The Living Building Challenge

In Pursuit of True Sustainability in the Built Environment

CASCADIA
REGION GREEN BUILDING COUNCIL

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AUTHORSHIP

The Living Building Challenge was authored and conceived by Jason F. McLennan prior to joining the Cascadia Region Green Building Council. McLennan now serves as the Principal Investigator overseeing the development of the standard and associated tools.

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Imagine buildings that are built to operate as elegantly and efficiently as a flower. Imagine a building that is informed by the eco-region's characteristics and

- that generates all of its own energy with renewable resources,
- that captures and treats all of its water on site
- that uses resources efficiently, and for maximum beauty

The Cascadia Region Green Building Council (Cascadia) has issued a challenge to all building owners, architects, engineers and design professionals to build in a way that will provide all of us and our children with a sustainable future.

It is time to move beyond Platinum to the level of the Living Building.

The Living Building Challenge

Executive Summary

No credits, just prerequisites.

The *Living Building Challenge* is attempting to raise the bar and define a closer measure of true sustainability in the built environment, at least as far as what is currently possible and given the best knowledge available today. Projects that achieve this level of performance can claim to be the 'greenest' in North America and as close to true sustainability as currently possible.

When LEED emerged in the late nineties, it filled a huge void in the marketplace as designers all over the country were trying to understand how to effectively define green building and measure it in a consistent way. Even though the tool was far from perfect, it quickly blossomed and did more for the green building market than anything previously conceived. When the Platinum level was defined it was immediately viewed as the highest level of environmental performance possible by many and, indeed, it is a significant achievement to attain the Platinum level under the current system. And yet, Platinum is not the highest level possible but rather it was chosen based on what was likely possible at the time of the tool creation. Several things have transpired in the short time since LEED 1.0 emerged that put the Living Building Standard in context:

1. LEED has been adopted at a far greater rate than anyone's expectations and has begun to transform the whole building industry. LEED has continued to evolve and improve and many municipalities have adopted LEED Silver as a baseline standard.

2. Multiple Platinum Buildings have emerged around the country and some with zero or small first-cost premiums, signaling that the market is ready to move beyond Platinum in the near future.

3. The USGBC has begun to explore the idea of LEED V3.0 as a major restructuring of how its system works. The specifics have not yet been determined and the implementation timeline is likely another one to two years.

4. Zero energy and zero waste water buildings are beginning to emerge around the country and the cost of wind, solar and other sustainable technologies continue to drop just as it is becoming clear that we are past the point of peak oil and cheap energy. Carbon neutral construction of buildings will no doubt follow.

5. Most significantly, it is clear that major environmental trends such as climate change are directly linked to human resource use and from the building industry itself. The rate of change and potential disastrous scenarios for our communities and quality of life are increasing. It is also clear that public opinion is finally awakening to that reality as evidenced by the shift in mass media attention of the issue, the Clinton Climate Initiative, the Mayor's Climate Initiative, the 2030 challenge and governmental efforts led by the State of California.

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Because of these issues, Cascadia feels compelled to release The *Living Building Challenge* to provide a signal to the green building industry where it needs to head in the next few years if we are to address the daunting challenges ahead. Cascadia views this Living Building Standard as an act of optimism and faith in the marketplace to reach high-level goals once they have been set. Cascadia believes that the Living Building Standard described here will be met in the Cascadia bio-region and elsewhere within the next three years, with increasing numbers of Living Buildings appearing within the next five years.

This standard is in no way meant to compete with LEED and the USGBC or the CaGBC. The Cascadia Green Building Council, as a chapter, views this document as support for the USGBC and CaGBC's goals by setting a new vision and as a way of raising the bar. It is our sincere hope that as the V.3 vision unfolds, the ideas put forth in our Living Building Standard will influence outcomes for greater environmental benefit and true sustainability. Perhaps the result could be an 'automatic platinum' or 'Platinum-Plus' rating – or simply that a Living Building level just gets added above the Platinum level.[1]

At the heart of the *Living Building Challenge* is the belief that our society needs to move quickly to a state of balance between the natural and built environments. Although highly difficult to achieve, understanding and documenting compliance with our system is inherently easy. No credits to count, models to create and large paperwork to compile. Just sixteen simple and profound prerequisites that must be met.

