homestar® v4

Technical Manual

NZGBC NEW ZEALAND GREEN BUILDING COUNCIL

homestar® v4

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Introduction to Homestar

Homestar is a comprehensive, national, residential rating tool that evaluates the environmental attributes of New Zealand's homes, providing a scale that creates value around warm, healthy, sustainable and efficient dwellings.

Homestar Background

The rating tool was released in 2009 as a result of a joint venture between BRANZ, Beacon Pathway and the New Zealand Green Building Council (NZGBC) for existing and new dwellings in New Zealand. It is now operated solely by the NZGBC. While based on a number of successful international rating tools, it was developed for New Zealand's specific conditions in consultation with a Technical Advisory Group (TAG) made up of industry experts from across the building value chain. Since the tool was originally developed, it has periodically undergone updates in response to industry feedback. A significant review in 2016-2017 resulted in widespread changes to the structure and content of the Homestar tool, which was released as Homestar® v4. This review was also completed in consultation with a TAG. For further details on the TAGs, please refer to the Acknowledgements on page 5.

Aims and Objectives of Homestar

The overarching objective of the Homestar rating tool is to improve the performance and reduce the environmental impact of new and existing New Zealand dwellings, making them warm, healthy, comfortable places to live. To achieve this objective, the Homestar rating tool aims to:

1. Establish a common language and standard of measurement for efficient, comfortable, healthy dwellings.
2. Reduce the environmental impact of New Zealand dwellings.
3. Provide advice that enables the building and construction industry to produce targeted solutions that deliver results for owners and tenants.
4. Create a value proposition for investment into the attributes that improve the performance of New Zealand dwellings, by rewarding good design with a higher rating.
5. Raise awareness of the benefits of sustainability for owners and tenants and the construction industry.

A formal certified rating carried out by a Homestar Assessor shows exactly how a dwelling rates across a number of sustainability criteria on a scale of 6 stars to 10 stars.

How Homestar Works

A Homestar rating is an assessment of achievement within categories and credits that provide solutions to improving the health, comfort, sustainability and quality of New Zealand dwellings.

Eligibility

The Homestar tool allows all types of dwellings to be rated. To be assessed, a dwelling must be considered as being 'self-contained' with the following minimum requirements:[1]

- At least one bathroom with toilet and shower or bath
- At least one kitchen or kitchen area which must include an oven, a food preparation area and food storage space.
- Constructed on permanent foundations.

Categories

The Homestar tool is divided into seven categories that form the key foundations of Homestar. Within each category are credits that address specific areas within that category.

Density and Resource Efficiency: rewards smaller dwellings and residential developments with smaller footprints because they require fewer resources to build, operate and occupy.

Energy, Health and Comfort: rewards attributes that contribute to a reduction in energy use within the dwelling such as energy-efficient water heating. This category also rewards dwelling attributes that contribute to occupant thermal comfort, for instance insulation and bathroom ventilation.

Water: rewards dwelling attributes that contribute to reduced water consumption, such as low-flow tapware.

Waste: rewards dwelling attributes that provide the ability to readily recycle waste, as well as rewarding construction practices that reduce waste going to landfill.

Management: rewards dwelling attributes that contribute to making a safe, secure and adaptable dwelling.

Materials: rewards the use of responsibly-sourced products and materials that have lower environmental impacts over their lifetime. It also recognises interior finishes that minimise the detrimental impact on occupant health from products that emit pollutants such as Volatile Organic Compounds (VOCs).

Site: rewards the attributes of the site such as effective stormwater management, the contribution to local ecology, and the location of the dwelling in relation to key amenities.

[1] More information about minimum requirements for dwellings, including sizes of kitchen areas (Clause 7) and bedrooms (Clause 8) can be found in the Housing Improvement Regulations 1947, http://www.legislation.govt.nz/regulation/public/1947/0200/latest/DLM3505.html

Points and Star Bands

Homestar rates a dwelling on a scale of 6 to 10 stars. These stars correspond to the total number of points achieved against the Homestar credit criteria within each category. There is a total of 120 points available within the tool, as well as 10 innovation points.

Points Distribution		
Category	Points available	Percentage of total
Density and Resource Efficiency	8	6%
Energy, Health and Comfort	60	50%
Water	14	12%
Waste	6	5%
Management	6	5%
Materials	14	12%
Site	12	10%
Total	**120**	**100%**
Innovation	10	

Star Bands	
Rating	Required score
6 Star	60 – 69.9 points
7 Star	70 – 79.9 points
8 Star	80 – 89.9 points
9 Star	90 – 99.9 points
10 Star	100+ points

The majority of Homestar questions/credits are optional. Therefore, a dwelling can achieve points in any of the categories above in order to achieve a star rating. In order to ensure a baseline standard, however, a number of key areas have mandatory minimum levels that must be achieved for a particular star rating. These mandatory minimum levels are outlined on page 221.

The assigned weight of each category (i.e. the number of points allocated to each category) was developed in consultation with the Technical Advisory Group (TAG) and in consideration of national and international precedents set within other relevant frameworks. The weightings have been fine tuned to reflect the New Zealand built environment and the objectives of Homestar.

Types of Homestar Assessments

Design Rating: a full assessment of a proposed dwelling based on detailed plans, specifications and any other documentation required to fully describe the build. A Design Rating is a checkpoint on the path to a Homestar Built Rating and expires two years after being issued.

Built Rating: a physical inspection of a completed dwelling by the Homestar Assessor. It can be conducted on an existing property without a prior Homestar Design Rating. If a Homestar Design Rating has been completed, the documentation may be used to streamline the process for a Homestar Built Rating.

Volume Assessment: where a developer has standard house designs, aspects of these designs relating to various Homestar credits may be pre-assessed, thus making the assessment process significantly more streamlined when the dwellings are built.

Types of Homestar Professionals

Homestar Practitioner: can assist in the design or building of Homestar projects. They have access to this Homestar Technical Manual and have a good understanding of the Homestar process and credits.

Homestar Practitioners are well-placed to advise developers and building owners on design features but are not able to submit Design or Built Ratings to NZGBC for audit.

Homestar Assessor: professionals who are trained and accredited to perform Homestar Certified Design and Built Ratings. The role of the Homestar Assessor is to use the Certified Tool to assess dwellings against the criteria in the Homestar Technical Manual, as well as to support owners in understanding how Homestar works and its purpose.

Homestar Assessors are contracted to NZGBC and carry out rating assessments according to the Rules and Methodology specified by the Homestar Certified Tool. To qualify as a Homestar Assessor, one must attend specific training and pass the examinations. The first assessment submitted after qualifying as an Assessor will undergo a supervised assessment.

The Homestar Process

The following process for a Homestar rating helps to maintain the robustness of the certification while providing a clear framework for Homestar Assessors and their clients.

Registration

The first step in the Homestar process should be the registration of a project with NZGBC. This allows NZGBC to become aware of the project's existence and, therefore, to provide help and guidance as required throughout the duration of the project.

To register a project with NZGBC, either the Homestar Assessor, or another person associated with the project, needs to complete the Homestar Registration Form (available on the Homestar section of the NZGBC website) and submit it via email to homestar@nzgbc.org.nz.

Admin and Audit Fees

When the NZGBC receives a completed registration form, the project will be registered in the Homestar database and an invoice for the Admin and Audit Fees will be issued. This fee covers both the Design and Built Rating stages. Submission for a Design Rating is optional but is included in the fees regardless.

The Admin and Audit Fees depend on the number of dwellings and typologies in the project and includes:

- Fixed admin fee
- Admin fee per dwelling
- Audit fee per typology

There may be additional costs for the following extras:

- Energy modelling audit
- Technical Questions

Please refer to the NZGBC website for current pricing.

Once payment is received, a Homestar registration letter is issued with a Homestar registration number. This document can be used in support of resource consent applications if required.

Compiling a Submission

It is necessary to collect documentation in order to evidence the points claimed for the Homestar rating. The documentation requirements are noted in each credit, along with whether that documentation needs to be submitted with your assessment.

The Pro Forma of Credit Compliance is used as a means of confirming compliance with a selection of credits, reducing the amount of documentation needed for audit. The pro forma is completed by the Assessor following visual verification on site for a Built Rating or analysing documentation evidence (e.g. drawings and specifications) for a Design Rating.

All supporting documentation and photographic evidence must be retained for a minimum of 36 months and provided to NZGBC upon request. These will only be requested by NZGBC if any issues are raised regarding the project (either by NZGBC or project owner).

The following credits are eligible to use the Pro Forma for Credit Compliance:

- EHC – 6 Lighting
- EHC – 7 Natural Lighting
- EHC – 9 Sound Insulation
- EHC – 10 Inclusive Design
- EHC – 11 Energy Efficient Drying
- WST – 2 Household Waste Minimisation
- MAN – 1 Security
- STE – 2 Native Planting
- STE – 3 Neighbourhood Amenities

Submitting an Assessment

Following completion of an assessment on a property, the Homestar Assessor must collate all of the required audit documentation into the Homestar submission template folder (downloaded from Assessor Resources page on NZGBC website)) and submit this to NZGBC for audit. Please refer to Appendix A for further information on how to compile and submit a good submission.

Audit Process

NZGBC is responsible for ensuring each assessment has been completed accurately and in a manner consistent with Homestar Assessor guidance provided within the Homestar Technical Manual. After a maximum of two rounds of review, the audit has been completed. The Homestar Assessor is notified of the number of points awarded and a Homestar rating is issued.

The general principle applied to audit is that the Homestar Assessor takes responsibility for ensuring:

- All documentation is included and is up to date.
- The submission contains the relevant documentation (highlighted or indicated as appropriate).
- Use of an efficient filing structure and file names to minimise audit time.

The role of the auditor is to check that the supplied documentation meets the requirements of the Homestar Technical Manual. The general principles applied to audit are:

- The submission is complete, with accurate, relevant and precise information.
- Sufficient work is undertaken to ensure documentation meets Homestar Technical Manual requirements.
- Confidentiality of process and handling is important.
- Consistency of process is applied throughout all audits.

Should the submission be deemed insufficient or incomplete, NZGBC will respond to the Assessor with questions. If a submission is deemed grossly insufficient, the auditor may reject the submission without fully scrutinising all credits and request a fresh submission.

Audit Results

Audit results using the following system will be provided to Assessors. There are two audit rounds allowed for in the admin and audit fee. During these rounds, the Homestar Auditor will provide responses in the following format:

Confirmed: all required documents have been submitted for the credit reviewed and, based on these documents, points have been awarded correctly.

Confirmed with Comments: the submission contained documentation or interpretation errors for the credit reviewed that do not affect the points awarded in the credit but need to be noted for future assessments.

Not Confirmed: submission contains significant errors that affect the points awarded. The Assessor is to review the credit and alter/award points accordingly. If points still have not been confirmed at the end of the second audit round, a Homestar Assessor may apply for a Charged Credit Review.

Rating Adjustment

If a submission contains a significant number of not confirmed credits, a rating adjustment (i.e. change in star rating) may be required. Should this occur, this will be reported and recorded against the Assessor. Assessors will be given the opportunity to appeal against the decision at their own cost.

homestar®

Project Team

Assessor

NZGBC

Preliminary building design

Engage an Assessor

Preliminary review

Revise designs

Preliminary review

Assess against Homestar Criteria

Send registration form to homestar@nzgbc.org.nz

Issue invoice for Admin and Audit fee

Pay Admin and Audit fee

Send Homestar Registration letter with Homestar Code

Upload Design Rating Round 1 submission to Dropbox and send *link* to homestar@nzgbc.org.nz

Send to external auditor

Upload Design Rating Round 2 submission to Dropbox and send *link* to homestar@nzgbc.org.nz

Send audit comments and request for additional documentation to Homestar Assessor

Award Design Rating

Build

Collect documentation

Upload Built Rating Round 1 submission to Dropbox and send *link* to homestar@nzgbc.org.nz

Send to external auditor

Upload Built Rating Round 2 submission to Dropbox and send *link* to homestar@nzgbc.org.nz

Send audit comments and request for additional documentation to Homestar Assessor

Award Built Rating

Volume Assessment

The NZGBC has introduced Volume Assessment as an approach for group home builders or developers to efficiently certify large numbers of homes that share the same standard design specification or design details and are built on multiple sites. Volume Assessment enables the common elements of the design of dwellings to be assessed once and then awarded to future dwellings using this standard design.

Homestar Volume Assessment allows projects to access the benefits of standardisation, including:

- Reduced registration fees per project.
- Reduced documentation fees per project, including Assessor fees.
- Increased certainty that common design, processes and materials comply with best practice benchmarks.
- Increased marketing opportunities and ability to demonstrate corporate leadership in sustainability.

Homestar Volume Assessment assesses an organisation's commitment to delivering sustainable homes from the outset. This may be in the form of standard design guidelines, specifications, standard details or other similar documentation. Achieving Volume Assessment demonstrates that an organisation delivers sustainable homes as standard.

The standard design assessed will overarch the 'housing scheme' or 'housing typology' and inform an individual home's Built Rating. Given that the standard design can be assessed early in the process, there is no need to submit repeated documentation for Homestar assessment. In its place, documentation confirming that the standard design has been implemented is all that's required.

Process

There are two main stages in the Volume Certification process:

1. Standard Design Assessment

2. Individual Project Assessment

Stage 1: Standard Design Assessment

For this stage, documentation is submitted to demonstrate that the standard design meets the Homestar requirements for the credits being targeted. This assessment follows the normal design rating process with the same documentation requirements, however targeted points do not have to be sufficient to achieve a Homestar rating. Only credits that relate to items that are standard across all dwellings built using the standard design should be submitted. If the standard design contains multiple options for some credits (e.g. a menu of lighting choices for EHC-6), evidence must be supplied to show that all the options meet the Homestar requirements. For items with regional differences (e.g. EHC-1), the assessor must note these differences and show compliance in all cases.

In addition, a Quality Assurance process will be submitted for review and approval by the NZGBC. This must be followed during the construction of any dwellings using this standard plan, and must contain a component for each credit reviewed at the Standard Design Assessment stage.

Outcome: Points achieved following the Standard Design Assessment will be totalled and a volume assessment certificate awarded. If the points total to 60+, the design will be awarded the a corresponding Homestar design rating (6 to 10 stars). A standard design that meets the Homestar mandatory minimums and achieves at least 40 points under the Standard Design Assessment may be marketed as 'Homestar Ready'. For a design that achieves fewer than 40 points, the points will still be considered pre-assessed and a certificate will be issued, but the design cannot be marketed as 'Homestar Ready'.

Example: A group home builder seeks to demonstrate that they meet the requirement of the EHC-1 'Thermal Comfort' credit using the schedule (R-value) method. The Homestar requirements are met within their architectural specification for all houses. The architectural specification is assessed and, where deemed compliant, points are awarded for EHC-1 as part of the standard design.

Stage 2: Individual Project Assessment

For this stage, documentation is submitted to demonstrate that the standard design has been implemented on the specific home or typology being assessed. Documentation is reduced and quality assurance process must be followed. Site-specific credits not assessed at the Standard Design Assessment stage must be submitted following the normal Homestar requirements.

Outcome: Where awarded, the credit points achieved will count towards the house achieving a certified Homestar rating.

Example: The group home builder (from above) demonstrates that the EHC-1 'Thermal Comfort' credit has been achieved for a specific house or typology by providing a statement from the main contractor confirming that the architectural specification has been implemented.

<table>
<tr><th colspan="2">EHC-1 'Thermal Comfort' Audit Documentation</th></tr>
<tr><th>Non-Volume Approach</th><th>Volume Approach</th></tr>
<tr><td>Drawings and specifications showing constructions type and relevant R-values as detailed below.
Walls and Windows: Marked up drawings showing (i) construction type (for both walls and windows) (ii) widths and heights of all walls and windows (iii) wall insulation (iv) orientation (v) window shading.
Roof: Marked up drawings showing (i) construction type (ii) widths and heights of any skylights (iii) ceiling insulation.
Flooring: Marked up drawings showing (i) construction type (ii) widths and lengths of flooring (iii) floor covering (iv) sub-floor insulation (if applicable).</td><td>Signed pro-forma (issued by NZGBC) from the main contractor confirming that the architectural specification has been implemented and that it meets the requirements of EHC-1 following the schedule method pathway.</td></tr>
<tr><td colspan="2">Using the Volume approach, documentation specific to that house prescribed within the Technical Manual is not required. Rather, only confirmation that the standard design (which has previously been assessed) has been implemented is required.</td></tr>
</table>

Reduced Documentation

The level of documentation to be submitted for the individual project is significantly reduced compared to that prescribed in the Technical Manual. This results in significant efficiencies in time, including reduced need to compile documentation for assessment, and cost, including reduced Homestar Assessor fees.

Using the Homestar Tool

The Homestar Tool consists of the scorecard, calculators and the technical manual. Each serves an essential purpose in helping to complete a Homestar assessment. For 6 and 7 Homestar, a simpler, optional checklist approach is also available as a substitute to the scorecard and calculators.

Checklist Approach for 6 and 7 Homestar

NZGBC publishes checklists for achieving 6 and 7 Homestar Built Ratings on our website. Using this optional approach can eliminate the need for calculators and provides a more streamlined and certain methodology. The documentation required is included in the checklist document. Because the checklist is less flexible than using the Homestar Tool, it may not be suitable for some projects.

The Homestar Scorecard

The Homestar Scorecard enables Assessors to conveniently record points awarded for various credits, for auditors to confirm/or deny those points and for both Auditors and Assessors to comment or respond to comments on specific credits. One Scorecard should be completed for each typology.

All values must be entered manually, including the points calculated using the provided calculators. This allows the same calculator file to be used across all stages and audit rounds while ensuring that the points recorded for past auditing rounds do not automatically change. It also ensures cross-platform reliability and performance.

For each rating stage (Design and Built), the awarded and confirmed points as well as the comments are on one page. Each rating stage has its own page. In general, the grey cells can be modified by assessors and the green cells may be modified by the auditor only. The auditor will award some or all of the points in the 'Point Award' column. If points are awarded despite all required evidence not being sighted, the auditor may select 'No' in the 'All Evidence Sighted' column to notify the assessor. This may be used when outstanding evidence is expected at the next rating stage. The auditor will then write comments, and these are highlighted using a traffic light system (Green: points confirmed, Amber: points confirmed conditionally, Red: points declined).

The final point tally (both targeted and awarded by auditor) and the star rating can be seen at the bottom of the scorecard. You can also see the mandatory minimums milestones which will help both the Auditor and Assessor to verify if the mandatory minimums have been met.

Coversheet: This is where you can enter general project information, the nature and current stage of the project, as well as the building footprint area, area of conditioned space, gross floor area and the number of bedrooms. It also has some information on the use of the scorecards. **This must be completed in order for the calculators and scorecards to function properly.**

Design Scorecard: This is to be used at the Design stage. The assessor is to enter the points claimed in the grey columns (Target Points) in the appropriate cell. Where multiple pathways exist to achieving a credit and these have different point structures or total points, a grey cell appears by the credit description which can be modified. Some cells can hold any value, some can only hold certain values and some only accept a simple Yes/No answer.

The scorecard accommodates two audit rounds and the assessor and auditor should take care to enter the points into the correct column. The columns are labelled 'R1' or 'R2' for round 1 and round 2. Only credits where all the targeted points were not awarded need to be addressed in Round 2. If a charged additional round beyond the two rounds is required, a new scorecard can be used.

Built Scorecard: This is to be used during the Built Rating stage. It covers two audit rounds and the Assessor and Auditor should take care to enter the points into the correct column. The columns are labelled 'R1' or 'R2' for round 1 and round 2. Only credits where not all the targeted points were awarded need to be addressed in Round 2.

Homestar Multi-Unit Summary

This is a summary that should be used in multi-typology developments where the data from the individual Homestar Scorecards can be entered in as a project-wide summary to streamline the audit process. Only the final credit totals need to be entered.

Homestar Calculators

Homestar calculators are provided to assist with calculating points for certain credits. Where a calculator is used, the calculated points still need to be transferred to the appropriate scorecard. The following credits use calculators:

Credit Name	Calculator Used
Density and Resource Efficiency	Points calculated automatically when coversheet is completed
EHC – 1 Thermal Comfort	Energy Calculator
EHC – 2 Efficient Space Heating	Energy Calculator
EHC – 5 Hot Water Heating	Water Calculator
EHC – 6 Lighting	Lighting Calculator
EHC – 7 Natural Lighting	Lighting Calculator (optional)
EHC – 8 Renewable Energy	Energy Calculator
WAT – 1 Water Use in the Home	Water Calculator
WAT – 2 Sustainable Water Supply	Water Calculator
MAT – 1 Sustainable Materials	Materials Calculator
MAT – 2 Healthy Materials	Materials Calculator
STE – 1 Stormwater Management	Water Calculator – for roof stormwater section only (optional)

Credits

Each Homestar credit within the seven categories is set out in a consistent manner.

Credit Title: provides the name of the credit.

Aim: outlines the purpose of the credit.

Credit Criteria: set out the benchmarks, or requirements, to achieve points for this credit. Also gives the maximum number of points available.

Assessment: gives instructions for assessing the credit.

Audit Documentation: audit documentation is listed separately for both Design Rating and Built Rating.

Additional Guidance: provides additional information to assist in assessing the credit as well as providing relevant definitions of Homestar terminology used in the credit.

Background: details the environmental issue the credit addresses along with the reasoning behind the approach taken to tackle this issue within Homestar.

References and Further Information: provides references to further information on the topic.

Terminology

Mandatory Minimum Levels

There are some core elements of Homestar that are considered so important that a minimum performance level needs to be achieved before it is possible to progress to a higher star rating. These are referred to as 'mandatory minimum levels'. If the assessed house fails to achieve these mandatory minimum levels, no matter what level of achievement in other areas of the tool, the minimum levels will limit the final star rating. In this case, the dwelling's final star rating will be the highest rating where the mandatory minimum levels are all met.

Mandatory minimum levels are in the Energy, Health and Comfort and Water categories and are in place at the 6, 7 and 8 star bands. Apart from these mandatory minimums, Homestar is flexible – the project owner can choose which credit criteria to meet. Details of the minimum levels are in the following table.

Level of achievement	Requirement	Outcome if not achieved
To achieve 6 stars or above	EHC-1: 12 points	No rating achieved.
	EHC-2: A fixed heating source serving the main living area except when annual heating energy demand is less than 15 kWh/m^2	
	EHC-3: 1.5 points	
	EHC-4: 0.5 points	
	WAT-1: maximum 9L/min shower and 6/3L dual-flush toilet (3 star WELS)	
To achieve 7 stars or above	All requirements for 6 Homestar	A maximum rating of 6 stars is available.
	EHC-1: 14 points	
	EHC-4: 1.5 points	
To achieve 8 stars or above	All requirements for 6 and 7 Homestar	A maximum rating of 7 stars is available.
	EHC-1: 16 points	

Typologies

Typologies are designs that are repeated for multiple dwellings. Multi-dwelling developments usually have multiple dwellings using the same typology. In this instance only the 'worst case scenario' of each typology is assessed under Homestar. The rating for that typology is then applied to all dwellings of that typology. All of the dwellings within a typology must have the same:

- Number of bedrooms
- Building footprint and ground floor construction
- Area of conditioned Space +/- 10%
- Wall area and construction +/- 10%
- Roof construction and ceiling area +/- 10%

All dwellings within a specific typology must meet or exceed the points claimed within each credit by that typology. When defining typologies in a project, please consider that the worst-case dwelling will be assessed, and the points applied to every other dwelling of that typology. Typologies in better orientations could feasibly yield better Homestar ratings, so if the project wants a range of ratings rather than a minimum rating, additional typologies will need to be included. Reducing the number of typologies will reduce the Admin and Audit fees but may result in lower points achieved for some dwellings.

Technical Questions

Technical Questions are used to suggest a change or update to the Homestar Rating Tool or Technical Manual that would affect the whole of Homestar, or to suggest an alternative means of compliance.

It is possible to achieve the intent of certain credits in an alternative manner/approach to that anticipated within the Homestar certified tool. When designing/advising on dwellings that are likely to target a Homestar rating, Homestar Assessors must submit a Technical Question to confirm their alternative method will be accepted before they submit for a rating. Technical Questions will be reviewed by the NZGBC for either immediate approval or consideration during tool review. Third-party expertise may be sought, which may have implications for our response time.

Please refer to the 'Assessor Resources' section under Homestar on the NZGBC website for a copy of the Technical Question form. Technical Questions should be submitted for approval prior to submitting a project for rating, and the response letter from the NZGBC should be included in the project submission. The approval of Technical Questions is at the discretion of the NZGBC.

Each project may submit two Technical Questions at no charge. Any further Technical Questions may incur a further charge at the NZGBC's discretion).

Not Applicable (N/A)

Some entire credits may be considered not applicable (N/A) to dwellings that have been in existence for more than 2 years and have not undergone major refurbishment. When credits or points within credits are deemed N/A, points are automatically redistributed across the whole Homestar tool (effectively increasing the value of all other points).

The following credits can be deemed N/A:

Category	Credit	Points
Management	MAN-3: Responsible Contracting	(2 points)
Waste	WST-1: Construction Waste Minimisation	(5 points)
Materials	MAT-1: Sustainable Materials	(10 Points)
	MAT-2: Healthy Materials	(4 points)

Glossary of Terms

Acoustic ceiling tile: any tile that has CAC > 30, NRC > 50.

ALF: Annual Loss Factor calculation tool available on BRANZ website: http://alf.branz.co.nz. Can be used for EHC-6 estimated heating load calculation for 6 and 7 Homestar ratings.

Adhesives and sealants: any adhesive and sealant product used in an internal application (including both exposed and concealed applications) and applied onsite (non-occupied areas included). This includes exterior-grade and solvent-based sealants and adhesives, should they be used in internal applications.

Apartment: self-contained dwelling that only occupies part of a building.

Applied coating: any liquid applied finish including paints, varnish, stains and oils used in an internal or external application (both exposed and concealed applications).

Bedroom: any room that is likely to and could potentially be used as a bedroom. It must be fully enclosed with a door, and at least 6m^2. A bedroom should also include at least one opening window, unless continuous mechanical ventilation is provided

Building footprint (BF): The area of land that is taken up by the permanent foundations of the dwelling (including any other enclosed outbuildings with permanent foundations that are associated with the dwelling). This is measured as the total floor area of the ground floor, including the area taken up by the external walls, lift shafts, service cavities and stairwells.

Conditioned space: space that is within the thermal envelope of the dwelling and could maintain a temperature band of between 20-25 degrees Celsius for 365 days of the year. Corridors outside apartments are not included within the conditioned space of these apartments. This is measured at the internal face of the external wall, please refer to the DRE credit for details.

Daylight cut-off device: a sensor which turns a lamp off once it has detected an appropriate amount of daylight is present and the light is not needed.

Drip line: the edge of that specimen or the area of land located directly under the outer circumference of a shrub/tree's branches for the purposes of ascertaining the percentage of site covered by native species on site.

Floor coverings: interior coverings installed over the floor structure. Floor coverings include but are not limited to: carpet, parquet, wooden planks, laminate, tiles and linoleum.

G-Value: a measure of how much solar heat (infrared radiation) is allowed through it relative to no glass.

