ENSPIRAL EVENTS AND RETREAT CENTER:
QUANTIFYING SUSTAINABILITY

Radiata Pine - CCA based treatment is used to prolong the life of timber used in constuction by keeping it weathertight. There are concerns around using chemically treated wood but scientific evidence has yet to reveal adverse effects on health, so for the sake of preventing mould, maintenance and renovation it is present in the design. If the building ends up being demolished it will likely be hard to sort treated form untreated timber - currently staining chemicals can be used to identify timber with applied copper-containing preservatives, in a time-consuming process. (Love 5) X-Ray fluoresence (XRF) and Laser induced breakdown spectroscopy (LIBS) are promising technologies for sampling and identifying wood to sort but are expensive. LIBS has been reported to be in a trend of "remarkable analytical development" and it is likely that it will have advanced by the end of the building's life. (Fernandes et al) Visual tests can be conducted with samples to track physical degradation.

Permeable pavement - A study similar to that of (Drake et al) can be conducted To measure quality of stormwater runoff, loading of Total Suspended Solids in mg/L (standards are specified on p.71-72), comparing concentrations of TSS against typical urban runoff concentrations. (Charters) produced figured for typical runoff on asphalt carparks in Addington, Christchurch. (fig 2.1) The study conducted by (Drake et al) found that pH of runoff, especially with permeable concreate, can exceed the standard level of 8.5 so this must be tested. This tends to stabilise as time passes. In gathering data cold months should be isolated as temperature can play a key role in results. Nutrient retention and long-term effects on surrounding ecosystems should also be adressed though is not covered in the study.
(Kumar et al) provide a method for returning to site to assess degradation in performance of infiltration over time, using the ASTM C1701 method. This uses two galvanised steel rings and timing the rate of water permeation. (fig 2.2) The study demonstrated that snowplowing had a heavy effect on degradation, and this is a confounding factor that simply will not be present for Enspiral, so better results can be expected. Suction cleaning and jet washing can help counter degradation but the biggest factor will likely be the amount of vehicle traffic on the car park.

Bikes -Wellington residents have generally shown a desire to cycle if adequate systems are put in place, even at the cost of car parking space. (Victoria University of Wellington) Mentoring, pooling, training, and security/guaranteed ride home systems all help incentivise bike use (O'Fallon). Higher use of bikes will mean less pollution from cars on road to Enspiral, eliminating health risks. Less use of cars will also have a marked positive effect on the car park's TSS concentration in stormwater runoff and degradation rate.

Water Conservation - The selected interior water conservation systems (Bidet, mist showerhead) can be monitored for their use of water and energy. The toilet is the most logical application to connect to recycled/ rainwater systems, and the locality of these systems will demonstrate how much water is saved, as inhabitants will have direct access to a stock of rainwater barrels.. (See section on rainwater.) It's assumed that there are multiple showers as people stay in dorms. A mist showerhead system provides a high degree of flexibility and people are immediately made conscious of the balance of water use and comfort. Showers will likely see heavy use due to the amount of people that stay in Enspiral. Because of this, shorter showers may be encouraged via social reinforcement. The sustainability of water use (and the connected energy) is contingent on habits and customs among inhabitants.

Air tightness - ventilation rate should be independant of outdoor windflow
There is potential for mould growth if the building is not properly ventilated but due to the open nature of the building it will be a surprise if this is a problem

Bioshelter - constitutes a diversity of benefits An analysis of the amount of time is spent driving from site for groceries can be measured to find the carbon footprint of shopping trips, as well as analyses of the food that ends up being bought, including having takeaways/ food deliveries. - though proper LCA analysis of store-bought groceries is time consuming. A better diversity of available plants can be guaranteed if the gardens are tended to correctly, to extend growing seasons and allowing year-round cultivatio. (Frey 27) Food is not packaged and largely biodegradable so it can be composted directly.

Rainwater - How much rainwater is saved? If there is excess, weigh cost/ benefits of water pumps and filters to gain more water autonomy. If systems such as filters and pumps for recycled water are introduced, this introduces costs and structural considerations around running dual plumbing systems through the building.
(Agar et al) assesses microbiology and bichemical content of reject water against global potable water standards and find that it meets these standards. (WHO)

Space Heating - Energy conservation can be measured simply by implementing a system which displays energy use and provides inhabitants control. A system like this was tested in 2001 to show how this sort of control can reduce energy use, developed to provide a solution that allows inhabitants access to detailed information on energy use and cost savings. (Stigge et al) The savings themselves will be contingent on attitudes of inhabitants, and variance has been estimated to range up to 30% (Mullaly) Energy-conscious attitudes are encouraged by other systems such as black-painted rainwater barrels, which teach an understanding of thermal mass.

STANDARDS

Passive house - This standard demands intelligent use of sun, adequate ventilation, airtightness, and thermal insulation with minimal thermal bridging. Requirements to take note of: Does not require a heating system to provide over 10 W/sq m (57.5kW) and does not exceed 15kWh per sq m. (86250kWh) Space cooling is not an issue in New Zealand. cools down by no more than .5.C over 12 hours, A limit of four times space heating is set for domestic applications. Airtightness must not exceed 0.6ACH at 50 Pa and thermal comfort levels must be satisfied. (Passive House Institute) Seeing as energy levels do not inherently bring thermal confort or air quality, these effects on inhabitants are important factors to consider. (Mlecnick) It can mean less respiratory illness, allergies, athsma, and productivity gains, meaning enriched community.