Concentric Sustainability Rings[2]

1 Perhaps in the future we will be able to define a level even higher than the Living Building- a truly restorative level.

2 Image courtesy of BNIM Architects

How The Living Building Standard Works

not what you are going to do.... but what you did
not less bad.... but good

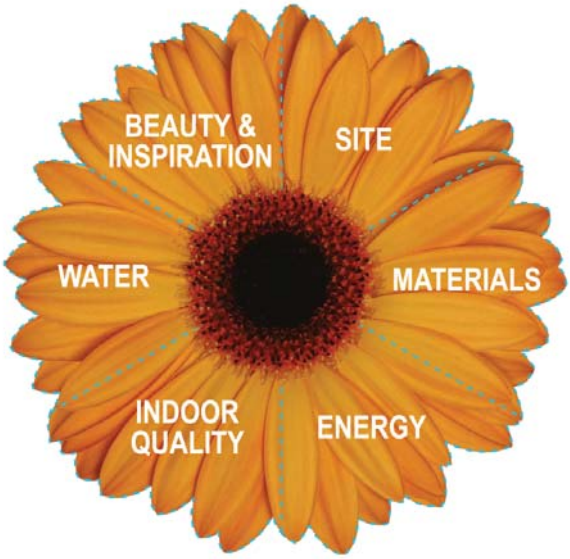
The purpose of the *Living Building Challenge* is simple – to define the highest measure of sustainability possible in the built environment based on the best current thinking-recognizing that 'true sustainability' is not yet possible. *The Living Building* is by definition difficult to obtain, and yet all facets of this tool have been attained in numerous projects around the world – just not all together. With this standard Cascadia hopes to encourage dialogue on where the building industry needs to head and engender support for the first pilot projects, until more and more living buildings emerge.

The rules are simple:

1. There are no credits – just prerequisites.
2. There are 16 prerequisites and all must be met to comply.
3. Many of the prerequisites have "exceptions" that show up in the footnotes and that are intended to acknowledge market realities. The Standard needs to be challenging – but not impossible to obtain.

Some useful guiding information:

- This new standard is an evolving tool and specific rules on how to document compliance and to seek living building designation will be presented in *The Living Building User's Guide*, which will be based specifically around what a project has done – not what it likely will do. A project cannot get a rating before it is completed and operating for at least a year.
- Over time, as market realities change, some exceptions noted in this document will be removed.
- The Living Building is performance based, not prescriptive and for the most part does not concern itself with how prerequisites are met, which should be the domain of the design team and owner.
- The Living Building does not dwell on basic best practice issues so, unlike LEED, it does not have to focus on so many things. It is assumed that to achieve this high level standard, typical best practices are being met.[3]



The "petals" to the *Living Building Challenge*

3 We highly encourage projects that cannot make the Living Building Standard to pursue a LEED Platinum or Gold rating since LEED remains the market's premier rating system.

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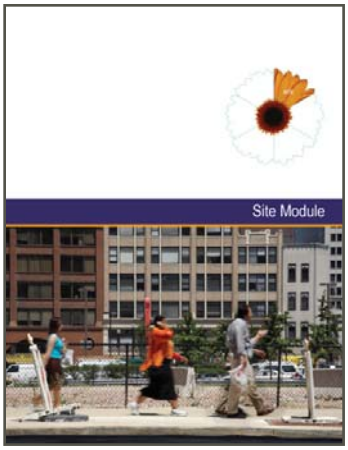
- The internal logic of the tool is based on pragmatic experience on what has been built in the marketplace. As hard as it may seem to achieve – it is achievable.
- The standard will work for existing buildings as well as for new buildings. Specific modifications for existing buildings will be defined in this document or the User's Guide.
- The Living Building Standard works for any building type since it is performance based and therefore based on absolute performance. As a result, the strategies to achieve it will vary widely by building type, which is appropriate.

It should be noted that ease of achieving the standard will vary by a number of factors including different climate locations and building types. For example, becoming water-independent in the desert means "evolving" building design to be more like a cactus and less like a tree. Making a 30-story building energy independent will require great investments in efficiency and a building skin that is all about harnessing energy. Architecture will be richer because of it.

The internal logic of the tool is based on pragmatic experience on what has been built in the marketplace. As hard as it may seem to achieve – it is achievable.