Gross Floor Area (GFA): sum of the internal measurements of each room including the thickness of the internal walls AND the thickness of the external walls or part area of any intertenancy walls, including garages and similar fully enclosed external spaces. Lift shafts, stair wells, service cavities, and fully enclosed voids above other fully enclosed spaces are also included. Fully enclosed sunrooms/ conservatories are included but partially enclosed spaces such as carports and balconies are excluded.

Habitable rooms: bedrooms, lounge/living rooms, dining rooms, open plan kitchen areas, studies and entertainment rooms. Excludes washrooms, laundry rooms, garages, etc.

Land area: area of the site that is not under the roof of the dwelling but includes the immediate landscaped area around the house, up to an area equal to the tool roof area of the house. This includes lawns and driveways. For rural properties, pasture, orchards, vineyards and long narrow vehicle access ways are not to be included in the calculations.

Lavatory equipment: must include toilet pan, cistern, and/or flushing device.

Local renewable electricity generation: a renewable energy system which is either fully contained within the legal boundary of the assessed site, or a community/neighbourhood-based system which has been assessed by a qualified person(s) and subsequently approved by Homestar.

Lumen: measure of the power of light perceived by the human eye.

Major refurbishment: refurbishment or renovation that has added more than 30m^2 to the net floor area or cost in excess of $30,000 for the total construction (including garages).

Mechanically ventilated: where the dwelling's primary source of ventilation throughout the floor area is provided by powered equipment such as an HVAC system, or fan that incorporates ducting to provide fresh air to various areas of the dwelling. This definition does not include small, localised exhaust units installed in kitchens and bathrooms.

Mixed-use residential development: include commercial and/or retail areas as well as residential areas within a single building. A boundary should be established to define the multi-unit residential component ('Homestar component') of the building at the start of the assessment process, and submitted to NZGBC as a note on the registration form or as a Technical Question. As the location of this boundary may be different case by case, please consult NZGBC for project-specific advice.

Multi-unit development: where multiple separate housing units are contained within one building, or multiple buildings are being constructed on a site or complex with a defined boundary. Phased developments must be registered in separate projects when being constructed more than 3 years apart.

Perimeter length: a measurement of the outside perimeter of the ground floor construction system, used for the purposes of calculating the construction R-value. See Appendix D for further guidance on perimeter measurements.

Previously developed: land which is or was occupied by a permanent structure (excluding agricultural of forestry buildings) and associated fixed surface infrastructure (i.e. urban land uses such as transport, utilities, residential and commerce and community services).

Security stay: allow the window to be opened for ventilation but prevents the window from being pried open from the exterior. The security stay does not necessarily require a locking mechanism but must be designed in way that does not allow it to be disabled from the exterior, thereby allowing an intruder to enter the dwelling.

Shading: a measure of how much solar heat gain enters through a window compared to an unshaded window.

Shading Ratio: is the ratio of annual solar energy received on the surface of a window with and without shading.

Solar aperture: is the equivalent area of an unglazed opening in a wall that would allow the same amount of solar energy into a dwelling as the provided glazed and shaded area of the wall.

Standalone house: a free-standing residential building; detached house with no intertenancy walls.

Suitable fixtures: fixtures which would allow the connection of a typical garden hose (e.g. tap) that could be used for garden watering or car washing.

Terraced house: a house with at least one common wall with another dwelling. This includes duplexes.

Thermal envelope: the division between the outside (i.e. unconditioned and uninsulated) area of the house and the inside (i.e. conditioned and usually insulated) area of the house. See EHC-1 for further guidance.

Typologies: dwellings with similar size, layout and thermal properties. See Terminology section for further information.

Volume Assessment: pathway for awarding credit points using a standard specification with a quality assurance process that demonstrates adherence.

WELS: Water Efficiency Labelling Scheme designed to provide information, through labelling at the point of sale, to consumers buying products that use water from six product classes (washing machines, dishwashers, lavatories, showers, taps and urinals).

The Homestar Tool

Density and Resource Efficiency	8 points
DRE Density and Resource Efficiency	8 points
Energy, Health and Comfort	**60 points**
EHC – 1 Thermal Comfort	20 points
EHC – 2 Efficient Space Heating	6 points
EHC – 3 Ventilation	4 points
EHC – 4 Surface and Interstitial Moisture	5 points
EHC – 5 Hot Water Heating	6 points
EHC – 6 Lighting	2 points
EHC – 7 Natural Lighting	3 points
EHC – 8 Renewable Energy	7 points
EHC – 9 Sound Insulation	3 points
EHC – 10 Inclusive Design	3 points
EHC – 11 Energy Efficient Drying	1 point
Water	**14 points**
WAT – 1 Water Use in the Home	10 points
WAT – 2 Sustainable Water Supply	4 points
Waste	**6 points**
WST – 1 Construction Waste Minimisation	5 points
WST – 2 Household Waste Minimisation	1 point
Management	**6 points**
MAN – 1 Security	2 points
MAN – 2 Home User Guide	2 points
MAN – 3 Responsible Contracting	2 points
Materials	**14 points**
MAT – 1 Sustainable Materials	10 points
MAT – 2 Healthy Materials	4 points
Site	**12 points**
STE – 1 Stormwater Management	4 points
STE – 2 Native Planting	2 points
STE – 3 Neighbourhood Amenities	4 points
STE – 4 Cycling	2 points
Innovation	**10 points**

Important – before you begin

Completing the Coversheet of the Homestar Tool

When using the Homestar Excel tool (including scorecards and calculators) it is essential that the Coversheet tab is completed as accurately as possible. The Coversheet gives an overview of the project and provides information on the location of the dwelling and stage of rating to the calculators and scorecards. Fill out as much information as possible; some fields are required for proper calculation of points.

Address: current address or lot number of the dwelling; can be left blank if not known.

City: choose the closest locality from the drop-down list provided. **This must be selected in order for the calculators to function properly.**

Homestar code: this is the code given to you following registration of the project; it is a unique identifier for the submission in the format Area Code – Project Number e.g. AKD123

Assessor: name of the Homestar Assessor.

Document purpose: choose from the drop-down list provided.

Dwelling type: choose from the drop-down list provided.

Dwelling status: choose from the drop-down list provided.

Rating stage: choose from the drop-down list provided under "Current Stage". Ensure that the scorecard used corresponds to the stage chosen here. **This must be selected in order for the scorecard to function properly.**

DRE Density and Resource Efficiency 8 points

Aim

To promote smaller dwellings and residential developments with smaller footprints and which require fewer resources to build, operate and occupy.

Credit Criteria

Up to 8 points are available, as follows:

(1)	Resource Efficiency: ratio of conditioned space to number of bedrooms	Up to 5 points
(2)	Density Ratio: ratio of gross floor area (GFA) to building footprint (BF)	Up to 3 points

Data Entry

Enter the conditioned floor area, number of bedrooms, gross floor area and building footprint in the appropriate cells in the coversheet tab; points will be automatically calculated.

Assessment

(1) Resource Efficiency

Calculate the dwelling's conditioned space using floor plan drawings. Round this figure up to 1 decimal point. Determine the number of bedrooms, then use the following table to determine points awarded out of a maximum of 5.

Conditioned Space (m^2) Thresholds Based on Number of Bedrooms						Points
1 bedroom (m2)	2 bedroom (m2)	3 bedroom (m2)	4 bedroom (m2)	5 bedroom (m2)	6 bedroom (m2)	
44	72	100	119	135	148	5.0
46	76	104	123	143	150	4.5
48	79	110	132	149	156	4.0
51	83	115	139	155	162	3.5
54	88	119	146	162	169	3.0
57	91	126	152	169	176	2.5
59	96	131	160	178	185	2.0
62	101	137	166	185	192	1.5
65	105	144	174	193	200	1.0

Conditioned Space

Conditioned space is the space within the thermal envelope of the dwelling that could maintain a temperature band of between 20-25 degrees Celsius for 365 days of the year. This space is measured at the internal edge of the external wall.

In a standalone house, conditioned space will typically follow the line of insulation on the exterior of the house. If there is a garage, it generally is not included, but can be considered part of the conditioned space provided it is fully insulated with an insulated and sealed garage door.

For terraced houses and apartments, the conditioned space includes the area taken up by internal partitions, but only includes half of the thickness of intertenancy walls. Corridors outside apartments are not included.

For dwellings with exposed concrete or masonry walls with insulation on the exterior, the project may choose to include the thickness of the concrete or masonry component of these walls within the conditioned space.

(2) Density Ratio

Calculate the Building Footprint (BF) and Gross Floor Area (GFA) using floor plan drawings. Divide the GFA by the BF to obtain the Density Ratio. The benchmarks shown are the minimum Density Ratio required for each point - round this down to the nearest whole number. For example, a Density Ratio of 4.7 will earn 2 points.

Use the following table to determine points out of a maximum of 3:

Density Ratio	Points
5+	3
3-4	2
2	1

Building Footprint

The building footprint is the total floor area of the ground floor, including the thickness of exterior walls. Areas that normally count towards the building footprint include conservatories, garages, permanent outhouses, fully enclosed permanent waste storage areas, communal garages or storage rooms, and any other permanent buildings used by the occupants. If a dwelling is raised above ground level on columns or other structures, the building footprint must be measured from the lowest floor of the dwelling.

Areas that will NOT normally count towards the building footprint include hard landscaping, semi-enclosed external spaces, pergolas and carports. Garden sheds will not count unless they are built on a permanent solid foundation and are fitted out as habitable space with heating, lighting and power. Green roofs cannot be deducted from the building footprint calculation.

In terraced houses, this also includes the area taken up by party walls and separating walls to common areas, with the exception of party walls to adjoining buildings. It may be calculated across the whole building or by single dwelling, provided the same method is used for gross floor area. For staggered dwellings, the Building Footprint area equals the total gross floor area of the ground floor.

For mixed-use residential where other non-residential occupied spaces form the ground floor or lower floors, the building footprint area must be measured as the net floor area of the lowest floor of the block of flats.

Gross Floor Area

The Gross Floor Area (GFA) is the sum of the internal measurements of each room including the thickness of the internal walls AND the thickness of the external walls or part area of any inter-tenancy walls. This includes garages and similar fully enclosed external spaces on permanent foundations. For apartment buildings, this also includes corridors and other common areas, lift shafts, stairwells, service cavities, and fully enclosed voids above other fully enclosed spaces, and is calculated across the whole building rather than a single dwelling. Terraced houses may also calculate across the whole building, provided the building footprint has also been calculated this way.

Audit Documentation

Design Rating

A dimensioned floor plan of the dwelling with bedrooms clearly denoted, and the conditioned space, GFA and building footprint clearly marked.

Built Rating

A dimensioned as-built floor plan of the dwelling with bedrooms clearly denoted, and the Conditioned Area, GFA and building footprint clearly marked.

Background

It is generally recognised that larger dwellings consume more resources than smaller dwellings over their lifecycle. Data published by BRANZ shows that the average New Zealand house size has increased markedly over the last two decades (by 65%), while the occupancy rate has dropped from 3.1 to 2.7 persons per house over the same period. At the same time, the benefits of increasing housing density in urban planning are recognized in terms of space utilisation, infrastructure development and housing affordability. The 'Density and Resource Efficiency' credit seeks to account for these impacts and reward less resource- intensive designs.

The two key components of measuring resources efficiency and density in version 3 of Homestar were the Dwelling Resource Adjustment Factor (DRAF) and Density Factor (DF). These were multiplied to obtain a Resource Adjustment Factor applied to the final raw point score. However, Homestar v4 promotes resource efficiency and density within a separate credit rather than through an overall adjustment factor. Thus, benchmarks are simplified and related directly to points rather than adjustment factors. The Density Factor is also simplified into the Density Ratio.

The DRAF was modelled on the USA's LEED for Homes (2008) tool. The neutral dwelling sizes (i.e. those houses which have a multiplier equal to 1 in the above Table) were established using a sample of mid-priced New Zealand dwelling plans currently freely available on the internet. An average of these dwellings was then taken and extrapolated to create a DRAF table. The Density Ratio has been developed to recognise homes that take up less footprint for a given floor area beyond the common New Zealand single storey home.

References and Further Information

1. LEED for Homes V4 Credit
   http://www.usgbc.org/credits/homes/v4-draft/eap4
2. LEED for Homes 2008 Home Size Explanation on 100K House
   http://www.100khouse.com/2008/04/02/leed-for-homes-home-size-adjustment-calculations/

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Energy, Health and Comfort

EHC-1 Thermal Comfort 20 points

Aim

To recognise the reduction of purchased energy associated with space heating and cooling of the house, through good design of the thermal envelope.

Credit Criteria

Up to 20 points are available for designs that provide passive thermal comfort all year round. Points are awarded according to the predicted energy demand of the home for heating and cooling as follows:

For 6 Homestar and 7 Homestar only:		
(1)	Schedule Method: building elements meet minimum R-values	Up to 13 points
	AND	
	Avoidance of Overheating: minimum measures put in place to reduce the likelihood of overheating	Up to 2 points
OR		
(2)	Calculation Method: calculated energy demand for heating (kWh/m2) has been shown to meet minimum standard using BRANZ ALF online calculator.	Up to 13 points
	AND	
	Avoidance of Overheating: minimum measures put in place to reduce the likelihood of overheating.	Up to 2 points
For all ratings:		
(3)	Thermal Modelling: modelled energy demand for heating and cooling (kWh/m2) has been shown to meet minimum standard using approved thermal modelling software according to the Homestar Energy Modelling Protocol	Up to 20 points
OR		
(4)	Passive House: a building certified as Passive House by the Passive House Institute Germany shall be awarded full points for this credit with submission of completed PHPP file for a design rating and on presentation of the certificate for a built rating.	20 points

Mandatory Minimums

The achievement of 12 points is a mandatory minimum for a 6 Homestar rating.

The achievement of 14 points is a mandatory minimum for a 7 Homestar rating.

The achievement of 16 points is a mandatory minimum for an 8 Homestar rating or higher.

Data Entry

Use Energy Calculator tab to determine points, transfer to appropriate scorecard.

Assessment

There are 4 pathways through which this credit can be assessed:

1. Schedule Method (only permissible for homes targeting a 6 or 7 Homestar rating)
2. Calculation: on-line BRANZ ALF calculator or NZGBC standalone excel calculator (only permissible for homes targeting a 6 or 7 Homestar rating)
3. Modelling: energy modelling using NZGBC-approved software and modelling protocol
4. Passive House: for dwellings targeting (Design) or which have achieved (Built) Passive House Certification, 20 points are awarded

1. Compliance by Schedule Method

This compliance method may only be used for dwellings targeting 6 or 7 Homestar rating.

Using the plans and specifications for the dwelling, 12 or 13 points are awarded where the following is confirmed:

Heating Energy

a) For standalone dwellings only: The total glazing area is 30% or less of the total wall area, AND the combined area of glazing on the east, south, and west facing walls is 30% or less of the combined total area of these walls.
b) For terraces and apartments only: the total glazing area is 30% or less of the total conditioned floor area AND there are no vented air cavities in any intertenancy walls (refer to Appendix E).
c) The area of all skylights is less than 1.5% of the roof area.
d) The thermal performance of each building element is greater than or equal to the R-values for the climate zone in which the dwelling is constructed shown in:
    - Table 1 for 12 points (this table may only be used for Homes targeting 6 Homestar)
    - Table 2 for 13 points (this table may only be used for Homes targeting 6 or 7 Homestar)

Climate Zones are defined in Table 3 below.

Alternatively, an area weighted heat loss calculation may be used to show compliance provided that:

- The total glazing area is no greater than 50% of the total wall area.
- No single glazing unit is less than R0.26 or 2 star WEERS.
- The reference building has a glazed area of 30% of the total wall area.Guide for the acceptable methodology for this calculation.

6 Homestar only – 12 points				
Building Element	**Building Element R-Value (m2.K/W)**			
	Climate Zone 1	**Climate Zone 2**	**Climate Zone 3A**	**Climate Zone 3B**
Roof	3.6	3.8	4.1	4.9
Wall	2.1	2.1	2.2	2.9
Floor	1.3[a,b]	1.8[b]	2.3	3.0
Windows and glazing	0.26 or 2 star WEERS	0.32 3 star WEERS	0.43 or 4.5 star WEERS	0.43 or 4.5 star WEERS
Skylights (max 1.5%)	0.40	0.40	0.50	0.50

Table 1: **Minimum R-values for compliance with the schedule method (6 Homestar only)**

[a] New Zealand Building Code states that slab on ground construction is deemed to comply, even though some area to perimeter ratios may not achieve R1.3. Homestar requires that all slab on ground construction demonstrates that it has met the R1.3 requirement.

[b] If underfloor heating is present, slab insulation is recommended in all cases, and a minimum R1.9 is required as per NZBC.

6 or 7 Homestar only – 13 points				
Building Element	**Building Element R-Value (m2.K/W)**			
	Climate Zone 1	**Climate Zone 2**	**Climate Zone 3A**	**Climate Zone 3B**
Roof	3.6	3.8	4.3	5.1
Wall	2.1	2.2	2.9	3.2
Floor	1.5 [b]	1.8 [b]	2.3	3.0
Windows and glazing	0.32 or 3 star WEERS	0.43 4.5 star WEERS	0.43 or 4.5 star WEERS	0.44 or 5 star WEERS
Skylights (max 1.5%)	0.40	0.40	0.50	0.50

Table 2: **Minimum R-values for compliance with the schedule method (6 and 7 Homestar only)**

[b] If underfloor heating is present, slab insulation is recommended in all cases, and a minimum R1.9 is required as per NZBC.

The R-values listed in the table are the R-values calculated for the building element (wall, roof, floor, window) considering the fraction of timber and insulation or other materials per NZS 4214:2006 or ISO6946. The BRANZ House Insulation guide may be used. These are NOT the insulation (product) R-values.

Window R-Values are the complete system R-values including the effects of frames as W_{window} in NZS 4218:2009. Generic R-values from NZS 4218:2009 may be used.

Floor R-values include ground effects for slab on grade as tabulated in the BRANZ Home Insulation Guide or calculated in accordance with NZS 4214:2006.

Unconditioned adjacent space (e.g. adjacent unconditioned garage) can be credited in the schedule method by following the ISO6946 method (see Appendix 2 of ISO6946) and adding the additional R-value calculated to that of the wall. Alternatively, consider unconditioned adjacent space as outside.

Climate Zones for Use in Homestar		
Zone	Territorial Regions	Representative Climate
1	Northland, Auckland Franklin District and the Coromandel Peninsula	Auckland
2	The rest of the North Island except the Central Plateau	Wellington
3A	The Central Plateau of the North Island and all of the South Island except 3B	Christchurch
3B	Queenstown-Lakes, Mackenzie, Western Waitaki, Central Otago regions	Queenstown

Table 3: Climate zones for use in Homestar

Cooling Energy

In order to limit overheating of buildings in a simplified manner, homes using the schedule method can be awarded further points by demonstrating that solar heat gain is kept to a minimum and that the dwelling is capable of cross ventilation. Points are awarded as follows:

Where the home features 2 out of the 3 following overheating prevention measures	1 point
OR	
Where the home features all of the following overheating prevention measures:	2 points
1. The solar aperture of each facade of the dwelling is less than 20%. 2. The net openable area of windows in each habitable space is greater than 5% of the conditioned floor area and at least 30% of the total required openable area for the dwelling as a whole is on an opposite/adjacent façade or on a different floor of the dwelling. 3. At least one window in each habitable space is fitted with lockable stays or secure restrictors to allow secure night-time ventilation. Windows on upper storeys that are not accessible are exempt. Dwellings on upper storeys with no windows accessible from public areas are compliant by default.	

Solar Aperture – Simple Method

The table below gives limiting window to wall ratios for windows with and without eaves/overhangs. It assumes standard double glazing (G-value = 74%). For multiple storey dwellings where upper storey windows are shaded, and lower storey windows are not shaded, the limiting window to wall ratios should be applied to each storey.

Façade orientation	Windows under deep eves (600mm or more) or heavily shaded	Windows under shallow eaves (300mm or more) or lightly shaded	Unshaded window
North	50%*	33%*	27%
North East / North West	40%*	31%*	27%
West / East	34%*	29%	27%

Table 4: Solar aperture simple method: limiting window to wall ratios to meet solar aperture of 20%

* Note: the limiting window to wall ratio for the schedule method is 30%. The higher values may be used where compliance is being shown by calculation (either ALF or NZS4218 calculation method).

Solar Aperture – More Complex Method

A more complex solar aperture calculation allows for flexibility between window area, window G-value and solar shading. Solar aperture is defined as the **Window to Wall Ratio × G-Value × Shading Ratio**. The window to wall ratio is the ratio of window area to wall area for each facade. It *excludes* windows within 45° either side of due south.

G-Value: The G-Value of the glass is a measure of how much solar heat (infrared radiation) is allowed through it relative to no glass. A low G-value indicates that a window lets through a low percentage of the solar heat. The G-value for a particular window is readily available from most window suppliers. However, if the G-value of the glass is not known, it can be assumed to be 74% (standard double glazing) or generic values may be used from NZS 4218:2009 (refer SHGC).

Shading Ratio: The shading ratio is the ratio of annual solar energy received on the surface of a window with and without shading. An unshaded window would therefore have a shading ratio of 1.0. The following table gives the shading ratio for different depths of overhang (D) relative to the height (H) of the shading above the bottom of the window.

Façade orientation	Shading Ratio				
	D/H=0.2	D/H=0.4	D/H=0.6	D/H=0.8	D/H=1.0
North	0.82	0.54	0.37	0.29	0.25
North East / North West	0.88	0.67	0.53	0.44	0.39
West / East	0.93	0.8	0.67	0.58	0.5

Table 5: Shading ratio for different orientations and depth of overhang

Lockable Stays – Window Restrictors

To be awarded points, occupants must be able to leave windows open in a secure manner such that they can be left open, particularly at night but also during the day when they might not be at home. This can be achieved with lockable stays or secure window restrictors. It is advisable (but not a Homestar requirement) that window restrictors are able to be disabled to allow the full use of the window for purge ventilation.

Figure 1: Example of a lockable stay

2. Compliance by Energy Demand Calculation

This compliance method may only be used for homes targeting 6 or 7 Homestar.

Heating Energy

Using the plans and specifications for the dwelling, up to 14 points may be awarded by completing a heat load calculation using the BRANZ ALF online calculator (http://alf.branz.co.nz/) **assuming a heating temperature of 20°C 24/7.**

Points are awarded as shown in Table 6 below:

Total predicted energy demand for heating *only* (kWh/m2)			
	14 points	**13 points**	**12 points**
Climate Zone 1	20	27	35
Climate Zone 2	40	50	60
Climate Zone 3A	50	60	70
Climate Zone 3B	60	70	80

Table 6: Heating loads for compliance by calculation method

For instructions on using the BRANZ ALF calculator refer to http://alf.branz.co.nz/help. For guidance on terminology and measuring for both ALF and the standalone calculator, refer to Appendix C.

Points are calculated by entering the estimated heating load into the Energy Calculator. Enter the heating load (kWh) from the results bar on the right-hand side of the window in ALF.

Cooling Energy

Use the Cooling Energy section of the schedule method to award up to an additional 2 points for minimising risk of overheating.

3. Compliance by Energy Modelling

Using the plans and specifications for the dwelling complete a model using the Homestar Energy Modelling Protocol (see Appendix B). The following outputs will be required from the model to input into the Energy Calculator tab to enable points to be determined:

- Modelled heating load (kWh/yr)
- Modelled cooling load (kWh/yr)

Points are awarded as shown in Table 7 below.

Total predicted energy demand for heating and cooling (kWh/m2)							
	20 points	**19 points**	**18 points**	**17 points**	**16 points**	**15 points**	**14 points**
Climate Zone 1	15	25	35	46	56	66	76
Climate Zone 2, 3A and 3B	15	27	38	50	61	73	84

Table 7: Heating and cooling loads for compliance by modelling method

4. Passive House

Where the dwelling has no on-site renewable energy generation enter 20 points into the appropriate scorecard.

Where the dwelling has on-site renewable energy generation enter calculated heating energy input into Energy Calculator tab.

Audit Documentation

Design Rating

Pathway (i): Schedule Method
Drawings and specifications showing constructions type and relevant R-values as detailed below.
Walls and Windows
Marked up drawings showing (i) construction type (for both walls and windows) (ii) widths and heights of all walls and windows (iii) wall insulation (iv) orientation (v) window shading.
Roof
Marked up drawings showing (i) construction type (ii) widths and heights of any skylights (iii) ceiling insulation.
Flooring
Marked up drawings showing (i) construction type (ii) widths and lengths of flooring (iii) floor covering (iv) sub-floor insulation (if applicable).
Pathway (ii): ALF Calculation
ALF report, with drawings and specifications showing constructions type and relevant R-values as detailed below.
General Details
Plan showing floor area and number of bedrooms.
Walls and Windows
Marked up drawings showing (i) construction type (for both walls and windows) (ii) widths and heights of all walls and windows (iii) wall insulation (iv) orientation (v) window shading.
Roof
Marked up drawings showing (i) construction type (ii) widths and heights of any skylights (iii) ceiling insulation.
Floors
Marked up drawings showing (i) slab construction (ii) area and perimeter of slab (iii) any slab insulation.
Thermal Mass
Photographs referenced to a floor plan OR marked up drawings showing the different areas of floor coverings.
Airtightness
Marked up drawings or specification showing the following (i) kitchen vents over hob (ii) mechanical bathroom vents (iii) mechanical ensuite vents (iv) window passive vents (v) metal flued heaters.
Pathway (iii): Modelling
Report containing the information / documentation as listed in Appendix B.
Pathway (iv): Passive House design

Extracts of “overview” and “verification page” from PHPP energy modelling report showing that dwellings have already met the design criteria of Passive House. Signed contract from accredited Passive House designer.

Built Rating

Pathway (i): Schedule Method
Walls and Windows
Photographs referenced to a floor plan OR marked up drawings showing (i) construction type (for both walls and windows) (ii) widths and heights of all walls and windows (iii) wall insulation (iv) orientation (v) window shading.
Roof
Photographs referenced to a floor plan OR marked up drawings showing (i) construction type (ii) widths and heights of any skylights (iii) ceiling insulation.
Flooring
Photographs referenced to a floor plan OR marked up drawings showing (i) construction type (ii) widths and lengths of flooring (iii) floor covering (iv) sub-floor insulation (if applicable).
Pathway (ii): ALF Calculation or NZGBC standalone calculator
ALF report OR completed calculator, photographs referenced to a floor plan OR drawings and specifications showing constructions type and relevant R-values as detailed below:
General Details
Plan showing floor area and number of bedrooms.
Walls and Windows
Photographs referenced to a floor plan OR marked up drawings showing (i) construction type (for both walls and windows) (ii) widths and heights of all walls and windows (iii) wall insulation (iv)
Roof
Photographs referenced to a floor plan OR marked up drawings showing (i) construction type (ii) widths and heights of any skylights (iii) ceiling insulation.
Flooring
Photographs referenced to a floor plan OR marked up drawings showing (i) construction type (ii) widths and lengths of flooring (iii) floor covering (iv) sub-floor insulation (if applicable).
Thermal Mass
Photographs referenced to a floor plan OR marked up drawings showing the different areas of floor
Airtightness
Photographs showing the following (i) kitchen vents over hob (ii) mechanical bathroom vents (iii) mechanical ensuite vents (iv) window passive vents (v) metal flued heaters.
Pathway (iii): Modelling
Report containing the information / documentation as listed in Appendix B.
Pathway (iv): Certified Passive House
Passive house certificate and extracts of “overview” and “verification page” from PHPP energy modelling report showing that dwellings have been certified to the Passive House standard.

