

GREEN CONSTRUCTION

Introducing Green Buildings & LEED® to Contractors





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IMAGE AND PHOTO CREDITS

A Case Study Index is provided at the end of the document, listing the consultants involved in each project.

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INTRODUCTION

This resource is designed to help contractors fulfil the requirements of the LEED Green Building Rating System.

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System is, in simplest terms, a method of measuring. It is a voluntary rating system that is used during the building design process to set environmental and human health protection goals. A third-party certification process confirms the project's achievement of the design goals by reviewing documentation collected during the design and construction process.

LEED GREEN BUILDING BENEFITS FOR CONTRACTORS

For contractors, LEED green buildings offer numerous business benefits:

- risk mitigation through consistent and accurate documentation which is required to be submitted for third party verification
- integrated design process reduces the risk of errors, deficiencies and project over-runs
- financial savings through on-site recycling, improved supply cost and management of materials (less waste), preference to local suppliers, and efficient construction techniques
- competitive value through leadership in a rapidly expanding field
- improved business efficiency through required diligent paper work and record keeping

Resources

Information about LEED versions for Canada is available at the web site of the Canada Green Building Council: www.cagbc.org

Information about LEED is available at the web site of the United States Green Building Council: www.usgbc.org

The LEED Green Building Rating System is a voluntary, consensus-based, market-driven green building rating system based upon existing, proven technology. It evaluates performance on a range of ecological and human health protection issues from a whole building perspective over a building's life cycle, providing a definitive standard for what constitutes a "green building".

LEED Certification Levels	
LEED Level	Credit Points
LEED Platinum	52+
LEED Gold	39-51
LEED Silver	33-39
LEED Certified	26-32

HISTORY OF LEED

In the early 1990s, a need was identified for a green building rating tool flexible enough to suit the many types and sizes of building projects. The tool would weigh all of the potential variables across the building industry and produce a standardized rating system to affirm and encourage green building.

The LEED Green Building Rating System emerged through the efforts of the United States Green Building Council (USGBC), founded in 1993. The USGBC is a coalition of leaders from across the building industry working to promote buildings that are environmentally responsible, profitable, and healthy places to live and work. The LEED Green Building Rating System was launched as LEED 1.0 in 1998. LEED 2.0 was launched in 2000, and LEED 2.1 in 2002. Since then, the need for LEED standards for different building types has been identified, and the LEED family of rating systems is growing (see table on page 7).

The Canada Green Building Council (CaGBC) was established in 2002 and is following a similar model to that of the USGBC.

PURPOSE OF LEED

LEED was structured to assess many types of projects, from small to large, from rural to high density urban, from the initial property purchase to the occupancy of the building, from major renovations to new buildings. To be flexible, the scoring system has both required credits (prerequisites) and elective credits (see table below). Each elective credit offers one or more credit points. The elective credits offer many categories and options from which to choose the best combination of credit points to suit the type, scale and direction of a project. Therefore, contractors and trades can expect to be involved in some categories and not in others, and can expect the combination of strategies used to be different for every project.

LEED OPPORTUNITIES

Now is the time to get involved at the very start of this transformation within the construction industry. Since its founding in 1993, USGBC membership has grown to more than 5000 organizations. The number of LEED registered projects has grown to 2,087 since 1998. Locally, the first LEED building in British Columbia was certified in 2002.

A particularly important consideration for contractors and trades is the number of private and public clients which have required LEED certification for one or more projects. Across Canada, numerous cities require LEED certification on current projects. A list of LEED clients is included in the LEED Project List in Appendix A.

In the LEED system, there are seven prerequisites and 70 elective credits, grouped into six credit categories.

ABBREVIATION	CREDIT CATEGORY	NUMBER OF PREREQUISITES	NUMBER OF POINTS AVAILABLE
SS	Sustainable sites	1	14
WE	Water Efficiency	0	5
EA	Energy & Atmosphere	3	17
MR	Materials & Resources	1	14
EQ	Indoor Environmental Quality	2	15
ID	Innovation & Design Process	0	5
TOTAL		7	70

VERSIONS OF LEED

As shown in the table below, there are many versions of LEED, including six versions administered by the USGBC and two Canadian versions administered by the CaGBC. The launch date for each version is shown. As of the end of 2004, Canadian projects will use LEED Canada-NC 1.0.

ABBREVIATION	FULL NAME OF VERSION	LAUNCH DATE	INFORMATION
LEED-NC v2.1	LEED for New Construction – new construction and major renovation projects.	2003	www.usgbc.org
LEED-CI	LEED for Commercial Interiors – this companion standard for LEED Core and Shell rates tenant improvements.	2004	www.usgbc.org
LEED-H	LEED for Homes – single-family and low-rise multi-family residences.	2005	www.usgbc.org
LEED-EB	LEED for Existing Buildings – operations and maintenance phase of buildings' life cycle.	2004	www.usgbc.org
LEED-CS	LEED for Core and Shell – this companion standard for LEED for Commercial Interiors rates the core and shell of buildings with leased space.	2005	www.usgbc.org
LEED-ND	LEED for Neighborhood Developments – integrates green building and smart growth.	2005	www.usgbc.org
LEED Canada-NC 1.0	LEED for Canada (CaGBC) – for Canadian new construction and major renovation.	2004	www.cagbc.org
LEED-BC	LEED for British Columbia (CaGBC) (being phased into LEED Canada) – for British Columbia new construction and major renovation.	2004	www.cagbc.org

LEED TERMS

LEED Reference Guide: This 400+ page book gives information on the LEED System and green construction techniques involved in capturing LEED credit points. It can be ordered online at www.cagbc.org.

LEED Accreditation: Individuals in the construction industry may become LEED Accredited Professionals by passing the LEED Exam (see sidebar on next page). A list of Accredited Professionals is posted on both the CaGBC and USGBC websites. One credit point is captured by having a LEED Accredited Professional on a project team.

LEED Coordinator: A LEED project needs one individual, called a LEED Coordinator, who is appointed by the project team. Their role is to advance the LEED process in general and oversee the collation of the necessary documentation and its submission to the CaGBC or USGBC. Additionally, a contractor may choose to identify one staffperson to champion the contractor's LEED-related work on a project. This contractor-appointed LEED champion works in cooperation with the overall LEED Coordinator on the project.

LEED Consultant: A project team may include a LEED Consultant whose role is to advise the team on ways to capture LEED points.

Integrated Design Process: An Integrated Design Process gathers the knowledge of all the designers and builders together in design meetings called charrettes early in the project. Synergies between the different design strategies (for example, using site and orientation to maximize solar benefits) can be more easily achieved when initial goal-setting meetings involve all the expertise available in the team.

LEED Score Card: The Score Card is a one-page summary table showing which of the 70 possible LEED credit points are being pursued in a given project (see Appendix B).

By August 2005, there were:

- more than 19,600 LEED Accredited Professionals
- more than 2230 LEED Registered projects
- more than 275 LEED Certified projects

The LEED Canada Accredited Professional Exam is a one-hour and 45-minute, computer-administered exam that includes 78 multiple-choice questions. Candidates study the LEED Reference Guide and green building information suggested by the Guide. Optionally, candidates may choose to attend a LEED workshop (see sidebar, page 8).

For more information, visit www.ca gbc.org

LEED Registration: After the decision has been made to design a building using the LEED Green Building Rating System, a member of the design team may register the project with CaGBC. This costs a few hundred to a few thousand dollars depending on the size of the project, and gives the design team access to technical guidance by independent LEED experts. The name and information for each registered project is posted on the CaGBC web site.

In October 2004, the CaGBC began accepting registrations for LEED Canada projects.

LEED Letter Templates: A LEED Letter Template is a spreadsheet completed by an appropriate member of the project team, used to summarize and verify information indicating that the requirements for a prerequisite or credit point have been met (see examples in Toolkit section of this guide).

LEED Binder: A LEED Binder, containing appropriate LEED Letter Templates for all LEED Credits sought, is part of the application package submitted to the USGBC or CaGBC in the process of getting a building certified.

LEED Certification: When a LEED project is complete a member of the design team applies for certification by sending the project's electronic LEED letter templates to the CaGBC or USGBC along with binders. The submission is assessed by a committee of LEED experts appointed by USGBC or CaGBC and all admissible points are confirmed. A random review of LEED points is done, and the supporting documentation for several randomly selected credits and any credits with outstanding issues/questions is requested to be submitted by the team. This back-up must be submitted prior to a final review by the adjudicators determining whether the project attains LEED certification and at what level.

NOTE: Buildings are LEED Certified, people are LEED Accredited.

PURPOSE OF THIS GUIDE

This resource assists contractors and trades to gain a general understanding of how to make LEED part of their standard business practice as methods of construction become greener across the country.

LEED is too broad and too flexible a tool for this guide to provide an answer for every trade in every situation. The materials included in this guide were selected as useful examples relating to frequently attempted credits. Some of the included forms and information sheets can be replicated and used immediately. Others can be adapted to the needs of specific projects.

CASE STUDY

Stratus is a new 1,870 m² wine making facility located in Niagara-on-the-Lake, Ontario, Canada. The demolition of an old poultry farm and associated buildings was carried out with re-use and recycling of the materials in mind. Even the existing Quonset hut was stripped down carefully to allow it to be re-used on another site. Great care was taken during construction to minimize the disturbance of the surrounding environment by establishing a soil erosion and sedimentation control plan, carefully monitored by the project and construction managers.



Photo Credit: Stratus Vineyards

The LEED Reference Guide is a 400+page manual that offers full information and further resources for implementing green construction using the LEED system. It can be ordered online at www.cagbc.org

LEED workshops are recommended as a way of gaining a better appreciation of how LEED includes all members of the design and construction industry.

To find out about upcoming scheduled LEED workshops, visit:

www.cagbc.org

Upon request, the CaGBC can provide private workshops for in-house company training.

This guide provide answers to the questions shown:

Involvement (pages 9 to 31)

- How does the contractor get involved with a LEED project?
- How is that involvement contractually structured?
- Which LEED credit points are likely to involve the contractor?
- Which Construction Index Divisions are likely to have LEED implications?
- How is a LEED culture developed on the job site?
- How is LEED documentation streamlined?
- How is a LEED Letter Template used?

Toolkit (pages 32 to 71)

- How are the following LEED issues addressed and documented by the contractor?
Sample plans and forms are included for:
 - Erosion and Sedimentation Control
 - Construction Waste Management
 - Material Selection and Procurement
 - Indoor Air Quality during Construction

INVOLVEMENT OF CONTRACTORS AND TRADES

WHY GET INVOLVED?

From a pragmatic point of view, the simple answer is that increasingly construction project clients are requiring a better solution to design and construction. A listing of LEED projects can be seen in Appendix A. From a global perspective, the days of inexhaustible resources, materials, and energy are rapidly ending. Interestingly, a whole market for building demolition and material reuse and salvage is changing the construction landscape, and many projects are actually making money from their waste.

HOW TO GET INVOLVED?

Without question, the best way to learn the LEED game is to be on a team. Active collaboration at the early stages in a project design through an Integrated Design Process between clients, designers and contractors has proved to be the optimal way for most projects to reach their highest scores, as well as to maximize benefits and minimize risk through greater control on buildability. It is also the quickest way to learn to apply the LEED processes and thinking. As a result of the free exchange of good ideas and direct feedback made possible by having all players participating together, the most effective solutions are discovered. This is also the best way to find capital cost efficiencies and ensure that a green building can be cost effective in both the short and long-term.

The degree and timing of the participation of contractors and trades influences their opportunity to know the “how and why” of the choices and decisions directing the project. Because the majority of the points on the LEED score card are elective and are selected to best reflect the type and design objectives of the specific building, these can change project to project. It is not like repeatedly conforming to a prescriptive list of requirements normally expected from a Building Code or from a standard trade practices manual. Being involved early aids in understanding which points apply to different types of LEED projects. This knowledge helps contractors and trades manage LEED-related resources and paperwork, make valuable contributions to LEED projects, resolve challenges, and mitigate risk.

TYPES OF INVOLVEMENT

The involvement of contractors and trades will vary from company to company and within the various contractual arrangements.

TENDERED FIXED PRICE

It is certainly possible for a knowledgeable design team to document and specify a project in a LEED format and to manage the project within the traditional CCDC2 General Contract / BCCA 200 Sub-Contract procedures. However, unless a contractor has previous LEED experience this can be a somewhat risky method of getting involved. If the tender is overbid to meet the requirements of the specification, the contractor will not be the low bidder; if underestimated, the contractor will bear the cost – and there are likely to be some extra documentation and management costs, especially when using LEED for the first time. Stipulated Sum agreements do not recognize ‘not knowing’ as an excuse.

Secondly, being in a Fixed Price circumstance typically does not encourage contractors and trades to volunteer good ideas or alternative solutions to the Client. The Contract language is just not conducive to encouraging a free exchange of ideas, the ‘give and take’ necessary to encourage the kind of thinking needed for a successful green building project.

Therefore, the CCDC2 / BCCA 200 approach is not optimal. Nevertheless, this guide will provide some background to make it easier to understand the program’s intent and then to weigh the amount of education, research, and/or effort each company may wish to undertake.

DESIGN/BUILD, OR CM AND/OR PM APPROACHES

Acting as the Design/Build contractor or Construction Project Manager is another way to participate openly since both are structured to be consultative and sequential arrangements. They provide a contractual vehicle for the contractor and certainly the major trades to be involved earlier, often on a fee-for-service basis. As the Design/Builder or Construction Manager is often retained at the same time or even before the design team, this format clearly brings all of the major players onto the project early, and into a collaborative integrated design process.

FREE ADVICE

All contractors and trades provide designers and owners with free advice on cost or buildability from time to time, with voluntary assistance being a keystone to good owner/contractor or trade/contractor relationships. This is a less risky and a less formal method of getting involved in LEED for a contractor who has the time and the inclination to participate. By participating in preliminary project working sessions, an understanding can be gained of how LEED considerations come together in the early days of a project's creation.

WHICH IS THE BEST ARRANGEMENT?

The type of involvement which the contractor will find most advantageous depends on the type of project and the specific abilities of the contractor. A contractor well versed in LEED projects may be suited to a tendered fixed price arrangement. One who is relatively new to LEED may find a Design/Build or CM and/or PM approach more appropriate. Any contractor with a desire to learn more about LEED can gain experience participating on a LEED team by providing free advice.

ROLES OF BUILDERS WORKING ON LEED PROJECTS

The builders' roles on LEED projects can be discerned by referring to the LEED Score Card, which is a one page Project Checklist. It records those required credits and elective categories which the team can choose to apply to any project. A copy of the basic Score Card is given in Appendix B, and an annotated version is shown on the following pages with a discussion of the seven required and 70 possible points. An indication is given as to which categories and to what extent a contractor might normally expect to be involved, while recognizing that every project is unique.

Prerequisite Items: It is important to notice that there are seven (7) required items which all LEED buildings must incorporate. These prerequisite actions reflect the belief that all seven are so fundamental to energy efficiency and ecological and human health protection that without them, no project can be considered sustainable. Builders would be involved in two (2) of these prerequisites:

1. **Erosion and Sedimentation Control (SS P1):** The Erosion and Sedimentation Control requirements within most of the municipalities in Canada already meet this credit. It requires nothing that has not already been required in the Lower Mainland – wheel wash for trucks, filter medium in run-off trenches, clearance from streams and so on. The only difference is that for LEED, these actions are documented.
2. **Fundamental Building Systems Commissioning (EA P1):** Most builders are involved in the commissioning of a building. This prerequisite requires the involvement of a Commissioning Authority whose implementation plan formalizes the normal practice somewhat. The contractor and the systems trades would collaborate with that Agent and it is the Agent who produces the additional documentation for LEED.



Photo Credit: Enrico Dagostini

CASE STUDY

White Rock Operations Centre (2003, 608 m²): This LEED Gold civic administration building in the City of White Rock, BC, was the second building to be LEED certified in Canada. Among many other green goals, the project diverted over 97% of its demolition and construction waste.

Documentation, Documentation, Documentation: There is a theme throughout LEED – documentation. If the project claims a point in any category, it must have the paperwork to prove it. Assembling the necessary evidence for the LEED submission (which normally occurs shortly after occupancy) is an ongoing effort and cannot be postponed until the end of the construction schedule. It is not an ‘As-Built’; it is a continuous trail of compiled evidence.

An example: typically the plumber will diligently collect all scraps of copper piping and recycle it. LEED only asks that the plumber provide the contractor and the LEED Coordinator with a way slip from the Recycling Depot for each load as proof.

Documentation collation is the one area within the LEED approach where it is likely that builders will either underestimate or overestimate costs. The additional paperwork may at first seem daunting. However, as with many of the usual contractual requirements – WCB forms, Statutory Declarations, Certificates of Payment – LEED documentation quickly becomes routine. The CaGBC is aware of the need to streamline documentation work as much as possible, and has made significant improvements, learning from the experience of people who have undertaken LEED projects.

The one piece of advice given by all those who have previously participated in a LEED project is “never get behind”! On the bright side, remember that the LEED Coordinator will be compiling and submitting all of the documentation, not the contractor or trade.

The following pages will review the elective points within the LEED Score Card. Bearing in mind that these will vary with each project as different credit points are chosen, what follows is an indication of how the typical builder is likely to be involved and to what extent.

CONTRACTOR INVOLVEMENT FOR EACH LEED POINT

This section presents an expanded LEED Score Card (the original LEED Score Card is provided in Appendix B), listing each LEED prerequisite and credit point. The abbreviated codes for the prerequisites and credits are shown, along with a phrase describing each point. To the right of each credit is a commentary column summarizing or highlighting the usual involvement or responsibility of contractors and trades. A detailed review of the original Score Card and/or the LEED guideline documents is highly recommended. A free, downloadable copy of the LEED Canada Rating System summary is available at www.cagbc.org. A copy of the LEED Rating System is available at www.usgbc.org.

Those activities normally carried through by other members of the project team are shown in grey. They are included here because as team players, the contractor and trades can perform their roles better with an awareness of how their actions fit within the overall strategy.

SUSTAINABLE SITES

CODE	CREDIT	CONTRACTOR'S INVOLVEMENT
SSp1	Erosion & Sedimentation Control	Make wheel washing arrangements, provide filter medium in runoff trenches, ensure clearance from streams, collate construction records, maintain photo records.
SSc1	Site Selection	By others
SSc2	Development Density	By others
SSc3	Redevelopment of Contaminated Sites	Participate / manage existing site cleanup and remediation, collate records, maintain photo record, gather way slips.
SSc4.1	Alternative Transportation Public Transportation Access	By others
SSc4.2	Alternative Transportation Bicycle Storage & Changing Rooms	By others, construct only.
SSc4.3	Alternative Transportation Alternative Fuel Vehicles	By others, construct only.
SSc4.4	Alternative Transportation Parking Capacity	By others, construct only.
SSc5.1	Reduced Site Disturbance Protect or Restore Open Space	Participate / manage limits of work area, maximum 40' from building face, 5' from roadways, collate construction records, maintain photo records.
SSc5.2	Reduced Site Disturbance Development Footprint	Reduce building footprint, by others, construct only.
SSc6.1	Stormwater Management Rate and Quantity	Participate in investigating methods to reduce run-off such as retention systems, coordinate with landscape architect, construct.
SSc6.2	Stormwater Management Treatment	Participate / investigate methods to recycle water including natural retention / filtration systems, coordinate with landscape, construct.
SSc7.1	Heat Island Effect Non-Roof	Participate / investigate design methods and selection of non-heat absorptive materials such as tree shading, paving materials, colours, reflectivity, etc.

