparative method of valuation does not consider the costs-in-use and any associated savings. In fact, there is no residential valuation methodology to account for costs-in-use.

- Homeowners in the UK move on average every 7 years; cost savings need to be considered within this timeframe for purchasers to see the benefits.

- In particular, research needs to address the issue of re-sale values of homes that are built to greener standards and incorporate energy saving measures.

- With any income-generating (rental) property, lower operating costs increase the building's net operating income (NOI). If energy costs continue to rise, demand for green buildings may increase and this needs to be reflected in how residential property is valued.

Key commentary and findings - Occupier issues

- **Public awareness** – the developers interviewed are selling EcoHomes to residential buyers but appear reluctant to promote the benefits of the scheme.

- On more than one occasion developers claimed that occupiers would either remove EcoHomes 'green features' or subsequently install 'unfriendly' appliances and fittings (such as tumble dryers and power showers) reducing the scheme's effectiveness.

- Several developers felt that the general public are not drawn to 'green home' issues and are reluctant to pay for such improvements. The general public's lack of understanding about the benefits of EcoHomes, together with the reluctance of developers to promote the scheme, self-perpetuates a lack of consumer awareness.

- The reverse was found in one non-EcoHomes development where the benefits of green homes were actively promoted as a series of 'optional green extras' that went well above the environmental benefits of the EcoHomes standards.

- In the above case study infrastructure installations such as wind turbines, rainwater recycling and photovoltaic cells were actively marketed at the development. These were provided if a minimum threshold of interest was reached and the homebuyers were willing to 'opt in' at an additional cost of £13,500 per dwelling. The developer reported significant interest in the scheme and has achieved an opt-in rate of 15% of house sales.

- Although it could be argued that there will always be a demand for state of the art environmental solutions from 'gadget lovers', the evidence suggests that families may be prepared to opt-in for 'visible' green installations that are well marketed when they demonstrate immediate pay-back through a reduction in power and water bills

- One of the key conclusions of the study is that the benefits of green homes needs to be packaged and marketed in such a way that explicitly identifies the improvement to a person's quality of life. For example, a designated Home Office not only saves on transport and related energy costs but also reduces commuting time and its associated stress.

- However, a 'green culture' develops over a period of time with countries like Germany or the Netherlands having a long tradition of green living. Consumer awareness is lacking in the UK and needs to be addressed in tandem with improving building standards.

- Affordability constraints as a result of high house price levels limits the ability for purchasers to choose green features that have an additional cost because of mortgage loan-to-value ratios and earnings levels.

- The study concludes that a reward system for developers and homeowners to encourage greener standards of living may be appropriate. As an example, developers promoting high environmental standards could be rewarded with favourable building density levels or a reduction in Section 106 contributions. If occupiers increase and maintain their level of "green" living then there should be some mechanism in place that rewards the homeowner such as a discount in local rates/ council taxes.

Further research

- **Further research –** it is clear that further research is required to ascertain whether the 'green value' observations from this small study are representative throughout the UK; and what steps are required to encourage house purchasers to demand green homes as a matter of first choice.

SOUTHERN REGION

Case Study 1 EcoHomes Scheme Milton Keynes

Background

The development is situated in the Westcroft area of Milton Keynes. It provides a total of twenty-two dwellings, ranging from 2 bedroom apartments at 650 sq ft to 5 bedroom detached houses at 1236 sq ft. The site achieved a density of approximately 15 units per acre. The dwellings are of traditional brick and block construction and comprise 2 and 3 storey accommodation. The scheme scored 65 points and achieved a "Very Good" rating under the BRE EcoHomes Assessment.

Milton Keynes has experienced significant rates of economic growth since it was designated a New Town in 1967. A combination of good infrastructure and availability of land through public sector land ownership has led to an expansion in the housing market. In addition, Milton Keynes falls within the *Sustainable Communities Plan* and as a consequence it is designated for population and economic growth over the next 10 to 15 years.

Performance against assessment criteria and standards

The following table summarises the EcoHomes Assessment for this scheme, which attained a Very Good rating and achieved a score of 73%.

The scheme scored very well under the Energy criteria (85%), the Pollution measures (86%) and Building criteria (90%). The scheme occupies a former agricultural site so it did not gain any points for brownfield regeneration. However, the scheme did benefit from the adjacent Westcroft district centre, which provides extensive local amenities, combined with good transport links to Milton Keynes city centre.

In addition, the scheme scored the maximum points available for the provision of cycle storage and a home office. The cycle storage was facilitated by wall-mounted brackets within enlarged garages (two brackets for 4 and 5 bedroom houses). For houses without a garage, sheds with suitable locking points were provided. In total, the scheme achieved 75% of the points available under the transport section.

The development scored poorly in three main areas: **Land Use and Ecology**, **Sound Insulation** and **Internal Water Usage**. In terms of future developments, the assessor advises the appointment of an ecological consultant to maximise the ecological value of the site. While these three areas have the potential to deliver up to 16 additional points, they are not required to achieve a Very Good rating.