Background

A thermally well performing house is a key tenet of sustainable design. With proper design and specification, purchased space heating and cooling loads can be significantly in much of New Zealand while still providing a comfortable indoor environment (of between 20°C and 25°C) all year around. Currently, space heating in New Zealand accounts for approximately a third of the energy requirements in houses.

For this credit, only the building composition and its relationship with the external environment are taken into consideration. The efficiency of the space heating appliances to provide additional comfort is accounted separately within the Space Heating Credit.

Air conditioning and mechanical cooling use significant amounts of electricity and require the dwelling to be closed off from the outside environment to work best. A recent study from BRANZ suggests that 60% of households with heat pumps use them for summer cooling which is creating a new and unwanted energy load for New Zealand.

References and Further Information

1. Smarter Homes
   www.smarterhomes.org.nz/design/

2. Passive House Institute of New Zealand
   www.phinz.org.nz

3. BRANZ - The Annual Loss Factor Method, A design tool for energy efficient houses, 3rd Edition
   www.branz.co.nz/alf

EHC-2 Efficient Space Heating 6 points

Aim

To encourage and recognize fixed, efficient and lower carbon dioxide (CO_2) emitting space heaters.

Credit Criteria

Up to six points are available for dwellings which have a very low 'carbon dioxide emissions to space heating load' ratio (i.e. kg CO2 per kWh/m2), with a fixed heating source provided in the main living area. Points are calculated using the Energy Calculator.

(1)	Non-centralised heating: where the dwelling is heated with one or more fixed approved heating sources
OR	
(2)	Centralised heating: where the dwelling is heated by a single centralised heating system serving at a minimum the main living area and all bedrooms.
OR	
(3)	No heating required: Passive House or heat load of 15kWh/m^2/y or less

Mandatory Minimums

Having a fixed heating source serving the main living area is a mandatory minimum for a 6 Homestar rating, except when the dwelling is a Passive House or has an annual heating demand of 15 kWh/m^2 or less.

Data Entry

Use the Space Heating section of the Energy Calculator tab and scorecard.

Assessment

First complete EHC-1, as EHC-2 takes into account the overall thermal performance of the dwelling. Then, review the plans and specifications or visually determine the fixed heating source(s) in the dwelling. Once this is done, use the Space Heating section of the Energy Calculator tab to establish points achieved for this credit.

Section 1: Heating Approach

Firstly, select one of the three approaches for space heating:

- Non-centrally heated dwellings (also complete section 2)
- Centrally heated dwellings (also complete section 3)
- Passive House or heat load of 15kWh/m2/a or less (no further action is required)

Then select from the list of acceptable heating sources whether there is a fixed heating source serving the main living area. This is a prerequisite for any points under the first two options above.

Section 2: Non-Centrally Heated Dwellings

Complete this section ONLY if the dwelling is not centrally heated.

Heat Source

The first column of this section is a list of heating sources. Each has a typical efficiency and emissions factor assigned to them. For heat pumps the coefficient of performance is 3 by default but may be adjusted for higher performing systems. If the chosen heating source is not listed, please contact NZGBC and submit a Technical Question.

Heater Type	Coefficient of performance	Emission Factor (main heater) kg CO_2 per MJ/m^2
Electric heat pump (air to air, air to water, ground to air or ground to water)	3	38
LPG gas flued	0.8	61
Natural gas heater flued	0.8	53
Electric resistive/oil column (generic)	1	38
Solid fuel burner (pellet and wood fuel)	0.75	3
Solid fuel (potbelly)	0.35	3

Table 8: Coefficient of performance and emission factors of space heating sources

Heating Contribution

The heating contributions of each heating source are entered as either kilowatt hours (kWh) or percentages in the second and third columns respectively. Only one of these columns should be used depending on how the heating demand was calculated for EHC-1 Thermal Comfort. Leave the other blank.

Use the second column to enter actual heating input of each heating source in kWh ONLY when heating demand is obtained using an approved thermal modelling software (see Appendix B) such as IES, Sefaira, Open Studio, etc. or Passive House Planning Package (PHPP). Note that the value entered is the actual input energy to meet the heating demand contribution, not the space heating demand itself.

The third column is where the heating contribution of each heating source type can be entered as a percentage. Use this column ONLY when either the schedule method is used for EHC-1 or the heating demand was calculated through ALF or AccuRate, where only a total heating demand estimate is given rather than contributions by specific heating sources in specific areas.

To calculate the percentages, divide the conditioned floor area of the dwelling into approximate heating zones according to space heater type. In some cases, more than one heater type will be used to heat a space. In these cases, enter the fixed heater type along with the contribution of each heater type as a percentage of the total conditioned area. For all remaining areas not usually heated, but still within the thermal envelope, select the electric resistive heater option. Where heat lamps are provided in bathrooms they are to be included in the electric resistive category. Enter these percentages in column two beside the appropriate heating source. The whole floor area (100%) must be assigned to a heating type.

It may be difficult to ascertain the thermal capacity (and resulting heated area) of the given heating appliance being assessed. Thus, the following approach should be taken for this credit. In the case of non-centrally heated spaces which have a large heater that heats more than the room/space it's in (typically a wood burner or large heat pump), only account for rooms/spaces which are:

- situated a storey higher than the heater itself, AND have a clear air pathway for the heat to get there (e.g. a stairwell), OR
- attached to the room/space through a heat transfer system, OR
- an adjoining hallway (i.e. the hallway space open to the room/space containing the heater can be counted).

The Assessor must verify the ability of this large heater to heat more than the room/space that it is in by reviewing the manufacturer's data.

Section 3: Centrally Heated dwellings

Complete this section ONLY if the dwelling is centrally heated, i.e. there is a single centralised heating system serving at a minimum the main living area and all bedrooms. This section consists of three steps:

1. **Heater Type:** select heating source from the drop-down menu.
2. **Manufacturer/make:** select from drop down menu. Select "generic" if specific make is not listed.
3. **Model:** select from drop-down menu. Select "generic" if specific model is not listed.

Audit Documentation

Design Rating

Non-centrally heated and centrally heated dwellings
Layout/floor plan (i) showing the fixed heating type(s) (ii) marked up to show areas/zones covered by each heater type or system (iii) thermal modelling report (where applicable).
Dwellings that do not require any space heating
Thermal analysis report.
Dwellings that are designed as Passive Houses
Extracts of "overview" and "verification page" from PHPP energy modelling report showing that dwellings have already met the design criteria of Passive House.

Built Rating

Non-centrally heated and centrally heated dwellings
Photograph of the main heater types referenced to a marked-up floor plan showing areas/zones covered by each heater type or system. Indicate presence of ducting for multi-room heating systems. Photographs not required for portable resistive heaters.
Dwellings that do not require any space heating
Temperature logging results or thermal analysis.
Dwellings that are designed as Passive Houses
Passive house certificate, OR Extracts of "overview" and "verification page" from PHPP energy modelling report showing that dwellings have already met the design criteria of Passive House (if not certified yet).

Background

Household indoor air temperature should ideally be between 20°C and 25°C, not dropping below 18°C. New Zealand dwellings regularly fall outside this comfort zone, even when space heating is installed. The World Health Organization recommends a minimum indoor temperature of 18°C, and ideally 21°C if babies or elderly people live in the house.

The Home Heating Calculator is predominantly based on the CO_2 emission factor figures (derived from the heater type, appliance efficiency, fuel source and distribution mode) for space heating. The credit determination is then factored though an algorithm sourced from EECA's HERS tool. The CO_2 emission calculation is modified to account for heater types that impact negatively on human health.

Un-flued space heaters release large amounts of undesirable moisture, oxides of nitrogen and carbon monoxide indoors, and that this is particularly harmful for occupants with respiratory issues. Open fires promote drafts and release small particles into the air; hence, while common, these are not included in the approved heating source list.

References and Further Information

1. New Zealand Business Council for Sustainable Development (NZBCSD) Emission Calculator http://www.nzbcsd.org.nz/emissions/content.asp?id=432

2. The Government's Standard Assessment Procedure for Energy Rating of Dwellings, UK, 2009 http://www.bre.co.uk/sap2009/page.jsp?id=1642

3. Easton, Lois. '*Beacon's HSS High Standard of Sustainability®. 2008 Update of Benchmarks*'. Report HR2370/4 for Beacon Pathway Limited. 2009.

4. Isaacs, N. et al. '*Energy Use in New Zealand Households – report on the Year 10 Analysis for the Household Energy End Use Project (HEEP)*'. BRANZ Study Report SR 155. 2006.

5. Passive House Institute http://www.phinz.org.nz/

EHC-3 Ventilation 4 points

Aim

To encourage and recognise ventilation measures that control indoor moisture levels, improve indoor environment for occupants, reduce respiratory illnesses and the risk of mould, and increase the durability of the dwelling.

Credit Criteria

Up to four points are available where it is demonstrated that indoor moisture levels have been managed through one or more of the four methods listed below.

(1)	Intermittent extract ventilation	Up to 1.5 points
OR		
(2)	Continuous extract ventilation	Up to 2 points
OR		
(3)	Balanced ventilation	2.5 points
OR		
(4)	Balanced ventilation with heat recovery	3 points
AND		
(5)	Commissioning of ventilation systems	1 point

Mandatory Minimums

The achievement of at least 1.5 points is a mandatory minimum for a 6 Homestar rating.

Data Entry

Enter points in scorecard tab.

Assessment

Review the plans and specifications or visually inspect the dwelling to determine if the following are present:

(1) Intermittent Extract Ventilation

Up to 1.5 points		
a.	There is a dedicated range hood for the cooking hob vented to outside.	0.5 point
b.	There is a dedicated extraction system for each bathroom vented to outside and automated to turn off such that the fans run sufficiently long to ensure effective moisture removal (e.g. delay timer).	0.5 point

c.	There is a net openable area of windows (or other openings) to the outside of no less than 5% of the floor area. Windows/openings required for passive ventilation (at least one in each room) are constructed in a way that allows them to be: • In accessible (i.e. ground floor) windows: secured against intruder entry while minimally open (i.e. to around 10mm along one edge) for background ventilation. • All other windows: fixed open to around 10mm along one edge for background ventilation. **OR** Background (trickle) ventilators have been installed in each habitable room in accordance with the areas set out in Building Code G4.	0.5 point

(2) Continuous Extract Ventilation

Up to 2 points		
a.	There is a dedicated range hood for the cooking hob vented to outside.	0.5 point
b.	A whole house continuous extract system is installed consisting of extract fans in each bathroom/toilet in accordance with NZ Building Code G4. These fans should be set to produce a total of at least 0.35 Air Changes per Hour (ACH) throughout the entire home. Doors to habitable rooms will require undercut or transfer grill setup (i.e. 20 mm high gap under 760 mm wide door if no final finish or 10mm high if carpeted). Attached garage door to the inside of the house must be sealed on all four edges to minimise the ingress of pollutants. Note: Care should be taken to ensure that non room-sealed combustion appliances (including wood stoves) are adequately ventilated in accordance with clause G4 of the buildings code. It is recommended to install room-sealed combustion appliances.	1.5 points

(3) Balanced Mechanical Ventilation

2.5 points		
a.	A whole-house balanced ventilation system is installed consisting of ducted supply and extract fans. The balance of flow rates for air volume supply and extract must be shown in the design documentation. The ventilation scheme does not require heat recovery and may have a temperature boost to temper the external supply air temperature. Doors to habitable rooms will require undercut or transfer grill setup (i.e. 20 mm high gap under 760 mm wide door if no final finish or 10mm high if carpeted). Attached garage door to the inside of the house must be sealed on all four edges to minimise the ingress of pollutants. Note: Care should be taken to ensure that non room-sealed combustion appliances (including wood stoves) are adequately ventilated in accordance with clause G4 of the buildings code. It is recommended to install room-sealed combustion appliances.	2.5 points

(4) Balanced Mechanical Ventilation with Heat Recovery

3 points		
a.	A whole-house balanced ventilation system is installed consisting of ducted supply and extract fans. The balance of flow rates for air volume supply and extract must be shown in the design documentation. The ventilation scheme must have heat recovery and may have a temperature boost to temper the external supply air temperature. Doors to habitable rooms will require undercut or transfer grill setup (i.e. 20 mm high gap under 760 mm wide door if no final finish or 10mm high if carpeted). Attached garage door to the inside of the house must be sealed on all four edges to minimise the ingress of pollutants. All combustion appliances (including wood stoves) must be room-sealed.	3.0 points

(5) Commissioning of Ventilation Systems

1 point		
	Installed ventilation systems are inspected, checked and required volume flow rates for mechanical systems are measured. A report or letter is provided demonstrating that the inspections, checks and testing indicated in Table 9 below have been carried out as a minimum.	1 point

System	Required Testing and Commissioning
Kitchen and bathroom extract	**Functional checks** a) Temporary protection and packaging has been removed from all products. b) Fan operates correctly when activated by manual or automatic control. c) Fan switches off after controls are de-activated and run-on timers are set to a minimum of 15 minutes. **Air flow measurement** a) Air flow measurements should be carried out using a calibrated air flow device and results recorded in litres per second. b) Record the extract air flow for each extract fan.
Opening windows and background ventilators (trickle vents)	**Visual inspection** a) Verify that the size and number of background ventilators or window openings meets the requirements. b) Verify that any openable windows have restrictors or lockable stays as required. c) Verify that any temporary protection and packaging has been removed and that shutters open and close correctly.
Continuous extract and balanced systems	**Functional checks** a) Verify that any temporary protection and packaging has been removed and that shutters open and close correctly. b) Verify that the air flow direction is correct at each room terminal. c) Check for the presence of any abnormal noises on start up or when the system is running in normal background ventilation mode. d) Verify that systems providing continuous ventilation can only be switched off at the main isolator. **Air flow measurement** e) The system should be balanced to ensure that design air flow rates are achieved at each terminal. f) Air flow measurements should be carried out using a calibrated air flow device and results recorded in litres per second at each room terminal.

Table 9: **Commissioning checklist for household ventilation systems**

Audit Documentation

Design Rating

Intermittent Extract Ventilation
Marked up drawings and/or specifications showing that there is a dedicated range hood for the cooking hob vented to outside.
Marked up drawings and/or specifications showing that there is a dedicated extraction system for each bathroom vented to outside and automated to turn off such that the fans run sufficiently long to ensure effective moisture removal (e.g. delay timer).
Marked up drawings and/or specifications showing (i) a net openable area of windows (or other openings) to the outside of no less than 5% of the floor area, (ii) of those openable windows, accessible ones can be secured against intruder entry while open to around 10mm along one edge, (iii) all others are able to be fixed open to around 10mm along one edge. **OR** Marked up drawings and/or specifications showing (i) background (trickle) ventilators have been installed in each habitable room (ii) and in accordance with the areas set out in Building Code G4.
Continuous Extract Ventilation
Marked up drawings and/or specifications showing that (i) the bathroom extract has been configured for whole house continuous extract in accordance with the submission requirements, (ii) all doors to habitable spaces are undercut or air transfer grilles specified in accordance with the submission requirements (iii) door(s) between the conditioned space and garages are fully sealed.
Balanced Mechanical Ventilation
Marked up drawings and/or specifications showing that (i) a whole-house balanced mechanical ventilation system is to be installed in accordance with the submission requirements, (ii) all doors to habitable spaces are undercut or air transfer grilles specified in accordance with the submission requirements (iii) door(s) between the conditioned space and garages are fully sealed.
Balanced Mechanical Ventilation with Heat Recovery
Marked up drawings and/or specifications showing that (i) a whole-house balanced mechanical ventilation system with heat recovery is to be installed in accordance with the submission requirements, (ii) all doors to habitable spaces are undercut or air transfer grilles specified in accordance with the submission requirements and (iii) door(s) between the conditioned space and garage are fully sealed, (iv) all combustion appliances (including wood stoves) are room sealed.
Commissioning of Ventilation Systems

Specifications showing that ventilation systems are to be commissioned according to the requirements.

Built Rating

Intermittent Extract Ventilation
Photographs referenced to a floor plan OR marked up drawings showing that there is a dedicated range hood for the cooking hob vented to outside.
Photographs referenced to a floor plan OR marked up drawings showing that there is a dedicated extraction system for each bathroom vented to outside and automated to turn off such that the fans run sufficiently long to ensure effective moisture removal (e.g. delay timer).
Marked up drawings and/or specifications showing (i) a net openable area of windows (or other openings) to the outside of no less than 5% of the floor area, (ii) of those openable windows, accessible ones can be secured against intruder entry while open to around 10mm along one edge, (iii) all others are able to be fixed open to around 10mm along one edge. **OR** Marked up drawings and/or specifications showing (i) background (trickle) ventilators have been installed in each habitable room (ii) in accordance with the areas set out in Building Code G4.
Continuous Extract Ventilation
Photographs referenced to a floor plan OR marked up drawings showing that (i) the bathroom extract has been configured for whole house continuous extract in accordance with the submission requirements, (ii) all doors to habitable spaces are undercut or air transfer grilles specified in accordance with the submission requirements, (iii) door(s) between the conditioned space and garages are fully sealed.
Balanced Mechanical Ventilation
Photographs referenced to a floor plan OR marked up drawings showing that (i) a whole-house balanced mechanical ventilation system has been installed in accordance with the submission requirements, (ii) all doors to habitable spaces are undercut or air transfer grilles specified in accordance with the submission requirements (iii) door(s) between the conditioned space and garages are fully sealed.
Balanced Mechanical Ventilation with Heat Recovery
Photographs referenced to a floor plan OR marked up drawings showing that (i) a whole-house balanced mechanical ventilation system with heat recovery is to be installed in accordance with the submission requirements, (ii) all doors to habitable spaces are undercut or air transfer grilles specified in accordance with the submission requirements (iii) door(s) between the conditioned space and garages are fully sealed, (iv) all combustion appliances (including wood stoves) are room sealed.
Commissioning of Ventilation Systems

Letter or commissioning report showing that ventilation systems have been commissioned according to the requirements.

Background and Guidance

A 2015 BRANZ survey of the condition of New Zealand houses found:

- Only around half of kitchens and half of bathrooms had some form of mechanical extract ventilation.
- Mould was present in a higher proportion of bathrooms and kitchens without mechanical ventilation.
- Mould was visible in nearly half of all homes in the survey.

Separately, BRANZ conducted a study of 36 homes in 2013 that showed around 1/3 had ventilation levels below that recommended for the removal of moisture and other contaminants. The homes were all built after 1995. It is known that the air tightness of new homes is gradually increasing, meaning that background ventilation is inadequate for the removal of moisture. Additionally, it is known that most occupants do not manually open windows frequently enough for this to work as a ventilation strategy, particularly in winter. The 2015 House Condition Survey goes on to say:

"…opening windows as an effective means of ventilation relies on occupants doing so regularly, for long enough and wide enough. Previous BRANZ research, which measured actual ventilation rates in combination with a survey of occupant behaviour, suggested householder practices were providing insufficient ventilation in around one-third of cases. This was particularly pertinent in newer, more airtight houses."

Ventilation aids in circulating the air in the dwelling, allowing moisture and airborne pollutants to escape, and fresh clean air to be drawn into the dwelling. Even in a well-ventilated dwelling, bathrooms, kitchens and laundries (where a clothes dryer is present) will require extract fans to remove the moisture. Where clothes dryers are installed, these should either be extracted to outside or condensing type.

Some form of continuous background ventilation is therefore recommended in new homes, particularly those targeting very high levels of air-tightness. Homes targeting air-tightness levels below 1 ACH should install balanced mechanical ventilation systems.

Mechanical ventilation systems have the advantage that they rely less on occupant behaviour. However, international experience of mechanical ventilation systems in homes suggests that they must be carefully designed to ensure optimum performance. In particular, fan noise should be kept low and any filters should be easily accessible for replacement.

Continuous exhaust-only ventilation has proven to be an inexpensive to install system and adequately addresses the CO_2 and moisture control requirements of modern homes. Exhaust-only ventilation is common in the USA and is acceptable for modern well insulated structures in heating climates as drier exterior air is pulled through the building thermal envelope. The exhaust fans should be set to produce 0.35 Air Changes per Hour (ACH) throughout the entire home with a timer that cannot be turned off except at the fan isolator. As these will be running 24/7, they need to be nearly silent. Continuous extract ventilation depressurizes the building, which can lead to backdraft in combustion appliances unless they are sealed. Additionally, the depressurization can pull garage pollution into the home, so the door to the garage needs to be sealed. Open fireplaces cannot be

used in modern buildings and other types of fires (e.g. wood burners) require a dedicated air supply in order to prevent back-drafting and potentially toxic fumes from entering the home.

Balanced fresh air supply and exhaust allows the benefit of heat recovery and tempering of the incoming fresh air. The ventilation ducting must be sufficiently insulated and wrapped in a vapour barrier when fresh outdoor air is being ducted through to the internal. Mechanical ventilation can be centralized or individual (standalone family house vs. apartments). Although balanced ventilation systems do not intentionally depressurize the building, sealed combustion appliances and a well-sealed garage entry door (from home to garage) is highly recommended. Open fireplaces cannot be used in modern buildings and other types of fires (e.g. wood burners) should have a dedicated air supply in order to prevent back drafting and potentially toxic fumes in the home.

References and Further Information

1. Smarter Homes
   http://www.smarterhomes.org.nz/smart-guides/air-quality-moisture-and-ventilation/

2. Beacon Pathway
   http://www.beaconpathway.co.nz/new-homes/article/balancing_temperature_moisture_and_ventilation

3. BRANZ
   https://www.branz.co.nz/cms_show_download.php?id=50335e67bb00f3e0464097be1d4d71ac8a85f6bf
   http://www.conference.net.au/cibwbc13/papers/cibwbc2013_submission_87.pdf

EHC-4 Surface and Interstitial Moisture 5 points

Aim

To encourage and recognise measures that reduce condensation on and within building components to improve the indoor environment for occupants, reduce respiratory illnesses and the risk of mould, and to increase the durability of the dwelling.

Credit Criteria

Up to five points are available where it is demonstrated that indoor moisture levels have been managed through one or more of the three methods listed below.

(1)	Minimising thermal bridges	Up to 3 points
(2)	Minimising condensation within the building envelope	Up to 2 points
(3)	A building certified as Passive House by the Passive House Institute Germany shall be awarded full points for this credit with submission of completed PHPP file for a design rating and on presentation of the certificate for a built rating.	5 points

Mandatory Minimums

The achievement of at least 0.5 points is a mandatory minimum for a 6 Homestar rating.

The achievement of at least 1.5 points is a mandatory minimum for a 7 Homestar rating or higher.

Data Entry

Use the scorecard tab to record points.

Assessment

Condensation and mould growth in homes is a function of interior surface temperatures and the temperature and humidity of the air inside the building. In order to reduce the risk of condensation and mould growth:

- Interior surface temperatures need to be kept above a specific value for the climate by limiting thermal bridges.
- Moisture needs to be prevented from accumulating within the building envelope.

In addition, interior humidity levels must be controlled by adequate ventilation. This is covered separately in credit EHC-3.

(1) Minimising Thermal Bridges

Points are awarded for building constructions that reduce the likelihood of low surface temperatures. Note that small, one-off, localised penetrations that cross the thermal envelope to support external structures such as for balconies in apartment buildings are permitted but not recommended, particularly in colder climates of New Zealand. Proprietary solutions to prevent cold bridging in balconies are available.

Where a combination of floor types or wall types is present all floors or walls must meet the respective requirements to gain 1 point. Review the plans and specifications or visually inspect the dwelling to determine if the following are present:

<table>
<tr><th colspan="3">Floors</th></tr>
<tr><td>Concrete on grade</td><td>For concrete slabs on grade the foundation perimeter edge (product) R-value should be no lower than those shown in the table below:<table><tr><th>Climate Zone</th><th>1</th><th>2</th><th>3A</th><th>3B</th></tr><tr><td>Min. Foundation Perimeter Edge R-value</td><td>R 0.7</td><td>R 1.0</td><td>R 1.0</td><td>R 1.25</td></tr></table></td><td>1 point</td></tr>
<tr><td>Timber suspended floor</td><td>Timber suspended floors must be fully insulated as a minimum to the (product) R-values in the table below and the insulation run past the line of the inside face of the outside wall above.<table><tr><th>Climate Zone</th><th>1</th><th>2</th><th>3A</th><th>3B</th></tr><tr><td>Min. Suspended floor R-value</td><td>R 0.7</td><td>R 1.0</td><td>R 1.0</td><td>R 1.25</td></tr></table>Note that these insulation values are a local minimum and much higher R-values will be required to meet the requirements of EHC-1.</td><td>1 point</td></tr>
<tr><td>Concrete suspended floor</td><td>The edge of any concrete suspended floors above unconditioned spaces (such as above garages or car parks) should be insulated to at least the (product) R-values in the table above in addition to a full cover of insulation under the slab also to the R-values listed as a minimum.<table><tr><th>Climate Zone</th><th>1</th><th>2</th><th>3A</th><th>3B</th></tr><tr><td>Min. Suspended floor R-value</td><td>R 0.7</td><td>R 1.0</td><td>R 1.0</td><td>R 1.25</td></tr></table>Note that these insulation values are a local minimum and much higher R-values will be required to meet the requirements of EHC-1.</td><td>1 point</td></tr>
<tr><td>Alternative calculation method for all floor types</td><td>Alternatively, compliance may be awarded by carrying out thermal bridging analysis.
1 point is awarded where the floor perimeter thermal bridge has been calculated in accordance with ISO 10211 and shown to meet the temperature factor fRsi for the climate zone as shown in the table below.<table><tr><th>Climate Zone</th><th>1</th><th>2</th><th>3A</th><th>3B</th></tr><tr><td>Minimum temperature factor fRsi</td><td>0.55</td><td>0.65</td><td>0.65</td><td>0.70</td></tr></table></td><td>1 point</td></tr>
</table>

Walls and Ceilings (excluding window frames)

Timber Frame*

1 point

For timber frame buildings where there are no concrete or steel penetrations through the insulation layer, award one point.

Where there are any localised concrete or steel penetrations through the insulation layer (e.g. steel/concrete lintels), they must be insulated with a minimum thickness of EPS/XPS insulation on the outside face as shown in the following table. Other insulation types may be used provided they meet the R-values shown.

Climate Zone	**1**	**2**	**3A**	**3B**
Min. Local R-value Approximation	R 0.56	R0.71	R 0.71	R 0.83
Minimum thickness of XPS/EPS thermal break around concrete or steel thermal bridges	20mm	25mm	25mm	30mm

Concrete Frame*

1 point

For concrete frame/masonry buildings where the bulk insulation layer is on the outside of the frame/concrete panel system, and any localised concrete or steel supports (e.g. lintels, wall framing) are insulated with a minimum thickness of EPS/XPS insulation on the outside face as shown in the following table. Other insulation types may be used, provided they meet the R-values shown.

Climate Zone	**1**	**2**	**3A**	**3B**
Min. Local R-value Approximation	R 0.56	R0.71	R 0.71	R 0.83
Minimum thickness of XPS/EPS thermal break around concrete or steel thermal bridges	20mm	25mm	25mm	30mm

Steel Frame*

1 point

For steel frame buildings where either the bulk insulation layer is on the outside of the frame or any framing members are insulated with a minimum thickness of EPS/XPS insulation on the outside face as shown in the table above. Other insulation types may be used provided they meet the appropriate R-values.