SSc7.2	Heat Island Effect Roof	Participate / investigate / select non-heat absorptive roofing materials, construct, complete data sheets.
SSc8	Light Pollution Reduction	By others, construct only, complete data sheets.
WATER EFFICIENCY		
WEc1.1	Water Efficient Landscaping Reduce by 50%	By others, construct only, take photographs.
WEc1.2	Water Efficient Landscaping No Potable Use or No Irrigation	By others, construct only.
WEc2	Innovative Wastewater Technologies	Participate / investigate / select low volume fixtures and/or grey water fixtures and/or on-site treatment equipment, construct, maintain photo records, collate data sheets.
WEc3.1	Water Use Reduction 20% Reduction	Similar to WE-2, by others, construct only, documentation done by others.
WEc3.2	Water Use Reduction 30% Reduction	Similar to WE-2, by others, construct only, documentation done by others.
ENERGY & ATMOSPHERE		
EAp1:	Fundamental Building Systems Commissioning	Agent of others, cooperate as usual only.
EAp2:	Minimum Energy Performance	By others, cooperate, construct only.
EAp3:	CFC Reduction in HVAC&R Equipment	By others, cooperate, construct only.
EAc1	Optimize Energy Performance	By others, cooperate, construct only.
EAc2.1	Renewable Energy 5%	By others, cooperate, construct only.
EAc2.2	Renewable Energy 10%	By others, cooperate, construct only.
EAc2.3	Renewable Energy 20%	By others, cooperate, construct only.
EAc3	Best Practice Commissioning	Agent of others, additional cooperation typical, provide additional documentation.
EAc4	Ozone Protection	By others, cooperate, construct only.
EAc5	Measurement & Verification	Provide long-term continuous measurement of consumption performance, agent of others.
EAc6	Green Power	Contract (2 year term) for power from 'green' sources, by others.
MATERIAL & RESOURCES		
MRp1:	Storage & Collection of Recyclables	Designate building area for occupant recycling, establish program, construct only.
MRc1.1	Building Reuse Maintain 75% of Existing Walls, Floors, and Roof	Design / selections by others, cooperate in selective demolition, collect salvaged and recycled materials way slips.
MRc1.2	Building Reuse Maintain 95% of Existing Walls, Floors, and Roof	Design / selections by others, cooperate in selective demolition, collect salvaged and recycled materials way slips.
MRc1.3	Building Reuse Maintain 50% of Interior Non-Structural Elements	Design / selections by others, cooperate in selective demolition, salvaged and recycled materials way slips.

MRc2.1	Construction Waste Management Divert 50% from Landfill	Establish strategy, enforcement program, sorting area, identify qualified haulers and handlers, collect monthly disposal way slips, do documentation and analysis.
MRc2.2	Construction Waste Management Divert 75% from Landfill	Establish strategy, enforcement program, sorting area, identify qualified haulers and handlers, collect monthly disposal way slips, do documentation and analysis.
MRc3.1	Resource Reuse 5%	Design / selections by others, cooperate in sourcing salvaged and refurbished products, complete data sheets.
MR-3.2	Resource Reuse 10%	Design / selections by others, cooperate in sourcing salvaged and refurbished products, complete data sheets.
MRc4.1	Recycled Content 7.5% (post-consumer + ½ post-industrial)	Design / selections by others, cooperate in sourcing recycled products, complete data sheets.
MRc4.2	Recycled Content 15% (post-consumer + ½ post-industrial)	Design / selections by others, cooperate in sourcing recycled products, complete data sheets.
MRc5.1	Regional Materials 10% Extracted and Manufactured Regionally	Design / selections by others, cooperate in sourcing local building products, complete data sheets
MRc5.2	Regional Materials 20% Extracted and Manufactured Regionally	Design / selections by others, cooperate in sourcing locally extracted products, complete data sheets.
MRc6	Rapidly Renewable Materials	Specification / selections by others, cooperate in sourcing renewable material, complete data sheets.
MRc7	Certified Wood	Specification / selections by others, cooperate in procuring Forest Stewardship Council certified wood, complete data sheets.
MRc8	Durable Building	
INDOOR ENVIRONMENTAL QUALITY		
EQp1:	Minimum IAQ Performance	Specification / selections by others, construct only.
EQp2:	Environmental Tobacco Smoke (ETS) Control	Building management policy.
EQc1	Carbon Dioxide (CO ₂) Monitoring	Specification by others, construct only.
EQc2	Ventilation Effectiveness	Design and specification by others, construct only.
EQc3.1	Construction IAQ Management Plan During construction	Meet/exceed SMACNA, protect materials from moisture, replace all filters (MERV 13) before occupancy. Record, sample, photo.
EQc3.2	Construction IAQ Management Plan Testing Before occupancy	Schedule and document a two (2) week pre-occupancy fresh air “flush” of the building or conduct baseline tests, record, sample, take photographs.
EQc4.1	Low-Emitting Materials Adhesives & Sealants	Meet specific VOC limits, cooperate in product selections, complete data sheets.
EQc4.2	Low-Emitting Materials Paints and Coating	Meet / exceed specific VOC limits, cooperate in product selections, provide data sheets.
EQc4.3	Low-Emitting Materials Carpet	Meet / exceed specific limits, cooperate in product selections, provide data sheets.

EQc4.4	Low-Emitting Materials Composite woods and Laminate Adhesives	Prohibit urea-formaldehyde resins, cooperate in product selections, provide data sheets.
EQc5	Indoor Chemical & Pollutant Source Control	Designate and design ventilation and other programs to prevent indoor air pollution, by others, construct only .
EQc6.1	Controllability of Systems Perimeter Spaces	Building and systems design by others, construct only .
EQc6.2	Controllability of Systems Non-Perimeter Spaces	Building and systems design by others, construct only .
EQc7.1	Thermal Comfort Compliance	Comply with ASHRAE 55-1992, systems design by others, construct only .
EQc7.2	Thermal Comfort Monitoring	Install permanent monitoring system, systems design by others, construct only .
EQc8.1	Daylight & Views Daylight 75% of Spaces	Design geometry by others, construct only .
EQc8.2	Daylight & Views Views 90% of Spaces	Design geometry by others, construct only .
INNOVATION & DESIGN PROCESS		
IDc1 – 4	Innovation in Design An opportunity to get up to four (4) points for exceptional and/or innovative performance for new and good ideas not otherwise addressed.	Participate in design think sessions and contribute alternative ideas.
IDc5	LEED Accredited Professional	Include LEED Accredited Professional in Design Team

CONTRACTOR INVOLVEMENT BY CONSTRUCTION DIVISION

Most contractors are comfortable working within the context of the industry's specification codes. Therefore, the following chart is provided to broadly reflect the types of work that may result within each of the 16 Division Categories. Construction works not likely to have LEED impacts are shown in grey.

Think of the following table as a crosscheck for the previous section, with I6 Division format on the left and LEED Credit references to the right. Note however, that some credits are applicable for a number of divisions. For example, all trades are involved in Credit MR 2, construction waste management / cleanup, or MRc5, local/regional materials, so these credits are not repeatedly mentioned.

When specifications are written for LEED projects, three main LEED specification strategies are used:

- either all LEED related provisions are grouped in section 01350, or
- LEED related provisions are built into all relevant sections, or
- some combination of both approaches.

SECTION NUMBER	SECTION NAME	ACTIVITY/STRATEGY	CREDIT
010000	GENERAL REQUIREMENTS:		
010100	Project Staff and Expenses	Record and document any staff time and costs associated with LEED efforts.	most
011000	Monthly Site Costs	Document costs to separate and dispose of construction waste.	MRc2
012000	Fixed Site Costs		
013000	Temporary Services		
014000	Weather Conditions		
015000	Equipment	Record rental or amortized costs for air quality testing equipment.	EQc3
020000	SITWORKS:		
020500	Demolition	Document sorting and salvage of material for reuse.	MRc1 MRc2
		Document sorting and disposal of material to recycling depot.	
020800	Hazardous Material Abatement	Document and photograph decontamination procedures.	SSc3
021000	Site Preparation	Limit site disturbance, provide wheel wash, etc.	SSc5

021400	Dewatering	Install and document stormwater management systems.	SSc6
021500	Shoring and Underpinning	Limit site disturbance.	SSc5
021700	Cofferdams	Install and document stormwater management systems.	SSc6
022000	Earthwork	Limit site disturbance, install stormwater swales and berms, install retention ponds for irrigation, consider alternative greywater recycling systems, and consider tertiary treatment sewage.	SSc5 SSc6 WEc1 WEc2 WEc3
025000	Paving and Curbs	Configure to maximize stormwater retention with permeable materials.	SSc6
026000	Site Services	Reduce domestic and sanitary service diameters through negotiation with municipality.	SSc6 WEc1
027000	Foundation Drains	Consider connection to stormwater management for irrigation.	SSc6
028000	Site Improvements		
029000	Landscaping and Irrigation	Choose indigenous planting and use of compost and mulch, eliminate irrigation, and manage run-off with retention and bioswales, possibly combine with greywater system.	SSc6 SSc7 WEc1 MRc3
030000	CONCRETE:		
030010	Concrete	Maximize flyash and salvaged aggregates.	MRc3
030050	Concrete Forming Materials	Maximize use of recycled formwork.	MRc4 MRc2
031050	Formwork Labour	Separate and salvage forms / wood.	MRc2
032000	Concrete Reinforcement	Select and procure recycled rebar.	MRc3
033000	Concrete Placing		
034000	Concrete Finishing	Choose low VOC sealants.	EQc4
035000	Special Concrete Finish	Note time required to cure / finish / strip high flyash concrete.	MRc3
036000	Concrete Access.		
037000	Grout	Choose low VOC grout.	EQc4
038000	Concrete Restoration and Cleaning	Record time and costs for building reuse.	MRc1 and 2
039000	Precast Concrete		
040000	MASONRY:		
042000	Unit Masonry	Document percentage of recycled or salvaged masonry units.	MRc2 and 3
044000	Exterior Stone	Document percentage of recycled or salvaged stone.	MRc2 and 3

045000	Masonry Restoration and Cleaning	Record time and costs for building reuse or salvage.	MRc1 and 2
050000	METALS:		
051000	Structural Steel and Joists	Document percent recycled or salvaged.	MRc2 and 3
051600	Geodesic Structures / Space Frames		
053000	Metal Decking	Document percent recycled or salvaged.	MRc2 and 3
055000	Metal Fabrications	Document percent recycled or salvaged.	MRc2 and 3
057000	Ornamental Metals	Document percent recycled or salvaged.	MRc2 and 3
058000	Expansion Joints		
060000	WOOD AND PLASTICS:		
061000	Rough Carpentry	Document percentage recycled or salvaged and use certified wood.	MRc2 and 3 MRc7
061700	Prefab. Structural Wood/Timbers	Document percentage recycled content, limit VOC adhesives and finishes, use certified wood, and avoid urea formaldehyde.	MRc4 EQc4 MRc7
062000	Finish Carpentry	Document percentage recycled content, choose rapidly renewable material, use certified wood, limit VOC adhesives and finishes, and avoid urea formaldehyde.	MRc4 MRc6 and 7 EQc4
064000	Architectural Woodwork	Document percentage recycled content, choose rapidly renewable material, use certified wood, limit VOC adhesives and finishes, and avoid urea formaldehyde.	MRc4 MRc6 and 7 EQc4
066000	Plastic Fabrications	Avoid VOC adhesives and finishes, choose products with recycled content and record percentage.	EQc4 MRc4
070000	THERMAL/MOISTURE PROTECTION		
071000	Waterproofing	Choose low VOC material if exposed to indoor air.	EQc4
071500	Damproofing	Choose low VOC material if exposed to indoor air.	EQc4
072000	Insulation	Choose low VOC if exposed to indoor air, choose insulation with recycled content, and choose rapidly renewable materials.	EQc4 MRc4 MRc6
072150	Sprayed Thermal Insulation	Document recycled content and choose rapidly renewable material.	MRc4 MRc6
072500	Sprayed Fireproofing	Avoid VOC.	EQc4
072700	Fire-stopping		

073000	Shingles and Roofing Tiles	Choose certified wood, choose reflective material to reduced heat island effect, select for recycled content, and choose salvaged material.	MRc6 and 7 SSc7 MRc4 MRc3
074000	Preformed Roofing/Siding	Record percentage recycled content, choose reflective material to reduced heat island effect, select for recycled content, and choose salvaged material.	MRc4 EQc4 MRc3
075000	Membrane Roofing	Choose reflective material to reduced heat island effect, select for recycled content, choose salvaged material, and choose a “green” roof.	MRc4 SSc6 and 7 MRc3
075700	Traffic Coatings		
077000	Roof Specialities and Accessories	Choose “green” or reflective roofing, record recycled content.	SSc6 and 7 MRc4
078000	Skylights	Integrate into natural venting system and as a component in natural light and views, record recycled content and energy efficiency.	EQc7 EQc8
079000	Caulking/Sealants	Avoid or limit VOC content.	EQc4
080000	DOORS AND WINDOWS:		
081000	Metal Doors and Frames	Document percentage of recycled content and use salvaged where possible.	MRc4 MRc3
082000	Wood Doors and Frames	Use certified wood and use salvaged where possible.	MRc4 MRc6 and 7
083000	Special Doors		
084000	Entrances and Storefronts	Document percentage recycled content, use salvaged where possible, and avoid or limit VOC content in sealants or gaskets.	MRc3 MRc4 EQc4
085000	Metal Windows	Document percentage recycled content, use salvaged where possible, avoid or limit VOC content in sealants or gaskets.	MRc3 MRc4 EQc4
086000	Wood and Plastic Windows	Document percentage recycled content, use salvaged where possible, and avoid or limit VOC content in sealants or gaskets.	MRc3 MRc4 EQc4
087000	Hardware	Record recycled content.	MRc4
088000	Glass and Glazing	Document percentage recycled content, and avoid or limit VOC content in sealants or adhesives.	MRc4 EQc4

088500	Glazed Aluminium Railings	Document percentage recycled content, use salvaged where possible, avoid or limit VOC content in paints and adhesives.	MRc3 MRc4 EQc4
089000	Curtain Wall	Document percentage recycled content, select glazing with high energy efficiency, consider access to daylight and views, and avoid or limit VOC content in sealants or adhesives.	MRc4 EAc1 to EAc10 EQc8 EQc4
<hr/>			
090000	FINISHES:		
092000	Lath, Plaster and Stucco	Avoid or limit VOC content.	EQc4
092500	Steel Stud and Drywall	Document percentage recycled content, and document construction waste disposal.	MRc4 MRc2
092600	E.I.F.S.		
093000	Tilework	Choose low VOC grout, and choose salvaged tile if possible.	EQc4 MRc3
094000	Terrazzo	Document recycled content, choose salvaged material if possible, and choose low VOC grout / cement.	MRc3 MRc4 EQc4
095000	Ceilings	Document percentage recycled content, choose rapidly renewable tile material, and avoid or limit VOC content.	MRc4 MRc6 EQc4
095400	Special Wall Treatment	Document percentage recycled content, choose rapidly renewable material, and avoid or limit VOC content.	MRc4 MRc6 EQc4
095500	Wood Flooring	Document percentage recycled content, choose rapidly renewable material, avoid or limit VOC content, and use certified wood.	MRc3 MRc6 and 7
096000	Interior Stone	Document percentage recycled content, use local/regional materials, and select salvaged stone.	MRc3 and 5
096500	Resilient Flooring	Document percentage recycled content, avoid or limit VOC content in tiles and adhesives, use rapidly renewable material (cork, linoleum, etc).	EQc4
096800	Carpet	Document percent recycled or salvaged, avoid or limit VOC content in carpet and adhesives, and select salvaged material if possible.	MRc2 and 3 EQc4

097000	Special Flooring	Choose rapidly renewable material, choose certified wood, and select salvaged material if possible.	MRc3 and 4 MRc7
099000	Painting	Avoid or limit VOC content in carpet, and select for recycled content.	EQc4 MRc4
099100	Sandblasting	Control / contain dust, document for IAQ plan.	EQc3
099500	Wall Coverings	Avoid or limit VOC content in coverings and adhesives, choose products with recycled content, and select for rapidly renewable materials.	EQc4 MRc4 MRc6
100000	SPECIALITIES:		
101000	Visual Display Boards		
101500	Compartment and Cubicles	Avoid or limit VOC content in materials and adhesives, select wood products or agrifibres with no added urea formaldehyde, choose rapidly renewable material, and use salvaged material.	EQc4 MRc3 MRc5 MRc6
102000	Louvres and Vents	Choose products with high energy efficiency and maximize controllability of systems.	EAc1 to 10 EQc8 EQc6
102600	Wall and Corner Guards		
102700	Access Flooring	Choose products which enhance controllability of systems and ventilation effectiveness.	EQc6 EQc2
102900	Pest Control	Choose non-toxic medium (diatomaceous soils, etc.)	
103000	Fireplaces	Choose products which enhance controllability of systems and energy efficiency.	EQc6 EAc1 to 10
103500	Flagpoles		
104000	Identifying Devices		
105000	Lockers	Choose salvaged/reused if possible, choose certified wood, choose products with recycled content, and choose rapidly renewable material.	MRc3 MRc7 MRc4 MRc6
105200	Fire Protection Specialities		
105300	Awnings/Canopies	Configure for passive solar and vent control, and consider in the controllability of systems.	EQc8 EQc6
105500	Postal Specialities		
106000	Demountable Partitions	Use salvaged systems or select for future salvageability, select rapidly renewable materials, and document recycled content.	MRc3 MRc4 MRc6

106500	Operable Partitions		
106700	Storage Shelving	Avoid urea formaldehyde, choose rapidly renewable material, and use certified wood.	EQc4 MRc6 MRc7
107500	Telephone Enclosures		
108000	Toilet and Bath Access.	Select water efficient fixtures.	WEc3
109000	Wardrobe and Closet Spec.	Avoid urea formaldehyde, choose rapidly renewable material, and use certified wood.	EQc4 MRc6 MRc7
110000	EQUIPMENT:	Select for highest energy efficiency, and do not use CFCs, HCFCs, Halons.	EAc1 to 10 EAc4
120000	FURNISHINGS:		
121000	Artwork		
123450	Laboratory Casework	Document percent recycled or salvaged, avoid or limit VOC in materials, avoid urea formaldehyde, select rapidly renewable material, and use certified wood.	MRc2 and 3 EQc4 EQc4 MRc6 MRc7
123700	Residential Cabinets	Document percent recycled or salvaged, avoid or limit VOC in materials, avoid urea formaldehyde, select rapidly renewable material, and use certified wood.	MRc2 and 3 EQc4 EQc4 MRc6 MRc7
125000	Window Treatment	Select for passive solar gains, vent controls, and controllable systems.	EQc8 EQc6
126000	Furniture	Avoid or limit VOC in materials, use no urea formaldehyde, select rapidly renewable materials, use certified wood, and use salvaged furniture if possible.	EQc4 MRc3 MRc6 MRc7 MRc3
126700	Foot Grilles/Floor Mats	Control tracking of contaminants into building.	EQc5
127000	Multiple Seating	Avoid or limit VOC in materials.	EQc4
128000	Interior Plants and Planters		