Site Design

Humanity has co-opted enough land - it is time to draw boundaries and declare it enough.



Major Environmental Issues/Prerequisite Intents

The continued outward spread of development and sprawl threatens the few wild places that remain. The decentralized nature of our communities increases transportation impacts and pollution. As flat, easy-to-build-on land diminishes, more and more development tends to occur in sensitive areas that are easily harmed or destroyed. Invasive species threaten existing ecosystems, which are already weakened by the constant pressure of development. The intent of these prerequisites is to clearly articulate where it is acceptable to build and how to protect and restore a place once it has been developed and degraded.

Ideal and Current Limitations

The ideal is to stop the seemingly never-ending growth outward and focus it into compact, connected communities, which is an inherent conservation tool for the natural resource systems that support human health. As previously built-on land is restored, the trend is reversed and nature's functions are invited back into a healthy interface with the built environment.

Prerequisites

Prerequisite One – Responsible Site Selection

You may not build on the following locations;

- Within 50-feet of Wetlands[4]
- On or adjacent to Sensitive Ecological Habitats[5] such as Primary Dunes[6], Old Growth Forest[7], virgin prairie[8].

4 Unless the building's purpose is related to wetland protection or interpretation.

5 Sensitive Ecological Habitats will be defined in the User's Guide.

6 Unless the building's purpose is related to primary dune protection or interpretation and demonstrates that the site's ecological systems are not disturbed.

7 Unless the building's purpose is related to forest protection or interpretation and demonstrates that the site's ecological systems are not disturbed.

8 Unless the building's purpose is related to prairie protection or interpretation and demonstrates that the site ecological systems are not disturbed.

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- Prime farmland[9]
- Within the 100 year flood plain[10]

Prerequisite Two – Limits to Growth

Projects may only be built on previously developed sites, either greyfield or brownfield.[11]

Prerequisite Three - Habitat Exchange

For each acre of development, an equal amount of land must be set aside as part of a habitat exchange[12].

Compliance/Documentation

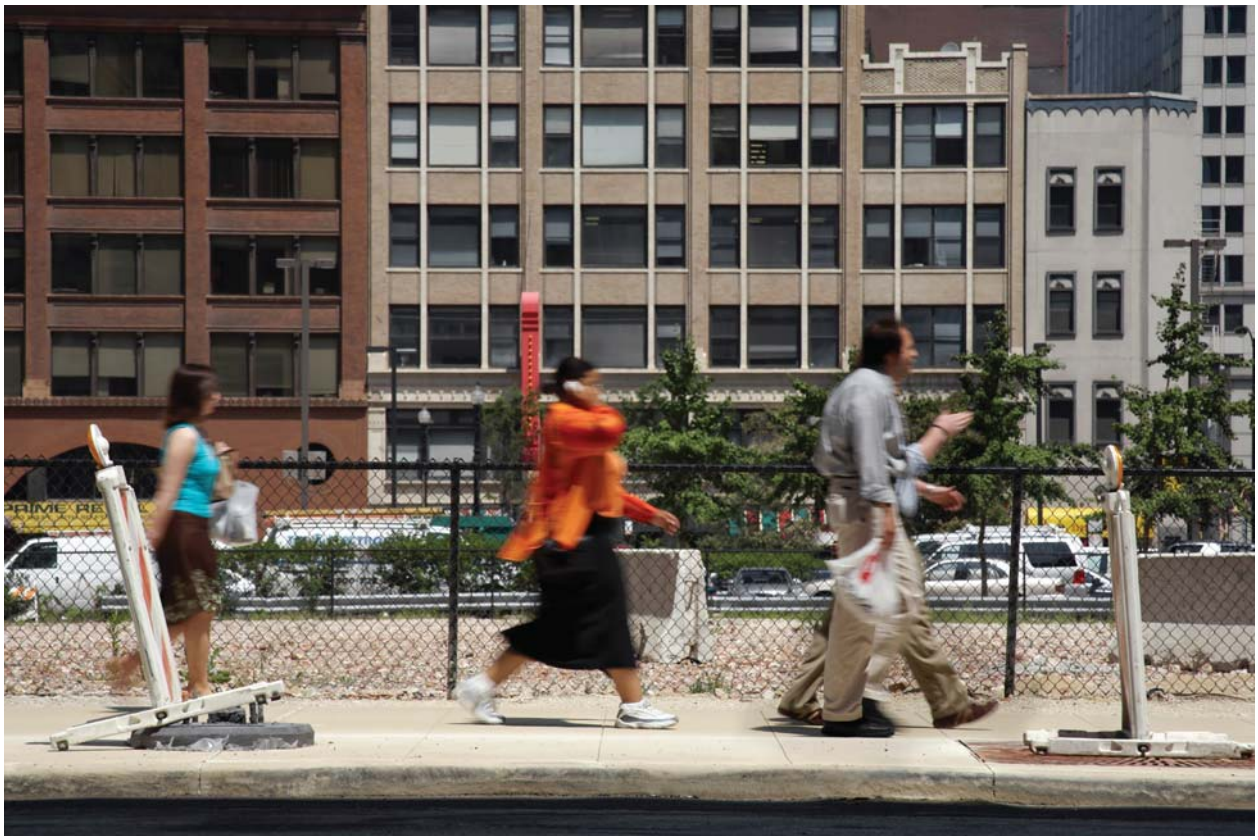
Compliance is outlined in the Living Building User's Guide.