Climate Zone	**1**	**2**	**3A**	**3B**
Min. Local R-value Approximation	R 0.56	R0.71	R 0.71	R 0.83
Minimum thickness of XPS/EPS thermal break around concrete or steel thermal bridges	20mm	25mm	25mm	30mm

Alternative calculation method for all wall or ceiling types*

1 point

Alternatively, compliance may be awarded by carrying out thermal bridging analysis.

1 point is awarded where thermal bridges have been calculated in accordance with ISO 10211 and shown to meet the temperature factor fRsi for the climate zone as shown in the table below.

Climate Zone	**1**	**2**	**3A**	**3B**

	Minimum temperature factor fRsi	0.55	0.65	0.65	0.70	

Window Frames	
All window frames are thermally broken	0.5 points
OR	
All windows and doors are thermally broken, and the thermal break is located inside the thermal control layer. See good practice notes for additional guidance.	1 point

Points are awarded where window and door details result in a minimum temperature factor fRsi for the climate zone as shown in Table 10 below. Window and door thermal bridges should be calculated in accordance with ISO 10211.

Climate Zone	1	2	3A	3B
Minimum temperature factor fRsi	**0.55**	**0.65**	**0.65**	**0.70**

Table 10: Minimum temperature factor fRsi for each climate zone

(2) Minimising Condensation Within the Building Envelope

Points are awarded for building constructions that slow the migration of moisture through the building envelope in winter. To be awarded points wall and roof constructions must show a designated air and vapour control layer in the envelope which is continuous and sufficient for the climate.

This credit requires the building designer to identify air and vapour control layers on the drawing and take responsibility that they are suitable for the specific dwelling in the climate in which it is located. NZGBC expects that industry will develop libraries of acceptable solutions for climate zones that would be acceptable as evidence.

Ground cover (e.g. polythene sheeting) is provided below all suspended timber floors. Points are awarded by default for concrete floors which are assumed to be impervious.	0.5 point
Air and vapour control layers are identified on wall, ceiling and floor (if suspended) construction drawings. Note(s) are provided on drawings/specifications for air sealing together with a statement from the designer/architect that "the building assemblies have adequate air and vapour control for the climate and expected internal loads".	1 point
OR	
Air and vapour control layers are identified on wall, ceiling and floor (if suspended) construction drawings. Note(s) are provided on drawings/specifications for air sealing together with a statement from the designer/architect that "the building assemblies have adequate air and vapour control for the climate and expected internal loads" **AND** Air leakage testing prior to interior lining is performed while the air control layer is still accessible for repair and the final as tested air tightness is measured to be under **3 air changes per hour** and reported to NZGBC for anonymous reporting aggregated by climate zone. Air tightness testing is to be to Method 2, per ISO 9972. Note: In air-tight homes care should be taken to ensure that non room-sealed combustion appliances (including wood stoves) are adequately ventilated in accordance with clause G4 of the buildings code. It is recommended to install room-sealed combustion appliances.	1.5 points
OR	
Air and vapour control layers are identified on wall, ceiling and floor (if suspended) construction drawings. Note(s) are provided on drawings/specifications for air sealing together with a statement from the designer/architect that "the building assemblies have adequate air and vapour control for the climate and expected internal loads" **AND** Air leakage testing prior to interior lining is performed while the air control layer is still accessible for repair. The final tested air tightness is measured to be under **1 air change per hour** and reported to NZGBC for anonymous reporting aggregated by climate zone. Air tightness testing is to be to Method 2, per ISO 9972. In view of the high levels of air-tightness required for this point, homes achieving an air tightness under 1 air change per hour must install as a minimum a balanced mechanical ventilation system as described in EHC-3. For the same reason it is required that all combustion appliances (including wood stoves) are room-sealed.	2 points

Good Practice Notes

Air and Vapour Control

Although it is not considered best practice to use the gypsum wall board lining as the air and vapour control layer, this may be acceptable if the design drawings/specifications notes show this is sealed (i.e. around penetrations such as sockets and downlights). The designer takes responsibility that this approach is adequate for the climate and expected internal loads.

Very high vapour resistance sheathing such as polyethylene (AKA polythene) vapour barriers are not recommended as they do not allow constructions to dry out in summer.

Unless a specific hygrothermal model of the assembly in the appropriate climate is provided, the air and vapour control layer must be on the interior of 75% of the insulation R-value. Concrete and masonry constructions must be insulated from the external side. Strapping and lining with fibrous insulation on the interior is not acceptable for concrete and masonry constructions without a specific hygrothermal model in the appropriate climate.

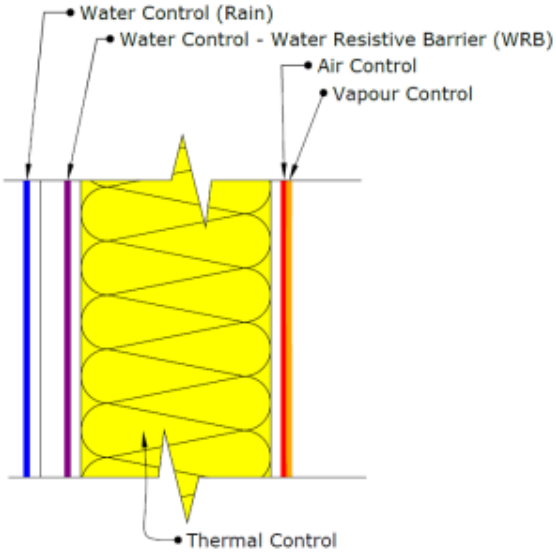

Figure 2: Example of air and vapour control layers in a wall detail showing the continuity of the four control layers at the junction. Note that poured concrete is considered airtight (masonry is not unless plastered).

Window and Door Placement

The performance of thermally broken windows is compromised where windows are placed in line with (or outside) the cold part of the surrounding wall insulation. This is currently the acceptable solution for compliance with Building Code E3 but is not ideal thermally as shown in the simulation below where the inside surface of the frame is very cold. It is expected that industry will develop and publish a range of standard details that meet these criteria and are E3 compliant, without need for calculation on a project-by-project basis.

The ideal location for thermally broken windows is in line with the warm part of the surrounding wall insulation as shown in the following simulation. The inside face of the window frame is considerably warmer and hence less prone to condensation.

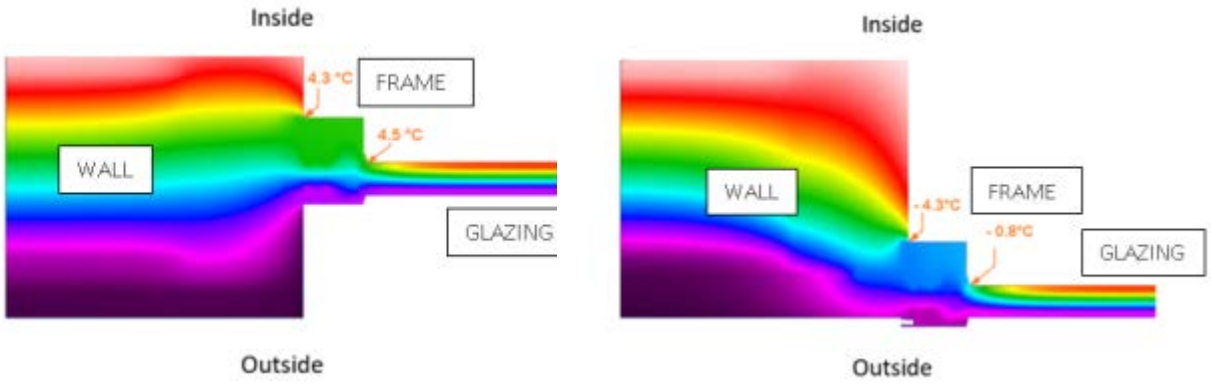

Figure 3: Comparison of heat loss through windows inside and outside the line of wall insulation

Condensation on Internal Surfaces

The temperature factor fRsi (fRsi): the difference between the interior surface temperature θsi of a component and exterior air temperature θe, divided by the difference of temperatures between interior air θi and exterior air θe. The surface temperature is to be determined with a defined surface resistance Rsi (which per ISO13788 is required to be 0.25m2K/W): fRsi = (θsi - θe) / (θi - θe), where θsi [°C] interior surface temperature, θe [°C] exterior air temperature, and θi [°C] interior air temperature.

Steel framing results in a large reduction of the respective layer R-Value (~30% is typical and increases as wall insulation levels increase) and causes surface temperatures to fall below acceptable limits. For light gauge steel framing, we recommend exclusively insulating on the outside to avoid low internal surface temperatures. Local steel usage, for example a steel column, should be either fully inside or outside of the thermal envelope allowing the insulation to be continuous over the steel.

Audit Documentation

Design Rating

Minimising Condensation on Internal Surfaces
Marked up drawings and/or specifications showing that ground floors and suspended floors above unconditioned spaces will be insulated to the minimum R-values required. **OR** Confirmation of thermal bridge temperature factor F_{Rsi} values calculated in accordance with ISO 10211.
Confirmation either that there are no highly conductive materials that penetrate the ceiling and wall thermal envelope. **OR** Calculations of localised R-values for thermal bridges through highly conductive materials that penetrate the thermal envelope or marked up drawings and/or specifications showing that thermal breaks will be insulated to the minimum thicknesses set out. **OR** Confirmation of thermal bridge temperature factor F_{Rsi} values calculated in accordance with ISO 10211.
Marked up drawings and/or specifications showing that all window frames are thermally broken. **OR** Marked up drawings and/or specifications showing (i) that all window frames are thermally broken (ii) confirmation of window and door installation minimum temperature factor F_{Rsi} values calculated in accordance with ISO 10211.
Minimising Condensation Within the Building Envelope
Marked up drawings and/or specifications showing that the ground floor is either in-situ concrete or that ground cover (e.g. polythene sheeting) is provided below all suspended timber floors.
Marked up drawings and/or specifications identifying air and vapour control layers in all wall, roof and (if suspended) floor constructions. Confirmation that the building assemblies have adequate air and vapour control for the climate and expected internal loads.
Extract from specification confirming that air leakage testing will be performed prior to interior lining while the air control layer is still accessible for repair. Air tightness testing is to be to Method 2, per ISO 9972. The target air-tightness should be confirmed. For homes targeting a pressure test of less than 3 air changes per hour: Extract from the specification showing that any combustion appliances are either room sealed or, if non room-sealed, have adequate provision for ventilation. For homes targeting a pressure test of less than 1 air change per hour: Extract from the specification showing that any combustion appliances are room sealed.
Building Certifying as Passive House

Passive House certificate or extracts of “overview” and “verification page” from PHPP energy modelling report showing that dwellings have already met the design criteria of Passive House (if not certified yet).

Built Rating

Minimising Condensation on Internal Surfaces
Marked up drawings and/or specifications showing that ground floors and suspended floors above unconditioned spaces will be insulated to the minimum R-values required. **OR** Confirmation of thermal bridge temperature factor F_{Rsi} values calculated in accordance with ISO 10211.
Confirmation that there are no highly conductive materials that penetrate the thermal envelope. **OR** Calculations of localised R-values for thermal bridges through highly conductive materials that penetrate the thermal envelope or marked up drawings and/or specifications showing that thermal breaks will be insulated to the minimum thicknesses set out. **OR** Confirmation of thermal bridge temperature factor F_{Rsi} values calculated in accordance with ISO
Marked up drawings and/or specifications showing that all window frames are thermally broken. **OR** Marked up drawings and/or specifications showing that all window frames are thermally broken **AND** Confirmation of window and door installation minimum temperature factor F_{Rsi} values calculated in accordance with ISO 10211.
Minimising Condensation Within the Building Envelope
Photographs referenced to a floor plan OR marked up drawings showing that the ground floor is either in-situ concrete or that ground cover (e.g. polythene sheeting) is provided below all suspended timber floors.
Marked up drawings identifying air and vapour control layers in all wall, roof and (if suspended) floor constructions. Confirmation that the building assemblies have adequate air and vapour control for the climate and expected internal loads.
Confirmation of the result of air leakage testing according to Method 2, per ISO 9972. For homes targeting a pressure test of less than 3 air changes per hour: Extract from the specification showing that any combustion appliances are either room sealed or, if non room-sealed, drawings and or photographs showing that they have adequate provision for ventilation. For homes targeting a pressure test of less than 1 air change per hour: Extract from the specification showing that any combustion appliances are room sealed.
Building certified as Passive House by the Passive House Institute Germany
Passive house certificate and extracts of “overview” and “verification page” from PHPP energy modelling report showing that dwellings have been certified to the Passive House standard.

References and Further Information

1. BRANZ
   http://www.branz.co.nz/cms_show_download.php?id=795f804f7dcea461b49bb922a5295ba2c6047a32

2. BRANZ
   http://www.buildmagazine.org.nz/assets/PDF/Build110-16.pdf

3. WUFI
   https://wufi.de/en/software/what-is-wufi/

EHC-5 Hot Water Heating 6 points

Aim

To encourage and recognise the reduction of carbon dioxide (CO_2) emissions associated with hot water production for the dwelling.

Credit Criteria

Up to six points are available based on the efficiency of the hot water system compared with an 'average' system, as measured by CO_2 emissions.

Data Entry

Complete the 'Hot Water Heating' section within the Water Calculator tab. Enter points in the scorecard.

Assessment

The EHC-2 Hot Water Heating section within the Water Calculator is used to estimate the kg of CO_2 emissions associated with water heating and the number of points awarded.

Recognising that less than 10% of New Zealand dwellings have more than one hot water heating system, only the main hot water system should be considered, i.e. the one connected to the most-used shower. However, solar hot water or wetback heating can be accounted for in the calculator.

Completing the Water calculator

Complete the 'EHC-5 Hot Water Heating' section within the Water Calculator by gathering data either from the plans and specifications or by visually determining and measuring in accordance with the guidance below. This section of the Water Calculator has four parts.

Part A: Hot Water System

All fields marked with an asterisk are mandatory.

*Hot Water Heating Type**

Choose the main hot water heating system type from the drop-down menu. Where there is more than one hot water heating system, this is the system connected to the most-used shower.

Note that if solar or wetback water heating is present, in all cases they will be treated as a 'boosting' feature in the calculator even if they are the main method of heating. It is expected that these systems will have another heating form as back-up/boosting (typically electric). This 'back-up' heating method is to be selected as the hot water heating type. This approach will not de-rate the contribution of solar or wetback heating as their contribution is offset from the heating demand first.

Individual / Central System

Select 'Central' from the drop-down menu if the dwelling has a shared centralised hot water heating system (present in some multi-unit developments). Otherwise leave blank or select 'Individual'

*Water Pressure**

Select either high pressure (mains) or low pressure depending on the system. In most low pressure systems, the hot water flow would be noticeably slower than the cold water flow. If a hot water system has an old copper cylinder inside a galvanised cylinder, it can be assumed to be low pressure. It will typically have a header tank in the ceiling space or on the roof or a pressure limiting valve on the cold feed into the cylinder.

Cylinder / Tank Capacity

Leave blank if the system is an instantaneous water heating system. If there is a cylinder, read the name plate, design specification or look up manufacturer's data to identify the nominal capacity.

*Cylinder / Tank Location**

Select either 'Indoors' or 'Outdoors' depending on cylinder location. This affects heat loss from the cylinder. When a hot water cylinder is in an unconditioned garage space or within a typical attic space, it is considered to be located outside (select the 'Outdoors' option).

Efficiency

Enter system conversion efficiency for any natural gas/LPG, oil, or diesel system. Leave blank for electric, geothermal, or wood burner systems (where typical combustion efficiencies are assumed within the calculation). This is the efficiency of the heater when heating cold water up to usage temperature.

The value should be quoted by the manufacturer and should be available on the system name plate or in manufacturer's literature. If the value is not known, the Hot Water Calculator assumes a default value equal to the minimum efficiency permitted by NZS 4305.

Type of Gas

For natural gas systems, select if the fuel is natural gas (piped) or LPG. Leave blank for all other heater types. LPG has higher associated emissions due to bottling. Piped natural gas is only available in the North Island, so if the dwelling is in the South Island it can be assumed that the system would be using LPG.

Lagging

Is the hot water cylinder and exposed sections of hot water pipes wrapped with effective insulation (lagging)? Select what applies to the dwelling. If both cylinder and exposed sections of pipes are lagged, select 'cylinder + pipe', if only the pipes or the cylinder is lagged, select the option that applies. If there is no lagging, select 'none'. Only sections of hot water pipes that are outside the dwelling (e.g. connected to an externally located cylinder or instantaneous gas heater) are considered 'exposed'.

Combine with Heating?

Select 'yes' only when the hot water heating system uses natural gas or oil/diesel and the same burner is used for space heating as well as water heating. In this case it is possible there are no additional back up/boosting systems and this cell accounts for the impact on overall system emissions when space and hot water heating is combined.

Select 'No' or leave blank for wetback systems (using wood burner) or heat pumps where the same outdoor unit is serving the water heater and heat pump (or any system where spacing and hot water heating is not combined).

Part B: Solar Hot Water and Wet-Back Systems

Review the plans and specifications or visually determine if a solar hot water or wetback system is provided for the dwelling. If not, leave this part blank. If so, complete the following questions.

- *Is there a wetback installed? Yes/No*
- *Is there a separate cylinder for the solar system? Yes / No*
- *If there a separate cylinder for the solar system, what is the capacity?*
- *If there a separate cylinder for the solar system, where it is located?*
- *What is the area of the solar panel/collector in square metres?*
- *What is the slope of the collector (approximate angle in degrees)?*
- *What is the direction of the collector from north?* Choose from 90°(E) / 60° / 30° / 360°(N) / 330° / 300° / 270° (W)
- *What type of collector is used?* Choose from plate / evacuated tube
- *What type of circulation is used?* Choose from thermosiphon / pump circulation

Wetbacks, i.e. systems which use enclosed burners (fuelled by wood, pellets or coal) to act as a primary or secondary means of heating water are catered for by selecting the solid fuel type.

Part C: Monthly COP Values for Very High Efficiency Heat Pumps

The default COP for heat pumps used in the Homestar tool is 3. This section is used when the project is using high efficiency heat pumps that have a COP of more than 3, and when monthly conversion COP data (Coefficient of Performance for heating an amount of water given average climate conditions of each month) is available. Otherwise, leave blank.

Part D: Centralised Hot Water

Review the plans and specifications to see if a centralised hot water system is used in the project.

The centralised hot water part is to be used when a single hot water heating plant is used to supply hot water to multiple dwellings. These are typically only found in apartment developments but may be possible in other dwelling types as well.

Use the following steps when assessing a dwelling connected to a centralised hot water system:

- Complete Part A (and B and C if applicable) as for an individual dwelling system
- Select the 'Central' option for *System Type*
- Fill out section D as much as possible, including pipe loss, pipe insulation thickness, pump head and pump motor efficiency information if these are known (all other fields must be completed)

The tool calculates carbon emissions associated with the hot water heating system apportioned to each dwelling based on the number of dwellings served by the system and the expected occupancy in each dwelling.

How Points are Calculated

The calculation for this credit is based on a simplified model of EECA's HERS hot water algorithms. These algorithms were originally developed to work in conjunction with the AccuRate (HERS) house modelling software[2], as part of the Australia/New Zealand Home Energy Rating Scheme (ANZHERS). They were simplified so that all dwellings are assumed to have a single water heating system, which is then assessed by the Hot Water Calculator. The algorithms are based on assumed user behaviour, in terms of hot water usage. Points awarded are based on how the CO_2 emissions of the hot water system compare against that of a reference building.

Some other defaults/assumptions used for the algorithm:

- Occupancy rate equals the number of bedrooms plus one (as with elsewhere in Homestar)
- Each person takes one 7-minute 40°C shower per day;
- The cold water inlet temperature is at the ground temperature of the region;
- Storage cylinders are calculated as having heat losses that are proportional to the temperature difference between water stored at 60°C and the surrounding air temperature, dependent on the insulation around the cylinder and related to the size of the cylinder;
- Internal spaces within the building envelope where hot water cylinders are stored are always at 20°C, and that the outside temperatures vary as given by the external temperatures available in the AccuRate climate data files;
- Four New Zealand climate zones provide the ambient inlet temperature of supply water, assuming a water storage temperature of 60°C, a tempered temperature of 40°C for bathing, and an interior space temperature of 20°C.

Audit Documentation

Design Rating

Parts A and D
Drawing(s)/specification(s) showing (i) type and capacity of water heater (ii) pressure of the water system (high or low pressure) (iii) specified Shower WELS rating (iv) heater efficiency /COP including any COP data used for Section D, if required.
Part B Solar Hot Water
Manufacturer's details about the system.
Part C High Efficiency Heat Pumps
Manufacturer's details about the system's COP.
Part D Multi-Unit Residential Buildings with Common Hot Water Systems
Hydraulic line diagram showing system, including details of tank capacity, pump head, motor power, details/ Specification of heating source

Built Rating

Photograph(s) OR invoice(s) of hot water system. Where photo or invoice does not demonstrate system details, include screen shot or manufacturer's data demonstrating compliance.
Screen shot or product brochure showing WELS rating OR measured flow rates.

Background

According to BRANZ studies, water heating accounts for around a third of energy use in an average New Zealand house. With a well-designed plumbing system and the use of low carbon, renewable energy sources (such as solar hot water heaters), the CO_2 emissions of water heating systems can be greatly reduced.

The Homestar hot water calculation is based on the CO_2 emissions of the actual system being assessed compared to a reference system, with NZGBC CO_2 emission fuel intensities replacing those used by EECA, to maintain consistency with the other parts of the Homestar tool as well as the Green Star rating tools.

Systems which rely on renewable forms of energy/fuels (e.g. solar hot water systems) score better than those reliant on fossil fuels.

Modern electric cylinders have a high level of insulation, resulting in relatively low standing loss.

References and Further Information

1. Energy Efficiency and Conservation Authority (EECA), Home Energy (HERS) www.eeca.govt.nz/

2. AS/NZS4234:2006, Solar water heaters – Domestic and heat pump – Calculation of energy consumption standards, Standards Australia, Sydney, Australia.

3. Camilleri, M.T., 2006. Hot Water Analysis. BRANZ Ltd Report EC124, BRANZ Ltd, Judgeford, Porirua, New Zealand, 2006.

4. Burgess, J.C., March 2009, ANZHERS – Upgraded hot water rating algorithms. BRANZ report EC1475C, BRANZ Ltd, Judgeford, Porirua, New Zealand, 2009.

EHC-6 Lighting 2 points

Aim

To encourage and recognise the reduction of energy consumption associated with interior and exterior lighting.

Credit Criteria

Up to two points are awarded where it can be demonstrated that the dwelling's indoor and outdoor lighting meets the following:

(1)	All indoor lighting has a minimum efficacy of 40 lumens per watt. Compact fluorescent (CFL) or LED achieves this by default.	0.5 point
(2)	All outdoor, balcony and indoor common area lighting has a minimum efficacy of 40 lumens per watt. CFL or LED achieves this by default.	0.5 points
(3)	All outdoor, balcony and indoor common area lighting has **Effective Lighting Controls**.	0.5 points
(4)	Total indoor lighting power density is no more than 5 W/m^2	0.5 points

Data Entry

Use Lighting Calculator tab and scorecard.

Assessment

Review the plans and specifications or visually inspect all applicable indoor and outdoor lamps and record the appropriate data within the Lighting Calculator or another suitable schedule. The requirements for lighting in various areas depend on the lighting category to which these areas belong.

This credit is applicable to fixed (not portable) fittings only. Lighting used for eye-adaptation near covered vehicle entrances or exits and emergency exit lighting in any area is exempt from this credit. Lighting on appliances, fixture like mirrors, building entrance signage, branding signboards or hoardings are also exempt.

For special areas that may not clearly fit into one of the four lighting categories or that may fit multiple categories, please consult NZGBC and submit a Technical Question.

<u>For standalone and terrace dwellings:</u>

- All lighting within the conditioned area of the house is considered **indoor lighting**
- All lighting within a balcony is included in the **balcony lighting** category
- All attached or detached garage, shed and workshop lighting needs to be included in the **indoor** or **outdoor** lighting calculations for this credit, based on assessor judgement.
- All other lighting outside the dwelling (e.g. garden or building façade) is included in **outdoor lighting.**

For multi-unit developments:

- All lighting within the dwelling is included as **indoor lighting**
- All lighting within a balcony is included as **balcony lighting**
- **Indoor common area lighting** is limited to lighting in corridors, stairways, entrance hallways, lobbies and lift lobbies, as well as any indoor car parks and bicycle parks / bicycle storage facilities. *
- **Outdoor lighting** is limited to lighting on pathways connecting building entrances to outdoor car/bicycle parks, entrances to the property (e.g. main gate), outdoor lighting on building façade (e.g. security lights), outdoor dining/ gathering areas, landscaped areas specific to one or more dwellings and entrance lighting.
    - Landscape areas specific to one or more dwellings would include gardens belonging to ground floor apartments, rooftop gardens dedicated to residents and other landscape areas that are associated with one or more dwellings and their occupants, similar to a garden of a standalone house.
    - General landscaped areas are not included.

** Lighting in other common areas such as laundries or gyms are not assessed, but energy efficiency considerations are encouraged in these areas as well since this may impact other credits such as EHC-8 (Renewable Energy) or any targeted innovations relating to lighting efficiency.*

Effective Lighting Controls

To be awarded 0.5 points one allowable method of lighting control should be chosen from the table below for each of the following areas:

- Balcony
- Outdoor
- Indoor common area (multi-unit residential only)

The requirement for effective lighting control depends on the lighting power density, which is the total wattage of lighting serving a particular area (e.g. balcony, patio footpath, etc.) divided by that area.

LPD (W/m^2)	Motion + Daylight Sensor	Daylight Sensor Only	Motion Sensor Only	PV	Manual switching Only	Adjustable Time Schedule
≤1.5	✓	✓	✓	✓	✓	✓
>1.5 & ≤3.0	✓	✓	✓*	✓	✓*	✓
>3.0	✓		✓*	✓		✓

Table 11: Lighting control requirements

* Allowed only when lights are in a location where natural light is not available.

Where a lamp does not have the efficacy listed on it or its packaging, the Homestar Assessor may use the 'Efficacy of Common Lamps' table as a guide, which can be found under the additional guidance section of this credit.

When calculating the total number of installed lamps, a lamp refers to an individual light bulb (i.e. if a light fitting contains three bulbs, this would be counted as three lamps).

Mixed Use Residential Developments

Lighting in any indoor exterior spaces that fall within a retail / commercial area and /or covered by the Green Star tool may be excluded from the Homestar tool.

Lighting in any outdoor areas that will be assessed under Green Star (excluding the Green Star Communities Tool) will be excluded from this credit.

Audit Documentation

Design Rating

Completed Lighting Calculator AND
Marked up lighting plans or specification for the dwelling.

Built Rating

Completed Lighting Calculator AND
Signed Pro Forma of Credit Compliance following verification on site. Maintain records of documentation as per Pro Forma.

Additional Guidance

Identifying Common Household Lamps

Homestar Assessors are expected to be able to identify common lamp types within the dwellings using the following table.

Compact Fluorescent Light Bulb (CFL)

Ambience standard CFL.

Classic shaped small decorative CFL.

Decorative CFL globe (wide diameter).

Ambience CFL Candle. Normally found in chandeliers.

Small decorative lustre CFL.

CFL reflector (has CFL inner ballast).