130000	SPECIAL CONSTRUCTION:		
130100	Air Supported Structures		
130300	Special Purpose Rooms		
130800	Sound, Vibration and Seismic Protection		
130900	Radiation Protection		
131200	Pre-Engineered Structures		
131500	Aquatic Facilities	Water efficiency/reuse Energy efficiency	
140000	CONVEYING SYSTEMS:		
141000	Dumbwaiters		
142000	Elevators		
143000	Escalators/Moving Walkways		
144000	Lifts		
145000	Material Handling Systems		
146000	Hoists and Cranes		
149000	Transportation Systems		
150000	MECHANICAL:		
153000	Fire Protection	Consider alternative sources – reservoir or greywater options.	SSc6 WEc3
154000	Plumbing	Limit site disturbance, negotiate minimized storm and domestic connections with municipality, choose low flow domestic water fixtures, and consider a greywater system.	SSc5 SSc6 WEc2 WEc3
154900	Gasoline Dispensing Systems		
155000	H.V.A.C	Design to exceed ASHRAE standards, review and choose alternate energy sources, and select equipment with high energy efficiency ratings.	EAp1 EAc1 EAc2
156500	Refrigeration	Select equipment with no CFCs, HCFCs or Halons.	EAc4
159500	Controls/Instrumentation	Consider post-occupancy monitoring systems, consider CO ₂ monitoring, maximize controllability of systems, and maximize thermal comfort throughout.	EAc5 EQc1 EQc6 EQc7
159900	Commissioning, Testing and Balancing	Expect additional commissioning requirements.	EAp1 EAc3
160000	ELECTRICAL:		

164000	Service and Distribution	Limit site disturbance, expect additional commissioning, participate in "green" power discussions, and consider on-site renewable energy generation.	SSc5 EAc3 EAc6 EAc2
165000	Lighting	Choose landscape fixtures with cut-off, and source highly efficient fixtures.	SSc8 EAc1
166000	Special Systems	Expect discussions of solar, wind, and other alternative sources, and expect provisions for alternate fuel vehicle plugs or other alternative fuel vehicle energy supply connections.	EAc2 SSc4
167000	Communications		
169500	Controls/Instrumentation	Anticipate a higher number of lighting controls, and expect more post-occupancy monitors.	EQc6 EAc5 EAc1

BRINGING LEED TO THE JOB SITE

To ensure a successful LEED project, the culture of the job site needs to incorporate the goals of LEED just as the design team does. This culture extends from the way the project is tendered to the way the site debris is managed.

CHOOSE LEED-AWARE TRADE CONTRACTORS

While LEED is too new to expect many trades to be familiar with its requirements, there are opportunities to prepare subcontractors for involvement within a LEED project. One approach is for the contractor to look in the specs for LEED-related information and point it out to trades. This is especially important in cases where the information is grouped in the General Conditions rather than being distributed through the Divisions.

NAME A LEED CHAMPION

When the job starts, a LEED Champion needs to be identified by the contractor to support all LEED-related activity on the site. The Champion, who ideally is not the project manager, can be in charge of providing continuous monitoring and worker education, as well as tracking whether documentation is being kept up-to-date. Despite well planned and well received LEED education, workers may, due to force of habit, revert to conventional methods, which could compromise LEED credits if not noticed and prevented.

The contractor-appointed LEED Champion will work in cooperation with the overall LEED Coordinator on the project, whose role is described on page 12. For example, the LEED Champion would assemble documentation about percentage of recycled content in materials, and the LEED Coordinator would incorporate the documentation into the overall LEED submission.

EDUCATE ABOUT LEED

LEED education can occur as workers arrive at the site when the Safety Officer orients them to the recycling system as well as the site's safety features. LEED can be constantly reinforced at site meetings, or in the lunch room by pointing out roles to each trade. Toolbox meetings each week can continue to emphasize safety and LEED issues. Near the conclusion of the project, the education coverage needs to be stepped up due to the increased number of people on site.

In addition, a job site meeting with all workers present, featuring a green building expert explaining the bigger picture of LEED and how it relates to the specific job, can boost morale and engage goodwill.

LEED DOCUMENTATION

For a LEED project to be certified by the Canada Green Building Council or the United States Green Building Council, it is necessary for the LEED Coordinator (appointed by the project team) to submit information supporting the claim of the design and construction team that the project has met the intent of each prerequisite and each credit point being sought. This information is submitted in an application package which includes a complete LEED binder containing Letter Templates (see below), required submittals and supplementary information for the credit points sought. This application package is the deliverable from the LEED documentation process. It is supported by further information that is retained by the building owner but may be requested by the USGBC or CaGBC during the application review process. The overall LEED Coordinator will assemble and submit the application package to the CaGBC or USGBC, based in part on information supplied by the LEED Champion.

The LEED program can be a challenge to document. The large volume of information coming to a project manager on a job site is already overwhelming in many cases, and LEED requirements can sometimes be viewed as only adding to the confusion. There are some basic ways to streamline the LEED documentation process to encourage its integration into the repetitive documentation requirements on any job site.

DOCUMENTATION RESPONSIBILITIES OF LEED CHAMPION

As suggested above, the contractor needs to designate one person on the job site to be responsible for tracking, monitoring and collecting all LEED information. This person should know the job well, and be given adequate time in their day-to-day work to fulfil their LEED responsibilities. It is not a good idea to load the primary project manager with this responsibility in addition to all of their normal job site responsibilities. It takes time to do a thorough job – be sure to budget this time into the job description. When contractors build this LEED documentation expertise in-house, work on LEED projects will become more efficient over time. By managing and streamlining documentation processes, the LEED portion of the project will become highly cost-effective. These abilities will help to qualify companies for future LEED projects. The contractor-appointed LEED Champion will work in cooperation with the overall LEED Coordinator on the project.

EDUCATE ABOUT THE LEED LETTER TEMPLATE

Be sure the project manager and all trades involved in the LEED application understand the documentation requirements of LEED before the project (or their part in the project) begins. Host a meeting at the beginning of a project with all trades. Be sure to hold 'refresher' meetings as new trades come onto the site. Sometimes a good deal of time has passed between the start of the project and when some of the trades start their work.

All documentation requirements feed into the LEED Letter Templates, which are explained fully in the next section. Run through all the LEED Letter Templates relevant to the sections for which the construction team is responsible. The application process is relatively straightforward, and the LEED Letter Templates help guide documentation efforts. Each LEED credit has a letter template attached to it, clearly describing the documentation needed in order to confirm that a credit has been met. Some of these templates have been mocked-up later in this guide to show what would be expected for LEED documentation.

CREATE INCENTIVES FOR COMPLETING DOCUMENTATION

Make LEED reporting a key part of trade contracts and have incentives in place to ensure that reporting is done properly, and on time. The primary incentive is to confirm that LEED documentation is a condition of the Contract and that this is reviewed in detail at the time of the award. A second incentive is to include contractual wording that identifies an amount to be withheld from a trade's invoice payment until their LEED reporting requirement is met. The best incentive, however, is to make reporting straightforward and easy. The Material Information Sheet (page 54 to 55) and the Construction Waste Management Sheet (page 46) are both examples of simple, straightforward information collection forms that can streamline reporting. A final incentive is to generate excitement and buy-in for the project's green building goals. Get people excited about the innovative, creative and leading-edge nature of the project and they will likely be more cooperative and interested.

An example: Recycled Content Materials Information Sheets are most easily collected at the time the material arrives on site. It becomes difficult once the work is complete and the trade has left as there is no incentive for them to forward the additional information.



Resources

www.buildsmart.ca

Best Practices Guide: Material Choices for Green Design

Old to New Design Guide: Salvaged Building Materials in New Construction

BUILDSMART Product Directory

Project Waste Management Master Specification

Building Deconstruction Master Specification

DOCUMENT EVERY CREDIT POINT THOROUGHLY

In conjunction with the LEED Coordinator, start a LEED documentation binder at the outset of the project. Set up dividers for each credit, and keep track of everything. “Everything” means relevant e-mail correspondence, faxes and letters relating to LEED challenges and issues met along the way, sections of specifications and contracts that relate to each credit, and, of course, the specific credit requirements as they are described in each letter template.

Although the CaGBC (or USGBC) does not require that all of this information be sent in when seeking certification, they will choose to audit the detailed documentation for several randomly selected project credits. This means the LEED team has to be prepared to submit the detailed documentation for each and every credit being sought. Neatly compiled and thoroughly prepared documentation is an essential part of a successful LEED application. Credits can easily be lost if they are not properly documented. Even if the building successfully meets the intent of the credits, points can be lost very quickly if the back-up documentation is not available.

LOOK FOR LEED IN THE SPECIFICATIONS

Look to the project specifications for guidance. If the owner/client and design team planned on creating a LEED green building from the early project stages, the specifications should offer good advice and requirements on how to meet which LEED credits. Specifications should help to identify materials that meet indoor air quality standards, identify local sources for materials, source rapidly renewable resources and certified wood, and help to find materials with high levels of recycled content, or materials that have been salvaged and reused. As members of the team, contractors and trades can often bring forward ideas and sources that the design team may not be aware of. A great deal of research and project history goes into a good set of LEED specs and should offer construction management a good place to start with LEED work.

Be sure to cross-check the information given in the specs with LEED requirements. The green building movement is new and rapidly changing, and better, cheaper, and more environmentally sound products and strategies are constantly being introduced.

LETTER TEMPLATES

The LEED Letter Template is a documentation tool, a certificate used by project team professionals when preparing LEED applications. Each prerequisite and credit sought requires an appropriate LEED Letter Template as part of its documentation.

Most of these Letter Templates are not completed by the contractor. Other project team members such as the architect, owner, interior designer, mechanical engineer or structural engineer have responsibility for all but six of the Letter Templates. The sidebar shows the list of Letter Templates which are noted in LEED Canada as being the responsibility of the contractor. However, documentation for other credits may require some cooperation from the contractor.

Letter Templates are discussed here because it is much easier to comprehend the entire LEED documentation process once the Letter Templates are understood. Each Letter Template has a basic layout, and most require items of information that are consistent throughout all of the templates. These include:

- Name, company and signature of the person responsible for assuring that all information provided is correct, and that the credit requirements have been met in full.
- Check boxes confirming that certain documentation requirements have been met and are included in the LEED certification binder.
- Confirmation that referenced regulations and/or standards were met.
- A set of calculations, list of strategies used, and other information specific to the credit.

The LEED Coordinator identified by the project team has overall responsibility for assembling all the necessary LEED Letter Templates. The LEED Champion identified by the contractor works in cooperation with the LEED Coordinator on any documentation involving the contractor.

The completed set of LEED Letter Templates for a project are submitted to the certifying organization (CaGBC or USGBC) in the LEED Binder, which forms part of the LEED Application Package.

Several examples of LEED Letter Templates, and the documentation required, are included in the Toolkit section of this guide (see next page) to help demonstrate how to collect, manage, and report the appropriate information.

All LEED Letter Templates included in this guide are provided courtesy of the CaGBC.

The contractor is responsible for the following credit points, if the project is designed to capture them:

Sustainable Sites:

Prerequisite 1: Erosion & Sedimentation Control

Credit 3: Redevelopment of Contaminated Sites

Energy & Atmosphere:

P1: Fundamental Building Systems Commissioning

C3: Best Practice Commissioning

Materials & Resources:

C2: Construction Waste Management

Indoor Environmental Quality:

C3: Construction IAQ Management Plan

TOOLKIT

This toolkit provides resources to help contractors and trades understand some of the documentation needed to compile a submittable LEED application. The resources are not intended to be exhaustive, and they do not cover all possible LEED documentation requirements for every contractor and trade on a given job. It is meant to be a sampler of what actions and documentation can be expected on a LEED project and to provide a taste of what to expect in terms of planning, implementing, document collection and tracking, information analysis, and management of the construction team. The examples included in this toolkit are geared to LEED Canada-NC (a CaGBC product).

CONTENTS OF TOOLKIT

In order to provide a sense of how the various LEED components are planned, implemented and documented, four issues have been chosen as examples in this Toolkit. These issues were selected because of their specific relevance to contractors and trades, and because they are all quite different in nature. Please note that three of the issues are composed of elective actions, being points that can be pursued if they make sense for a given project. One (the first) is a prerequisite credit, which all projects have to meet in order to earn certification. Meeting a prerequisite does not earn a point toward the project total. The prerequisite credits require careful attention at the very beginning of a project to ensure they are met.



Photo Credit: McCallum Sather Architects Inc.

CASE STUDY

The EMS Fleet Centre is a new 2044m² ambulance centre operated by the Region of Waterloo. Indoor environment is enhanced by isolating (and separately venting) all photocopiers, low VOC paints, adhesives, sealants and finish materials throughout, operable windows and exterior views from all occupied rooms. Over 75% of construction waste was diverted from landfill and recycled. Over 20% of the building materials contain high amounts of post-industrial and post-consumer recycled content. Over 40% of the buildings materials were locally harvested while over 70% of the components manufactured locally.

For each issue, the relevant LEED Letter Templates are included, with annotations to clarify how they are completed. The included templates are:

ISSUE	LEED LETTER TEMPLATE
Erosion and Sedimentation Control	SS Prerequisite 1
Construction Waste Management	MR 2.1 – 2.2: Construction Waste Management
Material Selection	MR 3.1-3.2: Resource Reuse MR 4.1-4.2: Recycled Content MR 5.1-5.2: Regional Materials MR 6: Rapidly Renewable Materials MR 7: Certified Wood EQ 4.1-4.4: Low-emitting Materials
Construction IAQ Management	EQ 3.1-3.2: Construction IAQ Management Plan

Sample documentation is included with each example. The Letter Templates and data management sheets can be adapted to fit the projects at hand. These resources are not the definitive or only way of managing LEED projects, but they are a great place to start and have been used successfully for projects located across Canada.

The four issue examples follow a consistent format. The first page introduces the issue and suggests ways in which the builders can manage the planning, information collection, trade involvement, and final documentation for the credit(s). Ensuing pages provide additional guidance using mocked-up templates, example plans, samples of standard documentation types, and copies of the relevant LEED Letter Templates.

Toolkit items for this issue:

- Overview
- Erosion and Sedimentation Control – Example Letter
- Detail B2/01: Silt Fence
- SSP1 Letter Template

ISSUE ONE: EROSION AND SEDIMENTATION CONTROL

Contractors and trades working in Canada are very familiar with the erosion protection and sedimentation prevention expected of this Sustainable Site Prerequisite (most contractors working within the Lower Mainland will have experience complying with these criteria in some form, especially where work has involved the Federal Department of Fisheries and Oceans (DFO)). Within the current LEED manual and checklist (which presently references the US Environmental Protection Act (EPA)), some clauses offer the option of using local codes and regulations if they are more stringent. In most municipalities, our Canadian requirements achieve this equivalency. Nevertheless, it is necessary for contractors and trades to verify that local expectations and DFO requirements do in fact meet or exceed the EPA goals for each project and Municipality.

In the preparation of an Erosion Control Plan, there are two general categories of control suggested:

- Protection of in situ sensitive or susceptible areas (note that there is a probable link to Credit SSc5 Reduce Site Disturbance).
- Construction of physical measures and controls.



Photo Credit: Prairie Architects Inc.

CASE STUDY

From the perspective of material reuse, the Winnipeg MEC utilized a technique often referred to as deconstruction or ecorenovation. This involved the careful dismantling of two of the three existing buildings on the site, conducting an inventory of reclaimed materials then designing and constructing entire new sections of the building from these materials. In total, almost 4,000 tonnes of material was diverted from the landfill fulfilling the projects environmental objectives while reducing the projects total design and construction budget to less than \$1000 USD per square foot and providing weathered materials such as Douglas Fir timber columns and reused brick that enhanced the retail aesthetic of the buildings program, demonstrating that true sustainable design has many diverse and complementary benefits.

Given the wide range of possible sites where a project might be located (from urban to sub-urban to rural), it is necessary to assess each for its own requirements, but the suggested measures are all familiar in our region and several are listed:

- Setbacks from, and fencing off of, out-of-bounds areas, streams and waterway.
- Stabilization of surfaces exposed to wind and run-off using hydro-seeding, mulching, etc.
- Filter media in run-off channels, for example straw and filter cloth dams, etc.
- Filters at / under municipal storm drain catch basin covers.
- Dust and wind erosion during demolition.
- Three stage settlement basins for de-watering.
- Wheel washes and load covers on trucks during excavation.
- Concrete trucks cleaning stations prior to leaving the site, or ensure all concrete is supplied in trucks with onboard self-cleaning systems.

Throughout LEED, the emphasis is on the preparation of a comprehensive plan, the implementation of that plan, and then the thorough and ongoing recording and documentation of efforts. That documentation may include photographing the measures taken, compiling laboratory test results of settlement basin waters, copying of permits and approvals from the municipal engineer and, if applicable, from DFO, and so on.

Remember, this is a prerequisite; it is not an option. If the Plan is not well conceived, enforced, or documented, the whole LEED application will be rejected.

And again, never get behind!

LEED Canada and the LEED-BC Application Guide are available at the CaGBC website.

www.cagbc.org

EROSION AND SEDIMENTATION CONTROL – EXAMPLE LETTER

This example letter shows how an Erosion and Sedimentation Control program could be described to confirm the project's compliance with SSPI: Erosion and Sedimentation Control.

This Erosion and Sedimentation Control Sample Letter confirms that the project's Erosion and Sedimentation program meets the requirements of the prerequisite SSPI.

This letter confirms the Erosion / Sediment Control program, developed by _____, meets, or exceeds, the Best management practices outlined in the EPA's Storm Water management for Construction Activities (EPA Document No. EPA-832-R-92-005, Chapter 3).

I have reviewed the District Erosion and Sediment Control and Storm Water Management programs, to verify which program, or combination thereof, is the more stringent. In addition, I have reviewed the most recent EPA SWMP methods designed to reduce erosion and control sediment (e.g. EPA Document 832-F-999-006, September 1999). During a recent conference in Reno, Nevada, we had the opportunity to discuss the new EPA Erosion and Sediment Control Program measures with the senior staff member assigned to promulgate these on the NRCS Web site (Mr. _____ Forest Ecologist, USDA, Watershed Science Institute, NRCS, Portland, Oregon).