9 Unless the building is related to farming or is a working farm/farmhouse.

10 Unless part of an existing urban core where significant density exists.

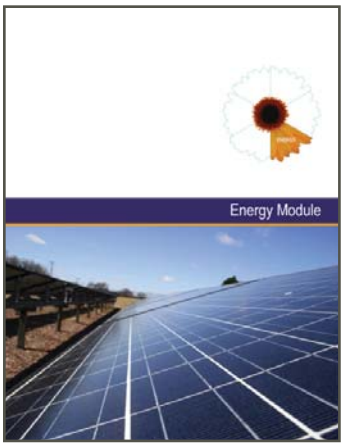
11 Unless the building purpose is related to the protection or interpretation of the virgin land.

12 A list of acceptable habitat exchange programs will be provided in the User's Guide. Credit will be given for brownfield reclamation.



Energy

A living building relies solely on current solar income.



Major Environmental Issues/Prerequisite Intents

The majority of energy generated today is from unsustainable sources including coal, gas, oil and nuclear energy. Large-scale hydro, while inherently cleaner, brings widespread damaging ecosystem impact. The effects of these energy sources on regional and planetary health is becoming more and more evident, with climate change being the most worrisome of major global trends due to human activity. The intent of this prerequisite is to signal a new age of design, whereby all buildings rely solely on renewable forms of energy and operate year in and year out in a pollution-free manner. Since renewable energy sources are inherently more expensive than energy efficiency measures, efficiency as a first step is assumed.

Ideal and Current Limitations

The ideal is simple - a safe, reliable decentralized power grid relying completely on renewable energy powering incredibly efficient buildings. The major limitation currently is cost.

Prerequisites

Prerequisite Four – Net Zero Energy[13]

100 percent of the building's energy needs supplied by on-site renewable energy[14] on a net annual basis.

Compliance/Documentation

Compliance is outlined in the forthcoming Living Building User's Guide.

13 Must include all electricity, heating and cooling requirements. Back-up generators are excluded. System may be grid-tied or off the grid.

14 Renewable energy is defined as photovoltaics, wind turbines, water-powered microturbines, methane from composting only, direct geothermal or fuel cells powered by hydrogen generated from renewably powered electrolysis.

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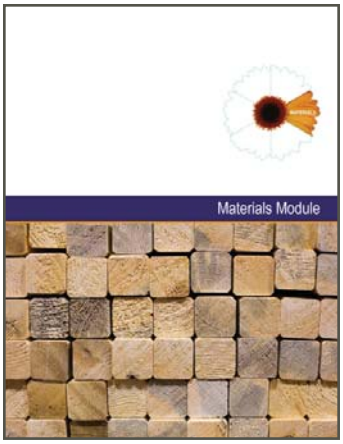

Materials

Safe, healthy and responsible for all species.

Major Environmental Issues/Prerequisite Intents

The environmental issues surrounding materials are numerous and include health and toxicity, embodied energy, pollution and resource depletion. The intent of these prerequisites are to remove, from a health standpoint, the worst known offending materials, and to reduce and offset the environmental impacts associated with the construction process. At the present time it is impossible to gauge the true environmental impact and toxicity of the buildings we build.