Par 38 Reflector CFL. Generally used outdoors.

Standard CFL. Spiral or stick shaped.

Dimmable CFL.

CFL R80.

Halogen and Halogen Replacements

CFL downlight replacement for 12V (low voltage) halogen.

MR 11 12V (low voltage) halogen.

GU10/ MR16 mains voltage halogen.

Infrared Coated (IRC) Halogen.

Incandescent (GLS)

Common standard lightbulb used for general light

Decorative globe light, for smaller fittings.

GLS Globe light.

GLS Reflector lamp. Used mainly in downlight

GLS Candle bulb. For chandeliers or other fittings.

Par 38 Reflector GLS. Generally used for outdoor flood lighting.

Halogen Ballast Replacements for GLS

Halogen ballast candle bulb.

Classic shaped halogen ballast bulb.

Halogen ballast R50 and R63 reflector bulb.

Fluorescent Tube and LED Bulbs

Fluorescent tube.

LED bulbs can be used for strip lighting in hall-ways, or feature

Recessed Fittings

Downlight fitting.

Recessed downlight fitting (reflective or non-reflective).

Type	Efficacy (lumens per watt)
Compact Fluorescent (CFL)	45-60
Light Emitting Diode (LED)	15-20 (old)
	50-200 (new)
Incandescent	17
Halogen	10-15 (standard old)
	20-30 (new)
Fluorescents (standard tubular)	50-67 (common)

Table 12: Efficacy of common lamps

Background

On average, a New Zealand household uses 9,370 kWh of electricity per annum. Based on studies by KEMA and BRANZ, 920 kWh (or nearly 10%) of this total is consumed by lighting[1]. Lighting is one of the aspects of the dwelling which is easier to address when making a significant reduction to the electricity consumption. With the adoption of more energy-efficient lighting habits within New Zealand homes, a significant amount of electricity could be saved nationwide.

Standard incandescent light bulbs are extremely inefficient, wasting 95% of their electricity as heat, with only 5% converted into visible light. Replacing them with new energy-efficient CFL, LED or halogen bulbs will help decrease energy use/costs, maintenance and the dwelling's impact on the environment[2].

The purpose of this Credit is to reward dwellings that have installed both energy-efficient lighting inside and outside the dwelling, as well as devices/fittings that control lighting use and maintain the efficiency of the lighting within the dwelling. These steps will contribute to the overall reduction in electricity consumption of the dwelling.

References and Further Information

1. Environment
   http://www.rightlight.govt.nz/residential/why-change/better-environment

2. Save Money
   http://rightlight.govt.nz/residential/save-money

3. Types of Efficient Bulbs
   http://www.rightlight.govt.nz/residential/choosing-right-light/types-bulbEHC

EHC-7 Natural Lighting 3 Points

Aim

To encourage and recognise dwellings which provide good levels of natural light for occupants.

Credit Criteria

Up to three points are available for this credit where:

(1)	Window areas in external walls are no less than: • 15% of the floor areas for living areas and bedrooms where the windows are **not significantly shaded**. • 20% of the floor areas for living areas and bedrooms where the windows **are significantly shaded**, e.g. by eaves, balconies, purpose designed shading, etc.
OR	
(2)	An average daylight factor of no less than 1.5% (as measured at the floor level under an overcast sky) for living areas and bedrooms.

Awarded points are distributed for all types of dwellings as follows based on the number of bedrooms:

Studios	Habitable (living and sleeping) space complies	3 points
OR		
1-bedroom dwellings	Living room and kitchen complies	2 Point
	Bedroom complies	1 Points
OR		
Dwellings with 2 or more bedrooms	Living Room and kitchen complies	1 Point
	Master bedroom (the largest bedroom) complies	1 Point
	All other bedrooms comply	1 Point

Data Entry

Use scorecard tab.

Assessment

Review the plans and specifications and/or physically inspect the dwelling for either window to floor area ratio or average daylight factor.

Definition of Areas

For the purpose of this credit, **'living areas'** include kitchens whether they are part of a single open plan living/dining/kitchen area or a separate room. This is due to the importance of good daylight in kitchens. Home theatres and TV rooms are excluded as these do not have a high daylight requirement. **Master bedroom** is defined as the largest bedroom by floor area in the dwelling.

The assessor is to use their discretion when determining whether a room that maybe labelled as a 'study' is in fact a bedroom. If it is clearly not a bedroom, the study will need to be considered under living areas, due to the importance of daylight for the likely use of these spaces. These maybe a separate room or a part of the larger living area depending on the design.

(1) Window to Floor Area

Shading Guidance

Windows can be considered **not significantly shaded** if they have no eaves, balconies, deep reveals or purpose designed shading devices above or around them on the same floor as the window. Windows with eaves no more than 300mm deep are also considered unshaded. If the window does not meet these criteria, then the project can either opt to meet the percentage glazing for **significantly shaded** windows or calculate the angle of visible sky as below to show that the window is not significantly shaded.

Angle of Visible Sky

The angle of visible sky is the vertical angle between the lowest and highest points of the sky that are visible from the centre of the window. Windows should be considered **significantly shaded** if the angle of visible sky is less than 45°. It includes obstructions opposite the window as shown in Figure 4 below.

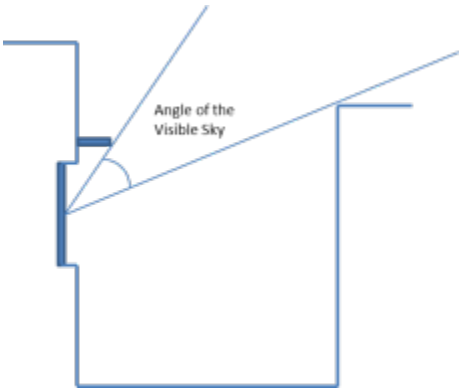

Figure 4: Angle of the Visible Sky

(2) Average Daylight Factor

Manual Calculation Method

There must be negligible overshadowing of glazed areas and a separate calculation must be provided for each of the bedrooms, kitchens and living areas.

The equation below is a simplified method that calculates the Average Daylight Factor (ADF) for a rectangular room whose depth is less than 2.5 times the window head height, under an overcast sky.

$$\textbf{ADF} = \frac{\textbf{VT} \times \textbf{angle of visible sky} \times \textbf{area of glass}}{\textbf{total surface area} \times (1 - \textbf{LR average}^2)}$$

VT is the visible transmittance of the glazing (data available from window suppliers).

Angle of visible sky is the vertical angle between the lowest and highest points of the sky that are visible from the centre of the window. For a vertical window, this value will be between 0 and 90 degrees.

Total surface area is the total area of interior surfaces (walls, floor, ceiling and doors).

Area of glass (not including frame) is approximately 80 percent of the overall window size.

LR average is the area-weighted average of the interior surfaces. Calculated by:

$$\frac{\text{wall area} \times \text{wall reflectance}}{\text{total surface area}} + \frac{\text{floor area} \times \text{floor reflectance}}{\text{total surface area}} + \text{. . . etc.}$$

Angle of Visible Sky

The angle of visible sky is the vertical angle between the lowest and highest points of the sky that are visible **from the centre of the window**. Windows should be considered significantly shaded if the angle of visible sky is less than 45°. It includes obstructions opposite the window as shown in Figure 4 above.

Computer Modelling Compliance Method

Review outputs of the daylight model to confirm the following:

- modelling software used to calculate the Daylight Factors
- weather file used to calculate the Daylight Factors where climate-based daylight modelling is used
- values of reflectance and transmittance used for each relevant material/glazing
- uniform Design Sky or CIE Standard Overcast Sky used for the daylight model
- output from the daylight modelling showing the Daylight Factors for living spaces and bedrooms

Acceptable software includes but is not limited to: Radiance, Daysim, IESVE, Dialux. Recommended daylighting simulation tools list could be found here: http://thedaylightsite.com/library-3/links/simulation-tools-2/.

Point calculations

All software calculates Daylight Factor at points on a plan. Some systems calculate the Daylight Factor for an almost infinite number of points, providing very accurate results. Other modelling programs request the user to identify the points matrix on the floor plan.

The Daylight Factor must be calculated for at least one point for each square metre of floor area. A maximum 1m² grid must be overlaid over the floor plan to determine these points and at all

perimeters, and each 1m² must begin at the façade. Daylight Factor is then calculated in the centre point for each box in the grid.

Reflectance

The ratio of the flux reflected from a surface to the flux incident on it.

Reflectance level required[1]	Minimum Surface Reflectance		
	Ceilings	Walls[2]	Floor
Medium reflectance	0.7	0.4	0.2
High reflectance[3]	0.7	0.6	0.4

Table 13: Minimum Surface Reflectance

1. Where the exact materials are not yet specified. Actual reflectance must be used when specific materials have been selected.
2. Reflectance calculation for walls doesn't include windows.
3. All apartments are required to use the high reflectance.

Physical Measurements Method (Built Rating)

- Measurements using a lux meter can only be taken on an overcast day and when the outdoor illuminance is no greater than 10,000 lux; internal and external measurements need to be taken at exact the same time.
- To determine the outdoor illuminance, the sky needs to be completely visible with no obstructers nearby (no less than 10m to the obstruction that is less than 5m in height).
- If the outside lux measurement is less than 10,000 lux, then internal measurements can be taken to demonstrate compliance with the Credit Criteria (an average of 150 Lux would correspond to an ADF of 1.5%).
- A minimum of 5 measurements are to be taken for each room and the results averaged. A measurement is to be taken in each corner of the room, 1m out from the wall at floor level and then a final measurement in the centre of the room.
- Measuring devices must be calibrated. Smartphone applications are only acceptable if these can be (and are) calibrated and connect to a separate physical measuring device rather than the light sensor on the smart phone. This is due to the inaccuracy and variability of results between phone applications and different phones.

Overshadowing: Overshadowing must be taken into account. A nearby building or feature (such as a retaining wall or fence) must be accounted for in overshadowing.

Overcast sky: A recognised and validated overcast design sky model with an illuminance of 10,000 lux is to be used and, for physical measurements, a uniform overcast sky with an illuminance of 10,000 lux or less.

Standard year: For the purposes of determining natural lighting, the hours between 8 am and 5 pm each day with an allowance being made for daylight saving.

Audit Documentation

Design and Built Rating

For dwellings compliant with credit criteria 1
Signed Pro Forma of Credit Compliance. Maintain records of compliance as per Pro Forma. Suggested documentation: Calculations or drawings which demonstrate that window areas in external walls are no less than 20% of the floor areas for living areas (lounge, living room, kitchen, dining room) and bedrooms.
For dwellings compliant with credit criteria 2
Signed Pro Forma of Credit Compliance. Maintain records of compliance as per Pro Forma.
Manual Calculation Method
Manual calculations describing the calculation method used and stating all assumptions made.
Modelling Compliance Method
Summary of outputs from the model stating (i) modelling software used (ii) brief description of the building model including values of reflectance and transmittance used (iii) description of the design sky used (iv) floor plan showing the daylight factors achieved in living areas and bedrooms.

Background

The sun has been used for centuries to light building interiors during the day. However, many dwellings today place greater importance on artificial lighting rather than on natural daylight. This is especially true in multi-unit developments.

Unfortunately, studies are now starting to show that the increased reliance on artificial lighting is having a detrimental impact on occupant health and well-being. These studies also show that the introduction of natural light into building interiors can offer substantial energy savings and at the same time improve the well-being of occupants.

References and Further Information

1. NZS 1680.1-2006 Interior Lighting - General Principles and Recommendations
   www.standards.co.nz
2. International Energy Agency Daylighting in Buildings, IEA 2000
   www.iea.org
3. CIBSE (Chartered Institution of Building Services Engineers, U.K.) Daylighting and Window Design, CIBSE 1999
   www.cibse.org
4. Baker, Nick and Koen Steemers, Daylighting Design of Buildings, James and James 2002.

EHC- 8 Renewable Energy 7 points

Aim

To encourage and recognise the installation and operation of local renewable electricity generation systems to reduce carbon dioxide (CO_2) emissions as part of everyday dwelling operations.

Credit Criteria

Standalone and Terraced Houses		
(1)	Reduction of CO_2 emissions through on-site generation of renewable electricity	Up to 6 points
(2)	Dedicated electric vehicle charging point provided within the property	1 point
Apartments		
(1)	Reduction of CO_2 emissions through on-site generation of renewable electricity	Up to 5 points
(2)	There are dedicated electric vehicle charging points provided within the development numbering no less than 5% of the total number of apartments, which are available for use by ANY resident.	1 point
	OR	
	There are dedicated electric vehicle charging points provided within the development numbering no less than 5% of the total number of apartments, which are available for use by residents AND the public.	2 points

Assessment

Review documents and/or observe renewable energy generation and electric vehicle charging systems installed on site.

Renewable Energy

Determining Emissions Offset

Energy supplied by remote large-scale electricity generating plants (i.e. supplied via the national grid) will not be eligible for any points in this credit. Electricity procured through either a carboNZero retailer or any other 'Green Tariff' or 'Carbon Offset' scheme, is not eligible either.

Use the BRANZ Photovoltaic Generation Calculator to determine the kWh/annum generated by the PV System. Input the kWh/yr figure into the appropriate cell on the Energy Calculator Tab.

Reference CO_2 Load

The reference CO_2 Load is calculated by summing the contributions from space heating and cooling, hot water heating, appliances, and lighting associated with the dwelling being assessed. The annual reference CO_2 load is automatically determined.

The CO_2 contribution from the dwelling's space heating and cooling, lighting and hot water heating is generated from the Energy, Lighting and Water Calculators. A default figure for the appliance related CO_2 contribution is automatically generated and is related to the number of occupants.

Number of bedrooms/occupants	kWh/year	$kgCO_2$
2 or less	1200	164
3 or 4	1500	205
5 and greater	1900	260

Since this credit is based on standardised operational behaviour, it may not be reflective of the actual energy use/CO_2 emissions in some instances. However, the approach taken represents the best currently available estimates.

For the renewable energy system's contribution to be credited, it does not need to feed into the dwelling's household supply. Renewable systems that feed entirely into the grid or common areas of multi-unit developments are acceptable.

BRANZ Photovoltaic Generation Calculator

Review the plans and specifications and/or manufacturers system specification to determine the answers to the following:

- *PV's angle of inclination:* (Horizontal = 0°)
- *PV's orientation (North = 0°):* Use a compass to establish the orientation of the dwelling. The orientation figure needs to be based on true not magnetic north.
- *PV's peak rated output (kWp):* For amorphous this should be the stabilised rated output.
- *PV type*: Choose from Monocrystalline / Polycrystalline / Amorphous

Wind, Hydro or Other Systems

Please contact the NZGBC for assistance in determining the energy production and associated points.

Worked Example

The following example is provided for a high performing standalone dwelling that has a 3kWp array of photovoltaics (which generates 3,200kWh of energy on an average year), and has no other electrical energy generation systems:

Item	Calculation	Source
CO_2 'emitters'		
a. Space Heating and Space Cooling energy load by pellet fire (annual)	= 5 kg CO_2	Automatically extracted from Space Heating Calculator
b. Hot Water energy load (annual)	= 306 kg CO_2	Automatically extracted from Hot Water Calculator
c. Appliance load (annual)	= 270 kg CO_2	From default load appliance figure based on occupant number
d. Lighting load (annual)	= 82 kg CO_2	
d. Reference CO_2 Load (annual)	= 663 kg CO_2	a + b + c + d
CO_2 'savers'		
e. Annual renewables - photovoltaic system	= 544 kg CO_2	PV CO_2 savings automatically estimated from BRANZ Photovoltaic Generic Calculator
Percentage supplied by renewable system		
f. Percentage of reference electricity load supplied by the renewable system	= (544 / 663) x 100 = 82%	Automatic calculation
Amount of points awarded (out of 8)	= 5.5 points	

Calculating Points

The table below outlines points corresponding to percentage offset benchmarks of CO_2 emissions. Emissions relating to space and water heating systems, lighting and general appliances are considered for this credit. The total amount of renewable energy generated is apportioned to the dwelling using the ratio to the dwelling conditioned space to the sum total of all conditioned areas in the development (sum of conditioned areas of all dwellings).

When the percentage offset is between these benchmarks, the number of points awarded is interpolated by the energy calculator. However, the lowest offset benchmark shown is the minimum for any points.

Standalone and Terraced Houses		
(1)	15% offset	1 point
(2)	30% offset	2 points
(3)	45% offset	3 points
(4)	60% offset	4 points
(5)	75% offset	5 points
(6)	90% or more offset	6 points

Apartments		
(1)	5% offset	0.5 points
(2)	15% offset	1 point
(3)	30% offset	2 points
(4)	45% offset	3 points
(5)	60% offset	4 points
(6)	75% offset	5 points

Note that energy generated on-site may be used by apartment common areas, wired directly into each apartment or exported to grid. EHC-8 is solely concerned with the amount of energy generated (and therefore the proportionate CO2 emissions abated) rather than *where* the energy is used.

Electric Car Charging

Review provided documentation and observations on site, to confirm that the EV charging station(s) for which points are claimed are dedicated charge points that can deliver a charging rate of at least 7 KW (A level 2 charger). For safety, these charge points should have their own circuit breakers. Regular mains power outlets without additional infrastructure do not comply.

For apartments, all dwellings across all typologies will achieve the same points for communally-provided EV chargers.

Audit Documentation

Design Rating

Specification from manufacturer showing all the relevant details required for the BRANZ Photovoltaic Calculator and BRANZ PV Calculator screenshot.
Calculations for common electrical demand (multi-unit developments only).
Contact NZGBC for compliance with other renewable energy devices
Electric vehicle charging system specifications (must include current drawn and charge rate). If exact products have not yet been selected, specification extract(s) stating requirements to be met, including the necessary electrical and wiring requirements to enable the appropriate charger to be installed.

Built Rating

Specification from manufacturer showing all the relevant details required for the BRANZ Photovoltaic Calculator and BRANZ PV Calculator screenshot.
Electrical engineer's calculations for common electrical demand (multi-unit developments only) AND
Photograph(s) showing the system.
Contact NZGBC for compliance with other renewable energy devices
Photographs of electric vehicle charger clearly showing make and model

Background

CO_2 is a major greenhouse gas, contributing towards climate change. Points for renewables are based on a net CO_2 approach, i.e. the portion of the calculated hot water; space heating, lighting and appliance-related CO_2 is met by the generation of electricity from renewables. The greater this CO_2 compensation is, the more points are awarded, based on a pro-rata system. This approach ensures that dwellings which are moving towards carbon neutrality are rewarded.

Over the next 40 years, New Zealand's energy mix is expected to change. The international economy will reward efforts to reduce greenhouse gas emissions to address climate change. Energy related greenhouse gas emissions in New Zealand will need to reduce in the longer term.

New Zealand is particularly well suited to local energy systems because of its abundant renewable energy sources (i.e. sun, wind and water). Although wind and hydro energy sources can be (and are already being) used in large electricity generating plants, such plants have drawbacks compared with energy sources in local energy systems.

The advantages of local energy systems include:

- Raising the overall efficiency and resilience of energy systems by spreading generation throughout the network;
- Improving energy security by making end-users more self-reliant;
- Using energy sources, particularly renewable sources, that are not suitable for big generating plants;
- Promoting competition and innovation by introducing new technologies into the marketplace; and
- Encouraging regional development by creating jobs for designers, manufacturers, and tradespeople.

For determining the reference CO_2 loads, standardised behaviour is assumed. Thus, for space heating, it is assumed that the entire area within the thermal envelope is kept at 20°C for the equivalent of eight hours each winter day. For hot water usage, calculations are based on the number of occupants (bedrooms), the plumbing system, the fuel source and any solar heating installed.

From the nation-wide BRANZ HEEP study, it is known that appliances (such as whiteware, heated towel rails, televisions, electric jugs, computers and DVDs) in an average New Zealand house account for 29% (or about 3,400kWh/yr) of energy use. From the same study it was shown that there is a direct relationship between appliance energy use and number of occupants.

References and Further Information

1. Level
   www.level.org.nz/energy/appliances/selecting-energy-efficient-appliances/
   www.level.org.nz/energy/renewable-electricity-generation/

2. Isaacs, N. (ed.) '*Energy Use in New Zealand Households. Report on the Year 10 Analysis for the Household Energy End Use Project (HEEP)*'. BRANZ Study Report 155 (2006). BRANZ. Porirua.

3. Energywise
   www.energywise.govt.nz/how-to-be-energy-efficient/generating-renewable-energy-at-dwelling

4. Sustainable Electricity Associated of New Zealand
   www.seanz.org.nz

5. Australian Standard AS4509.2
   AS 4509.2 Stand-alone power systems Part 2: System design guidelines

6. Energy Efficiency and Conservation Authority
   www.eeca.govt.nz/efficient-and-renewable-energy/renewable-energy

7. Ministry of Economic Development
   www.med.govt.nz/templates/ContentTopicSummary____19431.aspx

8. Electricity Authority

www.ea.govt.nz/about-us/documents-publications/

9. Parliamentary Commissioner for the Environment
   http://www.pce.parliament.nz/assets/Uploads/Reports/pdf/Get_Smart_think_small.pdf

10. Business Council for Sustainable Development
    http://www.nzbcsd.org.nz/

11. BRANZ Photovoltaic Generation Calculator
    http://www.branz.co.nz/PVcalculator

12. Electric Vehicle Information Site – NZ Government
    https://www.electricvehicles.govt.nz/

EHC-9 Sound Insulation 3 points

Aim

To encourage and recognise the provision of an improved sound environment protected from both internal and external sources.

Credit Criteria

Up to three points are available where the dwelling achieves any number of key sound insulation features from the following lists.

Standalone Houses		
(1)	**Windows:** All windows in habitable rooms have a Sound Transmission Class (STC) of 33 or more.	1 point
(2)	**Carpet or acoustic ceiling tiles:** 80% of the total area of habitable rooms (by m^2) contains carpet or acoustic ceiling tile.	1 point
(3)	**Ventilation:** the dwelling is either mechanically ventilated (whole-house) OR has sound-insulating trickle vents in all habitable rooms.	1 point
Terraced Houses or Apartments		
(1)	**Windows:** All windows in habitable rooms have a Sound Transmission Class (STC) of 33 or more.	1 point
(2)	**Adjoining walls, floors and ceilings:** ALL surfaces immediately adjacent to another space are or will be one of the following: • System with a Sound Transmission Class (STC) of at least 58 when the wall adjoins another dwelling, or an internal common space, such as a lounge /lobby, that is likely to be regularly occupied for more than an hour a day. • System with a Sound Transmission Class (STC) of at least 55 for walls adjoining space that is not consistently occupied, such as corridors and access ways.	1 point
(3)	**Ventilation:** the dwelling is either mechanically ventilated (whole-house) OR has sound-insulating trickle vents in all habitable rooms, where a window is fitted.	0.5 point
(4)	**Carpet or acoustic ceiling tiles:** 80% of the total area of habitable rooms (by m^2) contains carpet or acoustic ceiling tile.	0.5 point

AS/NZS 2107:2016		
(1)	The sound levels in the dwelling are within the Design Sound Level Range as provided in Table 1 of AS/NZS 2107:2016. For the purposes of the test all ventilation systems, whether natural or mechanical, should be in operation. Mechanical ventilation systems should be switched on and/or trickle vents should be open.	3 points

Data Entry

Use scorecard tab.

Assessment

Standalone Houses

(1) Windows

Review drawing(s)/specification(s) or visually inspect to verify that the dwelling is designed to have or has all windows in habitable areas with a Sound Transmission Class (STC) of 33 or more. Refer to Table 14 for STC ratings.

(2) Carpet or Acoustic Ceiling Tiles

Review drawing(s)/specification(s) or visually inspect to verify that 80% of habitable rooms (by area) contain carpet or acoustic ceiling tile.

(3) Ventilation

Review drawing(s)/specification(s) or visually inspect to verify that the dwelling is designed to be mechanically ventilated with a whole-house ventilation system or that the window frames incorporate sound insulating ventilation strips (trickle vents).

Terraced Houses and Apartments

(1) Windows

Review drawing(s)/specification(s) or visually inspect to verify that the dwelling is designed to have or has all windows in habitable areas with a Sound Transmission Class (STC) of 33 or more. Refer to Table 14 for STC ratings.

(2) Adjoining Walls and Ceilings

Review Drawing(s)/specification(s) to ensure that ALL surfaces immediately adjacent to another space are one of the following:

- System with a minimum STC 58 when surface adjoins another dwelling or an internal common space that is likely to be occupied for more than 1 hr/day, such as a lounge or lobby.
- System with a minimum STC 55 when the surface adjoins transient space that is not regularly occupied such as corridors and access ways

(3) Ventilation

Review drawing(s)/specification(s) or visually inspect to verify that the dwelling is designed to be mechanically ventilated with a whole-house ventilation system or that the window frames incorporate sound insulating ventilation strips (trickle vents) in all habitable rooms.

(4) Carpet or Acoustic Ceiling Tiles

Review drawing(s)/specification(s) or visually inspect to verify that 80% of habitable rooms (by area) contain carpet or acoustic ceiling tile.

Glass type	Sound Transmission Class (STC)
4/12/4 Standard IGU	30
5/12/5 Standard IGU	32
6/12/6 Standard-Laminated IGU	34
7/12/6 acoustic-laminated IGU	38
10/12/8.76 acoustic-laminated IGU	42

Table 14: Sound transmission class for a variety of glazing types and configurations

AS/NZS 2107:2016

Review a letter or report from an acoustic engineer to confirm that the sound levels in the dwelling are within the Design Sound Level Range as provided in Table 1 of AS/NZS 2107:2016.

Type of Occupancy	Design Sound Level Range, L_{Aeq}, dB(A)	
Houses in areas with negligible transportation:		
1. Sleeping areas	25	30
Houses and apartments near minor roads:		
2. Living areas	30	40
3. Sleeping areas	30	35
4. Work areas	35	40
5. Apartment common areas (e.g. foyer, lift lobby)	45	50
Houses and apartments near major roads		
6. Living areas	35	45
7. Sleeping areas	35	40
8. Work areas	35	45
9. Apartment common areas (e.g. foyer, lift lobby)	45	50

Table 15: Table 1 of AS/NZS 2107:2016

Audit Documentation

Design Rating

Signed Pro Forma of Credit Compliance. Maintain records of compliance as per Pro Forma.

Built Rating

Signed Pro Forma of Credit Compliance following verification on site.

Background

Internal noise within a dwelling is a significant factor in terms of occupant health and wellbeing. It can have major negative impacts such as: hearing loss, stress related somatic and psychological effects, as well as impairing cognition. Internal noise has also been recognised as a health hazard by the World Health Organisation (WHO).

The purpose of this credit is to recognise dwellings with internal spaces that are protected from both internal and external noise. These conditions are dependent on the dwelling's internal and external attributes that reduce the propagation of sound. Sound Transmission Class (STC) is a rating of the transmission loss of airborne sound through a building element. Improving the sound insulation of a dwelling will reduce the negative impacts of noise on the owners and allow them to further enjoy their dwelling.

References

1. Health Effects of Noise – World Health Organisation
   http://ec.europa.eu/environment/noise/health_effects_en.htm

2. Noise: basic concepts – Level
   http://www.level.org.nz/passive-design/controlling-noise/noise-basic-concepts/

3. Economics of better acoustic – BRANZ Build Magazine
   http://www.buildmagazine.org.nz/articles/show/economics-of-better-acoustic-insulation

EHC-10 Inclusive Design 3 points

Aim

To encourage and recognise dwellings that are inclusive, visit-able, easily adaptable, and accessible, to meet the changing needs of current and future occupants.