The following information outlines the program that has developed to meet, or exceed, the LEED standards with respect to Erosion and Sediment Control program requirements.

As noted in the LEED documentation the plan should meet the following objectives:

- Prevent loss of soil during construction by storm water runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
- Prevent sedimentation of storm sewer or receiving streams
- Prevent polluting the air

The Erosion and Sediment Control program developed for the site is based upon the four principles of Stormwater Management. These principles can be summarized as "The Four Cs" – control, collection, conveyance, and cleansing. Measures do not fall neatly into one category in most cases. For instance, measures that control runoff, such as grassed swales, may convey and clean runoff as well.

The following section was abstracted from the Ohio State University Fact Sheet, Agricultural Engineering document entitled "Stormwater and Your Community". This document was produced in 2000 and forms the basis for measures recommended by the District for use during construction projects.

The four principles, outlined in the Ohio document, provide a helpful framework for reviewing the efficacy of proposed stormwater management plans.

Control. Control measures can be broken down into two categories: source control and runoff control; source control measures focus on pollution prevention. Their objective is to avoid or limit the generation of pollutants. Typical source control measures include proper containment measures, spill prevention and cleanup, waste reduction, public education, illicit connection control, and reduced use of fertilizers and pesticides.

Runoff control measures focus on minimizing runoff from new developments, and siting infrastructure to encourage development in environmentally sensitive areas. These controls are cost-effective if implemented in the site-planning phase of new development projects. Runoff control measures also include techniques for slowing down runoff velocities using such methods as limiting impervious surfaces, directing flow over grass swales or other vegetated areas, storing runoff in ponds, and installing infiltration systems. An important consideration with these systems is to have a clear understanding of who will determine if they will function properly and who will manage them when installed. All collection systems require regular monitoring and maintenance to ensure their continued effectiveness.

Collection. Capture and storage of runoff for more timely release is a vital component of most stormwater management systems.

Retention basins are areas designed to hold the stormwater permanently until it infiltrates into the ground. Detention basins are meant to slow and hold stormwater before releasing it. When runoff is collected in vegetated storage areas such as retention and detention basins, adverse impacts on water resources can be greatly reduced. For sites where total capture is feasible, studies suggest that collecting the “first flush”, the (first 0.5 to 1.2 inches of rainfall) can capture a high percentage of contaminants.

Conveyance. Conveyance systems are used to drain and direct the flow of runoff generated on a site. This is often done with catch basins feeding into storm sewers. More natural systems, using vegetated depressions and bioswales which look and function much like the natural drainage system, should be used whenever possible. Existing systems can be adapted to reduce runoff; for example, perforated pipes can be used to promote infiltration.

Cleansing. Control, conveyance, and collection of runoff mean little without provisions for cleansing. Cleansing is commonly accomplished through techniques that promote filtration and settling of pollutants and their natural processing by vegetation and soil. Filtering devices include engineered structures like sediment basins and porous pavement, but also include natural systems like stream buffers and vegetated filter strips. Depending on their design, many collection systems like ponds and constructed wetlands also serve to clean water. Infiltration of stormwater into the ground, which allow pollutants to be filtered by natural biological and chemical processes in the soil, should be encouraged whenever soil type and groundwater systems can support it.

In reviewing the proposed erosion and sediment control measures, designed for the site has adopted a suite of methods that meet both EPA and District requirements. The following identifies measures adopted for specific erosion and sediment control issues, outlined in Construction and Final Civil Design documents.

1. Construction Activities Scheduling – Practices for erosion and runoff control will be designed and installed in accordance with an approved site plan. The plan lists the sequence of construction activities and the specific control, collection, conveyance, and cleansing methods to be used.
2. Straw Bale Barrier – This method is to be used as a temporary sediment barrier to reduce the velocity of flow, permit deposition and retain sediment. Since straw bale barriers are not designed to withstand high heads, their use will be restricted to small drainage catchments, with the barrier located such that the water depth does not exceed 1 foot at any point. The installation and maintenance of straw bale barriers will be in accordance with recommended EPA practices.
3. Storm drain Inlet Protection – The installation of a storm drain inlet protector will permit the trapping of sediment around drop inlets or curb inlets prior to permanent stabilisation of any disturbed area. The use of a gravel and geo-textile inlet drain filter will be restricted to catchment areas not exceeding one acre and is not intended to control large, concentrated stormwater flows.
4. Grassed bioswales – The conveyance of storm water to treatment wetlands will be via grassed bioswales. This method permits higher flows to be conveyed at lower velocities, permitting the sedimentation of particulates, through the use of filtering vegetation.

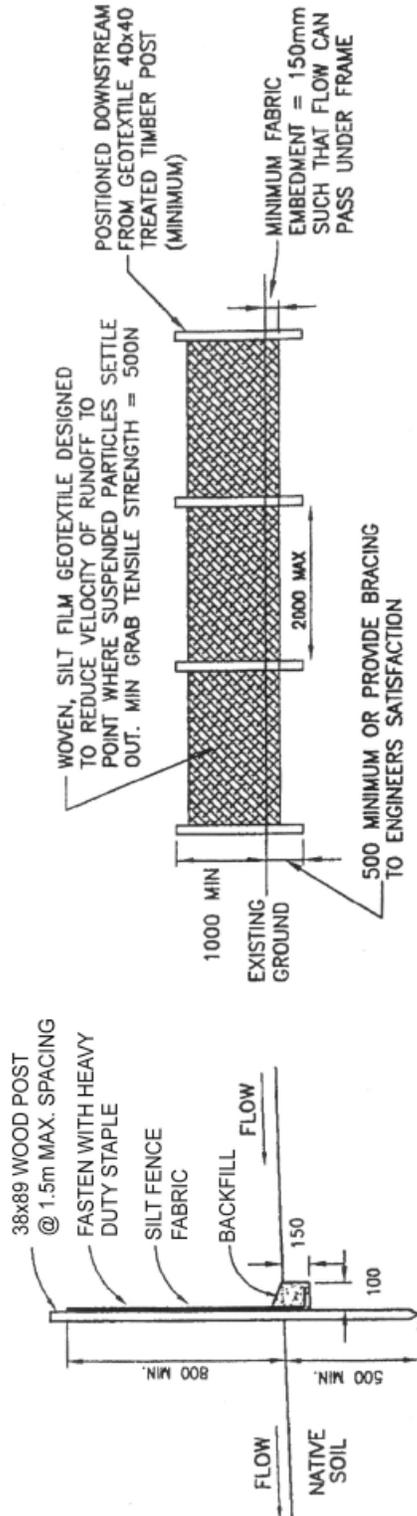
All installations will be made following the most recent EPA recommended guidelines (e.g. EPA 832-F-99-006, September 1999 Storm Water Technology Fact Sheets). This program of Erosion and Sedimentation Control thus meets, or exceeds, the recommended guidelines established in the EPA’s Storm Water management for Construction Activities (EPA Document No. EPA-832-R-92-005; Chapter 3).

As the Senior Aquatic Ecologist retained to develop the Storm Water management program, in collaboration with the District _____ and the _____, I attest to the veracity and accuracy of the information provided in this letter.

Sincerely,

SAMPLE DETAIL OF SILT FENCING FOR EROSION AND SEDIMENTATION CONTROL

This detail of silt fencing is supporting documentation for SSPI, Erosion and Sedimentation Control.



SILT FENCE PROFILE

NTS

SILT FENCE DETAIL

NTS

SILT CONTROL NOTES:
 1. PERMITTIVITY OF GEOFABRIC TO BE $\sim 10L/S/m^2$
 2. SPLICES TO BE AT POSTS SUCH THAT EACH PIECE IS WRAPPED FULLY AROUND POST.
 3. SILT FENCE TO HAVE AN EFFICIENCY $>75\%$. WHERE EFFICIENCY IS LESS THAN THIS EMPLOY SUCCESSIVE FENCES TO REACH THE DESIRED AMOUNT.
 4. AT COMPLETION OF WORK SILT TO BE REMOVED AND DISPOSED OF.

NOTE: SURROUND TOPSOIL PILES WITH SILT FENCE AS PER DETAIL B2.

DETAIL B2 GEOTECHNICAL FABRIC
 SCALE N.T.S. 01 SILT FENCE

Toolkit items for this issue:

- Overview
- Sample Construction Waste Management Plan
- Construction Waste Management Plan Reporting Forms
- Letter Template MR Credit 2.1-2.2

ISSUE TWO: CONSTRUCTION WASTE MANAGEMENT

Construction and demolition activities generate a huge amount of waste: about one-third of the waste sent through the GVRD system is from this sector. Contractors and trades are well-placed to find innovative and creative ways to reduce this waste. New markets for recycled and salvaged or reused materials are emerging all the time. Contractors are becoming very good at finding places where construction and demolition waste is reused, rather than thrown away, and they are recovering costs.

There are two LEED credits available for construction waste management

- MR 2.1 for diverting 50% of waste from the landfill.
- MR 2.2 if 75% is diverted.

Meeting the requirements of LEED documentation for construction waste management takes place in the context of a properly developed Job Site Recycling Program. For an overview of how to set up a Job Site Recycling Program, see the resources listed in the sidebar.

The following steps integrate the LEED documentation requirements into a Job Site Recycling Program.

STEP 1. Construction waste management begins with a plan which is best developed as early as possible. Note that there are cross-over related credits which could precede the development of the construction waste management plan. For example, measures for SS Prerequisite 1, Erosion and Sedimentation Control, should already be in place. Build on that momentum! Establishing good housekeeping practices, and getting trades to sort their own waste (copper, metal, gypsum and wood) into identifiable bins from day one, are steps which nurture a positive project attitude. A recycling clause in their trade contract is an 'incentive'. A sample construction waste management plan (CWMP) is included in this toolkit.



CASE STUDY

Vancouver Island Technology Park (2002, 16,000 m²): A great success achieved in this project was the diversion of 99% of construction waste from the landfill, especially considering that this project was a major renovation and there was a large volume of material removed from the site.

STEP 2. Hold a meeting with the project team, including the trades and/or the recycling contractor(s) if one has been hired. Go through the construction schedule together, and review all potential sources of construction waste generation. Review potential alternatives to landfill disposal for each material. Look for reuse/salvage and recycling opportunities that are of low-cost by identifying on-site uses and reuses. Increasingly, recycling and demolition contractors are finding businesses that purchase recycled and salvaged materials, including used building material yards. Depending on the nature of the construction waste produced, a great deal of money can be saved through carefully planned waste removal and reuse. Each trade should develop their own waste management plan for their own waste. These CWMP's should all be filed in the master LEED binder.

STEP 3. Add the Construction Waste Management Plan as a recurring action item at the project's weekly or bi-weekly trade meeting. Require all trades attending to complete the Construction Waste Management Sheet provided in this toolkit. By having the status of the plan reviewed together, peer pressure will be established and documentation will be submitted in timely fashion. Having the discussion recorded in the trade meeting minutes also supports the documentation. If necessary, withholding a percentage of invoice payments will encourage all trades to file their information. The CWMP should clearly define a person responsible for collecting this information.

STEP 4. The person responsible for collecting and tracking this information should continually update the LEED Letter Template as new information comes in. If the project is a large one, it may be best to create a separate spreadsheet to track the detailed construction waste information and then use the detailed sheet to complete the LEED Letter Template in a summary form. Keep both versions up to date and complete, and file them both in hard copy in the master LEED binder.

And never get behind!

Resources

Recycling Council of British Columbia
www.rcbc.bc.ca
RCBC Recycling Hotline:
604-732-9253 in the Lower Mainland or 1-800-667-4321 throughout BC.

www.buildsmart.ca



Best Practices Guide: Material Choices for Green Design

Old to New Design Guide: Salvaged Building Materials in New Construction

BUILDSMART Product Directory

Project Waste Management Master Specification

Building Deconstruction Master Specification

Job Site Recycling: A Guide for Building Contractors

Demolition and Salvage: a Guide for Developers and Renovators

Hauling Services

Local Recycling Depots

SAMPLE CONSTRUCTION WASTE MANAGEMENT PLAN

This sample construction waste management plan shows strategies for achieving MR Credit 2.1-2.2.

_____ Construction Co. Inc.

Project Name:

Project Size: (gross sq.metres)

Project Type:

Goals: To minimize the amount of construction waste produced on-site through a range of recycling, salvage and reuse strategies. To exceed the Leadership in Energy and Environmental Design (LEED) target of 75% diversion of construction waste.

1. Analysis of Expected Job-site Waste:

< Summarize the general categories of waste likely to be produced on the project.>

General construction debris will include:

- Drywall
- Wood
- Paper
- Concrete debris
- Cardboard
- Asphalt debris
- Foam board
- Plastic
- Plywood
- Gravel
- Dirt
- Trees, branches, and other organic products mixed with dirt
- Metals, including rebar, brass, chrome, aluminum, copper, metal stud scrap, screws, nails.

2. Rough quantities will be measured in tonnes where possible, and in cubic yards and pounds where necessary and converted to tonnes afterward. The recycling coordinator estimates a total of _____ tonnes of material will be produced through our activities on this job site, and that _____% of these materials will be recycled, reused, or salvaged.

3. Removal Methods

<Outline the best method for your project or your region for getting rid of waste – do-it-yourself, have the trades do it, hire a recycling depot, or a combination.>

_____ Construction Co. has entered into an agreement with _____, a wasteless disposal service, to provide

recycling services for the duration of the project. The disposal bin is set up as the main recycling station.

Drop boxes will be used for individual materials as space quantities allow. Projected savings for all debris will be around \$_____.

All materials will be taken to _____'s recycling depot, _____, located at _____ <address> _____. Mixed waste drop boxes will be separated by the disposal company offsite and recycled to the greatest extent possible. At their location, the disposal company, _____, is currently recycling 90% – 100% of their intake.

4. Removal Costs and Revenues:

<Generate a table of likely materials and their costs/credits per unit.>

The current costs and revenues in this region for recycling construction waste materials are as follows¹:

Material	Cost or Revenue/40 cubic yard bin
Asphalt and Concrete	_____ <\$75> _____ cost
Commingled Recyclables	_____ <\$100> _____ cost
Wood	_____ <\$100> _____ cost
Light Scrap Metal	_____ <\$100-\$120> _____ revenue
Cardboard	_____ <\$90-105> _____ revenue

5. Options for Disposal:

<Mention any specific methods that are special or unusual opportunities.>

Demolition materials for reuse will first be removed by the Client, then by the demolition contractor. To the greatest extent practicable, all reusable items will be salvaged. The demolition and deconstruction plans will address in detail the measures to be taken.

Items to be reused include (but are not limited to):

- Siding
- Roof decking
- Glu-lams
- Timber and beams
- Windows
- Doors and hardware
- Mechanical and electrical equipment
- Concrete (pulverize and used as base rock)
- Landscaping and organic materials (as mulch and compost)

¹ Sample figures from the Greater Vancouver Regional District, January, 2004

All salvageable materials will be donated to a local _____<insert charity>_____ organization, or sold to a used building supplier, _____<insert name>_____. Any materials that cannot be retained or salvaged will be recycled.

Furnishings, equipment, doors and hardware, electrical, mechanical will be salvaged to the greatest extent possible. Asphalt and concrete will be ground as appropriate for reuse. Dirt and gravel will be trucked to reclamation or reuse sites as appropriate for the material.

Any wood landscape waste to be chipped and mulched for reuse on site. All non-woody organic materials to be composted for reuse on site. Mixed dry waste, including wood, drywall, metal, cardboard, paint, and styrofoam will all be recycled.

6. Materials Handling Procedures:

<Summarize the roles of the contractor and trades participating. Attach a site plan if possible with receptacles indicated etc.>

- An area will be designated for recycling and separation activities.
- the interior of the construction job office will also have recycling containers for paper, glass, cardboard and aluminum.
- Drop boxes will be used adjacent to the new building as appropriate.
- Labels directing the separation of materials will be posted at the construction trailer and on each of the drop boxes.
- Construction debris will be continually picked up during the day and placed into the proper recycling or disposal bins.

The Project Manager will instruct each Trade's Supervisor and all workers as to proper waste management and recycling practice. This instruction will include hazardous wastes generated through chemical use and through demolition. _____
_____. Construction Co. Inc. will incorporate waste reduction and recycling instructions into each Trade's Contract, requiring all Trades to cooperate fully.

7. Personnel: The following list further describes individuals and their responsibilities. Name _____, Project Manager, will supervise the implementation of this plan in the field.

Name _____ Assist with oversight and monitoring of the plan in the field.

Name _____ Organize and keep recycling area tidy.

Name _____ Coordinate recycling bin pick up and removal.

Name _____ Receive waste production and recycling information from each Trade and vendor.

Name _____ Compile and report of all waste material information sheets.

Name _____ Review waste management plan results, and complete the LEED letter templates.

_____, Contracted Disposal Services. Recycling material will be placed into individual boxes, as space is available to include but not be limited to wood, cardboard, metals, concrete, along with a mixed debris box to be sorted by _____ <local recycling company>. When quantities dictate, _____ will provide special bins for the specific materials.

Where materials are not separated, they will be placed into a mixed bin and they will be transported by _____ <local recycling company> who will sort and remove any recyclable materials from the mixed bins.

_____ <local recycling company> will provide a complete report, using the template provided, that includes material types, quantities, and location where materials were sent to for recycling or disposal. A listing of the cost for recycling or disposing each of these materials will also be provided in a monthly summary report.

Trade Contractors. Each Trade will designate a representative responsible for that Trade's waste management plan. Each Trade will be required to recycle, reuse or salvage their construction waste to the greatest extent possible.

The Construction Waste Management Reporting Sheet will be submitted to _____ Construction Co. Inc. at the Trade meeting and on a biweekly basis, no later than 15 days after month end. Each Trade will be responsible for ensuring the accuracy of this information.

Construction debris will be continually picked up during the day and placed into the proper recycling or disposal bins.

8. Hazardous Wastes:

<Summarize any special material, WHMIS and HAZMAT procedures.>

Hazardous wastes will be separated, labelled, stored and recycled or disposed of according to local regulations, workers safety regulations, and provincial and federal regulations under the direction of _____ Construction Co.'s Safety Officer. Where practical, efforts will be made to reuse hazardous materials like paints, adhesives and other products.

9. New Opportunities:

The project team shall continue throughout the project to explore new opportunities to recycle, reuse, or minimize (in other ways) the project's negative impacts on people and the environment.

CONSTRUCTION WASTE MANAGEMENT PLAN REPORTING FORMS

This form is used to report construction waste management amounts.

Company Name:	Contact Person:	Phone: E-mail:
Project Location:	Waste Contractor:	Report Start Date: Report End Date:

Material :	Total weight produced (tonnes) :	Weight recycled/ salvaged/ diverted (tonnes) :	Weight Disposed (tonnes):	Recycling and/or disposal facility :

I, _____, declare that this report is accurate to the best of my knowledge.

Submitted on this ____ day of _____, 20__.