Milton Keynes Eco Homes Assessment					
Energy	Ene 1	Carbon Dixoide		7/10	
	Ene 2	Building fabric		5/5	
	Ene 3	Drying space		1/1	
	Ene 4	Ecolabelled goods		2/2	
	Ene 5	External lighting		2/2	85%
Transport	Tra 1	Public transport		1/2	
	Tra 2	Cycle storage		2/2	
	Tra 3	Local amenities		2/3	
	Tra 4	Home office		1/1	75%
Pollution	Pol 1	HCFC Emissions		2/2	
	Pol 2	NOx Emissions		3/3	
	Pol 3	Reduction of surface run off		1/2	86%
Materials	Mat 1	Timber: Basic Building Elements		6/6	
	Mat 2	Timber: Finishing Elements		3/3	
	Mat 3	Recycling facilities		6/6	
	Mat 4	Enviornmental impact of Materials		13/16	
		Roof	3		
		External Walls	3		
		Internal Walls	3		
		Floors - upper and ground	0		
		Windows	2		
		Hardlanscaping	1		
		Fences	1		90%
Water	Wat1	Internal water use		2/5	
	Wat 2	External water use		1/1	50%
Land use and ecology	Eco 1	Ecological value of site		0/1	
	Eco 2	Ecological enhancement		0/1	
	Eco 3	Protection of Ecological Features		0/1	
	Eco 4	Change of Ecological Value fo site		1/4	
	Eco 5	Building footprint		0/9	11%
Health and wellbeing	Hea 1	Daylighting		3/3	
	Hea 2	Sound insulation		0/4	
	Hea 3	Private space		1/1	50%
		Total		**65/89**	73%

Building Costs

According to this developer their standard building costs for a house in Milton Keynes is £72 per sq ft. and at this cost they achieve a very good rating of between 63-65 points.

This build cost includes the cost of the EcoHomes assessment estimated to be in the region of £10,000 plus the post-construction sign-off fee of £250 per unit (£5,500). However, the cost of the assessment is significantly reduced if the developer has an in-house assessor.

The developer estimated the difference in cost - and in terms of quality and level of sustainability reached - between developments built to conventional standards and those built to EcoHomes Very Good as negligible.

In order to obtain the additional 5-6 points required for an Excellent rating, the developer estimated that an additional cost of £10-12 per sq ft would be required bringing the build cost up to £84 per sq ft. Interestingly, this unit cost was achieved by a developer using a recognised alternative to the EcoHomes Very Good standards, as discussed in the following case study.

Costs will inevitably vary according to a sites geographical location. The developer estimated that the same product, 25-30 miles further south and inside the M25, would cost £95 per sq ft. £10 of this additional costs relates to the high specification for the area and the balance of the difference would be related to location, labour rates and general higher cost of living. On the other hand, the developer estimated that a similar development north of Milton Keynes in Northampton, would achieve an average unit cost of £70 per sq ft.

Attitudes of Key Stakeholder

The developer was under a contractual obligation to build to EcoHomes Very Good standards. However, the difference between their basic product and the EcoHomes Very Good product was considered negligible. However, with regard to improving on a Very Good rating, the developer stated "***when you have to get that extra 7-8 points to get Excellent it just pushes everything over the edge***".

The development at Westcroft was not marketed as an EcoHomes scheme. The developer expressed doubt regarding the saleability of some of the green features and expressed concern that post-occupation the homeowner would install a tumble dryer (perhaps not grade A rated) or install a power shower, both of which would have crippled the developers Eco score.

Valuation

Scheme Details

	Scheme Total	Per Unit	Per Sq ft
No of units	22		
Private Average Unit Area (sq ft)		1035	
Private Average Sales Price [note 1a]		£288,132	£278
Density (units per acre)	15		
Land area (acres)	1.5		
Land cost (per acre)	£1,590,000		
Land cost	£2,385,000		
Gearing	75%		
Cost of Debt Capital	6.1%		
Return of Equity Capital Required	11%		
Construction period (months)	18		
Average sale period (months)	12		
Construction costs (sq ft) [note 1b]			£72.00
Private units	22		

Profit and Loss			**Scheme Total**	**Per Unit**
Sales - Private	£6,338,900			£288,132
Total Sales Revenue			**£6,338,900**	**£288,132**
Land (at cost)		**£2,385,000**		
Private Construction Cost	£1,639,440			
Total Construction Cost		**£1,639,440**		
Total Cost			**£4,024,440**	**£182,929**
EBIT			**£2,314,460**	**£105,203**
Debt Interest on land cost	£272,784			
Cost of Equity on land cost	£163,969			
Debt Interest on Construction [note 1c]	£131,258			
Cost of Equity on Construction [note 1c]	£78,898			
Total Cost of Financing		**£568,011**		
Profit after interest before tax			**£1,746,449**	**£79,384**
ROCE [note 1d]				**38.03%**

Note 1a Based on sales ***achieved*** to date

Note 1b No Social Housing

Note 1c Construction costs assumed ***straight-lined*** over project

Note 1d Estimated capital employed

Important Note:

DTZ were not granted detailed financial information and have based the above on a number of assumptions and best estimates. DTZ will not accept and responsibility for errors in the calculations above.

In all of the valuations we have estimated gearing at 75%, cost of debt capital at circa 6% (unless told otherwise by developer) and return of equity employed of 11%.

Additional commentary

An outturn construction cost of £72 per sq ft was viewed by the developer as very acceptable. By comparison with the other five case studies described in this report, this is the lowest construction cost achieved by a developer yet the development is located in the most expensive area in terms of end user prices.

In general, house prices in the South should be more expensive than those in the Midlands and the North, by virtue of the location. An analysis of the house prices for this scheme reveal a house price range of £154,950 for a two bed apartment up to £419,950 for a five bed detached house. By comparison, the Non-EcoHomes scheme described below had sale prices ranging from £165,995 for a two bed apartment and £434,995 for a five bed room house.