Ideal and Current Limitations

The ideal is a future where all materials in the built environment are safe and replenishable and have no negative impact on human and ecosystem health. The precautionary principle guides our materials decisions.

There are significant limitations to achieving the level of the Living Building in the materials realm. The biggest limitation is due to the market itself. While there are a huge number of "green" products on the market, there is a shortage of good data that really backs up manufacturer claims and provides consumers with the ability to make conscious, informed choices. Cascadia recognizes the PHAROS[15] protocol developed by the Healthy Building Network as the best framework for evaluating sustainable materials and the most progressive tool for consumer benefit. Projects are encouraged to eliminate all known persistent bio-accumulative toxins (PBT's), carcinogens and reproductive toxicants.[16]

15 www.Pharos.net

16 For more information see: http://www.healthybuilding.net/healthcare/HCWH-CHD-POP_PBT_list.pdf and http://www.oehha.ca.gov/prop65.html

At the present time it is impossible to gauge the true environmental impact and toxicity of the buildings we build.

Prerequisites

Prerequisite Five – Materials Red List[17]

The project cannot contain any of the following red list materials or chemicals.

- No added formaldehyde
- Halogenated Flame Retardants[18]
- PVC[19]
- Mercury[20]
- CFC's
- HCFC's
- Neoprene (chloroprene)
- Cadmium
- Chlorinated Polyethylene and Chlorosulfonated Polyethlene[21]
- Wood treatments containing Creosote, Arsenic or Pentachlorophenol
- Polyurethane
- Lead[22]
- Phthalates

17 Cascadia is going to adopt an ongoing 'red-list' of materials that it believes should be phased out of production due to health/toxicity concerns. This list will be updated as new science emerges.

18 Halogenated flame retardants include: PBDE, TBBPA, HBCD, Deca-BDE, TCPP,TCEP, Dechlorane Plus and other retardants with bromine or chlorine.

19 A temporary exception is made for PVC in wiring applications where it is mandated by code.

20 A temporary exception is made for low-mercury fluorescent lighting.

21 HDPE and LDPE are excluded.

22 An exception is made for solder and off-grid solar battery systems only.

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Prerequisite Six – Construction Carbon Footprint[23]

The project must account for the embodied carbon footprint of its construction through a one-time[24] carbon offset tied to the building's square footage and general construction type.[25]

Prerequisite Seven – Responsible Industry[26]

All wood must be FSC certified or from salvaged sources.

Prerequisite Eight – Appropriate Materials/Services Radius

Materials and Services must adhere to the following list:

Weight/Distance List

MATERIAL OR SERVICE	MAXIMUM DISTANCE
Ideas	12,429.91 miles
Renewable Energy Technologies[27]	7000 miles
Consultant Travel[28]	1500 miles
Lightweight Materials [29]	1000 miles
Medium Weight Materials	500 miles
Heavy Materials	250 miles

23 This number can be reduced by 50 percent for retrofits of existing buildings, which will be described in the User's Guide.

24 It should be recognized that buildings continue to accrue embodied energy as systems are replaced and repaired over time. It is recommended that additional offsets be purchased at 7-10 year intervals; however, this is not currently part of the program.

25 This offset formula will be presented in the User's Guide.

26 Subsequent iterations will include standards for other industries as they become available. All standards referenced must be from independent 3rd party organizations and not standards funded by the industries themselves such as the SFI wood standard.

27 Defined as wind, solar thermal, photovoltaics or fuel cells.

28 Applies only to major project team members including the architect of record, MEP and Structural Engineers of record. Specialty consultants qualify up to 3000 miles.