Signed: _____

CONSTRUCTION WASTE MANAGEMENT PLAN REPORTING FORMS

This is an example of a completed construction waste management plan reporting form, filled in.

Company Name: <i>Green Contracting</i>	Contact Person: <i>Your Name</i>	Phone: <i>604-888-1111</i> E-mail: <i>me@greenmail.com</i>
Project Location: <i>Vancouver, BC</i>	Waste Contractor: <i>Less Waste</i>	Report Start Date: <i>Nov.1 2003</i> Report End Date: <i>Nov.15 2003</i>

Material :	Total weight produced (tonnes) :	Weight recycled/ salvaged/ diverted (tonnes) :	Weight Disposed (tonnes):	Recycling and/or disposal facility :
CONCRETE ASPHALT CONCRETE	<i>5.0</i>	<i>3.5</i>	<i>1.5</i>	<i>ROADWAY</i>
METAL	<i>6.0</i>	<i>6.0</i>	<i>0</i>	<i>METAL RECYCLERS</i>
MIXED WASTE	<i>38.0</i>	<i>32.5</i>	<i>5.5</i>	<i>LOCAL RECYCLERS</i>
WOOD	<i>115.0100.0</i>	<i>15.0</i>	<i>15.0</i>	<i>LOCAL RECYCLERS</i>
GLASS	<i>2.5</i>	<i>2.5</i>	<i>0</i>	<i>LOCAL RECYCLERS</i>

I, YOUR NAME, declare that this report is accurate to the best of my knowledge.

Submitted on this 18 day of Nov, 2003

Signed: Your Signature

ISSUE THREE: MATERIAL SELECTION, SPECIFICATION AND PROCUREMENT AND LEED DOCUMENTATION

The “Materials and Resources” aspect of a LEED project is one of most importance for contractors and trades because it not only deals with construction waste management, but plays directly to strengths in sourcing and procuring materials and products. It offers a great opportunity for contractors and trades to contribute directly to a project’s success through detailed knowledge of speciality areas.

Project architects and owners with commitment to LEED are becoming much better at specifying LEED-friendly materials in their documents, and some will list specific product names and suppliers. Others may simply list the LEED requirement or goal for the particular material and ask/expect the contractor and trades to then source and provide them.

In a construction management arrangement, the trades can play a very significant role early in the selection of materials. As familiar as all designers would like to be with products and materials, contractors and trades are the experts in their own speciality areas. Bring those ideas forward. In particular, contractors and trades can assist in sourcing salvaged materials as part of the design process. It is easier for the design team to incorporate a found/proposed salvaged material into their design than to try, after the design is complete, to find a chosen component which may not be available.

Toolkit items for this example:

- Instructions to bidders: Green Materials Info Sheet
- Letter Template MR Credit 3.1-3.2
- Sample recycled content letter from rebar supplier
- Green Materials Info Sheet mocked-up for recycled content – rebar
- Letter Template MR Credits 4.1-4.2
- Letter Template MR Credit 5.1-5.2
- Letter Template MR Credit 6
- Letter Template MR Credit 7

CASE STUDY

Green building objectives included site considerations, massing and orientation, energy modeling, passive solar heating, natural day lighting, energy efficient HVAC and electrical systems, the use of recycled construction materials and sustainable construction management methods. The accomplishments of this building are: use of 40% less energy (natural gas, electricity), use of over 40% less water, and it provides for a healthy building in terms of air quality & lighting.



Photo Credit: Marshall Tittlemore Architects

Materials selection is vitally important for many reasons. Careful selection of materials can:

- Reduce the extraction of raw materials.
- Ensure that wood products are harvested and processed in ecologically responsible ways.
- Reduce energy inputs into manufacturing processes.
- Reduce through-put of materials to landfills.
- Create healthier, non-toxic interior environments.

There is a growing array of resources available for sourcing “green” materials. See

www.buildsmart.ca for:

BUILDSMART Product Directory

Best Practices Guide: Material Choices for Sustainable Design

Old to New Design Guide: Salvaged Building Materials in New Construction

www.greenspec.com for:

GreenSpec Directory, Product Directory with Guideline Specifications

There are a total of 12 points available (8 MR and 4 EQ) through conscientious material selection in the following categories:

- MR 3: Resource Reuse (2 points)
- MR 4: Recycled Content (2 points)
- MR 5: Regional Materials (2 points)
- MR 6: Rapidly Renewable Materials (1 point)
- MR 7: Certified Wood (1 point)
- EQ 4: Low-Emitting Materials (4 points)

Sample Letter Templates are included in this section for each of these credits.

In order to clarify this process of specifying, sourcing, installing, and documenting materials, what follows is a walk-through of the general steps involved. Although there are twelve points available in six different credits, the same basic specification and documentation process is applicable. A great deal of time and energy can be saved by using this process to streamline the materials credits.

STEP 1. Carefully review the project goals, LEED opportunities and specifications to determine how much of the material selection work has been done already and how achievable the goals are. Review these opportunities with the whole project team, find any gaps in information, and ensure that LEED materials goals and objectives can be adequately met. The team discussion and crosstalk often help with sourcing some of the more challenging materials.

STEP 2. Write materials requirements, including documentation requirements, into the contracts of all trades. Include a sample of the Materials Information Sheet (provided in the following pages) into each spec section and contract to guide documentation requirements. Also include a reporting schedule for submitting completed Sheets. One mocked-up Materials Information Sheet is provided, based on fictitious information provided on material reuse by a concrete forms contractor.

STEP 3. It is very important that the LEED coordinator review all of the completed Material Information Sheets before the materials are installed. Sheets should be provided at time of contract award, confirming that the products meet the specifications. Ensure that cut sheets of products are included at the same time the Material Information Sheets are submitted.

This allows time for material selections to be changed before it is too late or before it costs extra money. Of particular concern are the low-emitting materials – if one material is installed that does not meet LEED requirements, the whole credit is lost.

- STEP 4. Keep a running record of materials submitted and acknowledged by the LEED coordinator using a spreadsheet or database program that generates a percentage reading, which in turn lets the team know how well the project is doing against the credit threshold. It can also help to manage the documentation needed from sub-trades, helping to identify gaps in information and to track that information down before the sub-trades are paid and gone. A sample spreadsheet has been prepared as an example.
- STEP 5. In a few instances, the contractor would be expected to sign a Letter Template 'certifying' the extent of achievement under a particular LEED credit point. MRc2 (Construction Waste) and EQc3 (Indoor Air Quality) are commonly under the contractor's control. Samples of Letter Templates for similar categories follow.

The contractor's contribution to the effort is to provide the back-up data, receipts, way-slips, manufacturer's product data and/or certificates etc., all of which must be given to the LEED coordinator in a timely way. Remember, all of that information is compiled into the LEED submission after completion and occupancy. It is critical to keep the information flowing early and consistently. Once trades, sub-trades or suppliers are paid out or off-site, it is very difficult to get historic information from them.

OTHER LEED DOCUMENTATION FOR MATERIALS

In order to complete the various calculations necessary to validate the savings with respect to resource reuse, recycled content, local/regional materials, rapidly renewable materials, and certified wood, the contractor and trades are required to provide the related material cost or volume amounts for the project. This information is eventually summarized on the LEED Letter Templates for each credit.

Where the information is for a material cost amount, this does not include labour costs and it particularly excludes mechanical and electrical components. Essentially, this represents construction divisions 2 through 10. Recently, the CaGBC has changed its requirements. Instead of having to individually total up all of these unit costs, they will now accept 45% of the contract/trade contract amount (excluding mechanical and electrical).

In the specific case of MRc7 Certified Wood, the total material cost of all wood products used in the project is required to determine if the certified wood credit is achieved. Formwork lumber and panels can be included in this unless they are rented or they have been previously counted as Resource/Reuse wood under MRc3.

Note: Under a construction management contractor, the contractor can play a significant role in the selection of materials. In particular, the contractor can assist in sourcing salvaged materials as part of the design process. It is difficult to find salvaged materials to meet a finished design, whereas, identifying such materials during design allows for the design to accommodate the materials.

INSTRUCTIONS TO BIDDERS: GREEN MATERIAL SELECTION

This Materials Information Sheet should be included in the contracts of all trades.

INSTRUCTIONS TO BIDDERS: GREEN MATERIAL SELECTION

The project being worked on will be certified under the Canada Green Building Council “Leadership in Energy and Environmental Design (LEED®)” program. Product selection will meet the targets and limits described here. “Material Information Sheets” and supporting documentation are to be completed in full for each material used in the building, and submitted as part of the Tender Submission and/or Contract Award.

MATERIAL REUSE AND SALVAGE

At least [5%, 10%] the total value of building materials will consist of salvaged, refurbished or reused materials, products and furnishings. These selections will be recorded against LEED® Credits MR 3.1 and 3.2.

RECYCLED CONTENT

At least 7.5% post-consumer + 1/2 post-industrial, 15% post-consumer + 1/2 post-industrial] of the total value of building materials will have recycled content. “Post-consumer” recycled content is the percentage of waste materials (by weight) from consumer use incorporated into a building material. “Post-industrial” recycled content is the percentage of waste materials (by weight) from industrial use incorporated into a building material. The value of the recycled content portion of a material or furnishing shall be determined by dividing the weight of recycled content in the item by the total weight of all material in the item, then multiplying the resulting percentage by the total value of the item; see LEED® Credits MR 4.1 and 4.2.

REGIONAL MANUFACTURE AND HARVEST OF MATERIALS

At least 20% of the total value of building materials will be manufactured and harvested, extracted or recovered locally, within a radius of 800 km of the building site if transported by truck OR within a radius of 3500 km if transported by rail. “Manufacture” includes the final assembly of components into the building product that is installed. See LEED® Credits MR 5.1 and 5.2.

RAPIDLY RENEWABLE MATERIALS

At least 5% of the total value of all building materials shall come from rapidly renewable sources. A rapidly renewable source is one that is made from plants that are typically harvested within a ten-year or shorter cycle. See LEED® Credit MR 6.

CERTIFIED WOOD

At least 50% of the total value of wood-based materials and products used on the project will be certified in accordance with the Forest Stewardship Council’s Principles and Criteria. Wood-based materials and products include (but are not limited to): structural framing, general dimensional framing, flooring, furnishings, and non-rented temporary construction applications such as bracing and formwork. See LEED® Credit MR 7.

LOW-EMITTING MATERIALS

Any adhesives, sealants, paints and other coatings, and any carpet products selected for the project shall meet or be less than the emission limits for volatile organic compounds (VOCs) and other relevant chemicals as described in the tables below. All composite wood and agrifibre products (such as plywood, glulam, LVL, PSL, and OSB) shall have no added urea-formaldehyde resins. See LEED® Credits EQ4.1, 4.2, 4.3, and 4.4, as well as the tables on the next page.

TABLE 1 California South Coast Air Quality Management District Rule #1168 for adhesives		TABLE 2 Extract from "Green Label" Testing Program Limits	
ARCHITECTURAL APPLICATIONS	CURRENT VOC LIMIT	CARPETS	MAXIMUM EMISSION FACTOR (MG/M ² JHR)
Indoor carpet adhesives	50		
Carpet pad adhesives	50	Total VOC's	0.5
Outdoor carpet adhesives	150	4-Phenylcyclohexene	0.05
Wood flooring adhesives	100	Formaldehyde	0.05
Rubber floor adhesives	60	Styrene	0.4
Subfloor adhesives	50		
Ceramic tile adhesives	65	CUSHION	
VCT and asphalt tile adhesives	50	Total VOC's	1.00
Drywall and panel adhesives	50	4-Phenylcyclohexene	0.05
Cove base adhesives	50	Formaldehyde	0.05
Multipurpose construction adhesives	70	BHT	0.30
Structural glazing adhesives	100		
Single ply roof membrane adhesives	250	ADHESIVES	
		Total VOC's	10.00
		Formaldehyde	0.05
SUBSTRATE SPECIFIC APPLICATIONS		2-Ethyl-1-Hexanol	3.00
Metal to metal	30		
Plastic foams	50		
Porous material (except wood)	50		
Wood	30		
Fibreglass	80		

TABLE 3 California South Coast Air Quality Management District Rule #1168

SEALANTS	CURRENT VOC LIMIT	SPECIALTY APPLICATIONS	CURRENT VOC LIMIT
Architectural	250	PVC Welding	510
Marine Deck	760	CPVC Welding	490
Non-membrane Roof	300	ABS Welding	400
Roadway	250	Plastic Cement Welding	350
Single-ply Roof Membrane	450	Adhesive Primer for Plastic	650
Other	420	Computer Diskette Manufacturing	350
SEALANT PRIMERS		Contact Adhesive	250
Architectural – non-porous	250	Special Purpose Contact Adhesive	250
Architectural –porous	775	Tire Retread	100
Other	750	Adhesive Primer for Traffic Marking Tape	150
		Structural Wood Member Adhesive	140
		Sheet Applied Rubber Lining Operations	850
		Top and Trim Adhesive	250

TABLE 3A Extract from State of California South Coast Air Quality Management District's Rule #1168 - Architectural Coatings

COATING	VOC LIMIT	COATING	VOC LIMIT
Bond Breakers	350	Magnesite Cement Coatings	450
Clear Wood Finishes		Mastic Coatings	300
- varnish	350	Multi-colour Coatings	250
-sanding sealers	350	Pigmented Lacquer	550
-lacquer	350	Pre-treatment Wash Primers	780
Concrete-curing Compounds	350	Primers, Sealers and Undercoats	350
Dry-fog Coatings	400	Quick-dry Enamels	400
Fire-proofing Exterior Coatings	350	Roof Coatings	300
Fire-retardant Coatings		Shellac	
-clear	650	-clear	730
-pigmented	350	-pigmented	550
Flats	100	Stains	350
Graphic Arts (sign) Coatings	500	Swimming Pool Coatings	
Industrial Maintenance Primers & TopCoats		-repair	650
-Alkyds	420	-other	340
-Catalyzed Epoxy	420	Traffic Coatings	150
-Bituminous Coatings Materials	420	Waterproofing Sealers	400
-Inorganic Polymers	420	Wood Preservatives	
-Vinyl Chloride Polymers	420	-below-ground	350
-Chlorinated Rubber	420	-other	350
-Acrylic Polymers	420	Low-solids Coating	120
-Urethane Polymers	420		
-Silicones	420		
-Unique Vehicles	420		
Japans / Faux Finishing Coatings	350		

TABLE 4 Environmental Choice (EcoLogo) Criteria

PRODUCT	EMISSIONS CRITERION	REMARKS
Non-flat Low-VOC Paints	125 gVOCs/L	More stringent than Green Seal GS-11 Interior Coating criteria
Flat Low-VOC Paints	50 gVOCs/L	Same as Green Seal GS-11 Interior Coating criteria
Varnishes	250 gVOCs/L	More stringent than SCAQMD Rule 1113
Stains	100 gVOCs/L	More stringent than SCAQMD Rule 1113
Carpeting, Commercial Modular (tiles)	TVOC: 0.25 mg/ m ² -hr FORMALDEHYDE: 0.25 mg TVOC/m ² -hr	-Formaldehyde criterion is less stringent than CRI Green Labels' -No requirement for 4-Phenylcyclohexene or Styrene, unlike CRI Green Label
Sealants & Caulking Compounds	VOCs <= 4% by weight	Environmental Choice criterion in weight terms, instead of g/L as SCAQMD criterion, so will require conversion calculations to demonstrate compliance.
Contact Adhesives	VOCs <= 8% by weight	Environmental Choice criterion in weight terms, instead of g/L as SCAQMD criterion, so will require conversion calculations to demonstrate compliance.
Multi-purpose Construction Adhesives	VOCs <= 7% by weight	Environmental Choice criterion in weight terms, instead of g/L as SCAQMD criterion, so will require conversion calculations to demonstrate compliance.
Special Purpose Construction Adhesives	VOCs <= 5% by weight	Environmental Choice criterion in weight terms, instead of g/L as SCAQMD criterion, so will require conversion calculations to demonstrate compliance.

SAMPLE MATREIALS INFORMATION SHEET FOR RECYCLED CONTENT

This sample Materials Information Sheet would support the Letter Template for MR Credit 4.1-4.2

GENERAL INFORMATION REQUIREMENTS

Product Name _____

Company Name _____

Total Project Costs: \$ _____

Total Material Costs: \$ _____

Total Value of all Wood-based Materials \$ _____

Cost of this material \$ _____

MATERIAL REUSE AND SALVAGE

Is this material (in whole or in part) salvaged, refurbished, or reused? yes no

What is the value of the salvaged, refurbished, or reused part of this material?

If it is reused, use market replacement value. (This value should match the material cost listed above) \$ _____

Comments:

RECYCLED CONTENT

Does this material contain recycled content? yes no

If so, please fill in the following details:

Weight of post-consumer recycled portion: _____ kg

Weight of post-industrial recycled portion: _____ kg

Total weight of material/product: _____ kg

Recycled content information source (describe and attach): _____

Comments:

RAPIDLY RENEWABLE MATERIALS

Is this material made from a rapidly renewable resource? yes no

What is the value of the rapidly renewable portion? \$ _____

Rapidly renewable resource information source (describe and attach): _____

Comments:

REGIONAL MANUFACTURE AND HARVEST OF MATERIALS

Is this material manufactured locally, within a 800 km (truck)/3500 km (rail) radius of the project?

yes no

Distance between project and manufacturer (km):

Was it transported by truck, rail or other means?

Is the raw material in the product harvested and/or extracted locally, within a 800 km (truck)/3500 km (rail) radius of the project?

yes no

Distance between the project and the harvest/extraction site (km):

Regional manufacture and harvest information source(s) (describe and attach):

Comments:

CERTIFIED WOOD

Is this material a wood-based product or material?

yes no

If so, is it certified by the Forest Stewardship Council (FSC)?

yes no

If yes, give the vendor's FSC chain-of-custody certificate number:

What is the value of the FSC certified portion of this product or material?

\$ _____

Certified wood information source(s) (describe and attach):

Comments:

LOW-EMITTING MATERIALS

Is this material an adhesive, sealant, paint or other coating, carpet, or composite wood/agrifiber product?

yes no

If yes, does it meet the emission limits described on page 2 of this document?

yes no

For all adhesive, sealant, paint or other coating, or carpet product, what is the VOC level of the material:

_____ g/L

For composite wood products, does the material contain added urea-formaldehyde resin?

yes no

Low-emitting material information source(s) (describe and attach):

Comments:

SAMPLE CERTIFICATE LETTER FROM FORMWORK SUPPLIER

This sample Certificate Letter would support the “Rebar” item in the Letter Template for MR Credit 4.1 – 4.2 (page 60).

November 30, 2003

Dear Project Manager,

Forms Are Us, Inc. would like to confirm the information that we provided to you for the Green Building site we have just completed. Our company provided the forms and concrete services for this project.

Forms

The forms that we used for the project cost approximately \$120,000 CDN. We estimated the new, replacement costs for the reused forms used for the project to come up with this materials cost. Approximately 18% – 20% of the forms used in this project were reused – this is a standard practice for our company, and any particular form may be reused up to 8 or 10 times.