Caution must be drawn when directly comparing these prices because we do not have enough detailed information to categorically say we are comparing like for like. However, the price differential may be attributed to the higher construction cost based on a £per sq ft for the non-EcoHomes development.

This developer found little difference between the cost of building homes to conventional standards and those built to EcoHomes Very Good rating. However, the BRE assessment revealed that costly items such as sound insulation and ecological landscaping were not addressed and these green features would have pushed up the construction costs.

In conclusion, the scheme scored 75% on the EcoHomes rating system which is well above the minimum requirement for a Very Good rating (60%) implying that the rating was relatively easy to attain for this site which benefited from a good location and any extra construction costs as a result of meeting the higher green standards were negligible.

Case Study 2 Non Eco Scheme Milton Keynes

Background

The development is situated in Milton Keynes and comprises a total of 228 units, ranging from one bedroom apartments (535 sq ft) to five bedroom detached houses (2038 sq ft). The development is on 14.2 acres and achieved a density of approximately 16 units per acre.

The first phase of development comprised a forty-bed retirement home and this negated any additional on-site affordable housing in the subsequent phase of the development. However, the second phase of the development included 8 'live/work' units and 8 discounted homes for key workers which was over and above the affordable requirement and aimed at "***getting the right ticks in the right boxes***" in the planning application.

Method of construction

The developer used the Space4 method of construction, which is a modern building solution that conforms to NHBC building regulations. The Space4 concept is recognised as an alternative to the BRE EcoHomes standards. Space4 is a prefabricated modular system, which enables the structure of the house to be built off-site and assembled on-site in a day or two. Once assembled, both internal and external contractors can work simultaneously which "***reduces the on-site construction time by as much as 50%***". Space4 is a fast build construction technique, which promotes the efficient use of both materials and labour and the reduction of waste on-site. In addition to utilising prefabrication, which is considered a sustainable

construction method, composting bins were provided for each unit.

Attitudes of key stakeholders

The developer views the BRE rating system as inherently problematic because of its subjectivity. For example, two sites, one with a Very Good rating and an identical site, in terms of layout, house type and product mix achieves a Good or Poor rating because of the orientation of the site or the approximate position of the bus stop. In other words, the rating system is dependent on factors that are outside the control of the developer such as transport networks, a site's ecological value, local recycling policies and brownfield land remediation.

As a consequence, sites that score high on site-specific factors have to do less on improving the sustainability of the house and therefore, it costs less to achieve a good rating. While BRE recommend that developments address each criteria of the EcoHomes Assessment, evidence suggests that developers will score a Very Good rating without addressing important sustainable factors such as reducing internal water usage.

In addition, there is the subjectivity of the examiner and the fact that there are very few local authorities with the ability or resource to undertake the assessment. Although an independent assessor should carry out the assessment some developers have their own in-house assessor, which may compromise the assessment process.

Milton Keynes "***is a unique situation in that most of the land is under the control of EP***", which has pushed higher building standards. Land procured through private landowner's is subject to current building regulations, which tend not to be as high those required by EP. However, the developer believes many of the BRE Very Good EcoHomes regulations are already covered by standard building regulations.

The building regulation process was described as "***constrained and demanding***", primarily as a result of frequent changes to the building regulations. It was also suggested that planning officials experience difficulties coping with the continual changes to building regulations and often have difficulty interpreting Central government requirements at the local level.

Construction costs

	House Type A		House Type B	
Unit Size	549	sq ft	1119	sq ft
Space 4 construction costs	£48,021		£95,359	
Space4 cost per sq ft	£87.47	per sq ft	£85.22	per sq ft
Unit Size	549	sq ft	1119	sq ft
Traditional costs	£63,820.50		£124,146.85	
Traditional costs per sq ft	£116.25	per sq ft	£110.94	per sq ft
Difference between Traditional and Space4	**£28.78**	**per sq ft**	**£25.73**	**per sq ft**
Unit Size	549	sqft	1119	sq ft
EcoHomes construction costs	£39,528.00		£80,568.00	
EcoHomes costs per sq ft	£72.00	per sq ft	£72.00	per sq ft
Difference between Traditional and EcoHomes	**£44.25**	**per sq ft**	**£38.94**	**per sq ft**

- Construction costs using the Space4 concept were estimated at an average of £86 per sq ft. This was compared to a traditional build in the same location and was estimated at an average cost of £113.60 per sq ft, an additional cost of £27 per sq ft.

- Compared to the EcoHomes scheme described in the previous section, which had a construction cost of £72 per sq ft, the Space4 approach costs an extra £14 per sq ft.

- Importantly, the cost differential between the EcoHomes scheme and the traditional costs estimated above is £41.60. The EcoHomes cost of £72 per sq ft appears low for that region. The EcoHomes assessment sheet shows that the development benefited substantially from site-specific green features and scored poorly on the green features that would have created additional costs and increased the build costs.

- The following valuation focuses only on the cost of constructing the 228 units comprising Phase 2. It has not considered the cost of Phase 1 (forty bed retirement home), the Section 106 agreement and any additional community payments.