Credit Criteria

A maximum of three points are available for this credit. Points are awarded by adopting specific features as outlined in Inclusive Design Checklist

Compliance Pathway	
All requirements for vision impaired occupants achieved	0.5 point
All items in Visit-able Design Checklist achieved OR All items in Adaptable Design Checklist AND Visit-able Design Checklist achieved	1 point 1.75 points
OR	
The Project has achieved Life Mark Certification OR An assessment of contextually appropriate universal design needs has been carried out with a third-party expert and recommendations incorporated	3 points

Data Entry

Use scorecard tab.

Assessment

0.5 point can also be achieved by meeting the Requirements for Vision Impaired Occupants.

The Visit-able and Adaptable Design Checklists corresponding to 1 and 1.75 points have been developed based on industry benchmarks and existing accessibility standards. To achieve points, the design must include all the features on the relevant checklist (table 16 and table 17). Note that the Adaptable Design Checklist includes all items of the Visit-able Design Checklist. Achieving all requirements of table 17 alone is not sufficient.

The highest levels of achievement in this credit requires obtaining a Lifemark certification or collaborating with a relevant disability service (e.g. The Blind Foundation) to ensure occupant-specific accessibility needs are determined and incorporated.

For a Design Rating, it is the responsibility of the Assessor to check that design details such as dimensions, clearances, surfaces etc. are clearly identified in either the house specification and/or floor plan.

Requirements for Vision Impaired Occupants

Projects may achieve 0.5 point by meeting all the following Requirements for Vision Impaired Occupants.

Requirements for Vision Impaired Occupants	
For 0.5 point, achieve all requirements below	
Glare control	Matte colours are used for walls, doors and floor. Floor surfaces to have a matte finish. Lighting to be diffused to not create a reflective effect on floors below ceiling mounted lights
Depth Perception	Skirting more than 100mm high to be the same colour as walls.
Hazard mitigation	Stair edgings, handrails and other safety features are detailed and coloured to stand out from the background.
Colour contrast	The Light Reflectance Value (LRV) of adjacent walls and ceilings should be at least 30 points apart (use provided calculator to determine). Doors and door handles, switches, and power/phone outlets contrast with the background.
Switch and power point placement	All, light switches, other service controls and door handles are aligned, at between 900mm to 1200mm above the finished floor. In addition, each room (except corridors and toilets) has at least 1 power outlet at this level and the dwelling has at least one phone jack point (BS6312, 6P2C or 8P8C) at this level (and aligned with lighting and other controls, unless a wireless internet service is installed and available) Switches, power points and phone jack points are placed in a cluster within 300mm of a doorway (as measured from the edge of the opening)

Visit-able Design

To achieve 1 point, the design must comply with Table 16: Visit-able Design Checklist

Visit-able Design Checklist	
Key element	**Required features for 1 point**
Entrance and internal access	A step-free, slip resistant path (extending to property boundary and any vehicle parking area within the boundary) with a gradient of no steeper than 1 in 12 and width of at least 1200mm to an entrance door that has a maximum threshold of 20mm is provided. For multi-unit developments, this includes the path from building entrance to dwelling (apartment entrance), which must be slip resistant with step-free access to all occupied levels.
	All hallways are at least 1050mm wide.
	All internal and external doors have a minimum clear opening of 810mm (door leaf of 860 mm).

	The entry is undercover and slip resistant.
Habitable rooms	A habitable room is located on the entry level of the home.
Bathroom	A toilet is located on the entry level with provisions for a future clear transfer space of 800mm beside and/or in front of the toilet, toilet pan being 450-460mm from the sidewall and a vanity which extends a minimum of 400mm from the back wall. Must be step free.
Fixtures and Fittings	Lever handles required on all doors.
	PowerPoints, TV, phone and computer outlets are a minimum of 300mm above the finished floor
	Light switches, other service controls and door handles are aligned, at between 900mm to 1200mm above the finished floor.
Kitchen	Dining and cooking areas are located next to each other.
Car parking	Provide vehicle parking if designated disabled parking or a safe drop off zone is not available directly outside the property boundary with step-free access to the property. If vehicle parking is provided, provide a space adjacent to the bay that can be widened to 3500mm. A safe drop off zone is where a vehicle can park to pick up or drop off a disabled rider, with step free access to a footpath and without the need to navigate through moving or parked traffic.

Table 16: Visit-able Design Checklist

Adaptable Design

To achieve 1.75 points, the design must comply with Table 17: Adaptable Design Checklist

Adaptable Design Checklist	
Key element	**Required features for 1.5 points**
Mandatory	All requirements met from Visit-able Design Checklist.
Kitchen	All appliances are placed at least 300mm from a corner.
	Minimum distance between two fixed kitchen benches (e.g. an island bench and a bench attached to a wall) is 1200mm.
Bedroom	There is space on the entry living level where a standard single bed (measuring 900mm x 1900mm) can fit with a minimum 800mm clear space available around one side and the foot of the bed. A clear minimum 800mm wide path is also required from the door to the side of the bed.
Bathroom	The bathroom walls are reinforced to provide a fixing surface for grab rails.
Bathroom	Space and plumbing is allowed for an entry level shower (installed either now or in the future) with a minimum dimension of 1200mm x 1200mm.
Laundry	If applicable, the laundry space or room shall be large enough to provide at least 1050mm clearance in front of fixed benches and appliances.
Stairs	Stairwells in multi-storey dwellings shall provide a minimum clear width of 1000mm and be straight in design with no winders. Handrails are available along the entirety of the stair case.

Table 17: Adaptable Design Checklist

Inclusive Design Pathway

Inclusive Design	
For 3 points, achieve all requirements for one of the below pathways	
Pathway 1	The project has achieved Lifemark Certification (any level)
Pathway 2	The project has • worked with the intended occupant(s) to identify their specific, contextual needs, as well as those of others associated with the dwelling (residents, visitors including service providers, and emergency services) • consulted a practitioner or advocacy organisation with expertise in those specific accessibility needs, to establish how these needs are best met • Implemented these recommendations.

Audit Documentation

Design and Built Rating

Requirements for vision impaired occupants	
Assessor to review plans and / or on-site check and confirm in Pro- Forma of Credit Compliance, OR provide marked u drawing highlighting how all the requirements for vision impaired occupants are met.	
Visit-able and adaptable design checklist pathways	
Assessor to review plans and / or on-site check and confirm in Pro- Forma of Credit Compliance, OR provide marked u drawing highlighting how all features in the visitability, and adaptability checklists are met.	
Inclusive design pathway	
Pathway 1	• Project is recognised to have met these requirements if a Lifemark certification is achieved and the confirmation can be provided with the submission.
Pathway 2	• Provide construction drawings where all elements of the visibility or adaptability checklist are marked up. • Provide evidence to show a third-party organisation or certified assessor with expertise on disability needs was engaged to advise on the project. This could be emails or scanned letters confirming the engagement, or an invoice from the organisation/ practitioner on official letterhead, and if it is an individual, a resume/CV highlighting relevant expertise.

Background

This credit has been developed in response to the growing demand for dwellings that work for people as our needs change. By 2061, life expectancy at birth will have increased by about six years and the 65+ age group is predicted to account for 27% of the population. Disability rates will increase with age and this means New Zealand will have many more people with sensory impairments and mobility issues as they grow older.

Unfortunately, the design of most New Zealand houses does not yet consider this dramatic shift in demographics. At present, there is no statutory requirement for accessible housing and market is not yet delivering. Currently, approximately 59% of older people have a disability and it is estimated that between 45-50% of disabled adults live in dwellings that are not modified for their needs. Attitudes are changing and New Zealanders are beginning to demand dwellings that are accessible to all people. The aim of this credit is to make dwellings fit around people, rather than the current practice of making people fit around their dwellings.

We recognise three levels of design for accessibility; (i) *visitability,* in which someone with a disability is still able to visit the home with access to a bathroom and a habitable space with a comfortable sitting area on the entry level, (ii) *adaptability*, in which the dwelling has the potential to be modified to meet the specific needs of an occupant with relative ease, and (iii) universal design, in which the dwelling is built with customisations to meet the needs of a specific occupant.

References and Further Information

1. Lifemark
   http://www.lifemark.co.nz/home.aspx
2. Stats NZ
   http://archive.stats.govt.nz/browse_for_stats/health/disabilities/DisabilitySurvey_HOTP2013/Commentary.aspx
3. Design Guidelines for the Visual Environment (National Institute of Building Sciences)
   https://cdn.ymaws.com/www.nibs.org/resource/resmgr/LVDC/LVDP_Guidelines_052815.pdf
4. Colour and Contrast Design Guide
   https://www.graduseurope.se/files/downloads/LRV%20Booklet%20with%20Colour%20Sheets_0.pdf

EHC-11 Energy Efficient Drying 1 point

Aim

To recognise and encourage the reduction in the amount of energy used to dry clothes.

Credit Criteria

Up to one point is available where either washing lines of sufficient length in an adequate space or efficient heat pump dryers are provided.

Washing Lines – up to 1 point		
(1)	Adequate line length requires a minimum of: 18m of line for each three (or more) bedroom dwelling, OR 12m for each one or two bedroom dwelling.	0.3 points
(2)	Primary Space: fixed washing line that is located in an external space where the primary use is to dry washing.	0.3 points
	OR	
	Secondary Space: washing line that is located in a space where the secondary use is to dry washing (e.g. in a garage, workshop or similar space outside of the dwelling's thermal envelope).	0.1 points
(3)	Covered washing line (only awarded when the dwelling meets the criteria for adequate line length and suitable space above)	0.4 points
Heat Pump Dryers		
(1)	There is a heat pump dryer that has an Energy Rating of 6 star or higher	1 point

Data Entry

Use scorecard tab.

Assessment

Review the plans and specifications or visually inspect the dwelling to determine that a washing line(s) or dryer is present that meets the credit criteria.

A dwelling may have more than one line that can contribute to the total adequate line length. For example, a dwelling may have an external line in a primary space and another line in a garage (a secondary space). The available line length would therefore be the total of these two spaces.

Where a dwelling has lines in both a primary and secondary space (and that total meets the adequate line length requirement) then the full line length requirement does not need to be covered to award the 0.4 points. This is because a covered line is only required in adverse weather. However, in this case the line(s) may be awarded 0.3 points for being within a primary space ONLY if the section of the line within the primary space meets the length requirements. Otherwise the line(s) would be awarded 0.1 points. This is because the benefits of a primary space are not realised without a sufficient line length.

Audit Documentation

Design Rating

Signed Pro Forma of Credit Compliance. Maintain records of compliance as per Pro Forma.

Built Rating

Signed Pro Forma of Credit Compliance following verification on site.

Background

The sun provides us with an excellent resource for drying our laundry. Not only does it save on electricity, but it has secondary health benefits of ensuring that moisture is being kept away from the internal environment while the clothes are being naturally sterilised by the sun's UV rays.

References and Further Information

1. Level
   http://www.level.org.nz/wet-areas/

2. Smarter Homes
   http://www.smarterhomes.org.nz/design/moisture/

3. Energy Wise
   http://www.energywise.govt.nz/how-to-be-energy-efficient/your-house/dampness
   http://www.energywise.govt.nz/how-to-be-energy-efficient/your-house/ventilation

4. Energy Wise - Action sheet 1 - Energy saving tips for your dwelling
   http://www.energywise.govt.nz/sites/all/files/action-sheet-1-energy-saving-tips-10-09.pdf

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Water

WAT-1 Water Use in the Home 10 points

Aim

To encourage and recognise the reduction of potable water consumption in the dwelling through the use of water-efficient fittings.

Credit Criteria

Up to ten points are awarded where it is demonstrated that fixtures and fittings within the dwelling meet flow rate benchmarks associated with relevant WELS (Water Efficiency Labelling Scheme) ratings as set out in this credit. Maximum points awarded are as follows:

(1)	Water-efficient shower heads	4 points
(2)	Water-efficient lavatory equipment	3 points
(3)	Water-efficient taps in bathrooms and toilets	1.5 point
(4)	Water-efficient kitchen taps	1.5 point

Mandatory Minimums

6 Homestar: the dwelling must have dual flush toilets with a maximum 6/3 L/flush and showers must have a flow rate of 9L/min or less. Mandatory minimums for 6 Homestar are marked with an asterisk.

Assessment

For a Design Rating, if specific products have already been chosen, WELS ratings and flow rates for these products must be sighted and used to award points. If specific products have not yet been chosen, the dwelling plans and / or specification must outline the required WELS rating or flow rate benchmarks, and these benchmarks must be used in the assessment. For a Built Rating, points should only be based on specific products that are installed in the dwelling.

The Homestar Assessor will begin by collecting any available product sheets, specifications or labels displaying a WELS rating for all required fixtures and fittings. Once the WELS ratings or flow rates are found, enter these flow rates into relevant cell in the 'WAT-1 Water Use in the Home' section in the Water Calculator Tab. The calculator will then award points which are visible at the top of the spreadsheet. If required, use the WELS rating reference table in the water calculator to verify the flow rates corresponding to various WELS ratings.

Distribution of Points

Points are awarded for each type of fixture based on the following tables:

Showers	3.5 points *	4.0 points
WELS Star Rating	3 Star	4 Star or above
Flow Rates (L/min)	≤ 9	≤ 7.5

*** 6 Star mandatory minimum**

Lavatory Equipment	1 point*	2 points	3 points
WELS Star Rating	3 Star	4 Star	4.5 Star or above
Flow Rates (L/flush)	6.0 L closet pans with matching 6/3 L cisterns. Average flush volume more than 3.5 but not more than 4.0 L/flush.	4.5 L closet pans with matching 4.5/3 L cisterns. Average flush volume more than 3.0 but not more than 3.5 L/flush.	Avg. flush volume not more than 2.5 L/flush. Council approved composting toilets achieve 3 points.

*** 6 Star mandatory minimum**

Kitchen, Bathroom and Toilet Sink and Basin Taps	0.5 points	1 point	1.5 point
WELS Star Rating	4 Star	5 Star	6 Star
Flow Rates (L/min)	≤ 7.5	≤ 6	≤ 4.5

Where New Zealand WELS ratings are not known, product sheets/labels displaying an Australian WELS rating will also be accepted. If the owner is able to provide manufacturer's specifications displaying the appropriate flowrates that can be assessed against the Credit Criteria, this will also be accepted.

Where the owner does not have product sheets displaying the WELS Rating for showers or taps, the flow rates associated with these items must be measured by the Homestar Assessor. Points can then be awarded based on the flow rate information within the relevant tables of the Credit Criteria. Where flow restrictors have been installed on taps or showers, this is acceptable, and these fittings are to be measured.

For all fixtures and fittings, the item with the highest flow rate (or lowest WELS rating) per category are to be used when measuring and awarding points. Only one point allocation can be awarded per fitting/fixture category. The points from each category are to be summed to gain the total points achieved for the credit.

Where, in the individual fitting/fixture categories, the Homestar Assessor is unable to verify the flow rate / WELS rating using any of the methodologies outlined above, no points can be awarded in that equipment category.

Measuring flow rates

In all cases the worst performing (highest use) fixture or fitting should be the basis of assessment in each category and fittings should be measured as follows:

Showers

The Homestar Assessor should measure using a bucket or similar device with measuring lines in litres to hold water and a suitable timing device. Turn the tap or shower mixer on to its maximum capacity, achieve a suitable average showering temperature and run the water into a bucket for 15 seconds. Measure how much water is in the bucket then multiply this figure by four to get the flow rate in litres per minute (L/min).

Taps

The Homestar Assessor should use a similar methodology to shower measurement, utilising a collection device and timer to measure water flow rate in litres per minute (L/min).

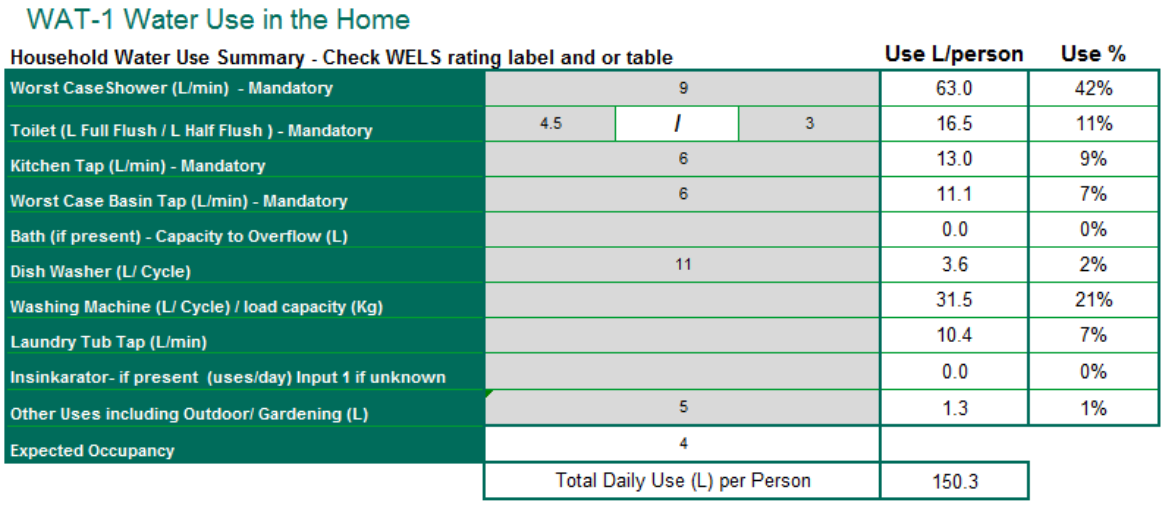
Lavatory equipment

In situations where WELS ratings are unknown the following should be noted: Single flush toilets only have a single button to flush and are unlikely to meet required efficiency levels. Dual style flush devices are obvious by the flush mechanism, having two buttons compared to a single one for a single flush. New dual style flush toilets have smaller cisterns and, in some cases, smaller pans. Flush volumes are sometimes recorded on the toilet cistern, or inside the unit. If the make and model number is available, search online or contact the manufacturer to obtain flow rates.

Where it is not possible to obtain the flowrates or WELS Rating for lavatory equipment through one of the aforementioned means, the flow rates associated with these items are not to be measured. Instead award 1 point for dual flush toilets (as the vast majority of dual flush toilets in New Zealand will meet the WELS 3 Star criteria) and no points for single flush toilets.

Water Calculator

The Water Calculator includes calculations for WAT-1 (this credit), WAT 2 (Water Supply Management), the roof water component of STE-1 (Site Storm Water Management), and EHC-2 (Hot Water Heating). Central to this calculator is the household water use summary, which estimates daily per person water use in litres for the dwelling as shown in



WAT-1 Water Use in the Home

Household Water Use Summary - Check WELS rating label and or table				Use L/person	Use %
Worst Case Shower (L/min) - Mandatory		9		63.0	42%
Toilet (L Full Flush / L Half Flush) - Mandatory	4.5	/	3	16.5	11%
Kitchen Tap (L/min) - Mandatory		6		13.0	9%
Worst Case Basin Tap (L/min) - Mandatory		6		11.1	7%
Bath (if present) - Capacity to Overflow (L)				0.0	0%
Dish Washer (L/ Cycle)		11		3.6	2%
Washing Machine (L/ Cycle) / load capacity (Kg)				31.5	21%
Laundry Tub Tap (L/min)				10.4	7%
Insinkarator- if present (uses/day) Input 1 if unknown				0.0	0%
Other Uses including Outdoor/ Gardening (L)		5		1.3	1%
Expected Occupancy		4			
	Total Daily Use (L) per Person			150.3	

Figure 5 below.

WAT-1 Water Use in the Home

Household Water Use Summary - Check WELS rating label and or table				Use L/person	Use %
Worst Case Shower (L/min) - Mandatory		9		63.0	42%
Toilet (L Full Flush / L Half Flush) - Mandatory	4.5	/	3	16.5	11%
Kitchen Tap (L/min) - Mandatory		6		13.0	9%
Worst Case Basin Tap (L/min) - Mandatory		6		11.1	7%
Bath (if present) - Capacity to Overflow (L)				0.0	0%
Dish Washer (L/ Cycle)		11		3.6	2%
Washing Machine (L/ Cycle) / load capacity (Kg)				31.5	21%
Laundry Tub Tap (L/min)				10.4	7%
Insinkarator- if present (uses/day) Input 1 if unknown				0.0	0%
Other Uses including Outdoor/ Gardening (L)		5		1.3	1%
Expected Occupancy		4			
	Total Daily Use (L) per Person			150.3	

Figure 5: Household Water Use Summary

This is the only section of the calculator that needs to be completed for WAT-1. Each line of the summary corresponds to water use through a fixture / fitting or appliance. Outdoor and other uses are also included. Enter known water use information using the provided guidance. While only flow rates for shower, toilet, hand wash basin tap and kitchen sink tap are mandatory, the more information provided, the more accurate the estimate is, and this will affect points in WAT-2.

Water source

This Credit is assessed independently of how water is supplied. The source of the water is not considered relevant as all water systems (rainwater, greywater, bore, mains etc.) have differing negative environmental impacts including electricity consumption for pumping, purification and the resulting need for wastewater treatment.

Audit Documentation

Design Rating

No evidence required if make and model not yet specified; include target rating.

Built Rating

Photograph or invoice showing make and model number. Where photo or invoice doesn't show rating, include screenshot or manufacturer's data.
For taps and showers where WELs rating is unavailable or that are fitted with flow restrictors: signed table showing measured flow rates.

Background

The average family of four in New Zealand uses 720 litres of water every day. It's important not to waste water, particularly in parts of the country that experience periodic water shortages. Reducing water demand also lowers costs to the community for water treatment and pumping; reducing the consumption of potable water and using water more efficiently has both environmental and economic benefits.

According to Energy Efficiency and Conservation Authority (EECA) figures, around 80% of a household's hot water is used in showers and one-quarter of their water is used to flush the toilet. Many older style water fixtures/fittings, dishwashers and clothes washing machines use more water than they need to, which means wasted energy, water and money.

The New Zealand Water Efficiency Labelling Scheme (WELS) provides information and helps consumers when buying products to choose those that use less water but still provide a satisfactory level of quality and performance. Like the energy efficiency labels seen on appliances such as fridges, the WELS label shows how water-efficient a product is compared to other similar products. New dishwashers and washing machines will display a combined energy/WELS label because they use both energy and water.

The purpose of this Credit is to encourage owners and developers to install water efficient fixtures and fittings. While washing machines contribute to a large proportion of household water use, these are rarely provided by the developer / builder in new dwellings which constitute the majority of Homestar assessments. Instead, families typically keep a washing machine for many years and take it as they move. Due to this, washing machines are often not present when a built rating is awarded and cannot be treated as a fixed component in the home; therefore, they are excluded.

On the other hand, while dishwashers are commonly provided with new dwellings and can be considered a fixed asset, their water use is minor, and is hence not considered for points. However, both washing machines and dishwashers are included in the water calculator in order to allow an accurate estimate of household water use, and NZGBC recommends that water efficient

dishwashers and washing machines with a WELS rating of 5 or higher are purchased whenever possible.

The use of more efficient fixtures and fittings and appliances helps to minimise the overall water consumption of the dwelling as well as reducing the amount of wastewater generated.

References and Further Information

1. Ministry for the Environment
   http://www.mfe.govt.nz/issues/water/wels-scheme/index.html

2. Energy Efficiency and Conservation Authority
   http://www.eeca.govt.nz/

3. Efficiencies of New Products
   http://www.waterrating.gov.au/

4. Reducing Water Flow
   www.smarterhomes.org.nz/water/reducing-water-flow/

5. Minimising Water Use
   http://www.level.org.nz/water/water-supply/

6. WELS
   http://www.mfe.govt.nz/issues/water/wels-scheme/index.html

7. WELS Online Product Database
   https://apps5a.ris.environment.gov.au/wels-public/search-product-select-load.do

WAT-2 Sustainable Water Supply 4 points

Aim

To encourage and recognise reducing a dwelling's demand on water supplies through the collection and use of rainwater on and around the dwelling and by promoting responsible water use behaviour through separate metering of apartment water consumption.

Credit Criteria

Up to four points are available for dwellings which reduce the consumption of potable water in and around the dwelling through the collection and use of rainwater. Apartment developments are also rewarded for incentivising conservation through individual metering of each dwelling. A water calculator is used to estimate the percentage of household water demand able to be met with rainwater:

Standalone and Terraced Dwellings		
(1)	The dwelling has a rainwater harvesting system with a minimum connected roof catchment area of 30m^2 per dwelling, connected to a tank with a minimum rainwater holding capacity of 500L per dwelling, with at least one connection to a tap for outdoor water use.	0.5 points
	The rainwater harvesting system is connected to and can meet all or part of the water use demand from, laundry, outdoor water use, toilets and dishwasher.	Up to 3.5 points
Apartments		
(2)	The development has a rainwater harvesting system with a minimum roof catchment area of at least 30% of available roof area, connected to a tank with a minimum rainwater holding capacity of 5000L, with at least one connection to outdoor water use and /or common area water use.	0.5 point
	The rainwater system is connected to and can meet all or part of the usage demand from, laundry (common or individual) and / or toilets and / or dish washing in every dwelling where points are claimed.	Up to 2.5 points
	Each apartment dwelling has a separate water check meter that enables each apartment to be billed separately for its water use.	1 point

Distribution of Rainwater Use Points

Points for rainwater use are awarded based on proportion of total water demand from laundry, toilets, outdoor uses and dishwasher that is offset, even if not all of these may be connected to the rainwater harvesting system. The points and proportions are distributed differently for apartments and standalone / terraced dwellings, due to differences in water use in different dwelling types and potential regulatory restrictions.

Rainwater Use Points for Standalone and Terraced Dwellings

The rainwater system is connected to supply the water use demand from some or all of the following: laundry, outdoor water use, toilets or dishwasher, and can meet at least:

Percentage of Demand	Points
15% of demand	0.5 point
25% of demand	1 point
35% of demand	1.5 points
45% of demand	2.0 points
55% of demand	2.5 points
65% of demand	3.0 points
75% of demand	3.5 points

Rainwater Use Points for Apartments

The rainwater system is connected to supply at least a portion of the water use demand from:

Area	Points
Laundry (common or individual)	1 point
Toilets	1 point
Dishwashing	0.5 point

Data Entry

Complete relevant fields in the Water Calculator Tab and enter resulting points in the scorecard. The WAT-1 section of the Water Calculator must be completed first before attempting WAT-2.

Assessment

The Water Calculator Tab is used to determine points awarded for a number of credits including WAT-1 and WAT-2 (this credit). Ensure that the WAT-1 part of the Water Calculator (Household Water Use Summary) is completed as accurately as possible before attempting WAT-2, as the water use summary is used to estimate water use demand. Some Information is also imported from the coversheet. The guide below only covers items to be entered into the calculator in WAT-2.

Calculator Inputs

As a first step, establish the following using plans and specifications or through an onsite inspection, then enter into the calculator:

Does the dwelling have rainwater collection?

Select "yes" if there is a rainwater system.

Location

Choose the appropriate location from the dropdown box (note that the options here are slightly different to the coversheet for some regions).