Life Cycle Analysis - (Mithraratne et al) developed a model for LCA for New Zealand buildings for energy as well as cost including appliances and furniture, provideing a means to model performance, estimating the net present cost using valies from the New Zealand Building Economist and market energy prices, as well as estimates of GHG emissions. It also allows for whatever degree of complete and reliable data is available, Factored in is a "reasonable indicator" of environmental impact. This can be used as a baseline for conducting a Life Cycle Analysis of the building, with the adaptability factor allowing as holistic and exact an assessment as desired.

HAZARD CLASSIFICATIONS
(See NZS 3640: 2003 for more information)

HAZARD CLASS	EXPOSURE	SERVICE CONDITIONS	BIOLOGICAL HAZARD	TYPICAL USES
H1.1	Protected from the weather, above ground	Protected from the weather, always dry	Borer	Interior finishing timber – see NZS 3602
H1.2	Protected from the weather, above ground, but with a possibility of exposure to moisture	Protected from weather, but with a risk of moisture content conducive to decay	Decay fungi and borer	Wall framing – see NZS 3602
H3 (AS/NZS 1604)	Exposed to the weather, above ground	Periodic wetting, not in contact with the ground	Decay fungi and borer	Plywood – see NZS 3602
H3.1	Exposed to the weather, above ground	Periodic wetting, not in contact with the ground	Decay fungi and borer	Cladding, fascia, joinery – see NZS 3602
H3.2	Exposed to the weather, above ground or protected from the weather but with a risk of moisture entrapment	Periodic wetting, not in contact with the ground, more critical end uses	Decay fungi and borer	Decks, pergolas, external beams, posts not in ground
H4	Exposed to the weather, in ground or in fresh water	Ground contact, or conditions of severe or continuous wetting	Decay fungi and borer	Fence posts, landscaping timbers not requiring a building consent
H5	Exposed to the weather, in ground or in fresh water	Ground contact, or conditions of severe or continuous wetting, where uses are critical and where a higher level of protection than H4 is required	Decay fungi and borer	House piles and poles, crib walling, posts in ground for decks, verandas, pergolas

IDENTIFYING TIMBER TREATMENTS
(See NZS 3640: 2003 for more information)

HAZARD CLASS	METHODS OF IDENTIFICATION	
H1.1	End branding	
H1.2	Permethrin plus TBTO, TBTN or IPBC	Blue
	Boron	Pink
H3 (AS/NZS 1604)	Face branding	
H3.1	H3.1 framing shall be face branded along the length at 1500 mm centres only on its face or edge. TBTO / TBTN	No added colour or, if coloured green, the colour is to be distinctly different from the green of the H3.2 preservative treatment (colour green 368).
H3.2	No added colour, the natural colour of treated timber is varying shades of green/brown.	
H4		
H5		

BUILDING COMPONENTS AND TREATMENT

BUILDING COMPONENT		SPECIES OR TYPE	MINIMUM TREATMENT REQUIRED
External in contact with ground	Building piles Plywood and timber frame foundations Crib walling Sawn poles House poles Retaining walls – uprights	Radiata pine	H5
	Retaining walls – horizontal members		H4
External not in contact with ground	Posts, bearers, beams, floor joists, rafters, guardrails, stair stringers	Radiata pine	H3.2
	Laminated beams and posts Plywood cladding as wall bracing		H3
Subfloor	Jackstuds, subfloor braces, bearers, wall plates, floor joists to the subfloor, blocking etc, subfloor wall studs, walings and battens, wall studs and nogs, diagonal boards	Radiata pine and Douglas fir	H1.2
	Plywood sheet bracing	Plywood	H1.2
Floors	Interior flooring **Note:** Flooring in wet areas may require timber or plywood treated to H3.1 – refer to NZS 3602: 2003 for full requirements.	Plywood and particleboard	None
		Dressed timber	See NZS 3602

BUILDING COMPONENT		SPECIES OR TYPE	MINIMUM TREATMENT REQUIRED
Walls	Timber: • within enclosed decks or balconies • supporting enclosed decks or balconies, where failure could be life threatening eg, enclosed post and beam construction • to which shelf angles and lintel angles for masonry veneers are fixed and their supporting members • cavity battens behind cladding • in exterior walls where monolithic claddings that **do not comply** with E2/AS1 are fixed directly to framing • used as weatherboards • for exterior joinery such as window and door frames.	Radiata pine	H3.1
	Timber: • within or beneath a parapet • supporting enclosed decks or balconies • in exterior walls except where otherwise specified eg, where monolithic claddings that **do comply** with E2/AS1 are fixed directly to framing.	Radiata pine and Douglas fir	H1.2
	Plywood exterior wall bracing	Plywood	H3
	Timber: • in exterior walls clad with masonry veneer and complying with special conditions (refer to NZS 3602) • in internal wall framing excluding those supporting decks and balconies • midfloor framing excluding boundary joists.	Radiata pine – KD gauged	None
		Radiata pine – other	H1.1
		Douglas fir	None
	Internal wall bracing	Plywood	None

fig 1: NZS3602 Hazard classifications and standards for timber treatment (Department of Building and Housing)

Pollutant		Carpark surfaces: Commercial carpark (Site TJC)	Industrial carpark (Standard; Site KRC)	Industrial carpark (Manoeuvring; Site GBC)
TSS (mg/L)	FF	305 (120-730)	447 (96-1,400)	516 (290-990)
	SS	34 (7-73)	84 (14-128)	78 (26-176)

fig 2.1: (Charters p. 152)

fig 2.2: infiltration test

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