Valuation

Scheme Details	Scheme Total	Per Unit	Per Sq ft
No of units	228		
Social Average Unit Area (sq ft) note 1a		1153	
Private Average Unit Area (sq ft)		1153	
Private Average Sales Price note 2a		£275,637	£239
Social Average Sales Price note 3a		£220,510	£191
Density (units per acre)	16		
Land area (acres)	14.25		
Land cost (per acre)	£1,400,000		
Land cost	£19,950,000		
Gearing	75%		
Cost of Debt Capital	6%		
Return of Equity Capital Required	11%		
Construction period (months)	24		
Average sale period (months)	12		
Construction costs (sq ft) note 4a			£85.22
Social units note 5a	8		
Private units	220		
% social	4%		
Social construction cost discount note6a	0%		
Social Housing Discount note 7a	20%		

Note 1a Assumed same as ***average*** floorspace for private housing

Note 2a Based on sales ***achieved*** to date

Note 3a Private sales price per sq ft less ***20%*** (discount)

Note 4a Assumes same cost per unit for social and private

Note 5a Key worker Units (8)

Note 6a Social Construction discount due to lack of garage (est. 5%)

Note 7a Sale price is market value less ***20%***

Important Note:

DTZ were not granted detailed financial information and have based the above on a number of assumptions and best estimates. DTZ will not accept and responsibility for errors in the calculations above.

Profit & Loss

Profit and Loss			Scheme Total	Per Unit
Sales - Social Housing	£1,759,667			£220,510
Sales - Private	£60,645,653			£275,637
Total Sales Revenue			**£62,405,319**	**£273,708**
Land (at cost)		**£19,950,000**		
Social Construction Cost	£784,104			
Private Construction Cost	£21,618,870			
Total Construction Cost		**£22,402,974**		
Total Cost			**£42,352,974**	**£185,759**
EBIT			**£20,052,345**	**£87,949**
Debt Interest on land cost	£2,693,250			
Cost of Equity on land cost	£1,645,875			
Debt Interest on Construction note 1b	£2,016,268			
Cost of Equity on Construction note 1b	£1,232,164			
Total Cost of Financing		**£6,355,393**		
Profit after interest before tax			**£13,696,952**	**£60,074**
ROCE note 2b				**28.12%**

Note 1b Construction costs assumed ***straight-lined*** over project

Note 2b Estimated capital employed

Important Note:

DTZ were not granted detailed financial information and have based the above on a number of assumptions and best estimates. DTZ will not accept and responsibility for errors in the calculations above.

There is a difference of 10% on the return on capital employed (ROCE) with the EcoHomes scheme. However, if the debt interest on land cost is removed from the above valuation (£2,693,250) the ROCE increases to 35.62% and therefore the difference in ROCE between the 2 schemes reduces to 2.41%.

Additional commentary

Space4 is considered a sustainable method of construction because of its prefabricated component and is considered by the housebuilding industry as an accepted alternative to the EcoHomes assessment practice.

As a consequence it could not be compared to the EcoHomes scheme as a traditional construction method and therefore we obtained additional data on a traditional cost in the same location which cost an £25-£28 per sq ft on the Space4 cost and £41 on the EcoHomes scheme.

THE MIDLANDS

Case Study 3 EcoHomes Scheme Wolverhampton

Background

The development comprises 50 units ranging from two bedroom units to five bedroom detached houses. The target market is second and third homeowners, rather than investors or first time buyers. The development has achieved a density of 12 units per acre and provides some green open spaces. The site was acquired from EP, the driver behind the EcoHomes standards in this region.

Wolverhampton Eco Homes Assessment					
Energy	Ene 1	Carbon Dixoide		6/10	
	Ene 2	Building fabric		3/5	
	Ene 3	Drying space		1/1	
	Ene 4	Ecolabelled goods		1/2	
	Ene 5	External lighting		2/2	65%
Transport	Tra 1	Public transport		2/2	
	Tra 2	Cycle storage		2/2	
	Tra 3	Local amenities		2/3	
	Tra 4	Home office		1/1	88%
Pollution	Pol 1	HCFC Emissions		2/2	
	Pol 2	NOx Emissions		3/3	
	Pol 3	Reduction of surface run off		0/2	71%
Materials	Mat 1	Timber: Basic Building Elements		6/6	
	Mat 2	Timber: Finishing Elements		3/3	
	Mat 3	Recycling facilities		6/6	
	Mat 4	Enviornmental impact of Materials		7/16	
		Roof	3		
		External Walls	0		
		Internal Walls	3		
		Floors - upper and ground	0		
		Windows	0		
		Hardlanscaping	0		
		Fences	1		71%
Water	Wat1	Internal water use		2/5	
	Wat 2	External water use		1/1	50%
Land use and ecology	Eco 1	Ecological value of site		0/1	
	Eco 2	Ecological enhancement		0/1	
	Eco 3	Protection of Ecological Features		1/1	
	Eco 4	Change of Ecological Value fo site		2/4	
	Eco 5	Building footprint		0/2	33%
Health and wellbeing	Hea 1	Daylighting		2/3	
	Hea 2	Sound insulation		3/4	
	Hea 3	Private space		1/1	75%
		Total		**59/89**	66%

Performance against assessment criteria and standards

In general, EcoHomes standards are a relatively new concept both in this region and for the developer and for this reason the affordable housing requirement was waived on this occasion. According to the BRE assessment sheet, the development achieved 64%. The scheme scored badly in two sections: Land use and ecology and Water, scoring 33% and 50% respectively. The site benefited from access to transport links and local amenities scoring 88% for these criteria. This section includes a home office which was indicated in each dwelling and cycle storage provided in the form of garden sheds, at a cost of £400 per unit.