Total number of dwellings / bedrooms in dwelling(s) connected to rainwater tank

There are two data entry cells, separated by a '/'. If this is a rainwater harvesting system serving a single dwelling, either leave both cells blank or enter 1 in the left cell, and the number of bedrooms in the dwelling in the other. If the tank serves multiple dwellings, input the number of dwellings in the left cell and the total number of bedrooms across all those dwellings in the right-hand cell.

Note that you must include all dwellings served by the rainwater system even if some are of a different typology. The calculator uses these to apportion an effective tank and roof catchment size for the assessed dwellings that use a shared rainwater harvesting system.

Rain water tank size (L)

Either review the specifications or drawings of the rainwater harvesting system to ascertain the volume of rainwater tank(s) or physically measure the relevant dimensions of the rainwater tank and calculate its volume.

Roof catchment area (m^2)

Either review the specifications or drawings of the rainwater harvesting system to verify the plan area of roof catchment or physically measure the dimensions of the roof catchment area taking particular note of the connections into the rainwater tank (to ensure that the correctly measured roof area is appropriately connected).

Run off co-efficient

The Water Calculator uses the compliance document for NZ Building Code Clause E1 Table 1 and Table 2 (see below) to determine the runoff coefficient of the roof. Table 18 is the suggested coefficients based on roof type and Table 19 is how to adjust these coefficients based on roof slope angles.

First of all, select the **Roof Type** from the drop-down menu. The calculator will assign the appropriate run-off coefficient based on Table 18. This figure then needs to be adjusted by multiplying it by the adjustment figure in Table 19 for the roof slope angle. This is done by the calculator when the percentage roof slope is entered in for **Roof Slope/Angle**.

Run-Off Coefficients	
Roof Type	**Run-off Coefficient**
Steel and non-absorbent roof surfaces	0.9
Near flat and slightly absorbent roof surfaces	0.8

Table 18: **Run-Off Coefficients**

Slope Correction	
Roof slope angle (angle to the horizontal)	**Adjust run-off coefficient by**
0-5% (0˚ - 3˚)	subtracting 0.05
5-10% (3˚ - 6˚)	no adjustment
10-20% (6˚ - 11˚)	adding 0.05
20% or steeper (11˚ +)	adding 0.10

Table 19: **Slope Correction for Run-Off Coefficients**

Rainwater Uses

Select which water uses within the dwelling are connected to the rainwater tank by ticking the boxes in the Water Calculator. Review specifications or drawings of the rainwater harvesting system to verify the fittings and fixtures within the dwelling that are connected to it. Otherwise, for Built Ratings, visually trace the plumbing from the rainwater tank to its end use within the dwelling. Alternatively, check the end use (e.g. toilets) by using water and listening for any pump activity from the rainwater harvesting system. Where the Homestar Assessor cannot be relatively certain of the rainwater tank connection to the point of use, the tick box cannot be selected.

Metering (apartments only)

Tick this box if the assessor can ascertain that the dwelling is individually metered for water use. This can contribute to a better awareness of household water use and provide an impetus to conserve water when each household is separately billed.

Minimum Infrastructure Capacity Requirements

Minimum infrastructure capacity requirements in terms of minimum apportioned tank and catchment area sizes are set to ensure that the system is of sufficient size to have a reasonable benefit in terms of water conservation.

To award relevant points, the assessor must firstly ensure that the minimum size requirements are met. Then, ensure that for standalone and terraced dwellings there is at least one connection to a tap for outdoor water use. For an apartment development, a connection for either outdoor use or common area water use (e.g. common area toilet flushing) is acceptable. If all these conditions are met, points will be awarded by the calculator.

Ability to Collect Rainwater

The Water Calculator uses rainfall data from NIWA to determine how much rainwater is available in locations around the country. The calculator uses the following formula to determine how much rainwater is available to collect each month:

Apportioned roof catchment (m^2) * runoff coefficient * monthly rainfall (mm)

Rainwater Use

The Water Calculator uses the estimated daily household water use (L) calculated by inputs to the Household Water Use Summary to estimate demand for rainwater. For standalone and terraced dwellings, the total demand for rainwater use is limited to demand for toilets, laundry, dishwashing and outdoor uses. For apartments outdoor /common area water use is also excluded due to these uses being irregular, difficult to apportion per dwelling and often negligible when done so.

For standalone or terraced dwellings, the calculator assesses the total demand for rainwater use and the maximum proportion of that demand which can theoretically be met based on provided connections. This is then compared with the amount of rainwater that is available in the tank to determine the average annual rainwater use percentage and associated points.

The Water Calculator checks if the provided rainwater system has the ability to meet the demands of the dwelling on a month by month basis. If in any month the provided system is not able to meet the demands of the dwelling, the Water Calculator automatically down rates the % of demand met and, therefore, the number of points awarded.

Audit Documentation

Design Rating

Drawing(s) and/or specification(s) that detail the (i) catchment area, (ii) capacity of the rainwater tank (iii) fixtures that will be fitted to the rainwater harvesting system, if available.

Built Rating

Drawing(s) and/or specification(s) that detail the (i) catchment area, (ii) dimensions of the rainwater tank and (iii) fixtures fitted to the rainwater harvesting system.
Photograph of the rainwater tank and its connection to the roof (where possible).

Background

Only 3% of water delivered to dwellings at a potable standard is actually used for drinking. The remainder is employed for domestic purposes such as flushing toilets and watering gardens[1].

Reducing water demand through harvesting rainwater also lowers costs to the community for water treatment and pumping; reducing the consumption of potable water and using water more efficiently has both environmental and economic benefits[2].

Rainwater can be used for a variety of purposes around the dwelling and garden – the greater the number of uses, the bigger the reduction in potable water use. When plumbed into the dwelling it can also be used for washing clothes, flushing toilets and – if it is properly treated or purified – for drinking and other household uses such as hot water and showering[3].

The size of the rainwater tank and the overall catchment area of the roof determine how much water can be accessed and stored for use in and around the dwelling. Even a 1,000 litre tank can make a substantial difference to a household's water demand requirements. Having an alternate source of water on site also provides the dwelling with resilience in times of civic emergency.

The purpose of this Credit is to encourage rainwater collection for the dwelling. The collection and use of rainwater in and around the dwelling will reduce the dwelling's dependency on mains potable water as well as reducing the amount of stormwater leaving the site.

References and Further Information

1. The need to save water
   http://www.beaconpathway.co.nz/further-research/article/the_need_to_save_water

2. Ministry for the Environment
   http://www.mfe.govt.nz/issues/water/wels-scheme/index.html

3. Collecting and using rainwater
   http://www.smarterhomes.org.nz/water/collecting-and-using-rainwater/

4. Rainwater Systems
   http://www.level.org.nz/water/water-supply/mains-or-rainwater/harvesting-rainwater/

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Waste

WST-1 Construction Waste Minimisation 5 points

Aim

To encourage and recognise effective waste management practices by having a waste minimisation plan in place during construction and/or major refurbishment. To encourage and recognise a reduction in the amount of waste generated onsite during construction and/or major refurbishment.

Data Entry

Use scorecard tab.

Credit Criteria

Design Rating

Up to five points are awarded where the following can be demonstrated during construction and/or refurbishment of the dwelling:

Site Waste Minimisation Plan		
(1)	A Site Waste Minimisation Plan (SWMP) has been implemented and adhered to in accordance with Resource Efficiency in Building Related Industries (REBRI) guidelines. Site waste monitoring must be included in the plan in order for any other points to be achieved.	1 point
(2)	The SWMP targets limiting landfill/cleanfill waste to 15 – 20 kg per m^2 of gross floor area for the whole construction/refurbishment project or 60-69% diversion.	1 point
	The SWMP targets limiting landfill/cleanfill waste to 10 – 14.99 kg per m^2 of gross floor area for the whole construction/refurbishment project or 70-79% diversion.	2 points
	The SWMP targets limiting landfill/cleanfill waste to under 10 kg per m^2 of gross floor area for the whole construction/refurbishment project or 80-100% diversion.	3 points
(3)	The Site Waste Minimisation Plan (SWMP) includes provisions for on-site waste sorting, with a minimum of 3 sorting stations.	1 point
(4)	This credit is deemed Not Applicable for dwellings that have been in existence for more than three years (before the date of assessment) and have not undergone major refurbishment within the past two years (from the date of assessment).	N/A

Built Rating

Up to five points are available for this credit where it can be demonstrated that the waste generated from construction activities has been reduced or diverted from landfill and cleanfill. Points can be achieved via one approach only.

Reduced Construction Waste		
(1)	A Site Waste Minimisation Plan (SWMP) has been implemented and adhered to in accordance with Resource Efficiency in Building Related Industries (REBRI) guidelines. Site waste monitoring must be included in the plan.	1 point
(2)	Where 15 – 20 kg is sent to landfill/cleanfill*l per m^2 of gross floor area for the whole construction/refurbishment project.	1 point
	Where 10 – 14.99 kg is sent to landfill/cleanfill* per m^2 of gross floor area for the whole construction/refurbishment project.	2 points
	Where less than 10 kg is sent to landfill/cleanfill* per m^2 of gross floor area for the whole construction/refurbishment project.	3 points
(3)	This credit is deemed Not Applicable for dwellings that have been in existence for more than three years (from the date of assessment) and have not undergone major refurbishment within the past three years (from the date of assessment).	N/A
On-Site Waste Sorting		
(1)	An additional point is available where on-site waste sorting is included in the Site Waste Minimisation plan, with a minimum of 3 sorting stations.	1 point

*Landfill is defined as any earth filling activity other than cleanfill. Cleanfill is defined as per the MfE "A Guide to the Management of Cleanfills Jan 2002".

Waste Diversion		
(1)	A Site Waste Minimisation Plan (SWMP) has been implemented and adhered to in accordance with Resource Efficiency in Building Related Industries (REBRI) guidelines. Site waste monitoring must be included in the plan.	1 point
(2)	Where 60-69% of total waste is reused and/or recycled and/or recovered for the whole construction/refurbishment project.	1 point
	Where 70-79% of total waste is reused and/or recycled and/or recovered for the whole construction/refurbishment project.	2 points
	Where 80% or more of total waste is reused and/or recycled and/or recovered for the whole construction/refurbishment project.	3 points

(3)	This credit is deemed Not Applicable for dwellings that have been in existence for more than three years (from the date of assessment) and have not undergone major refurbishment within the past two years (from the date of assessment).	N/A
On-Site Waste Sorting		
(1)	An additional point is available where on-site waste sorting is included in the Site Waste Minimisation plan, with a minimum of 3 sorting stations.	1 point

Assessment

This Credit is only applicable to dwellings built within the previous two years (from the date of assessment) and existing dwellings that have undergone major refurbishment within the last two years (from the date of assessment). Check that the SWMP is in accordance with the REBRI guidelines (see Additional Guidance). For the purposes of this Credit, a waste contractor may provide a SWMP where they have ensured it has been adhered to onsite.

Audit Documentation

Design Rating

All Projects
SWMP **OR** where a SWMP has not yet been written, an extract from either the building contract or tender documentation (i.e. specification extract) that requires that a SWMP must be developed in accordance with the REBRI guidelines, including any waste reduction or diversion targets AND any requirements for onsite sorting.

Built Rating

All Projects unless Not Applicable
Monthly waste and RRR reports for the entire duration of construction works are to be signed and witnessed at each stage of reporting by authorised waste company representatives of the waste and RRR contractor. These reports will clearly state the reported level of RRR that has actually taken place.
Reduced Construction Waste
Photo or copy of the completed waste records based on monthly reports for the whole of site which display the weight of waste sent to landfill/cleanfill measured in units of kg/m^2.
Increased Waste Diversion

Photo or copy of the completed waste records and RRR records for the whole of the site which display the percentage of total waste reused, recycled or recovered measured in units or kg. If the waste has been sorted off site (i.e. mixed waste has been collected from site) then proof of RRR performance must be provided. This may be performance across the entire waste stream collected during this period from multiple sites, where it is not possible to isolate RRR performance for one site. Receipts/dockets from the recycling providers are acceptable.
Not Applicable
Signed Confirmation of Existing Dwelling from the owner to confirm that the dwelling has not been built within the last two years and has not undergone a major refurbishment.

Additional Guidance

REBRI Guidelines

The REBRI Contract Specifications for Waste Management (i.e. REBRI Guidelines) state that the SWMP shall contain the following:

- Person(s) responsible for instructing workers and overseeing and documenting results of the waste management
- Waste avoidance or reduction at source measures that will be taken during the project
- Analysis of the proposed job site waste to be generated, including reusable, recyclable and waste materials (by volume or weight).
- Proposed alternatives to landfill and cleanfill disposal – a list of each material proposed to be salvaged, reused, or recycled during the course of the project and the destination. Any waste that is not normally sent to landfill is excluded from this credit, such as soil (from land clearing and excavation activities) or waste that legally must be withheld from general construction waste (such as asbestos).
- At minimum, the following materials shall be recycled:
    - concrete/brick/concrete block
    - asphalt
    - bricks, tiles and concrete blocks
    - all metal
    - plasterboard
    - vegetation
    - treated timber
    - untreated timber
    - corrugated cardboard
    - plastic and polystyrene
    - soil
    - any building components
    - insulation

- The materials below shall be considered for deconstruction, for reuse or recycling
    - treated and untreated timber lengths and panels
    - heritage architectural elements such as mantle pieces, columns, mouldings etc

    - cabinets and casework
    - electric equipment and light fixtures
    - plumbing fixtures
    - windows, doors and frames
    - hardwood flooring
    - concrete – cast-in-place and precast
    - exterior cladding.

- Containers and signage: Description of bins/containers that will be used and the signage that will be used on the containers
- Materials handling and storage procedures: Identification of measures to be taken to prevent contamination of materials to be reused or recycled and to ensure materials are consistent with requirements for acceptance by designated facilities.
- Whether on-site separation will occur and how materials will be stored. Where space permits, source separation is recommended.

These guidelines further state that the contractor should maintain a record of waste materials, recycled, reused and disposed of by the project using the REBRI Waste Management Plan and REBRI C&D Waste Transfer Form or a form generated by the contractor containing the same information. For each material recycled from the project, include the amount (in cubic metres or tonnes), or in the case of reuse state quantities by number, type and size of items, and the destination (i.e. recycling facility, used building materials yard). For each material landfilled include the amount (in cubic metres or tonnes) of material and the identity of the landfill, cleanfill and/or transfer station.

Background

The construction and demolition (C&D) industry is one of the largest waste-producing industries in New Zealand. C&D waste may represent up to 50% of all waste generated in New Zealand, 20% of all waste going to landfill and 80% of all waste going to cleanfill[1].

Disposing of these materials to landfill not only means that they are not being recovered for further use but also that they then contribute to adverse environmental effects such as leaching of chemicals into soil and waterways as well as CO_2 and methane emissions. Much C&D waste can be reduced, reused and recovered, dramatically decreasing the amount thrown away[1]. Typically, at least 50% of waste can be recycled from a construction site.[2]

REBRI is a New Zealand initiative specifically developed to address construction-related waste. Its purpose is to promote, advocate, and assist resource efficiency measures in the building and related industries. REBRI grew from a collaborative effort in 1995 between the Auckland Regional Council, BRANZ and the Auckland City Council, with some funding by the Ministry for the Environment. It now is an extensive resource for the building industry, with research, demonstration projects, sorting trials, guidelines, information papers, checklists, market development and product stewardship resources all available as free downloads.

References and Further Information

1. REBRI Guidelines
   http://www.branz.co.nz/REBRI

   BRANZ Ltd – Waste Reduction - Construction
   https://www.branz.co.nz/cms_show_download.php?id=5e8633f5234594b316612f186e49687aff5475dd

2. On-site Waste Minimisation
   http://www.smarterdwellings.org.nz/construction/construction-site-practice/on-site-waste-minimisation/
   http://www.level.org.nz/material-use/minimising-waste/

3. Target Sustainability Waste Reduction Case Studies for House Builders
   http://www.targetsustainability.co.nz/CaseStudies/housebuilders.asp

4. Minimising Waste
   http://www.level.org.nz/material-use/minimising-waste/

5. Zero Waste Initiative
   www.zerowaste.co.nz

WST-2 Household Waste Minimisation 1 point

Aim

To encourage reduction of household waste sent to landfill through the provision of appropriate dedicated space for separating and storing recyclables and organic waste, and through dwelling and / or community composting

Data Entry

Use scorecard tab.

Credit Criteria

One point is available for the provision of household waste minimisation facilities:

Internal and External Recycling Facilities		
(1)	**Internal** All typologies: at least two separate compartments as a fixed facility within the kitchen for sorting household waste. At least one compartment must have a minimum 10L capacity bin dedicated to recyclables. **External** Standalone/Terraced House: a dedicated space that can accommodate a 240L recycling bin with easy access between the dwelling and any curb-side collection point. Multi-unit developments: a dedicated communal recycling area is accepted. For apartments, separate waste and recycling chute systems with separate bins also comply.	1 point
OR		
Composting Facilities		
(2)	Provision of adequate composting facilities in accordance with one of the following options: • Traditional composting facilities with a minimum bin size of 240L • Worm farm composting • Bokashi bin composting • Composting service: where dwelling is subscribed to a composting service with a minimum collection of once per week. (NB: this must be a composting service, not just garden green waste)	1 point

Assessment

For a Design rating check that facilities for which points are claimed for are indicated either on the plan or specification. For a Built rating visually check that both internal (recycling) and external facilities meet the credit criteria.

For multi-unit developments where communal worm farms or Bokashi bins are provided, documentation from the provider or manufacturer should demonstrate that the number of worm farms or bins provided is appropriately sized for the total number of bedrooms in the building/development.

Audit Documentation

Design Rating

All Projects
Signed Pro Forma of Credit Compliance. Maintain records of compliance as per Pro Forma.

Built Rating

All Projects
Signed Pro Forma of Credit Compliance following verification on site, and maintain records of appropriate compliance evidence as outlined below:
For Recycling Option
Maintain photographic records of internal and external facilities.
For Composting Option
Maintain photographic records of composting facilities.
Provider/manufacturer's confirmation letter of sizing for communal worm farms or communal Bokashi bin composting.
Service agreement or subscription with contractor or local government body to collect waste and complete the composting process offsite.

Background

Recycling is encouraged through provision of a dedicated space which is sized appropriately and located within the kitchen area. Having a dedicated space both inside and outside the house makes it easier and more likely that recycling will be undertaken.

Recycling conserves materials and energy. Most local councils in New Zealand collect household recycling in local kerbside collections. The main recycling materials in any average household are

paper, cardboard, glass bottles, jars, aluminium steel and some sorts of plastic. Recycling one aluminium beverage container can save enough electricity to run a computer or a TV for three hours.

In New Zealand over a quarter of landfill waste is recyclable organic matter and produces a large volume of Co2. Diverting this organic matter into local composting facilities is an initiative that can reduce the amount of rubbish going to landfills. Composting at dwelling reduces the transport costs of waste as well as utilising that waste as a precious resource for improving soil quality and productivity.

References and Further Information

1. Waste Minimisation – Love Food Hate Waste
   http://www.wasteminz.org.nz/projects/love-food-hate-waste/

2. Wellington City Council
   http://wellington.govt.nz/services/environment-and-waste

3. Greenpeace
   http://www.greenpeace.org/new-zealand/en/take-action/green-your-life/composting/

4. Ministry for the Environment Waste Information
   http://www.mfe.govt.nz/issues/waste/

5. Zero Waste
   http://www.zerowaste.co.nz/default,72.sm

Management

MAN-1 Security 2 points

Aim

To encourage and recognise the design of both the dwelling and site to provide a safe and secure dwelling and neighbourhood.

Credit Criteria

Up to two points are available. Choose from one of the following options:

(i) Standalone/Terraced Houses

Up to two points are available where a dwelling incorporates any features from the following list. Each feature is worth half a point.

(1)	Main entrance: well-defined and well-labelled main entrance with the house or building number clearly visible from the road entrance.	0.5 point
(2)	Street surveillance: one living room or kitchen window or glass door is clearly visible from the road.	0.5 point
(3)	Defensible boundary: the dwelling boundary is clearly defined between public and private areas to create defensible space for the house owner.	0.5 point
(4)	Security lighting: energy-efficient outdoor security lighting is installed to illuminate entrance door and any garage areas.	0.5 point

(ii) Multi-Unit Developments

Two points are available where a development undertakes a CPTED site assessment, in line with industry-recognised guidelines, and demonstrates safety and security measures have been applied as a result of this assessment. Please refer to the Ministry for the Environment's *National Guidelines for Crime Prevention through Environmental Design in New Zealand,* as an example of industry-recognised guidelines.

As a minimum, the assessment must address the following items:

- Identify the factors that increase the actual and perceived vulnerability for building occupants;
- Determine the measures and design applications that can be implemented to address these concerns; and
- Determine measures and design application to deter potential offending in and around the building.

Data Entry

Use scorecard tab.

Assessment

Standalone and Terraced Houses:

In assessing this credit, the Homestar Assessor is to check the dwelling plans or on-site for the presence of the items listed in the Safety & Security Checklist.

(1) Main Entrance

Review the drawing(s)/specification(s) or visually check for the presence of a well-defined and well-labelled main entrance indicating the house number/name that will be clearly visible from the road entrance.

(2) Street Surveillance

Review the plan or visually check that at least one window/glass door will be seen from the road and that it will not be obstructed by solid, visually impermeable fences or planted hedges to street frontage above 1.2m in height.

(3) Defensible Boundary

Review the plan or visually check that the dwelling's boundary is clearly defined with railings, low walls, and hedges or similar. For street-facing boundaries, the barrier shall be kept less than 1.2m in height so that front doors and windows remain open to view from the street. For non-street-facing boundaries (side and rear), the barrier shall be at least 1.8m in height for increased security.

(4) Security Lighting

Review the plan or visually check that outdoor security lighting is installed to illuminate entrance door and any garage or parking areas. It is recommended but not required that any path between garage and parking areas is also illuminated. Note that EHC-6 gives points where all outdoor lighting has a minimum efficacy of 40 lumens per watt and effective lighting controls.

Multi-Unit Developments

Review the CPTED report prepared for the development. As a minimum, ensure it has been prepared by a suitably qualified professional with reference to industry-recognised guidelines, that the recommendations within the report (measures and design applications) have been implemented on the project, and that the report's findings confirm a safe development (once the recommendations have been implemented).

Audit Documentation

Design Rating

Signed Pro Forma of Credit Compliance. Maintain records of compliance as per Pro Forma.

Built Rating

Signed Pro Forma of Credit Compliance following verification on site.

Background

Urban planning and good design strategies can reduce the likelihood of crime and deliver numerous social and economic benefits in the long-term. This credit addresses key security features to help enhance the security of a dwelling.

References and Further Information

1. Secured by Design
   http://www.securedbydesign.com/industry-advice-and-guides/interactive-design-guide/

2. National Guidelines for Crime Prevention Through Environmental Design in New Zealand
   http://www.mfe.govt.nz/publications/towns-and-cities/national-guidelines-crime-prevention-through-environmental-design-new

3. Smarter Homes – Safety and Security
   http://www.smarterhomes.org.nz/smart-guides/design/safety-and-security/

4. Waitakere City Council Sustainable Home Guidelines – Household Safety
   http://www.waitakere.govt.nz/abtcit/ec/bldsus/pdf/sustainabledesign/hsehldsafe.pdf

MAN-2 Home User Guide 2 points

Aim

To encourage and recognise the provision of guidance through a Home User Guide, which enables occupants to understand and operate their dwelling efficiently, as well as make the best use of local facilities.

Credit Criteria

Two points are awarded as follows:

(1)	For the provision of a Home User Guide (HUG) which conveys detailed information on the features of the dwelling to the occupants. This document must include all of the following as a minimum: • House design strategy, AND • Energy, AND • Water, AND • Household waste, AND • Maintenance, AND • Landscaping and ecology information, AND • Where available/applicable: o House plans and construction details, AND o Appliance manuals, AND o Warranties and Guarantees, AND o Local transport and community information	2 points

Data Entry

Use scorecard tab.

Assessment

Where a house has not yet been built, the information required for a complete HUG will not all be available. For a Design Rating, the objective should be that the HUG is made available to be easily completed during the building process. The Homestar Assessor should confirm that a HUG template has been started for the property. A sample template can be found on the NZGBC website.

For a Built Rating, the Homestar Assessor should view the contents of the HUG and check that it includes all the information specified in the Credit Criteria.

Audit Documentation

Design Rating

Specification extracts detailing the requirement for a HUG to be produced.

Built Rating

Softcopy of the completed HUG.

Additional Guidance

The purpose of the HUG is to convey basic operational information and details of the dwelling's features to the occupants in a non-technical way that they can use and understand.

Where the dwelling does not currently have a HUG, owners should be encouraged to make use of the Homestar Home User Guide template which is available as a download on the NZGBC website.

The main sections of the HUG should contain the following:

House Design Strategy

This section should contain details of specific design features of the dwelling that are intended to optimise house performance. This could include information about passive solar design of the dwelling, insulation levels, natural and mechanical ventilation systems, external shading devices, heat recovery systems, etc.

Energy

This section should provide operating and maintenance instructions for the main energy using systems in the house as well as any energy-saving features of the dwelling. This should include specific instructions for use and specifications for replacement of key components (manufacturer, model, efficiency rating of light bulbs, heating devices, etc.). The instructions should be directly related to the particular system(s) installed in the dwelling and should inform owners about how to achieve economy and efficiency in the use of energy in a way that can be easily understood. This should include detail of making adjustments for the seasons (e.g. winter/spring) as well as routine maintenance tasks (e.g. cleaning filters on heat pumps). Details of any onsite renewable systems and how they operate should also be included where appropriate.

Water

This section should highlight any water saving features of the house as well as providing instructions for use and specifications for replacement of fixtures and fittings (manufacturer, model, efficiency rating). The HUG should include instructions relating to any rainwater harvesting and/or greywater systems as well as providing information about the maintenance of such systems including provision of a schedule for major maintenance items such as filter changes, cleaning, etc.

Household Waste

This section should contain detail relating to the recycling / composting facilities available on site and times of collection, etc.

Maintenance

This section should provide a basic schedule with times and details for all major maintenance items for the house indicating when each task needs to be done and space to record dates of completion and notes. The maintenance log should cover items such as roofing and spouting, exterior walls and fences, landscape and grounds, underfloor/subfloor, roof space and attic, interiors, glass and windows, hot water and heating systems.

Background

The aim of the HUG is to assist owners with the day to day operation of the dwelling and ensure that all relevant information is passed on to new owners of the dwelling (or for people renting/using the dwelling on a short-term basis). This information will help the users of the dwelling to do so efficiently and ensure changes/refurbishments/maintenance to the dwelling are recorded and completed in the most environmentally appropriate manner.

References and Further Information

1. Homestar Home User Guide Template
   http://www.nzgbc.org.nz/Attachment?Action=Download&Attachment_id=111

2. Beacon Pathway Homeowner Manual
   http://beaconpathway.co.nz/existing-homes/article/homeowner_manual_get_the_best_from_your_home

3. Smarter Home Guide
   https://www.smarterhomes.org.nz/smart-guides/

MAN-3 Responsible Contracting 2 points

Aim

To encourage and recognise best environmental practice during construction and renovation.