Our company is also committed to using wood suppliers who harvest and manufacture their wood in an ecologically responsible way. We purchase all Canadian Standards Association (CSA) wood for our forms. I do not think that this is currently worth credit under the LEED system.

All of the wood used in the forms was harvested by the Local Logging Company, and manufactured by the Local Mill. Both of these facilities are located 150 kilometers from the green building project site. Although it is difficult to determine exactly where the trees used to make our forms were harvested, Local Logging Company harvests their wood from forests located within a 500 kilometer radius of their mill, making the maximum distance where a tree was harvested 650 kilometers from the green building site.

ReBar

The material cost of the rebar that was used in this project was \$50,800. This material comes from an eastern Canadian supplier. The product contains approximately 90% post-industrial recycled content. The materials used for the manufacture of this product may come from anywhere in Eastern Canada and the USA, depending on supplies at the time.

Concrete

We are aiming to use concrete with a high-percentage of fly ash content. At this time we have not yet determined the exact percentage, and will follow-up with another letter confirming this value.

If you have any other questions, please do not hesitate to contact us.

Sincerely,

John Doe

Project Manager, Forms Are Us, Inc.

604.555.1111

MOCKED-UP MATERIALS INFORMATION SHEET FOR RECYCLED CONTENT

This mocked-up Materials Information Sheet would support the "Rebar" item in the Letter Template for MR Credit 4.1 – 4.2.

GENERAL INFORMATION REQUIREMENTS

<u>REBAR</u> Product Name	<u>FORMS ARE US INC</u> Company Name
------------------------------	---

Total Project Costs: \$ 2,500,0000
Total Material Costs: \$ _____
Total Value of all Wood-based Materials: \$ _____
Cost of this material \$ 50,000

MATERIAL REUSE AND SALVAGE

Is this material (in whole or in part) salvaged, refurbished, or reused? yes no
What is the value of the salvaged, refurbished, or reused part of this material?
If it is reused, use market replacement value. (This value should match the material cost listed above) \$ _____
Comments:

RECYCLED CONTENT

Does this material contain recycled content? yes no
If so, please fill in the following details:
Weight of post-consumer recycled portion: _____ kg
Weight of post-industrial recycled portion: 7,500 kg
Total weight of material/product: _____ kg
Recycled content information source (describe and attach): LETTER FROM SUPPLIER
Comments:

RAPIDLY RENEWABLE MATERIALS

Is this material made from a rapidly renewable resource? yes no
What is the value of the rapidly renewable portion? \$ _____
Rapidly renewable resource information source (describe and attach): _____
Comments:

REGIONAL MANUFACTURE AND HARVEST OF MATERIALS

Is this material manufactured locally, within a 800 km (truck)/3500 km (rail) radius of the project?

yes no

Distance between project and manufacturer (km): _____

Was it transported by truck, rail or other means? _____

Is the raw material in the product harvested and/or extracted locally, within a 800 km (truck)/3500 km (rail) radius of the project?

yes no

Distance between the project and the harvest/extraction site (km): _____

Regional manufacture and harvest information source(s) (describe and attach): _____

Comments:

CERTIFIED WOOD

Is this material a wood-based product or material?

yes no

If so, is it certified by the Forest Stewardship Council (FSC)?

yes no

If yes, give the vendor's FSC chain-of-custody certificate number: _____

What is the value of the FSC certified portion of this product or material? \$ _____

Certified wood information source(s) (describe and attach): _____

Comments:

LOW-EMITTING MATERIALS

Is this material an adhesive, sealant, paint or other coating, carpet, or composite wood/agrifiber product?

yes no

If yes, does it meet the emission limits described on page 2 of this document?

yes no

For all adhesive, sealant, paint or other coating, or carpet product, what is the VOC level of the material: _____ g/L

For composite wood products, does the material contain added urea-formaldehyde resin?

yes no

Low-emitting material information source(s) (describe and attach): _____

Comments:

SAMPLE LETTER TEMPLATE MR CREDIT 5.1-5.2: REGIONAL MATERIALS

This sample Letter Template summarizes the total percentage of locally/regionally harvested materials in the project.
 Letter Template provided courtesy of USGBC.

MR Credit 5.1 - 5.2: Regional Materials

Declaration not made
 (Owner, Architect, Contractor or Responsible Party)

I, YOUR NAME, declare that a minimum of 20% of the total value of the materials and products used are manufactured regionally within a 500-mile radius. Of the 20% regionally manufactured materials requirement, at least 50% of the content is extracted regionally (equal to 10% of total materials by cost).

**Be sure to use the LEED-BC distances for this as they allow longer distance transport if it is: rail: 3,500 km.*

Total construction cost					2,500,000	<- Needed if using default materials calculation
for default total materials cost; OR					\$ -	
Provide total materials cost (exclude labor, equipment)						<- Needed if user providing own materials calculation
Product name	Vendor	Product Cost \$	Distance between project and manufacturer (in miles)	Distance between project and extraction site (in miles)	Regional content information source	
✓ → FORM LUMBER \$ PLYWOOD	FORMS ARE US INC	22,000	150 KM	650 KM	LETTER FROM SUPPLIER	
✓ → PAINT	ICI	28,000	450 KM	N/A	LETTER FROM SUPPLIER IS COMING	
<i>Other possibilities:</i>						
WINDOW ASSEMBLIES						
AGGREGATE						
NATIVE PLANTS					Harvest: Location where raw materials extracted	
FLOORING					Manufacture: Location of final assembly	
PLASTIC LUMBER						
Product Cost Subtotal \$					-	
Total cost of regionally manufactured materials					\$ -	
Cost of regionally manufactured products as a percentage of the cost of all materials						0.00%
Total cost of regionally extracted materials					\$ -	
Cost of regionally extracted materials as a percentage of total materials cost. (These materials were used in regionally manufactured products).						0.00%

MR Cr. 5.1 (1 point): Regional Materials: Manufactured Regionally
 MR Cr. 5.2 (1 point): Regional Materials: Extracted Regionally

Points Documented
 1
 0
Total Points Documented 1 *possible*

Name: _____
 Organization: Green Construction Ltd.
 Role in project: Construction Manager
 Signature: YOUR SIGNATURE
 Date: Jan. 22, 2004

File last modified: August 1, 2003

**Get a map with the project location highlighted & showing a 800km and a 3,500 km radius to show what areas qualify. File in LEED binder.*

SAMPLE LETTER TEMPLATE MR CREDIT 6: RAPIDLY RENEWABLE MATERIALS

This sample Letter Template summarizes the total percentage of rapidly renewable materials in the project.
 Letter Template provided courtesy of USGBC.

MR Credit 6: Rapidly Renewable Materials

*This will be tight.
 "Rapidly Renewable" means
 materials that are harvested
 in a 10 year or less cycle.*

Declaration not made
 (Owner, Architect, Contractor or Responsible Party)
 I, YOUR NAME, declare that rapidly renewable building materials and products (made from plants that are typically harvested within a ten-year or shorter cycle) were specified/used for 5% of the total value of all building materials and products used in the project.

Total construction cost	2,500,000	<-- Needed if using default materials calculation
for default total materials cost; OR	\$ -	
Provide total materials cost (exclude labor, equipment)		<-- Needed if user providing own materials calculation

Product name	Vendor	Product Cost \$	% Renewable	Rapidly renewable content information source
<u>Possibilities</u>				
COTTON BATT INSULATION				
CORK FLOORING				
LINOLEUM / MARMOLEUM				
BAMBOO FLOORING				
WOOL CARPET				
AGRIFIBER PANELS & WALL COVERINGS, MDF SUBSTITUTES				
FABRICS - WINDOWS, RUGS				
ADOBE BUILDING PRODUCTS				
Product Cost Subtotal		\$ -		
Total value of rapidly renewable products				\$ -
value+ of rapidly renewable building materials and products as a percentage of the cost of all project building materials				0.00%

?? Should you go for it ??

Points Documented
 0 (?)

MR Cr. 6 (1 point): Rapidly Renewable Materials >= 5%

Name: _____
 Organization: Green Construction Ltd.
 Role in project: Construction Manager
 Signature: YOUR SIGNATURE
 Date: Jan. 22, 2004

Much of this will be decided when the interior's are sped'ed but some decisions can be, and should be made now if we want to go for this. 5% is not a high target.

SAMPLE LETTER TEMPLATE EQ CREDIT 4.1-4.4: LOW-EMITTING MATERIALS

This sample Letter Template summarizes declarations regarding the selection of low-emitting materials on the project. Letter Template provided courtesy of USGBC.

EQ Credit 4.1 - 4.4: Low-Emitting Materials

EQc4.1: Adhesives & Sealants

Declaration not made
(Architect, Interior Designer, Contractor or Responsible Party)

I, YOUR NAME, declare that the VOC levels in all adhesives and sealants used in the project do not exceed the current VOC content limits of South Coast Air Quality Management District (SCAQMD) Rule #1168, AND all sealants used as fillers meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

I have provided a list of all adhesives and sealants used in the project and have indicated the VOC content for each product.

Credits Awarded: 1

EQc4.2: Paints & Coatings

Declaration not made
(Architect, Interior Designer, Contractor or Responsible Party)

I, YOUR NAME, declare that the VOC levels in all interior paints and coatings addressed by Green Seal Standard GS-11 do not exceed the VOC and chemical component limits of the standard.

I have provided a list of all interior paints and coatings used in the project that are addressed by the referenced standard and have stated the VOC content for each product.

Credits Awarded: 1

EQc4.3: Carpet

Declaration not made
(Architect, Interior Designer, Contractor or Responsible Party)

I, YOUR NAME, declare that all carpet systems meet or exceed the current Carpet and Rug Institute's Green Label Indoor Air Quality Test Program requirements.

I have provided a list of all carpet systems used in the project.

Credits Awarded: 1

EQc4.4: Composite Wood and Agrifiber Products

Declaration not made
(Architect, Interior Designer, Contractor or Responsible Party)

I, YOUR NAME, declare that all composite wood and agrifiber products used in the building contain no added urea-formaldehyde resins.

I have provided a list of all composite wood and agrifiber products used in the project.

Credits Awarded: 1

Points Documented

EQ Cr 4.1 - 4.4 (4 points possible): Low-Emitting Materials

4

Name: _____

Organization: Green Interior Design Ltd.

Role in project: Interior Designer

Signature: YOUR SIGNATURE

Date: Nov. 30, 2003

File last modified: August 1, 2003

ISSUE FOUR: INDOOR AIR QUALITY

INDOOR AIR QUALITY MANAGEMENT DURING CONSTRUCTION

Capturing the Indoor Air Quality Management During Construction for Credit EQ 3.1 requires good housekeeping during construction. Credit EQ 3.2 can involve changes to the construction schedule.

EQ 3.1 – The intention behind EQ 3.1 is to protect the HVAC systems and to avoid contamination of the building materials, particularly absorbent materials, during construction. The emphasis is on protection. Most of this is not new but the challenge is in the thoroughness and the documentation.

The first step is to prepare a strategic Indoor Air Quality (IAQ) Plan which addresses all of the criteria, outlining specifically how the different aspects will be addressed. The sample Plan in this section is broken into the principal categories – General Description of the Project, HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Monitoring. Also in this section is a sample Checklist which would serve to document regular walkabout inspections by whomever the contractor designates to monitor the program. Identifying variances and especially recording actions taken to solve those issues is also important – none of us is expected to be perfect.

Good housekeeping is fairly pragmatic; the HVAC is another matter. Central to the LEED concern is avoiding systems contamination, more specifically, the Return Air system. If the central system is run during construction, the Return Air side must be installed to a higher SMACNA standard and the openings temporarily filtered with MERV 13 medium. Using the base building heating system is always a subject of discussion – this is just one more consideration to weigh, to say nothing of the cost of MERV 13 filters.

EQ 3.2 – The two-week building flush-out provides an opportunity for the building to breathe before it is occupied, for that ‘new car’ smell (VOCs) to dissipate. It is all about schedule. This is a tricky credit in that there is no real cost attached but it occurs right at the end of the project – just when the finishing trades are trying to complete their work. The intent is to flush the building with 100% fresh air. Very limited activities are permitted – air balancing and moving in of hard surface furniture is allowed, but nothing that would be classified as construction. Even the final cleaning must be before the flushing period. There are some passing references to the flushing program in the sample IAQ. Obviously, the team has to schedule this extra two-week period into the design/construction schedule.

If the two-week flushout period cannot be scheduled, or if the schedule slips during construction, an alternative way of capturing Credit EQ 3.2 is to conduct air testing using a specific EPA protocol. However, the protocol requires that if any test fails the standard, the contractor is responsible for ventilating the building with 100% outside air until the building passes both air quality tests and duct inspections. Again, this step occurs right at the end of construction, just when move-ins are scheduled and likely critical.

Toolkit items for this issue:

- Overview
- Sample IAQ Management Plan
- Sample IAQ Checklist
- Letter Template EQ Credit 3.1

SAMPLE IAQ MANAGEMENT PLAN (DURING CONSTRUCTION)

This is a sample IAQ Management Plan (During Construction) which would be developed by the Contractor as a first step to meeting the requirements of EQ 3.1.

Date: _____

The Contractor, _____ <insert name> _____, the Mechanical Trade Contractor, _____ <insert name> _____, and the Finishing Trades propose the following Construction IAQ Management Plan for _____ <insert project name> _____.

Project Summary:

<Insert a brief description of the project – sample following:>

The _____ is a new 550,000 m² medical education and research facility. The mechanical systems are divided into four basic groups: 1.) a morgue and anatomy laboratory in the two Basements; 2.) a public Ground Floor dedicated to teaching theatres, demonstration and seminar rooms, administration and support; 3.) four storeys of experimental and research laboratories in three wings on the Typical Floors, and 4.) Two Atria separating the laboratory wings and connected to the Ground Floor. These Atria have separate air supply systems and can be 100% exhausted at the Roof level.

<insert a condensed description of the mechanical system, particularly as it relates to the Return Air cycle.>

The nature of the laboratory functions and the related high ventilation requirements result in nearly all areas within the facility being 100% exhausted. The Administration offices, the theatre-classrooms, and other areas of the Ground Floor are designed more conventionally with a return air component. To segregate the air supply, all the mechanical (and electrical) supply equipment is located in the Basements and all the exhaust equipment is positioned on the Roof, minimizing the possibility of cross contamination. This mechanical segregation of the functioning areas greatly assists the Indoor Air Quality strategy. For emphasis it is worth repeating – all laboratory floors and technical support areas are 100% exhausted; only the Ground Floor functions having re-circulating return air. Strategies for operational economies and heat recovery are discussed elsewhere in the LEED submission.

<Discuss any conditions regarding Occupancy, especially any phasing if construction and occupants will be in the building at the same time.>

The occupancy of the entire facility will be phased. The Basement areas, the Ground Floor, the Upper Storeys, and the Atria can be progressively brought on-line with their own isolated HVAC systems on a storey-by-storey and a wing-by-wing basis without any of that air being returned or being mixed with occupied areas. The Ground Floor and upper storeys can be flushed using operating windows and positive pressure.

<Discuss the Indoor Air Quality Strategies, covering the following general topics, and adding anything unusual pertaining to your specific project>

I. HVAC PROTECTION:

- During construction, the two very large supply air intake manifolds at grade will be protected from construction dust and debris. Each of the many HVAC air intakes off those manifolds will be blanked. When run for tests and balancing, the perimeter areas will have been hard landscaped and the air intakes will be filtered and those filters replaced following pre-occupancy flush.

- As mentioned in the Summary, the typical Laboratory Floors, the Atria, and the Basement areas will receive 100% outside air and can be segregated easily, flushed, and occupied floor-by-floor and/or wing-by-wing without cross contamination. Should the HVAC systems for those floors be used during construction for temporary heat or ventilation, the exhaust air system openings will be sealed off to prevent the accumulation of dust and debris in that exhaust duct system.
The diffusers will be sealed in plastic.
- The Ground Floor, being the only building area with a return air system, will have all return air openings blocked. If, for some unforeseen reason, there should arise a circumstance wherein the return air system is required, it will have temporary MERV 13 filters installed at each return air opening and will receive frequent inspection and maintenance.
The temporary filters would be replaced for the final flush. If inspections by the mechanical engineer discover that the return air ducts have become contaminated due to inadequate protection, the return air ducts will be cleaned professionally as specified.
- Two distinct layers of the building are designed to different standards. The Ground Floor and the upper Laboratory Floors are specified to meet SMACNA Duct Cleanliness Guidelines “Intermediate Level” standards. More sensitive areas in the lower Basement are specified to meet SMACNA Duct Cleanliness Guidelines “Advanced Level” standards. To reiterated, however, and with the exception of the Ground Floor mention previously, none of the upper or lower storeys have any return air components.
- The Basement mechanical rooms will not be used to store construction or waste materials and will be kept clean and neat.
- When activities that produce high dust or pollution levels occur, such as drywall sanding, concrete cutting, masonry work, wood sawing, and insulating, return and supply air system openings will be sealed off completely for the duration of the task. To avoid potential contamination of the ceiling tiles which form return air plenums, lay-in tile installation will be delayed until after the drywall, paint and floor finishing is completed.
- Pictures of typical methods and procedures will be taken periodically by the Mechanical Trade Contractor and submitted to the Construction Manager in addition to the photographs required under the monitoring section of this plan.

2. SOURCE CONTROL:

- Prefabricated insulated ductwork will be protected against moisture during delivery to the job site. Ductwork materials will be stored inside the structure in a dry and clean environment pending installation.
- Construction traffic volume will be limited in the vicinity of the air intake manifolds by the time the main HVAC systems are activated. The manifold plenum will be protected and then cleaned and the HVAC units’ manifold plenum filters will be protected and replaced as specified following the flush. Motor vehicles will be restricted to the Loading areas, well removed from any fresh air intakes, preventing emissions being drawn into the building.
- Electric or natural gas alternatives for gasoline and diesel equipment will be used where possible and practical. Equipment will be cycled off when not being used or needed.
- The specification of materials and products with high VOC and/or particulate levels will be avoided. Careful attention will be paid to choosing products or installation methods with low VOCs such as paints, sealers, insulation, adhesives, caulking and cleaners and to choosing materials that do not breakdown. To further reduce potential exposure during construction, isolation procedures and ventilation with 100% outside air will be used to exhaust contaminated air directly outside during the installation of VOC emitting materials.
- A broad range of related air quality design standards within the building following Occupancy are discussed elsewhere in the LEED

Submission. For example, EQ Prerequisite 1 for IAQ performance compliance with ASHRAE 62-1999 and EQ Credits 1 and 7 for CO2, temperature, humidity, and air movement are all presented by the Mechanical Engineer. EQ Prerequisite 2 for tobacco and related particulates is achieved by the University of British Columbia's strict Smoke Free Buildings Policy.