29 The scale for weight designations will appear in the user's guide.

Prerequisite Nine – Leadership in Construction Waste

Construction Waste must be diverted from landfills[30] to the following levels

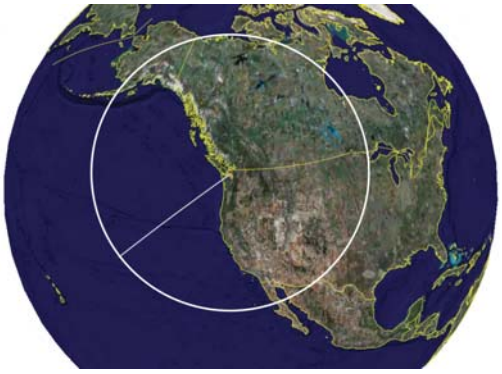
MATERIAL	MINIMUM Diverted/Weight
Metals	95%
Paper and Cardboard	95%
Soil, and biomass	100%
Rigid Foam, carpet & insulation	90%
All others – combined weighted average[31] Asphalt Concrete and concrete blocks Brick, tile and masonry materials Untreated lumber Plywood, OSB and particle board Gypsum wallboard scrap Glass Plumbing fixtures Windows Doors Cabinets Architectural fixtures Millwork, paneling and similar Electric fixtures, motors, switch gear and similar HVAC equipment, duck work, control systems, switches	80%

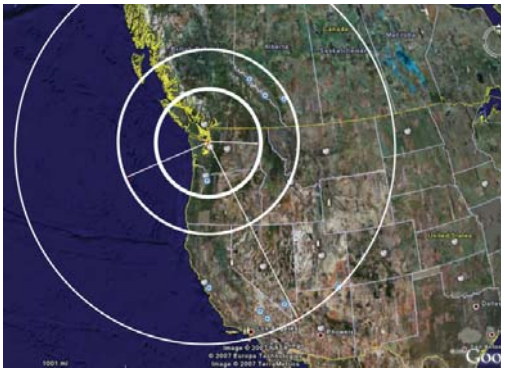
Compliance/Documentation

Compliance for each material's prerequisite is outlined in the Living Building User's Guide.

30 Diverted waste includes those that are: recycled, reused, salvaged or composted. Incineration is not permitted.

31 Weighted average is lower to account for lack of diversion markets in certain jurisdictions.





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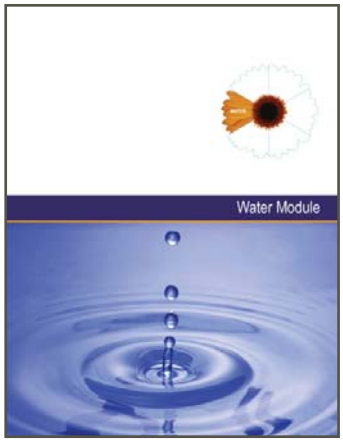


Water

A Living Building is water independent.

Major Environmental Issues/Prerequisite Intents

Scarcity of clean potable water is quickly becoming a serious issue in many countries around the world. The US and Canada have avoided the majority of these limitations and problems to -date due to abundant fresh water, but highly unsustainable water use patterns and the continued draw-down of major aquifers portent significant problems ahead. The intent of these pre-requisites is to realign how people use water in the built environment, so that people treat it as the precious resource that it is.

Ideal and Current Limitations

Cascadia envisions a future whereby all buildings are designed to harvest enough water to meet the needs of occupants. Water can be re-used and purified and re-used again. Currently, such practices are often illegal under health code regulations in North America, which arose precisely because people were not properly safeguarding the quality of their water. Reaching the ideal for water use presently is dependent on what is allowable by code. The Living Building Standard acknowledges this reality.

Prerequisites

Prerequisite Ten – Net Zero Water

100 percent of occupants' water use must come from captured precipitation[32] or reused water that is appropriately purified without the use of chemicals[33].

Prerequisite Eleven – Sustainable Water Discharge

100 percent of storm water and building water discharge must be handled on-site.

Compliance/Documentation

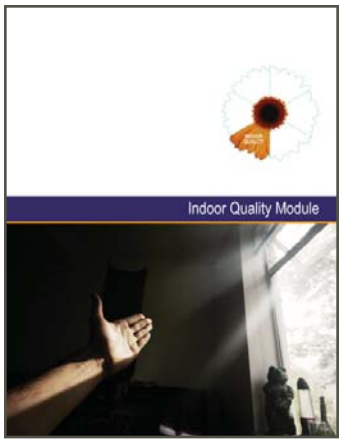
Compliance is outlined in the Living Building User's Guide.

32 The exception being water that must be from potable sources due to local health regulations, including sinks, faucets and showers but excluding irrigation, toilet flushing, janitorial uses and equipment uses.

33 An exception is made for an initial water purchase to get cisterns topped off. A Living Building only buys water once.