The developer also scored high for Pollution (71%) and health and wellbeing (75%). In contrast to the EcoHomes scheme in the Southern Region the scheme achieved 75% of the points available for sound insulation yet almost 20% less for the environmental impact of the building materials used.

The developer also supplied the results of their Eco Calculator, as shown below. This allowed the developer to calculate the extra cost of the green features on a cost per unit basis. To achieve a Very Good rating the developer estimated that it cost an additional £647 per unit. The developer estimated that this "***cost was cheap because of the very good location***" and therefore, the evidence suggests that a Very Good rating required minimal changes to the developer's standard product.

Collectively the energy measures cost £140 per unit or £7,000 for the whole development. Tra 1 and Tra 3 related to public transport and local amenities and are therefore site specific and do not directly impact on the cost of achieving a Very Good rating. However, if the developer scored badly on these criteria then more would have to be done to score on the other green measures. Of the four transport criteria only cycle storage incurred a cost through the provision of garden sheds at a cost of £400 per unit. In total this was the largest cost across the development at £19,200 for the 50 units. The provision of recycling bins cost £15 per unit and water butts £50 per unit.

Cost of Green Features

Code	Criteria	Action Required/taken	No Units	Cost / Unit	E/O Cost
Ene 1	Carbon Dioxide	Install Low Energy lights	50	£15.00	£750.00
Ene 3	Drying Space	Drying Facilities	50	£50.00	£2,500.00
Ene 4	Eco Labelled Goods	Energy Labelling: Defra publication	50	-	-
Ene 5	External Lighting	Energy efficient external lighting & security lights	50	£75.00	£3,750.00
Tra 2	Cycle Storage	Add cycle storage	50	£400.00	£19,200.00
Tra 4	Home Office	Indicate home office	50	-	-
Mat 1	Timber : basic building elements	FSC/PEFC Certificates requried. Complete tables	50	-	-
Mat 2	Timber: finishing elements	FSC/PEFC Certificates requried. Complete tables	50	-	-
Mat 3	Recycling Facilities	Confirmation of recycling scheme requried & bin positions to be identifed	50	£15.00	£750.00
Wat 1	Internal water use	Flow regulate showers	50	-	-
Wat 2	External Water use	Water butts required	48	£50.00	£2,400.00
Hea 2	Sound Insulation	3 Post completion sound tests required for Part E	3	£1,000.00	£3,000.00
Hea 3	Private Space	Private space required for 1 bed FOG's - not achieved	2	-	-
			Total	**£1,605.00**	**£32,350.00**
		Extra over cost / plot			£647.00

Attitudes of Key Stakeholder

The developer would consider building to these standards again but to subject to an appropriate land purchase deal and that the affordable housing requirements were kept to a minimum.

According to the developer the BRE EcoHomes standards are a relatively new concept in the area and as a result the developer perceives that there is limited demand for homes built to EcoHomes standards and limited competition among house builders to develop to these standards. Consequently, the homes were not marketed as EcoHomes as the green features are not perceived to add value.

Valuation

Scheme Details

	Scheme Total	Per Unit	Per Sq ft
No of units	50		
Private Average Unit Area (sq ft)		1484	
Private Average Sales Price note 1a		£216,100	£146
Density (units per acre)	12		
Land area (acres)	4.1		
Land cost (per acre)	£960,000		
Land cost	£3,936,000	£78,720	
Gearing	75%		
Cost of Debt Capital	5.5%		
Return of Equity Capital Required	11%		
Construction period (months)	24		
Average sale period (months)	12		
Construction costs (sq ft)			£47.48
Private units	50		

Profit and Loss			**Scheme Total**	**Per Unit**
Sales - Private	£10,805,004			£216,100
Total Sales Revenue			**£10,805,004**	**£216,100**
Land (at cost)		**£3,936,000**		
Private Construction Cost	£3,523,016			
Total Construction Cost		**£3,523,016**		
Total Cost			**£7,459,016**	**£149,180**
EBIT			**£3,345,988**	**£66,920**
Debt Interest on land cost	£487,080			
Cost of Equity on land cost	£324,720			
Debt Interest on Construction note 1b	£290,649			
Cost of Equity on Construction note 1b	£193,766			
Total Cost of Financing		**£1,102,449**		
Profit after interest before tax			**£2,243,539**	**£44,871**
ROCE note 1c				**26.21%**

Note 1a Based on income per sq ft supplied by developer

Note 1b Construction costs assumed ***straight-lined*** over project

Note 1c Estimated capital employed

Important Note:

DTZ were not granted detailed financial information and have based the above on a number of assumptions and best estimates. DTZ will not accept and responsibility for errors in the calculations above.

In all of the valuations we have estimated gearing at 75%, cost of debt capital at circa 6% (unless told otherwise by developer) and return of equity employed of 11%.

Based on the ROCE, this scheme would appear to be significantly more profitable that the non-EcoHomes scheme described in the following section.

Additional commentary

This was the only case study that used an eco calculator, which showed that the additional costs per unit to meet the Very Good standards cost as little as 2% of the selling price. However, the costs may be low in comparison to the other EcoHomes case studies, as a result of "***hidden costs***" which have not been included such as the EcoHomes assessment or professional fees required over and above standard building requirements.

Case Study 4 Non Eco Scheme Wolverhampton

Background

The development is situated in Wolverhampton and comprises 80 units with a mix of two bedroom houses (486 sq ft) to five bedroom properties (1596 sq ft). The development achieved a density of 14 units per acre and included 15% social housing. In order to meet 'Lifetime Homes' requirements, the affordable housing was 10% bigger than the standard size.