- During construction, a full time Safety Officer will enforce Ledcor's Health, Safety and Environmental Programme which includes an Exposure Control Programme section, governed by the Workman Compensation Board's Occupational Health and Safety Regulation 296/97 as amended by Regulation 185/99 and specifically Part 5: Chemical and Biological Substances and Part 6: Substance Specific Requirements. The Safety Officer or his/her designate will wear a gas sampler and/or a particulate sampler during their constant rounds. On a weekly basis, a certified laboratory will test the samplers' canisters. Results will be monitored and recorded. Any non-complying results will be flagged and corrective measures implemented. The following outlines the material source standards being proposed during construction by type and limit of pollutants.

Substance:	Construction Concentrations*:	Post Occupancy Concentration*:
Respirable Particulates	WCB Standards	150 micrograms / m ³
Carbon Dioxide	WCB Standards	800 ppm (comfort)
Carbon Monoxide	WCB Standards	9 ppm (alert)
		15 – 25 ppm (health)
Nitrogen Dioxide	WCB Standards	0.165 ppm (300 micrograms / m ³)
Sulphur Dioxide	WCB Standards	0.1 ppm (365 micrograms / m ³)
Total VOC	WCB Standards	3,000 micrograms / m ³

* all averaging times are 8 hours

- Containers of wet products will be kept closed as much as possible. Waste materials, which can release odour or dust, will be covered or sealed. Recycling and disposal strategies are discussed elsewhere in the LEED submission.
- Pedi-grids will be installed as all main entry doors on the Ground Floor to reduce the tracking of outdoor contaminants into the building.

3. PATHWAY INTERRUPTION:

- Dust curtains or temporary enclosures will be used to prevent dust from migrating to other areas when applicable. As each wing has two isolated laboratories, this can be accomplished on lab-by-lab, wing-by-wing, floor-by-floor basis. During construction, areas of work will be isolated to prevent contamination of clean or occupied areas. Pressure differentials will be utilized to prevent contaminated air from entering clean areas.
- Pollutant sources will be kept as far away as possible from supply ducts and areas occupied by workers when feasible. Isolation procedures and ventilation with 100% outside air will be used to exhaust contaminated air directly to the outside with portable fan systems using the operable windows on the north and south elevations.
- The specification of materials and products with high VOC levels will be avoided. Careful attention will be paid to choosing products or installation methods with low VOCs such as paints, sealers, insulation, adhesives, caulking and cleaners.

Isolation procedures and ventilation with 100% outside air will be used to exhaust contaminated air directly to the outside during installation of VOC emitting materials to further reduce exposure.

4. HOUSEKEEPING:

- General housekeeping and dust suppression programs will use wetting agents or sweeping compounds. Efficient and effective dust collecting methods such as damp cloths, wet mops, vacuum with particulate filters, or wet scrubbers will be used.
- Cleaning activities will be instituted concentrating on HVAC equipment and building spaces to remove contaminants from the building prior to pre-occupancy flushing.
- All coils, air filters, fans and ductwork will remain clean during installation and will be cleaned prior to performing the testing, adjusting and balancing of the systems.
- Accumulations of water inside the building will be removed. Porous materials such as insulation and ceiling tile will be protected from exposure to moisture.
- Representative photographs will be provided of the above activities during construction to document compliance.

5. SCHEDULING:

- The design of the facility and of its segregated HVAC systems suits the phased Occupancy planned for the building. A regimen of rough balancing will occur as construction in each area and/or storey is completed; flushing and detailed balancing will coincide prior to Occupancy.
- Move-in of hard surface fixture, furnishings and equipment (FF&E) will occur during the flush period, but soft or porous FF&E items will be delayed until after the flushing cycle.
- New MERV 13 filters will be installed immediately following the flush and prior to the arrival of the Occupants.

6. MONITORING:

- Contractor Site Co-ordination Meetings are held weekly with the superintendents of all Trade Contractors. Project Consultant Site Meetings are held every two weeks. The appropriate components of the IAQ plan will be reviewed as a regular action topic at these meetings and the implementation of the plan will be documented in the minutes of meeting. A modified version of the SMACNA Appendix 'A' will be used as a recording format.
- Progress photographs are taken regularly throughout the construction sequence, but a specific series of record photographs will be taken at the appropriate stages to document adherence with the USGBC expectation – at least 18 photographs taken on three different occasions to show adherence to the plan. Those stages will be a) of the manufacturing and site delivery processes, b) of the installation, protection, and housekeeping activities, and c) of the commissioning, flushing, and re-filtering of the systems.

SAMPLE IAQ INSPECTION CHECKLIST

This sample IAQ Inspection Checklist can be used to document regular inspections during construction.

<PROJECT NAME>

IAQ INSPECTION CHECKLIST

AREAS INSPECTED (tick box as appropriate) DATE:

BASEMENT: LEVELS (B1, B2 and B3)

NORTH BAR and ATRIUMS GROUND FLOOR

TOWER 1 (EAST) GROUND FL. 2nd FL. 3rd FL. 4th FL. 5th FL.

TOWER 3 (WEST) GROUND FL. 2nd FL. 3rd FL. 4th FL. 5th FL.

OBSERVED ACTIVITIES BY CONTRACTORS and TRADES:

A. HVAC PROTECTION: YES NO N/A

1. SUPPLY AIR INTAKES PROTECTED

2. FILTERS IN AIR INTAKE DURING TESTING AND BALANCING:

3. EXHAUST / RETURN AIR SYSTEM SYSTEM SEALED:

4. FILTERS (MERV 13) IN RETURN AIR SYSTEM:

5. RETURN AIR DUCTS CLEANED:

B. SOURCE CONTROL YES NO N/A

1. PREFABRICATED INSULATED DUCTWORK PROTECTED AGAINST MOISTURE DURING DELIVERY:

2. DUCTWORK STORED IN CLEAN AND DRY ENVIRONMENT:

3. MOTOR VEHICLES LIMITED IN VICINITY OF AIR INTAKE MANIFOLDS:

4. VENTILATION WITH 100% OUTSIDE AIR DURING INSTALLATION OF VOC EMITTING MATERIAL:

5. WET PRODUCT CONTAINERS CLOSED:

C. PATHWAY INTERRUPTION: YES NO N/A

1. DUST CURTAINS OR TEMPORARY ENCLOSURES USED:

2. PRESSURE DIFFERENTIALS USED:

D. HOUSEKEEPING: YES NO N/A

- 1. DUST COLLECTION SUPPRESSION:
- 2. COILS, AIR FILTERS, FANS and DUCTWORK KEPT CLEAN:
- 3. WATER ACCUMULATION CHECKED:

E. SCHEDULING: YES NO N/A

- 1. SOFT / POROUS, FF & E ITEMS AFTER FLUSHING
- 2. NEW MERV 13 FILTERS INSTALLED FOLLOWING FLUSHING

F. PHOTOGRAPHS TAKEN: YES NO N/A

G. MEASUREMENTS TAKEN: YES NO N/A

- 1. RESPIRABLE PARTICULATES
- 2. CARBON DIOXIDE
- 3. CARBON MONOXIDE
- 4. NITROGEN DIOXIDE
- 5. SULPHUR DIOXIDE
- 6. TOTAL VOCs

READINGS:

- 1. RESPIRABLE PARTICULATES _____
- 2. CARBON DIOXIDE _____
- 3. CARBON MONOXIDE _____
- 4. NITROGEN DIOXIDE _____
- 5. SULPHUR DIOXIDE _____
- 6. TOTAL VOC's _____

REMARKS:

SAMPLE LETTER TEMPLATEEQ 3.1: CONSTRUCTION IAQ MANAGEMENT PLAN

This sample Letter Template summarizes the measures taken to manage indoor air quality during construction.

(Letter Template provided courtesy of CaGBC)

EQ Credit 3.1: Construction IAQ Management Plan, During Construction

HVAC Engineer, Contractor or Responsible Party)
 I, YOUR NAME, declare that an Indoor Air Quality (IAQ) Management Plan has been developed and implemented for the construction and pre-occupancy phases of the building. The following filtration media was used during construction (if air handlers were operated) and installed after construction:

Filtration Media Used	Manufacturer	Model Number	MERV Value
<i>Installed during construction:</i>			
HI - FLO	CAMFIL FARR	HF/85/24/24/ 32/12	13
<i>Installed at the end of construction:</i>			
HI - FLO	CAMFIL FARR	HF/85/24/24/ 32/12	13

-18 digital photo's each with a descriptive caption highlighting SMACNA approach used are included in the LEED binder.

I have provided the following additional documentation to support the declaration:

- EITHER
- 18 photographs—six photographs taken on three different occasions during construction AND
 - Identification of the SMACNA approach featured by each photograph, in order to show consistent adherence to the credit requirements.
- OR
- I certify that the five Design Approaches of SMACNA IAQ Guidelines for Occupied Buildings under Construction, 1995, Chapter 3, were used during building construction. AND
 - I have included a brief description of some of the important design approaches employed.

Points Documented

EQ Cr 3.1 (1 point):Construction IAQ Management Plan, During Construction

1

Name: _____

Organization: Green Construction Ltd.

Role in project: Construction Manager

Signature: YOUR SIGNATURE

Date: Oct. 15, 2003

File last modified: August 1, 2003

APPENDICES

APPENDIX A: LEED PROJECTS IN CANADA

LEED CERTIFIED PROJECTS IN CANADA (as of August 19, 2005)

BUILDING NAME	BUILDING OWNER	LOCATION	CONTRACTOR'S NAME
Vancouver Island Technology Park <i>GOLD CERTIFIED</i>	BC Buildings Corporation	Victoria	Campbell Construction
Green Operations Building <i>GOLD CERTIFIED</i>	City of White Rock	White Rock	KDS Construction Ltd.
Semiahmoo Library and Community Policing Station <i>SILVER CERTIFIED</i>	City of Surrey	Surrey	Norson Construction
Vancouver National Street Works Yard <i>GOLD CERTIFIED</i>	City of Vancouver	Vancouver	Omicron Consulting Group
Alberta Urban Municipalities Association Building <i>CERTIFIED</i>	AUMA	Edmonton	
Technology Enterprise Facility <i>SILVER CERTIFIED</i>	Discovery Parks Inc.	Vancouver	Stuart Olson Construction
MEC Winnipeg <i>GOLD CERTIFIED</i>	Mountain Equipment Co-op	Winnipeg	
Spring Creek Firehall <i>SILVER CERTIFIED</i>	Resort Municipality of Whistler	Whistler	Whistler Construction Company
Canmore Civic Center <i>GOLD CERTIFIED</i>	Town of Canmore	Canmore	
Crowfoot Library <i>CERTIFIED</i>	Calgary Public Library	Calgary	
St. John Ambulance Headquarters <i>SILVER CERTIFIED</i>	St. John Council for Alberta	Edmonton	
Surrey Transfer Station <i>SILVER CERTIFIED</i>	GVRD/Wastech Services Ltd.	Surrey	Vanmor Constructors Inc.
Cardel Place and Library Facility <i>GOLD CERTIFIED</i>	City of Calgary	Calgary	
Banff Community High School <i>SILVER CERTIFIED</i>		Banff	
Stratus <i>SILVER CERTIFIED</i>	Stratus Vineyards	Niagara-on-the-Lake	
EMS Cambridge <i>GOLD CERTIFIED</i>	City of Cambridge	Cambridge	
BC Cancer Research Centre <i>GOLD CERTIFIED</i>	BC Cancer Foundation	Vancouver	Ledcor

APPENDIX A: LEED PROJECTS IN CANADA

CANADIAN PROJECTS THAT ARE LEED REGISTERED (as of August 19, 2005)

1 Kingsway	City of Vancouver		Vancouver
1120 West Georgia Street	Westbank Projects Corp.	high-rise residential	Vancouver
121 Research Drive	Innovation Place	office building	Saskatoon
150 Roehampton	150 Roehampton Inc. (an affiliate of MintoUrban Communities)	high-rise residential	Toronto
1st Choice Savings and Credit Union	1st Choice Savings and Credit Union	office building	Lethbridge
43 Division Police and No.26 Ambulance Station Facility	Toronto Police Service	public order & safety (police, jail, courthouse)	Scarborough
Abbotsford Regional Hospital and Cancer Centre	Access Health Abbotsford	hospital	Abbotsford
Aboriginal Personal Care Home	Southeast Resource Development Corporation		Winnipeg
Aérogare de Kuujuaq	Transport Canada		Kuujuaq
Agrandissement du Pavillon Sainte-Marie	Congrégation des Soeurs de l'Assomption de la Sainte Vierge		Nicolet
Alberta Heart Institute	Capital Health	health care	Edmonton
Aquatic Ecosystems Research Laboratory	UBC Properties Trust	laboratory	Vancouver
Arts & Administration Building	University of Toronto at Scarborough	school	Toronto
BC Wildlife Park Discovery Centre	Kamloops Wildlife Park Society	conservation centre	Kamloops
BCGEU Regional Office	BCGEU	office building	Langley
Bison Courtyard	Arctos & Bird Management Ltd		Banff
Bluewater Health	Bluewater Health	health care	Sarnia
Bruce Power Support Centre	Bruce Power	restaurant, commercial office, campus (corporate campus, school) assembly (conv. center, place of worship, theater)	Tiverton
Buchanan Renew, University of British Columbia Building 14	UBC Renew - University of British Columbia	school	Vancouver
Burke Science Building	McMaster University	commercial office	Burnaby
Burnaby Youth Custody Services/Youth Forensic Psychiatric Services	British Columbia Buildings Corporation	school	Hamilton
			Burnaby

CANADIAN PROJECTS THAT ARE LEED REGISTERED CONTINUED

Burnside Gorge Community Centre	City of Victoria		Victoria
Calgary Courts Centre	Government of Alberta Infrastructure and Transportation		Calgary
Cambridge EnviroTech Centre	Properties R US	other	Cambridge
CAMMAC - Camp Musical au Lac McDonald	CAMMAC		Harrington
Canadian Memorial Chiropractic College	Executive Member, Board of Governors, CMCC	school	Toronto
Capital Regional Headquarters Building	Capital Regional Environmental	office building	Victoria
Cedar Corner	Tofino Community Investments	multi-unit residential (apartments, dormitories), retail (store, supermarket, art gallery), restaurant	Tofino
Centre de Démonstration des Technologies de l'Environnement	Nature-Action Québec		Beloeil
Centre for Translational Research	Provincial Health Services Authority	laboratory	Vancouver
Centre Frederic Back	Centre de l'environnement		Quebec
Century Plaza	Harvard Developments Inc.	office building	Regina
Chapiteau des Arts	Cité des arts du cirque	assembly (conv. center, place of worship, theater), campus (corporate campus, school)	Montreal
Charles Dickens' Elementary School	Vancouver School Board District 39	school	Vancouver
Chiefs and Petty Officers' and Officers' Facilities, CFB Halifax, Stadacona	DND		Halifax
City of Grande Prairie Police RCMP Building	City of Grande Prairie		Grande Prairie
City of Richmond Oval	City of Richmond	school	Richmond
Cloverdale Trades & Technology Centre, Kwantlen University College	Kwantlen University College	campus (corporate campus, school), higher education	Surrey
Coast Captial Savings, Victoria Admin. Office	Coast Captial Savings Credit Union	financial & communications	Victoria

CANADIAN PROJECTS THAT ARE LEED REGISTERED CONTINUED

Cottonwood Lodge - Riverview, Coquitlam B.C. Fraser Health Authority Specialized Residential Prototype Project	Fraser Health Authority		Coquitlam
Country-Hills Multi-Services Centre	City of Calgary	other	Calgary
CSF Vancouver Secondary School	Conseil Scolaire Francophone	school	Vancouver
CSL Industrial Complex	Woodside Properties Limited		Cambridge
Cypress Hills Interprovincial Park Centre	Province of Alberta	interpretive center (museum, visitor center, zoo), conservation center	Elkwater
Czorny Alzheimer's Centre	Northview Golf & Country Club		Surrey
D'AMBROSIO architecture + urbanism - Office Interior	Sky Shoes Holdings Ltd.	higher education	Victoria
Devon Canada Corporation	Devon Canada Corporation	commercial office	Calgary
Diamond & Schmitt Architects	Diamond & Schmitt Architects	commercial office	Toronto
Dinosaur Provincial Park Visitor Centre	Province of Alberta		
Discovery Education Centre - Vancouver Aquarium Marine Science Centre	Vancouver Parks Board		Vancouver
DNR District Office	Department of Natural Resources	office building	Bathurst
DNR District Office Florenceville	PNB Dept of Natural Resources	office building	Florenceville
Douglas Border Crossing	Canada Customs Revenue Agency	other	Surrey
Downtown YMCA / Residential Project	YMCA Family Services Vancouver		Vancouver
Earth Rangers Centre	Earth Rangers	laboratory animal care (veterinary, kennel), interpretive center (museum, visitor center, zoo)	Woodbridge
Easywash	Easywash Inc.		North Vancouver
EcoCité on the Canal	6176666 Canada Ltee	high-rise residential	Ottawa

CANADIAN PROJECTS THAT ARE LEED REGISTERED CONTINUED

Édifice Hagen	Dahltan	office building	Montreal
EITC - Building E2	University Of Manitoba	higher education	Winnipeg
Electronic Arts (Canada) Inc.	Electronic Arts (Canada) Inc.	commercial office	Burnaby
Electronic Arts (Canada) Inc. Phase 3A Motion Capture Studio	Electronic Arts (Canada) Inc.		Burnaby
Electronic Arts Phase II	Electronic Arts Canada	office building	Burnaby
Engineering/Computer Science building	University of Victoria; Facilities Management	school	Victoria
Envision Credit Union - Willoughby Community Branch	Envision Credit Union	financial & communications (bank, post office, data center)	Langley
E'Terra Inn		hotel/resort	Tobermory
existing Firehall officeconversion/ renovation	CHP Architects		Chilliwack
Fort Rodd Hill Visitor Orientation Centre	Parks Canada		Victoria
Fort Saskatchewan DOW Centennial Centre	City of Fort Saskatchewan	commercial office, restaurant, retail (store, supermarket, art gallery), health care, recreation	Fort Saskatchewan
Ft. McMurray Tertiary Waste Water Treatment Plant	The Regional Municipality of Wood Buffalo		Ft. McMurray
Gatine-sur-l'eau	Matrixyz		Lac Ste-Marie
Glenmore Filtered Water Pumping Station	City of Calgary Waterworks	office building	Calgary
GOCB Building	PWGSC	office building	Charlottetown
Government of Canada Multi Client Building 740 Bel-Air	PWGSC		Montreal
Government of Canada Office Building	PWGSC	other	Charlottetown
Grant MacEwan Student Residence	Grant MacEwan College		Edmonton
GTAA	GTAA		Toronto
Guelph Hydro Phase 2 – Addition to Southgate Service Centre	Guelph Hydro Inc.	office building	Guelph
Halte récréative et culturelle de la Pointe Valaine	Ville d'Otterburn Park		Otterburn Park