Indoor Environmental Quality

Healthy for all people



Major Environmental Issues/Prerequisite Intents

Most buildings provide far less than ideal conditions for maximum health and productivity. As comfort decreases, environmental impact often increases as people often find inefficient and wasteful ways to improve their physical environment. The intent of these prerequisites is not to address all of the potential ways that an interior environment could be compromised, but to focus on the major conditions that must be present for a healthy interior environment to occur.

Ideal and Current Limitations

It is difficult to ensure that indoor environments will remain healthy, vibrant places for people - especially over time, as aspects of human comfort such as indoor air quality, thermal control and visual acuity can easily be compromised in numerous ways. The presence of these prerequisites does not insure a great interior environment due to the unpredictable nature of how people operate and maintain a building.

Prerequisites

Prerequisite Twelve – A Civilized Work Environment

Every occupiable space must have operable windows[34] that provide access to fresh air and daylight[35].

34 Exceptions being spaces where the absence of daylight is critical to the performance of the space (such as a theatre) or where operable windows could pose a health risk (such as laboratory spaces with fume hoods where air flow could be compromised).

35 Work spaces can be no more than 30 feet from a window.

As comfort decreases, environmental impact often increases as people often find inefficient and wasteful ways to improve their physical environment.

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Prerequisite Thirteen – Healthy Air/Source Control

All buildings must meet the following criteria:

- Entryways must have an external dirt track-in system and an internal one contained within a separate entry space.[36]
- All kitchens and bathrooms must be separately ventilated.
- All copy rooms, janitorial closets and chemical storage spaces must be separately ventilated.
- All interior finishes, paints and adhesives must comply with SCAQMD 2007/2008 standards[37]. All other interior materials such as flooring and case works must comply with California Standard 01350 for IAQ emissions[38].
- The building must be a non-smoking facility[39]

Prerequisite Fourteen – Healthy Air – Ventilation

The building must be designed to deliver air change rates in compliance with California Title 24 requirements.

Compliance/Documentation

Compliance is outlined in the Living Building User's Guide.

36 Acceptable Dirt track in systems are defined in the Users Guide.

37 South Coast Air Quality Management District http://www.aqmd.gov/

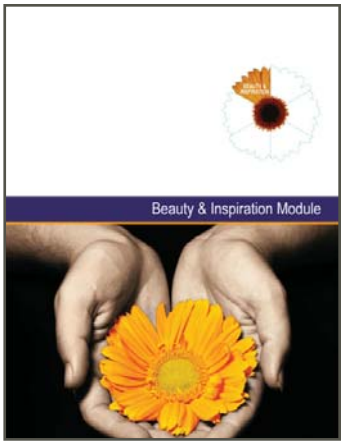
38 Based on Title requirements at the time of construction.

39 An exception is made for public housing and residential architecture.

This new standard is an evolving tool and specific rules on how to document compliance and to seek living building designation will be presented in *The Living Building User's Guide*, which will be based specifically around what a project has done – not what it likely will do.

Beauty & Inspiration

A Living Building Tells a Story.



Major Environmental Issues/Prerequisite Intents

As a society we are often surrounded by ugly and inhumane physical environments. Sustainable design must inspire and elevate our spirits to be successful. If we do not put care into our homes, streets and offices then why should we extend care outward to our farms, forests and fields? We accept billboards, parking lots and strip malls as being aesthetically acceptable in the same breathe that we accept clear-cuts, factory farms and strip mines. The Living Building Standard recognizes the need for beauty as a precursor to caring enough to preserve, conserve and serve the greater good.

Ideal and Current Limitations

Mandating beauty is, by definition, an impossible task. And yet, we believe we elevate the level of discussion and, ultimately, the results through attempting difficult but critical tasks. In this case the prerequisite is based merely on intention and attempt. We do not begin to assume we can judge beauty and project our own aesthetic values on others. But we do want to know people's intention and that there is an effort made to enrich people's lives with each square foot of construction on each project. This intentionality must carry forth into a program for educating the public about the environmental qualities of their Living Building.

Prerequisites

Prerequisite Fifteen - Beauty and Spirit

The project must contain design features intended solely for human delight and the celebration of culture, spirit and place appropriate to the function of the building.