The developer identified that because EcoHomes are a new concept in the region they chose not to comply with the BRE rating, driven by concerns over demand and profit margins. However, the scheme possesses a sustainable drainage system (SUDS), which is over and above standard building regulations.

Building Costs

The developer supplied the building costs for this scheme at £53.86 per sq ft and an income of £193 per sq ft, compared to £47.48 for the EcoHomes Very Good scheme and an income of £145.62 per sq ft. Therefore the EcoHomes was cheaper than the traditional by £5.32 per sq ft.

Based on these construction costs and income levels, the EcoHomes scheme achieved a profit of 33% per sq ft to 27% per sq ft for the scheme built to standard building regulations.

Valuation

Scheme Details

	Scheme Total	Per Unit	Per Sq ft
No of units	80		
Social Average Unit Area (sq ft) note 1a		1045	
Private Average Unit Area (sq ft)		950	
Private Average Sales Price note 1b		£200,504	£193
Social Average Sales Price note 1c		£171,423	£164
Density (units per acre)	14		
Land area (acres)	5.6		
Land cost (per acre)	£1,400,000		
Land cost	£7,840,000		
Gearing	75%		
Cost of Debt Capital	5.5%		
Return of Equity Capital Required	11%		
Construction period (months)	36		
Average sale period (months)	12		
Construction costs (sq ft) note 1d			£53.79
Social units	12		
Private units	68		
% social	15%		
Social construction cost discount note1e	0%		
Social Housing Discount note 1f	15%		

Note 1a Social housing is 10% than average unit sizes to meet Lifetime Homes Standards

Note 1b Based on average sales achieved to-date (Land Registry data) and income per sq ft supplied by developer

Note 1c Based on income per sq ft for the average unit size less 15% discount

Note 1d Supplied by developer

Note 1e No Social Construction Discount Assumed

Note 1f Discount for affordable 85% OMV

Important Note:

DTZ were not granted detailed financial information and have based the above on a number of assumptions and best estimates. DTZ will not accept and responsibility for errors in the calculations above.

Profit and Loss

Profit and Loss			**Scheme Total**	**Per Unit**
Sales - Social Housing	£2,057,080			£171,423
Sales - Private	£13,634,292			£200,504
Total Sales Revenue			**£15,691,372**	**£196,142**
Land (at cost)		**£7,840,000**		
Social Construction Cost	£674,527			
Private Construction Cost	£3,474,834			
Total Construction Cost		**£4,149,361**		
Total Cost			**£11,989,361**	**£149,867**
EBIT			**£3,702,011**	**£46,275**
Debt Interest on land cost	£1,293,600			
Cost of Equity on land cost	£862,400			
Debt Interest on Construction note 1g	£427,903			
Cost of Equity on Construction note 1g	£285,269			
Total Cost of Financing		**£2,583,903**		
Profit after interest before tax			**£1,118,109**	**£13,976**
ROCE note 1h				**7.67%**

Note 1g Construction costs assumed ***straight-lined*** over project

Note 1h Estimated capital employed

Important Note:

DTZ were not granted detailed financial information and have based the above on a number of assumptions and best estimates. DTZ will not accept and responsibility for errors in the calculations above.

NORTHERN REGION

Case Study 5 EcoHomes Scheme Warrington

Background

The development is situated in Warrington and comprises a total of 149 units, ranging from 2 bedroom apartments, terraced town houses and detached 4 bedroom properties. The development was constructed on approximately 9 acres of brownfield land and achieved a density of 16 units per acre.

The dwellings are of traditional brick and block construction and comprise 2 and 3 storey accommodation. The scheme scored 67% and achieved a Very Good rating under the BRE EcoHomes assessment tool.

Performance against assessment criteria and standards

The developer encountered numerous complications during the development process but in terms of the EcoHomes assessment it was the transport section that proved the most detrimental to the overall score, achieving just 14%. The site is not within walking distance of a transport link or local amenities and therefore the development did not score on these criteria.

In terms of other factors that went against the scheme, it failed to meet the recycling requirements because the local borough council had not implemented a recycling scheme. This issue was particularly problematic at the post construction review stage.

BRE encourage developers to consider the BRE assessment at the design stage, in order to maximise the development in relation to the rating system. BRE also recommend the early involvement of a qualified assessor. A number of issues raised by the assessor point ***to a lack of direction and planning in the early design stages***.

For example, the Water section achieved a low score and the assessor noted that specifying water butts and using more water savings devices would have resulted in a higher score. In response, the developer commented that, although water butts had been suggested, "***the scheme had been too far advanced to accommodate them***". A lack of developer commitment to incorporating EcoHomes at the start of the design and specification process produced inefficiencies and inevitably construction costs rose in the absence of sufficient knowledge regarding the EcoHomes process.

In brief the scheme scored high under the Energy section (70%), Pollution and Materials achieved (71%), Land Use and Ecology (67% but Transport achieved just 14%. The high points awarded for the Land Use and Ecology section was at the added expense of employing an ecological consultant who was brought into the project at a late stage and with the aim of salvaging points from those lost on the other criteria mentioned above. Maximum points were gained for ecological enhancement by including a mix of grass types, shrubs, plants and trees, and by providing bird and bat boxes.