CANADIAN PROJECTS THAT ARE LEED REGISTERED CONTINUED

Hamilton Fire Hall	City of Richmond	public order & safety (police, jail, courthouse)	Richmond
Harbourview Cafe	Harbourview Marina and Motel	school	Brighton
Havelock Elementary School	Province of New Brunswick, Dept of Education	school	Havelock
Hazel McCallion Academic Learning Centre	University of Toronto at Mississauga		Mississauga
Heritage Mountain Secondary School	School District No.43, Coquitlam, B.C.	assembly (conv. center, place of worship, theater), K-12 education	Port Moody
Herman Miller Canada Head Office Relocation	Herman Miller	commercial office, retail (store, supermarket, art gallery)	Toronto
Hesquiaht First Nation School	Hesquiaht First Nation	school	Refuge Cove
Hillside Fieldhouse	City of Kamloops		Kamloops
HOK 720 King St. Toronto	HOK Canada/Urbana Architects	commercial office	Toronto
Holy Trinity Academy	Christ the Redeemer Catholic Schools	school	MD of Foothills
Hughes Condon Marler :Architects Office Renovation	Bridgegate Enterprises	commercial office, retail (store, supermarket, art gallery)	Vancouver
International Terminal Building	YVR Airport Authority	transportation (airport, train station, bus station)	Richmond
Iona P-12 School	Nova Scotia Department of Education	school	Iona
Joint Use Regional and Police Facility	Region of Peel	office building	Brampton
Kingston Police Headquarters	Kingston Police		Kingston
Kingswood Landing	Kingswood Capital Corporation	industrial (manufacturing, warehouse, pub. works)	North Vancouver
Kortright Centre for Conservation - Living City Centre	Toronto & Region Conservation Authority	conservation centre	Vaughan
Kwantlen University College, Surrey Campus - Building "A" Library Expansion	Kwantlen University College		Surrey
Langara College Library	Langara College		Vancouver

CANADIAN PROJECTS THAT ARE LEED REGISTERED CONTINUED

Le casse-tête	Rayside Architectes	office building	Montreal
l'Ecole Brodeur	Conseil scolaire francophone	school	Victoria
Little Mountain Neighbourhood House	Little Mountain Neighbourhood House Society		Vancouver
London SE Pumping Station & Reservoir			London
Manitoba Hydro Downtown Office Building	Manitoba Hydro	office building	Winnipeg
Maple Ridge Care & Office Building	Lark Care Inv Ltd.		Maple Ridge
Markham Centre School for Athletics and Healthy Active Living	York Region District School Board	school	Markham
McArthur Island Sports Centre	City of Kamloops		Kamloops
McGill Life Sciences Building_Francesco Bellini and Cancer Pavillions	Facilities Management and Development	laboratory	Montreal
McGill University Health Centre	McGill University Health Centre	health care, hospital	Montreal
Metepenagiag Heritage Park Development Project	Metepenagiag Heritage Park Inc.		Red Bank
Metro Label Printing Facility	Metro Label Company Limited		Toronto
Mission District Park Recreation and Sports Centre	City of Kelowna		Kelowna
Mount Royal College Learning Centre	Mount Royal College	school	Calgary
National Research Council Canada Institute for Fuel Cell Innovation	National Research Council Canada	higher education, laboratory	Vancouver
New Calmar Grade K-6 School	Black Gold Regional Schools	school	Calmar
New Government of Canada Building - Renovations to Scotia Centre Galleria	PWGSC	office building	Regina
New Joamie Elementary School	Government of Nunavut	K-12 education	Iqaluit

CANADIAN PROJECTS THAT ARE LEED REGISTERED CONTINUED

New Science Building, Biological Station, St. Andrews, NB	Fisheries & Oceans Canada	laboratory	St. Andrews
North Bay Regional Health Centre	North Bay Regional Health Centre Project	health care	North Bay
North Cariboo Community Campus, Quesnel	College of New Caledonia	school	Quesnel
Nova Scotia Community College - New Metro Campus	Nova Scotia Community College		Dartmouth
Oakton Library	Fairfax County Public Works	assembly (conv. center, place of worship, theater), library	Fairfax
Office Building, 2350 Albert Street, Regina, SK	Saskatchewan Property Management	office building	Regina
Omron Dualtec ECU Division	OMRON DUALTEC Automotive Electronics Incorporated		Oakville
Ontario Tree Seed Management Facility Administration Building	Province of Ontario	office building	Angus
Operations Centre, Gulf Islands National Park Reserve	PWGSC	office building	Sidney
Operations, Maintenance and Administration Building, Pine Creek Wastewater Treatment Plant	The City of Calgary - Wastewater		Calgary
Ottawa Paramedic Services Building	OPS Headquarters Partnership		Ottawa
Parkside Victoria Resort & Spa	Fairfield Project Limited Partnership	high-rise residential	Victoria
Pavillon des Sciences biologiques - Université du Québec à Montréal	UQAM	laboratory, higher education, campus (corporate campus, school)	Montreal
Pavillons Lassonde	Ecole Polytechnique	higher education	Montreal
PCL Centennial Learning Centre	PCL Construction Management Inc.	commercial office	Edmonton
Pharmacy Building - University of Manitoba Bannatyne Campus	University of Manitoba	laboratory, higher education, campus (corporate campus, school)	Winnipeg

CANADIAN PROJECTS THAT ARE LEED REGISTERED CONTINUED

Pine Creek Wastewater Treatment Plant Campus Site	The City of Calgary		Calgary
Poirier Aquatic Facility	City of Coquitlam		Coquitlam
Pomari - 1455 Howe St.	Qualex-Landmark Projects Inc.	high-rise residential	Vancouver
QEH/St. Pat's High School	Department of Transportation and Public Works	school	Halifax
Queen's Centre - School of Physical and Health Education (Building D)	Queen's University	school	Kingston
Radiance @ MintoGardens	Minto Gardens Inc.	high-rise residential	Toronto
Ravensview WPCP Administration Building	Utilities Kingston		Kingston
RCMP Headquarters Relocation Project	PWGSC	office building	Surrey
RCMP 'V' Division & Iqaluit Detachment	RCMP		Iqaluit
Red Deer Recreation Centre Renovation	The City of Red Deer		Red Deer
Regina Taxation Building Recapitalization	Governemnt of Canada	office building	Regina
Renaissance of Richmond Hill	Tridel	high-rise residential	Richmond Hill
Renovated Office Space for Kerr Wood Leidal	Kerr Wood Leidal	commercial office	Burnaby
River Street Water Treatment Plant	City of Kamloops	industrial (manufacturing, warehouse, pub. works)	Kamloops
River Valley K-8 School Modernization	Chinooks Edge School Division #73	K-12 education	Sundre
Robson Square, Court complex, Provincial Court of B.C.	BCBC	other	Vancouver
Royal Inland Hospital-Mental Health Facility	Interior Health Authority	hospital special needs housing (assisted living, long-term care)	Kamloops
SAS Institute Canada Inc.	SAS Institute	commercial office	Toronto
Saskatchewan Forest Center Building	Innovation Place	commercial office	Prince Albert
SC3 - Smith Carter New Corporate Office Building	Smith Carter Architects and Engineers Inc.	office building	Winnipeg
Sea Island Fire Hall #4	City of Richmond	public order & safety (police, jail, courthouse)	Richmond

CANADIAN PROJECTS THAT ARE LEED REGISTERED CONTINUED

Seymour- Capilano Filtration Plant	GVRD	industrial (manufacturing, warehouse, pub. works)	Vancouver
Shenfield Civic Centre	City of Spruce Grove	office building	Spruce Grove
Shindico Office Building	Shindico Realty	commercial office	Winnipeg
Smith Carter Corporate Office	Smith Carter	commercial office	Winnipeg
Squamish Lil'wat Cultural Centre	Spo7ez Society		Whistler
St Margaret's School - New Junior School	St Mararet's School	school	Victoria
St. Gabriel's Church	Passionist Community of Canada	assembly (conv. center, place of worship, theater)	Toronto
Stantec Centre Tower III	Stantec	commercial office	Edmonton
Stantec Vancouver Office	Stantec Consulting Ltd.	commercial office	Vancouver
Steelcare - Plant 19	SteelCare Incorporated	industrial (manufacturing, warehouse, pub. works)	Hamilton
Student Centre - University of Toronto at Scarborough	University of Toronto	higher education	Toronto
Sunset Community Centre	Vancouver Parks Board		Vancouver
The Conservatory	Vintage Properties		Kelowna
The Cornerstone	SFU Community Trust		Burnaby
The Currents	Windmill Development Group		Ottawa
The Silva at West 16th St and Lonsdale Ave, North Vancouver	West Coast Projects	retail (store, supermarket, art gallery), single-family residential	North Vancouver
The Strand on Waterfront Drive	Friesen Tokar Architects	high-rise residential	Winnipeg
The Vento	Windmill Development Group		Calgary
The Water Centre	City of Calgary	office building	Calgary
Thomas L. Wells Public School	Toronto District School Board	school	Toronto
Toronto Botanical Gardens	City of Toronto Parks and Recreation		Toronto
Township of Langley Civic Facility	Corporation of the Township of Langley	commercial office	Langley
TRCA Environmental Regeneration Services	Toronto and Region Conservation Authority		Vaughan
Tsawwassen Town Centre Mall 'Mixed Use' Project	Century Group		Tsawwassen
Tyrrell Field Station Expansion, Dinosaur Provincial Park	Alberta Infrastructure	conservation centre	Near Patricia

CANADIAN PROJECTS THAT ARE LEED REGISTERED CONTINUED

U of A Centennial Centre for Interdisciplinary Science Phase II	University of Alberta	laboratory	Edmonton
University of Calgary Child Development Centre	University of Calgary	office building	Calgary
University of Lethbridge Health and Wellness Centre	University of Lethbridge		Lethbridge
University of Toronto at Scarborough Student Centre	University of Toronto at Scarborough	school	Toronto
University of Victoria Medical Building	University of Victoria		Victoria
UOIT/Durham College Shared Athletic Complex	University of Ontario Institute of Technology/ Durham College of Applied Arts and Technology		Oshawa
Upper River Valley Hospital	Province of New Brunswick	hospital	Waterville, Carleton Co.
Ursuline Sisters Residence	Ursuline Sisters		Chatham
VanCity Lynn Creek Community Branch	VanCity Savings & Credit Union		North Vancouver
Vancity Savings & Credit Union - Branch #46	Vancity Savings & Credit Union	financial & communications (bank, post office, data center)	North Vancouver
Vancouver Convention Centre Expansion Project	VCCEP Ltd.		Vancouver
Vancouver Port Authority - Corporate Head Office	Vancouver Port Authority		Vancouver
Vancouver Transit Centre	Greater Vancouver Transportation Authority		Vancouver
Vaughan Fire & Rescue Service & York Region E.M.S. Station	City of Vaughan		Vaughan
Verve	The Residences at Verve	high-rise residential	Toronto
Victoria Centre Facility	City of Victoria	stadium/arena	Victoria
Vulcan Elementary School	Palliser Regional Schools	K-12 education	Vulcan
Western HRM	HRSB	school	Tantallon
Whistler Conference Centre Renovation	Tourism Whistler	assembly (conv. center, place of worship, theater)	Whistler
Whistler Public Library & Museum/Archives	Resort Municipality of Whistler	library	Whistler

CANADIAN PROJECTS THAT ARE LEED REGISTERED CONTINUED

Winnipeg Humane Society	Executive Director, Winnipeg Humane Society		Winnipeg
Woodward Environmental Laboratory	McCallum Sather Architects Inc.	laboratory	Hamilton
Writing-on-Stone Provincial Park Visitor Centre	Province of Alberta	interpretive center (museum, visitor center, zoo), conservation centre	Milk River
Yellowknife Government of Canada Building	PWGSC	office building	Yellowknife



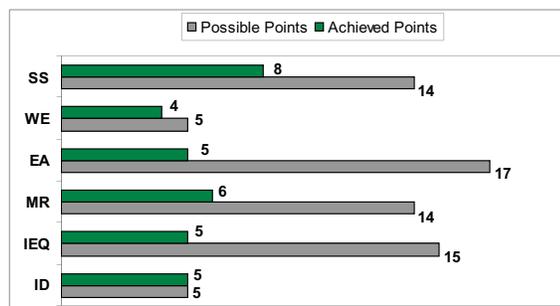
LEED
GREEN BUILDING RATING SYSTEM

LEED® Canada-NC 1.0
project name
date of certification

Points Achieved *level of certification* **Possible Points: 70**

Certified 26 to 32 points Silver 33 to 38 points Gold 39 to 51 points Platinum 52 to 70 points

Sustainable Sites			Possible Points: 14	Materials & Resources			Possible Points: 14
Prereq 1	Erosion & Sedimentation Control	Required		Prereq 1	Storage & Collection of Recyclables	Required	
Credit 1	Site Selection	1		Credit 1.1	Building Reuse: Maintain 75% of Existing walls, floors and roof	1	
Credit 2	Development Density	1		Credit 1.2	Building Reuse: Maintain 95% of Existing walls, floors and roof	1	
Credit 3	Redevelopment of Contaminated Sites	1		Credit 1.3	Building Reuse: Maintain 50% of Interior Non-Structural Elements	1	
Credit 4.1	Alternative Transportation, Public Transportation Access	1		Credit 2.1	Construction Waste Management: Divert 50% from landfill	1	
Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1		Credit 2.2	Construction Waste Management: Divert 75% from landfill	1	
Credit 4.3	Alternative Transportation, Alternative Fuel Vehicles	1		Credit 3.1	Resource Reuse: 5%	1	
Credit 4.4	Alternative Transportation, Parking Capacity	1		Credit 3.2	Resource Reuse: 10%	1	
Credit 5.1	Reduced Site Disturbance, Protect or Restore Open Space	1		Credit 4.1	Recycled Content: 7.5% (post-consumer + ½ post-industrial)	1	
Credit 5.2	Reduced Site Disturbance, Development Footprint	1		Credit 4.2	Recycled Content: 15% (post-consumer + ½ post-industrial)	1	
Credit 6.1	Stormwater Management, Rate and Quantity	1		Credit 5.1	Regional Materials: 10% Extracted & Manufactured Regionally	1	
Credit 6.2	Stormwater Management, Treatment	1		Credit 5.2	Regional Materials: 20% Extracted & Manufactured Regionally	1	
Credit 7.1	Heat Island Effect, Non-Roof	1		Credit 6	Rapidly Renewable Materials	1	
Credit 7.2	Heat Island Effect, Roof	1		Credit 7	Certified Wood	1	
Credit 8	Light Pollution Reduction	1		Credit 8	Durable Building	1	
Water Efficiency			Possible Points: 5	Indoor Environmental Quality			Possible Points: 15
Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1		Prereq 1	Minimum IAQ Performance	Required	
Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1		Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required	
Credit 2	Innovative Wastewater Technologies	1		Credit 1	Carbon Dioxide (CO ₂) Monitoring	1	
Credit 3.1	Water Use Reduction, 20% Reduction	1		Credit 2	Ventilation Effectiveness	1	
Credit 3.2	Water Use Reduction, 30% Reduction	1		Credit 3.1	Construction IAQ Management Plan: During Construction	1	
				Credit 3.2	Construction IAQ Management Plan: Testing Before Occupancy	1	
				Credit 4.1	Low-Emitting Materials: Adhesives & Sealants	1	
				Credit 4.2	Low-Emitting Materials: Paints and Coating	1	
				Credit 4.3	Low-Emitting Materials: Carpet	1	
				Credit 4.4	Low-Emitting Materials: Composite Wood & Laminate Adhesives	1	
				Credit 5	Indoor Chemical & Pollutant Source Control	1	
				Credit 6.1	Controllability of Systems: Perimeter Spaces	1	
				Credit 6.2	Controllability of Systems: Non-Perimeter Spaces	1	
				Credit 7.1	Thermal Comfort: Compliance	1	
				Credit 7.2	Thermal Comfort: Monitoring	1	
				Credit 8.1	Daylight & Views: Daylight 75% of Spaces	1	
				Credit 8.2	Daylight & Views: Views 90% of Spaces	1	
Energy & Atmosphere			Possible Points: 17	Innovation & Design Process			Possible Points: 5
Prereq 1	Fundamental Building Systems Commissioning	Required		Credit 1.1	Innovation in Design	1	
Prereq 2	Minimum Energy Performance	Required		Credit 1.2	Innovation in Design	1	
Prereq 3	CFC Reduction in HVAC&R Equipment	Required		Credit 1.3	Innovation in Design	1	
Credit 1	Optimize Energy Performance	1-10		Credit 1.4	Innovation in Design	1	
Credit 2.1	Renewable Energy, 5%	1		Credit 2	LEED Accredited Professional	1	
Credit 2.2	Renewable Energy, 10%	1					
Credit 2.3	Renewable Energy, 20%	1					
Credit 3	Best Practice Commissioning	1					
Credit 4	Ozone Protection	1					
Credit 5	Measurement & Verification	1					
Credit 6	Green Power	1					



APPENDIX C: CASE STUDY INDEX

STRATUS (page 7)

Owner: Stratus Vineyards Ltd.

Architects: Andrew Incorporated Architect

Structural: Enermodal Engineering Ltd.

Mechanical: Enermodal Engineering Ltd.

Electrical: Enermodal Engineering Ltd.

Landscape:

Location: Niagara-on-the-Lake, Ontario

EMS FLEET CENTRE (page 32)

Owner: Regional Municipality of Waterloo

Architects: McCallum Sather Architects Inc.

Structural:

Mechanical:

Electrical:

Landscape:

Location: Cambridge, Ontario

VANCOUVER ISLAND TECHNOLOGY PARK (page 40)

Owner: BC Building Corporation

Architects: Idealink Architecture; Bunting Coady Architects

Mechanical: Keen Engineering Co. Ltd.

Civil: First Team Engineering

Electrical: Robert Freundlich

Energy Consultant: Chris Jones

Contractor: Campbell Construction

Consultants: JVB Consulting (green building), Aqua-tex
(stormwater)

Location: Victoria, British Columbia

CITY OF WHITE ROCK OPERATIONS BUILDING (page 12)

Owner: City of White Rock

Architects: Busby + Associates Architects

Structural: Fast & Epp

Mechanical: Keen Engineering Co. Ltd.

Electrical: Flagel Lewandowski Ltd.

Landscape: Wendy Grandin Landscape Architecture Inc.

Location: White Rock, British Columbia

MEC WINNIPEG (page 34)

Owner: Mountain Equipment Co-operative

Architect: Prairie Architects Inc./ Sustainable Solutions Inc.

Building Envelope:

Structural Engineer:

Code Consultant:

Geotech Consultant:

Landscape Architect:

Contractor:

Electrical:

Civil Consultant:

Mechanical:

CANMORE CIVIC CENTER (page 49)

Owner: Town of Canmore

Architect: Marshall Tittlemore Architects

Mechanical Engineer: Keen Engineering

Structural Engineer: Keen Engineering

Electrical Engineer: Keen Engineering

Location: Canmore, Alberta