Prerequisite Sixteen - Inspiration and Education

Educational materials about the performance and operation of the project must be made available to the public in order to inspire and educate. Non-sensitive areas of the building must be held open to the public at least one day per year, to facilitate direct contact with a truly sustainable building.

Compliance/Documentation

Compliance is outlined in the forthcoming Living Building User's Guide.

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Next Steps and Protocol

The Living Building Standard is intended to be a living document. This version is merely a starting point in the continual development of the tool. As new ideas emerge, Cascadia will update and improve upon the tools and its supporting documentation. Major changes to the tool will happen periodically as new science emerges or as conditions in the marketplace change, thereby affecting what is possible. Specific developments that Cascadia will be supporting include the following:

- Development of the Living Building User's Guide.
- Development of new Living Building financial models.
- Development of a Living Building Forum for discussion and feedback.
- Development of a new Living Communities Tool based on this Standard.
- Continued discussions with the USGBC and CaGBC for LEED integration.

How to Get Involved

Continued development of the *Living Building Challenge* will require many minds and great ideas. Cascadia will be looking for help in various ways which include:

a) Informal feedback on version 1.2

b) 'Expert' committee development to work on each issue.

c) Research for various supporting documentation.

d) Donations to help sponsor the next round of work and to fund a competition.

e) Creation of project review committees.

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Appendix

Background History

The idea for the Living Building first emerged in the mid-nineties during the creation of the EpiCenter project in Bozemen, Montana which was funded by NIST[40]. The goal of this project, which was led by Bob Berkebile and Kath Williams, was to produce the most advanced sustainable design project in the world. Leading the research and technology efforts on the project was Jason F. McLennan, who originally coined the concept and began developing the requirements for what was known as the living building. Following the EpiCenter, Berkebile and McLennan continued to develop these ideas and publish several articles on the concept.[41]

In 2000, BNIM Architects[42] was selected to design the new headquarters of the David and Lucile Packard Foundation and, as part of this work, researched the economic implications of the Living Building Concept along with other levels of LEED which was presented in a document known as the Packard Matrix in 2001. Other major players in this effort included KEEN Engineering. The Packard Matrix demonstrated that the level of the living building was the smartest long-term choice economically, although it carried a hefty first-cost premium. An updated study a year later showed this premium to be a bit smaller. It is projected that the first-cost premiums will continue to diminish and living buildings will soon emerge in response to the challenge of this Standard.

The ideal of the Living Building continues to be mentioned within the green building movement, although no true Living Building has emerged. That said, every single aspect of the Standard has been tried successfully in multiple projects, just never all at the same time, proving that the concept is possible today; the specific Standard that unites them was missing until now.

The Cascadia Region Green Building Council

The Cascadia Region Green Building Council promotes the design, construction and operation of buildings that are environmentally responsible, profitable and healthy places to live and work in Oregon, Washington and British Columbia. Incorporated as a 501(c)(3) charitable organization in December 1999, Cascadia is one of two original chapters of the U.S. Green Building Council. It is also a chapter of the Canadian Green Building Council.

40 The National Institute of Standards and Technology

41 See Bibliography at the end

42 www.bnim.com

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Summary of Prerequisites

Number	Category	Prerequisite
One	Site Design	Responsible Site Selection
Two	Site Design	Limits to Growth
Three	Site Design	Habitat Exchange
Four	Energy	Net Zero Energy
Five	Materials	Materials Red List
Six	Materials	Carbon Footprint
Seven	Materials	Responsible Industry
Eight	Materials	Appropriate Materials Radius
Nine	Materials	Construction Waste
Ten	Water	Net Zero Water
Eleven	Water	Sustainable Water Discharge
Twelve	Indoor Environmental Quality	Civilized Work
Thirteen	Indoor Environmental Quality	Source Control
Fourteen	Indoor Environmental Quality	Ventilation
Fifteen	Beauty & Inspiration	Design for Spirit
Sixteen	Beauty & Inspiration	Inspiration and Education

Current Development Team - TBD

It is our intention to fully develop the technical team for the *Living Building Challenge* moving forward. The following individuals have contributed to the development of the tool to-date.

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CASCADIA
REGION GREEN BUILDING COUNCIL

Cascadia's mission is to promote the design, construction and operation of buildings in Oregon, Washington and British Columbia that are environmentally responsible, profitable and healthy places to live, work and learn.