Warrington Eco Homes Assessment					
Energy	Ene 1	Carbon Dixoide		5/10	
	Ene 2	Building fabric		4/5	
	Ene 3	Drying space		1/1	
	Ene 4	Ecolabelled goods		2/2	
	Ene 5	External lighting		2/2	70%
Transport	Tra 1	Public transport		0/2	
	Tra 2	Cycle storage		0/2	
	Tra 3	Local amenities		0/2	
	Tra 4	Home office		1/1	14%
Pollution	Pol 1	HCFC Emissions		2/2	
	Pol 2	NOx Emissions		3/3	
	Pol 3	Reduction of surface run off		0/2	71%
Materials	Mat 1	Timber: Basic Building Elements		6/6	
	Mat 2	Timber: Finishing Elements		3/3	
	Mat 3	Recycling facilities		2/6	
	Mat 4	Enviornmental impact of Materials		11/16	
		Roof	3		
		External Walls	3		
		Internal Walls	3		
		Floors - upper and ground	0		
		Windows	2		
		Hardlanscaping	0		
		Fences	0		71%
Water	Wat1	Internal water use		2/5	
	Wat 2	External water use		0/1	33%
Land use and ecology	Eco 1	Ecological value of site		0/1	
	Eco 2	Ecological enhancement		1/1	
	Eco 3	Protection of Ecological Features		1/1	
	Eco 4	Change of Ecological Value fo site		4/4	
	Eco 5	Building footprint		0/2	67%
Health and wellbeing	Hea 1	Daylighting		1/3	
	Hea 2	Sound insulation		3/4	
	Hea 3	Private space		1/1	63%
		Total		**60/89**	67%

Building Costs

The cost of construction was £129 per sq ft. While this is relatively expensive it reflects the additional costs incurred as a result of no site-specific credits and the standards are higher that in similar developments in the local area. The developer estimated that building to EcoHomes Very Good standards cost an extra £2 per sq ft, compared to conventional developments.

Stakeholders views

In contrast to the other two EcoHomes developments considered in this report, the scheme at Warrington was significantly disadvantaged in terms of location and other site-specific factors. As a result the developer found working towards the EcoHomes standards extremely difficult. Unless stipulated as part of the land purchase, the developer would not choose to

build to the EcoHomes standards again. Despite this, the developer commented that they had not needed "***to change any major aspect of the construction to suit EcoHomes***".

The scheme was not marketed as an EcoHomes development. The developer believes consumer awareness of green features is limited with some purchasers responding negatively to the green features included in the schemes. Furthermore, because of the lack of post-occupancy control many home-owners would remove the detachable green features that contributed to the EcoHomes Assessment such as energy saving light bulbs and the tidy drying facilities and replace these with normal light bulbs and tumble dryers.

Valuation

Scheme Details

	Scheme Total	Per Unit	Per Sq ft
No of units	149		
Private Average Unit Area (sq ft) note 1a		939	
Private Average Sales Price note 1b		£167,922	£179
Density (units per acre)	16.55		
Land area (acres)	9		
Land cost (per acre)	£500,000		
Land cost	£4,500,000		
Gearing	75%		
Cost of Debt Capital	5.5%		
Return of Equity Capital Required	11%		
Construction period (months)	40		
Average sale period (months)	18		
Construction costs (sq ft) note 1c			£129.00
Private units	149		

Profit and Loss			**Scheme Total**	**Per Unit**
Sales - Private	£25,020,378			£167,922
Total Sales Revenue			**£25,020,378**	**£167,922**
Land (at cost)		**£4,500,000**		
Private Construction Cost	£18,048,519			
Total Construction Cost		**£18,048,519**		
Total Cost			**£22,548,519**	**£151,332**
EBIT			**£2,471,859**	**£16,590**
Debt Interest on land cost	£897,188			
Cost of Equity on land cost	£598,125			
Debt Interest on Construction note1d	£2,357,588			
Cost of Equity on Construction note1d	£1,571,725			
Total Cost of Financing		**£3,852,900**		
Profit after interest before tax			**-£1,381,041**	**-£9,269**
ROCE note1e				**-5.23%**

Note 1a Based on the average floor area for houses sold - supplied by EP

Note 1b Based on the average net house price for houses sold - supplied by EP

Note 1c Construction cost supplied by developer

Note 1d Construction costs assumed ***straight-lined*** over project

Note 1e Estimated capital employed

Important Note:

DTZ were not granted detailed financial information and have based the above on a number of assumptions and best estimates. DTZ will not accept and responsibility for errors in the calculations above.

In all of the valuations we have estimated gearing at 75%, cost of debt capital at circa 6% (unless told otherwise by developer) and return of equity employed of 11%.

Case Study 6 Non Eco Scheme Warrington

Background

The scheme involved 116 units with a range of unit sizes from 665 sq ft to 2053 sq ft. This case study involved an interview with the developer but rather than describing the case study, the discussion focused on green buildings, green features, attitudes towards 'green living' and approaches taken within the housebuilding industry.

Developers attitude towards green housing design

This developer raised the issue of public awareness and occupier demand for sustainable housing. Attention was drawn to the research by WWF, CABE and HBOS, which provided empirical evidence of interest in sustainable homes. The research revealed that only 16% of the survey would not be prepared to pay extra for green features and that 17% of respondents were prepared to pay as much as 5% more for eco-friendliness.

The developer has created a package of green features, which is being marketed separately from the basic product. The total cost of the green package is £13,500 and the developer estimates that take-up to-date has been about 15%. It requires that a minimum of 7 houses take up the offer to permit the cost of the wind turbine (£7000*7=£49,000). The rainwater recycling relates to the use of rainwater for toilets and the photovoltaic cells and wind turbine would be used to produce electricity.

According to the developer, as a result of increased domestic energy consumption, the production of CO_2 from dwellings has increased by 1% in recent years. With the green features offered by the developer there is the potential to save on energy costs and sell excess energy back to the national grid. The developer estimated that the energy savings would enable a 3.8 year payback time frame.

Cost of Green Features	
	Per dwelling
Rainwater recycling	£2,500
Photovoltaic	£4,000
Wind Turbine	£7,000
	£13,500

The developer raised the issue of the house building industry's minimalist approach to building regulations. The industry tends to be profit driven and costs must fall within certain acceptable parameters (minimum profit margin of over 20%). However, the developer has found that many of the green features are cost effective and does not think that developing to EcoHomes Very Good costs over and above standard building costs.

In terms of laying out a scheme on site the developer does not believe that there are additional costs for EcoHomes schemes as compared to standard building regulations. Developers should design a site so that it maximises the orientation of the site and benefits from a Southerly aspect. This would

enhance the scores available for EcoHomes Assessment but the developer believes that this should be done as a matter of course and not just on EcoHomes sites. Furthermore, the developer argued that the professional fees associated with architects and landscape architects are not higher for EcoHomes schemes. It is up to the developer to define the task for an architect or landscaper and costs will only over run if the task is changed or altered further down the line.

Valuation

Scheme Details

	Scheme Total	Per Unit	Per Sq ft
No of units	116		
Private Average Unit Area (sq ft)		1251	
Private Average Sales Price note1a		£216,198	£173
Density (units per acre)	12.46		
Land area (acres)	9.31		
Land cost (per acre)	£720,890		
Land cost	£6,711,489		
Gearing	75%		
Cost of Debt Capital	6.0%		
Return of Equity Capital Required	11%		
Construction period (months)	24		
Average sale period (months)	12		
Construction costs (sq ft) note1b			£90.49

Profit and Loss			**Scheme Total**	**Per Unit**
Sales - Private	£25,078,948			£216,198
Total Sales Revenue			**£25,078,948**	**£216,198**
Land (at cost)		**£6,711,489**		
Private Construction Cost	£13,131,547			
Total Construction Cost		**£13,131,547**		
Total Cost			**£19,843,036**	**£171,061**
EBIT			**£5,235,912**	**£45,137**
Debt Interest on land cost	£906,051			
Cost of Equity on land cost	£553,698			
Debt Interest on Construction note1c	£1,181,839			
Cost of Equity on Construction note1c	£722,235			
Total Cost of Financing		**£2,641,588**		
Profit after interest before tax			**£2,594,324**	**£22,365**
ROCE note1d				**11.54%**

Note1a Based on average sales prices ***supplied by developer***

Note 1b Construction costs calculated as £19,244,920 less land cost; across units = £90.49 per sq ft

Note1c Construction costs assumed ***straight-lined*** over project

Note1d Estimated capital employed

Important Note:

DTZ were not granted detailed financial information and have based the above on a number of assumptions and best estimates. DTZ will not accept and responsibility for errors in the calculations above.

In all of the valuations we have estimated gearing at 75%, cost of debt capital at circa 6% (unless told otherwise by developer) and return of equity employed of 11%.

Appendix 1

The EcoHomes Assessment Method

The Building Research Establishment Environmental Assessment Method (BREEAM) is a system for measuring the environmental impact of buildings and rates a building performance on a scale of Pass to Excellent.

This rating draws together a comprehensive environmental assessment process that covers various aspects of building performance including management, operational energy, transport, health and well-being, water; materials, pollution and land use and ecology. Each scheme is assessed by a licensed assessor, trained and monitored by BRE. The assessment criteria are grouped under the following headings:

- Energy
- Water
- Pollution
- Materials
- Transport
- Ecology and land use
- Health and well-being

All of the elements are optional and the developer can choose the ones that most suits both circumstances and priorities for environmental improvement. EcoHomes assessments can be carried out at the design stage in a similar way to a SAP rating. Formal certification is carried out by the BRE when all the stages are completed. Every house type on a site is considered, but the award is given for the whole development. This enables the developer to promote the whole site – every house has the same rating.

Although EcoHomes can be used at any time during the design stage, developers are encouraged to consider the issues at the earliest opportunity to maximise the benefits. While the BRE recommend a fee scale, these are at the discretion of the assessor. The assessment does not include detailed advice on how to achieve the best rating, however this service is available for an additional fee.

The Housing Corporation recommend that a Very Good rating be achieved. Homes that are compliant with building regulations will automatically achieve several of the EcoHomes credits. Extra costs associated with achieving a Very Good rating will reduce significantly as building regulations catch-up and consumer awareness of the benefits of building homes with greater environmental performance improves.

BRE EcoHomes Assessment Costs		
Assessor's fee circa £1500-£2000		£1,750
BRE assessment fee		
Schemes >40	£200 per unit	£8,000
Schemes <40	£5 per unit	
Post Construction Review		
BRE fee	£225 per submission	£9,000
Assessor's fee	£100 per unit	£4,000
Estimated cost		£22,750

The above is based on a scheme of 40 units. The estimated cost represents the maximum fee for a development of this size. Fees for a Post Construction Review will vary, as they are acquired as and when units are completed; therefore units are either submitted individually or in groups. Costs will be considerably reduced if an in-house assessor is available to carry out the assessment, as there will be no assessor's fee.

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