Credit Criteria

Up to two points are available for this credit, points awarded as follows:

(1)	Where a contractor(s) on site holds any of the following accreditations or registrations (0.5 points, up to a total of 1 point): • Enviro-Mark NZ Gold Standard or above (0.5 points) • Resene Eco Decorator (0.5 points) • EcoSmart Electrician (0.5 points) • IAONZ accreditation (0.5 points) • Homestar Practitioner (0.5 points) • Homestar Assessor (0.5 points)	1 point
(2)	Where an Environmental Management Plan (EMP) is in place for the construction or renovation works in accordance with the Homestar template and/or Section 4 of the NSW Environmental Management System guidelines 1998 or 2007 OR The contractor holds ISO 14001 certification that covers the construction of the dwelling.	1 point
(3)	Credit is Not Applicable for dwellings that have been in existence for more than two years (from the date of assessment) and have not undergone major refurbishment within the past two years (from the date of assessment).	N/A

Data Entry

Use scorecard tab.

Assessment

(1) Contractor Accreditation

For a Design Rating review the certificate(s) of the nominated contractors for the build OR if no contractors have been confirmed for the job, verify that the specification clearly requires contractors to be certified with accreditation from the list in this credit.

For a Built Rating review the contractors' certificate(s).

(2) Environmental Management Plan (EMP)

Where an EMP is in place for the construction or renovation works in accordance with the Homestar template and/or Section 4 of the NSW Environmental Management System guidelines 1998 or 2007 OR The contractor holds ISO 14001 certification that covers the construction of the dwelling.

Check that the EMP is completed OR Check that the contractor holds a ISO 14001 certification that covers the dwelling.

Audit Documentation

Design Rating

Contractor Accreditation
Copy or photo of the contractor's certificate. OR Specification extract detailing the requirement for contractor(s) to hold accreditation.
Environmental Management Plan
EMP or ISO 14001 certification clearly showing that it covers the dwelling being developed. OR Specification extract detailing the requirement for an EMP to be produced or for ISO 14001

Built Rating

Contractor Accreditation
Copy or photo of the contractor's certificate.
Environmental Management Plan
EMP or ISO 14001 certification clearly showing that it covers the dwelling being developed.
Not Applicable
Signed Confirmation of Existing Dwelling from the owner to confirm that the dwelling has not been built within the last two years and has not undergone a major refurbishment.

Background

Construction and demolition are responsible for significant impacts, especially at the local level. These arise from site disturbance, pollution, construction waste, transportation to and from the site as well as water and energy use.

It is important that responsibility is taken for creating and executing management procedures to minimise or avoid these impacts. The Enviro-Mark NZ programme takes the requirements of ISO

14001:2004 and breaks the implementation of them down into five simple steps: Bronze, Silver, Gold, Platinum and Diamond[1]. ISO14001 is applicable worldwide and provides management tools for organisations or contractors to control their environmental impacts and to improve their environmental performance. These tools can provide significant tangible economic benefits, including:

- Reduced raw material and resource use
- Reduced energy consumption
- Improved process efficiency
- Reduced waste generation and disposal costs and
- Utilisation of recoverable resources.

References and Further Information

1. Enviro-Mark NZ Gold
   http://www.enviro-mark.co.nz/Category?Action=View&Category_id=160

2. Builder's Pocket Guide
   http://bpg.co.nz/

3. International Organization for Standardization – ISO 14001 Environmental Management Systems
   https://www.iso.org/iso-14001-environmental-management.html

4. Smarter Homes Construction Site Practice Information
   http://www.smarterhomes.org.nz/construction/construction-site-practice/

Materials

MAT-1 Sustainable Materials 10 points

Aim

To encourage and recognise the specification and use of responsibly sourced materials that have lower environmental impacts over their lifetime.

Credit Criteria

Up to ten points are available where there is a selection of reused, eco-preferred (see definition below) or responsibly sourced (see definition below) materials as follows:

(1)	One material category is eligible	Up to 2 points
(2)	Two material categories are eligible	Up to 4 points
(3)	Three material categories are eligible	Up to 6 points
(4)	Four material categories are eligible	Up to 8 points
(5)	Five or more material categories are eligible	Up to 10 points
(6)	This credit is deemed **Not Applicable** for dwellings that have been in existence for more than two years from the date of assessment and have not undergone major refurbishment from this date.	N/A

Data Entry

Use the MAT Materials Calculator tab and scorecard tab.

Assessment

This credit is only applicable to new dwellings that have been built, and existing dwellings that have undergone major refurbishment within the previous two years (from the date of assessment).

Points are awarded for each of the following material categories only where **at least** 50% of the total material content is reused, eco-preferred or responsibly sourced. Up to two points can be awarded to each material category depending on the means of compliance. Table 20 below outlines each material type and the measurement unit to establish that 50% of the content is compliant. These material categories consider materials that are typically used in large volumes in construction. Contact NZGBC if your project uses a significant amount of a specific material that is not covered.

	Material Category	Unit of Measurement
(1)	Concrete (any type of concrete cast on or off site e.g. foundation, floor slab, concrete blocks, precast panels, roof)	Tonnes/ cubic metres
(2)	Solid structural and framing timber (e.g. frame, trusses, beams and non-structural framing such as cavity battens)	Lineal metres
(3)	Other solid timber (e.g. decking, flooring)	Lineal metres
(4)	Interior engineered wood (e.g. joinery, wall, ceiling and floor lining exposed to interior including cork, MDF and plywood)	Square metres
(5)	Other engineered wood (includes engineered wood framing, and any engineered wood used on the exterior within walls, floors, etc. that are not exposed to the interior)	Square metres
(6)	Interior plasterboard and fibre cement linings (wall and ceiling)	Square metres
(7)	Timber cladding (e.g. weatherboard, roof shingles and solid timber in log houses)	Square metres
(8)	Non-timber wall cladding	Square metres
(9)	Non-timber roof cladding (e.g. long-run steel roofing)	Square metres
(10)	Floor coverings (e.g. carpet, linoleum, floor tiles)	Square metres
(11)	Applied coatings (paint)	Litres
(12)	Structural Steel (excluding concrete reinforcing)	Lineal metres
(13)	Insulation (soft insulation including thermal and acoustic only, excludes rigid insulation such as XPS and EPS)	Square metres

Table 20: Materials Categories for MAT-1 Sustainable Materials

For projects that have multiple dwellings across one or several typologies, there are two acceptable approaches to quantify the material amounts used in each material category to establish whether the 50% threshold is met:

1. Whole Development Approach
2. Typology Approach

1. Whole Development Approach

The amount of material in each category across the whole development is used to establish whether the threshold is met. For an example, in a development of 100 dwellings and 10 typologies the total FSC certified structural timber amount across all 100 dwellings may be considered to establish the 50% threshold is met for 2 points under the Structural Timber category. In this case, all homes in the development will achieve the same points for MAT-1.

While this may mean that in some cases an individual dwelling is rewarded for a material not actually present in its construction, the environmental impact of the development depends on the total amount of material used. In cases where a development is completed in stages, a whole development approach is not possible, and a typology approach should be used

2. Typology Approach

In this case, the total amount of material in each category across a whole typology is used to establish whether the threshold is met, rather than quantifying material used on an individual dwelling. For an example, in a development of 100 homes and 10 typologies where typology 1 consist of 5 dwellings, the amount in lineal metres of structural timber with FSC certification across all 5 dwellings will be considered to establish whether points can be achieved. In this instance, dwellings of different typologies may achieve different points for MAT-1. In cases where a development is completed in stages, this is the only allowable approach.

Establishing Eligibility and Calculating Points

For a Design Rating, review the plans or specifications to confirm what products are specified and check the datasheets and/or materials' third-party verification scheme certificates to determine if points can be awarded.

For a Built Rating, review the invoices/receipts demonstrating the materials used in the house and check the datasheets and/or materials' third-party verification scheme certificates to determine if points can be awarded.

For each material category that may be eligible for points, list the amount of each material provided in the Materials Calculator tab. While some material categories listed contain a single material (e.g. concrete) that may be used for multiple building components, some material categories may contain more than one material. For example, non-timber wall cladding may include any veneer brick as well as metal or plasterboard cladding. Additionally, the same material may have been obtained from different suppliers who have different means of compliance. Therefore, some of the material categories may have multiple line items in the Materials Calculator Tab.

Once each material and their amounts are entered, select the compliance method, which may be recycled content, eco-labels, and other certifications recognised by NZGBC. A full list is available on the NZGBC website. Note some products qualify for multiple compliance methods, ensure the best one is picked. For recycled content, points awarded equate to twice the percentage of recycled content within a material (100% recycled content - 2 points), however this pathway is only available for some materials (see compliance table) due to practicalities of assessing components of some products. For all other compliance methods 0.5, 1, 1.5 or 2 points may be awarded per material category depending upon the chosen compliance method. Approved compliance methods and points are listed below.

<table>
<tr><th colspan="3">Means of Compliance with MAT-1: Sustainable Materials</th></tr>
<tr><th>Type</th><th>Points available</th><th>Definition</th></tr>
<tr><td>Reused material</td><td>2</td><td>Research has shown that reuse of existing products provides the strongest environmental benefit; therefore, reused items (including purchased second hand) are awarded 2 points.</td></tr>
<tr><td>Approved eco-labels as per NZGBC website</td><td>Up to 2</td><td>‘Eco-labelling’ is a voluntary method of environmental performance certification and labelling that is practised around the world. An ‘eco-label’ is a label which identifies overall environmental preference of a product or service within a specific product/service category based on life cycle considerations. An eco-label is awarded by an impartial third-party in relation to certain products or services that are independently determined to meet environmental leadership specifications. Calculator points are awarded where a product holds an eco-label recognised by the NZGBC. The list of approved schemes is available on the NZGBC website (www.nzgbc.org.nz). Third Party Certification levels (A, B & C) are defined in the GBCA’s Framework for Product Certification Scheme. For more information, refer to the Product Certification information page on the GBCA website. http://www.gbca.org.au/.

<table><tr><td>Level A Eco-label</td><td>2 points</td></tr><tr><td>Level B Eco-label</td><td>1.5 points</td></tr><tr><td>Level C Eco-label</td><td>1 points</td></tr></table></td></tr>
<tr><td>Forest Stewardship Council (FSC)</td><td>2</td><td>Three types of FSC are recognised: FSC Mix, FSC 100% and FSC Recycled.</td></tr>
<tr><td>Programme for the Endorsement of Forest Certification</td><td>2</td><td>2 points are awarded per material category, where material is PEFC certified.</td></tr>
<tr><td>Recycled Content Product</td><td>Points = 2 X Fraction of product content that is recycled</td><td>Product contains materials that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer) or after consumer use (post-consumer). Pre-consumer material does not include materials normally re-used by industry within the original manufacturing process and is also termed ‘post-industrial’.</td></tr>
</table>

		Applicable to all Engineered Wood, Steel, Non- and Timber Cladding material categories, as well as Floor Coverings, and Insulation. However, any timber product that is reused from another project in solid wood form should be counted as reused material rather than as recycled content.
Dematerialisation	2	Can be claimed only under Floor Coverings, Applied Coatings and Interior Linings, when no product or material is installed / applied where these are typically expected. Each aforementioned material category is eligible for 2 points when at least 50% of the total conditioned floor area has no floor covering, at least 50% of the wall and ceiling area has no applied coatings, or at least 50% of the total wall and ceiling area have no interior linings.
Environmental product Declaration	Up to 1.5	Environmental Product Declarations (EPD) detail the life cycle environmental footprint of a product. EPDs published through an independently verified scheme that, as a minimum consider a cradle-to-gate scope will achieve points based on the EPD format as follows: Product Specific EPD – 1.5 points Industry wide EPD – 1 point See additional guidance for further compliance requirements for each EPD format.
ISO 14001	1	An international standard published by the International Organisation for Standardisation (ISO) which specifies a set of management standards that help organisations administer and control a company's environmental impact and compliance with regulations. 1 Point is awarded when products within a material category is sourced from an ISO14001 certified manufacturer. Where the manufacturer in question operates both ISO14001 certified and non-certified plants, only products where the

		main production process is carried out in certified plants can be counted (i.e. raw materials and minor individual components may come from non-certified suppliers).
End-of-Life Stewardship Programme	1	Product stewardship programs encourage projects and suppliers to share responsibility for the effective reduction, reuse, recycling or recovery of products. Product stewardship also helps manage environmental harm arising from the product when it becomes waste. Products stewardship programs must be demonstrated with a product stewardship contract or product stewardship accreditation from the Ministry for the Environment. There are two types of Product Stewardship Contracts, for a leased item and a purchased item.
CarboNZero product certification	1	Independent verification and certification that a product's carbon footprint has been calculated in accordance with the internationally recognised and agreed PAS 2050:2011 standards. Organisations with CarboNZero certified products have taken measures to manage, reduce and mitigate the product's net greenhouse gas emissions to zero. They have made a commitment to manage and reduce their greenhouse gas emissions by working to an emissions management and reduction plan. Any remaining unavoidable emissions are offset by purchasing verified carbon credits.
Enviro-Mark NZ Gold or above	0.5	This is a New Zealand based certification programme that provides member organisations with the tools and resources necessary to implement an environmental management system.
Declare	0.5	The Declare labelled products have declared their ingredients, source and manufacturing locations. Manufacturers of the products included in the Declare database have voluntarily disclosed their ingredients list and a company head has personally ensured this information is true.

CEMARS product certification	0.5	Independent verification and certification that a product's carbon footprint has been calculated in accordance with the internationally recognised and agreed PAS 2050:2011 standards. Organisations with CEMARS certified products have measured the emissions resulting from the lifecycle of the product. The product's lifecycle greenhouse gas emissions have been measured so they understand its associated greenhouse gas emissions. They then make a commitment to manage and reduce the greenhouse gas emissions of the product by working to an emissions management and reduction plan.

Table 21: Sustainable Materials Compliance

Products that are identical in manufacture and recipe to Environmental Choice licensed products except for their R-value (and thickness and weight related to R-value), may be recognized and awarded points under this credit. Confirmation must be provided from the manufacturer to demonstrate that the products are identical (i.e. same ingredients, manufactured at same location, manufactured using same process, etc).

For the purposes of measuring applied coatings figures can be recorded and submitted in either meter square (m^2) or litres (L) when demonstrating compliance.

The criteria apply to internal and external applications, whether it is exposed or concealed, but refer only to paint applied within the site boundary or in a prefabrication yard (e.g. excludes paint applied to a retail product/component during the production process in a factory , such as powder coatings on steel roofing).

Additional Guidance on Environmental Product Declarations

Products with a product-specific, third-party verified EPD

The product must meet the following minimum requirements:

- The EPD is issued in conformance with ISO 14025 or EN15804;
- The EPD must be independently audited; and
- The EPD must be based on a cradle-to-gate scope as a minimum.

Products with an industry-wide, third-party verified EPD

The product must meet the following minimum requirements:

- The EPD is issued in conformance with ISO 14025 or EN15804;
- The EPD must be independently audited;
- The EPD must be based on a cradle-to-gate scope as a minimum; and
- The product manufacturer must be recognised as a participant in the EPD.

Audit Documentation

Design Rating

All Projects
• Drawings or specifications clearly showing selected products • Product data sheet or certificate demonstrating compliance • Completed Materials Calculator tab
OR
If exact products have not yet been selected, specification extract(s) stating requirements to be met.

Built Rating

All Projects
• Invoices or supplier/installer confirmation letters clearly showing selected products • Product data sheet or certificate demonstrating compliance • Completed Materials Calculator tab
Not Applicable (N/A)
Signed Confirmation of Existing Dwelling from the dwelling owner to confirm that the dwelling has not been built within the last two years and has not undergone a major refurbishment.

Background

The production and use of building materials can have serious and widespread impacts on the natural environment. A significant amount of energy is used to extract, manufacture and transport building materials, and many natural resources are exploited for their use. The construction sector is a major consumer of resources, including metals, wood, plastics, and the constituent materials for cement and masonry. In addition to materials themselves, the manufacturing process needs to be resource efficient in order to reduce energy consumption, minimize waste, and reduce greenhouse emissions. The manufacturing process causes environmental pollution (such as fly ash from cement production) and construction materials themselves become more difficult to process as waste. The environmental impact from building materials can be reduced by limiting the quantities of virgin building materials used in projects and choosing the least harmful of these materials for use. Homestar awards points for the selection of materials that have an approved eco-label or are responsibly sourced. Eco-labels are where products and materials are third party verified by organisations - those independent from both the manufacturer and supply side as well as from Homestar - to identify which are environmentally preferable compared to similar products.

References and Further Information

1. Environmental Choice New Zealand
   http://www.enviro-choice.org.nz/

2. New Zealand Green Building Council
   https://www.nzgbc.org.nz/Category?Action=View&Category_id=253

3. Toitu Envirocare
   https://www.toitu.co.nz/

MAT-2 Healthy Materials 4 points

Aim

To encourage and recognise specification and use of interior finishes that reduce the detrimental impact on occupant health from products that emit pollutants.

Credit Criteria

Up to four points are available where interior finishes are selected that meet the low volatile organic compounds (VOC) limits as follows:

(1)	Where 50% of applied coatings meet the VOC limits as specified by a NZGBC recognised IAQ scheme or eco-label (or no applied coatings are used).	1 point
(2)	Where 50% of adhesives and sealants meet the VOC limits as specified by a NZGBC recognised IAQ scheme or eco-label (or no adhesives and sealants are used).	1 point
(3)	Where 50% of floor coverings meet the VOC limits as specified by a NZGBC recognised IAQ scheme or eco-label (or no floor coverings used).	1 point
(4)	Where 50% of engineered wood meet the VOC limits as specified by a NZGBC recognised IAQ scheme or eco-label (or no engineered wood is used).	1 point
(5)	This credit is deemed Not Applicable for dwellings that have been in existence for more than three years (from the date of assessment) and have not undergone major refurbishment within the past three years (before the date of assessment).	N/A

Data Entry

Use Materials Calculator Tab or similar to determine points and enter these into scorecard

Assessment

This Credit is only applicable to dwellings built within the previous three years (from the date of assessment) and existing dwellings that have undergone major refurbishment within the last two years (from the date of assessment).

For a Design Rating, review the plans or specifications to confirm what products/materials are specified and check the datasheets and/or materials' third-party verification scheme certificates to determine if the product/material is compliant.

For a Built Rating, review the invoices/receipts demonstrating the products/materials used in the house and check the datasheets and/or materials' third-party verification scheme certificates to determine if the product/material is compliant.

If required (i.e. the compliant products are not specified for 100% of the interior finishes categories), perform a calculation to determine that the 50% threshold is met.

Where a product holds a third-party verified eco-label, this product may be deemed to comply with VOC requirements. Eco-labels generally specify maximum permissible VOC content within a particular product type. Eco-labels deemed compliant for this credit can be found on the NZGBC website.

Indoor Air Quality schemes test the emission rates of VOCs. Products certified with a recognised IAQ scheme are deemed to comply with the criteria. For a list of recognised IAQ schemes, refer to the NZGBC website.

Project teams may demonstrate that a product meets the VOC content or emission requirements of a recognised Eco-label or the emission requirements of a recognised IAQ scheme through the provision of product data sheets or test results. Where test results are provided, a test report from a competent laboratory comparing the VOC limits of the product as measured against the limits set by the recognised label/scheme(s) is acceptable to show compliance as long as the units of measure are the same.

If VOC levels are determined by laboratory testing, the supporting information must include the test report from a laboratory competent to complete the relevant test method. Laboratories may demonstrate their competency by being accredited or registered to ISO/IEC 17025 from International Accreditation New Zealand (IANZ) or another recognised accreditation agency (e.g. NATA in Australia).

The following sections outline the maximum Toxic and Volatile organic compound (TVOC) content acceptable for various materials. In lieu of certification with IAQ schemes or eco- labels recognized by NZGBC, test reports that show compliance with limits set below may be provided.

Applied Coatings

Applied coatings are defined as:

- Any liquid applied finish including paints, varnish, stains and oils;
- Any paint, varnish or protective coating used in an internal application (including both exposed and concealed applications) and applied on site (non-occupied areas included);
- Any exterior-grade and solvent-based paints should they happen to be used in an interior application; AND
- Must meet the total volatile organic compounds (TVOC) content limits outlined in the following table.

Paint Type	Maximum TVOC content (g/L of wet paint)
Low sheen (interior)	60
Low sheen (exterior)	60
Flat (interior) - washable	55
Flat (interior) - ceiling	60

Flat (exterior)	55
Semi gloss (interior)	65
Semi gloss (exterior)	65
Gloss (interior)	75
Gloss (exterior)	75
Stains and varnishes	100
Sealers and Primers	
Exterior timber primer	60
Interior sealer	60
Latex primer (for galvanised iron and zincalume)	50
Undercoats	
Exterior latex	60
Interior latex	60
Performance Coatings	
One and two pack performance coatings for floors*	140
Intumescent Paints	100

Table 22: Maximum VOC Content for Applied Coatings
***EU Directive**

Adhesives and Sealants

Any adhesive and sealant product(s) used in an internal application (including both exposed and concealed applications) and applied on site (non-occupied areas included), must meet the VOC limit criteria for the applications outlined below. This includes exterior-grade and solvent-based sealants and adhesives, should they be used in internal applications.

Product Type	Maximum TVOC content* (g/L of product)
Indoor carpet adhesive	50
Carpet pad adhesive	50
Wood flooring and laminate adhesive	100
Rubber flooring adhesive	60
Sub-floor adhesive	50
Ceramic tile adhesive	65
Cove base adhesive	50
Dry wall & panel adhesive	50

Product Type	Maximum TVOC content* (g/L of product)
Multipurpose construction adhesive*	70
Structural glazing adhesive	100
Architectural sealants*	250
Sealants used to enhance the fire and water-proofing properties are included.	

Table 23: Maximum VOC content for adhesives and sealants
***N.B. clause in information above the table for multipurpose and architectural sealants.**

Floor Coverings

Where floor coverings targeting points in this credit do not have Eco-label certification or certification with a recognised IAQ scheme, compliance may be confirmed via VOC emissions testing. All VOC emission limits and compliance testing must meet or exceed those stated within the appropriate current Environmental Choice NZ specifications (currently EC-33-14 for synthetic carpets and EC-32-17 for other flooring).

Floor coverings that consist entirely of naturally occurring material (e.g. wood, cork, clay, stone, etc.) without any adhesives/binders, chemical treatment (e.g. for treated timber) or coatings (e.g. varnish, paints) comply by default. If the floor covering product consists of any adhesives, binders, coatings or are chemically treated, compliance should be through Eco-label/IAQ scheme certification or VOC emissions test results as above.

Engineered Wood Products

The emission levels for engineered wood products must be established by an IANZ (International Accreditation New Zealand), NATA (National Association of Testing Authorities) or ISO/IEC 17025 registered laboratory as per the testing methodologies provided below.

In lieu of certification with an eco-label that restricts VOC content, compliance with these requirements shall be demonstrated by providing test reports from a competent laboratory using the relevant test method below:

- AS/NZS 4266.16 Reconstituted wood-based panels – Methods of test – Formaldehyde emission – Dessicator method;
- AS/NZS 2098.11 Determination of formaldehyde emission from plywood;
- AS/NZS 4357.4 Structural laminated veneer lumber - Part 4 Determination of formaldehyde emissions;
- Panels shall demonstrate a level equivalent to or below E1 limit values provided in the table below.

Test Protocol	E1 Emission limit/ Unit of measurements
AS/NZS 2269:2004 - testing procedure AS/NZS 2098.11:2005 method 10 for plywood	< 1.0 mg/L
AS/NZS 1859.1:2004 - particle board, with use of testing procedure AS/NZS 4266.16:2004 method 16	< 1.5 mg/L
AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16	< 1.0 mg/L
JIS A 5908:2003 – particle board and plywood, with use of testing procedure JIS A 1460	< 1.0 mg/L
JIS A 5905:2003 - MDF, with use of testing procedure JIS A 1460	< 1.0 mg/L
JIS A1901 (not applicable to plywood)	< 1.0 mg/L
ASTM D5116	<0.1 (+/- 0.0005) mg/m^2hr (may also be represented as $mg/m^2/hr$)
ISO 16000 part 9, 10 and 11 (also known as EN 13419)	<0.1 (+/- 0.0005) mg/m^2hr (may also be represented as $mg/m^2/hr$)
ASTM D6007	$0.12mg/m^3$*
ASTM E1333	$0.12mg/m^3$**
EN 717-1 (also known as DIN EN 717-1)	$0.12\ mg/m^3$
EN 717-2 (also known as DIN EN 717-2)	3.5 mg/m^2hr (may also be represented as $mg/m^2/hr$).
*The test report must confirm that the conditions of Table 1 comply for the particular wood product type, and the final results must be presented in EN 717-1 equivalent (as presented in the table) using the correlation ratio of 0.98.	
** The final results must be presented in EN 717-1 equivalent (as presented in the table), using the correlation ratio of 0.98.	

Audit Documentation

Design Rating

Drawing(s) and/or specification(s) clearly showing selected products AND product data sheet or certificate demonstrating compliance AND completed Materials Calculator. OR If exact products have not been selected stating requirements to be met.

Built Rating

Invoices or supplier/installer confirmation letters clearly showing selected products AND
Product data sheet or certificate demonstrating compliance of each product AND completed Materials Calculator when targeted construction systems don't have 100% compliant products. For naturally occurring, unprocessed materials please provide manufacturer written confirmation to show the product is free of adhesives/ binders, resins, coatings (paints/varnish) or chemical treatment
Where the Credit is deemed Not Applicable to the dwelling:
Signed Confirmation of Existing Dwelling from the dwelling owner to confirm that the dwelling has not been built within the last two years and has not undergone a major refurbishment.

Background

People spend over 90% of their lives indoors and their exposure to air pollutants is far greater from breathing indoor air than outdoor air. It is commonly found that indoor air concentrations of most air pollutants are far more than those outdoors. Consequently, there is considerable research underway concerning:

- Eliminating or controlling sources of indoor pollutants; and
- Ensuring building ventilation rates are sufficient to remove pollutants for which source control is limited.

VOC is the term used to describe the several hundred organic chemicals in the boiling point range of 50°C to 260°C. These consist primarily of petrochemical solvent-type compounds such as aliphatic and aromatic hydrocarbons, alkenes, halogenated hydrocarbons, ketones, aldehydes and esters. The global problems attributed to VOCs arise from the use of solvents in many industrial processes.

Sources of VOCs in buildings include:

1. In new buildings: paints, adhesives, carpets, sealants, reconstituted wood products, new furniture; and
2. In established buildings: cleaning products, printed materials, office equipment, consumer products, dry-cleaned clothing and car exhaust.

Due to the large number of compounds, indoor air concentrations are typically based on Total VOC (TVOC) concentrations, essentially the sum of the individual concentrations.

The health effects of exposure to VOC are consistent with 'sick building syndrome' effects – eye, nose and skin irritation, headache, lethargy. These have been observed in subjects exposed to 1,000 ppb and indoor air goals have been set to limit exposures to much lower levels.

References and Further Information

1. Environmental Choice New Zealand
   http://www.enviro-choice.org.nz/

2. New Zealand Green Building Council
   https://www.nzgbc.org.nz/Category?Action=View&Category_id=253

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Site

STE-1 Stormwater Management 4 points

Aim

To encourage and recognise houses/sites that reduce stormwater run-off from buildings and hard surfaces, in order to mitigate flooding, pollution and stream erosion.

Credit Criteria

Up to four points are available for managing site and roof stormwater runoff.

Site stormwater runoff

Up to 2 points are awarded where it can be demonstrated that a percentage of the site (not including area under roof) is permeable or designed to capture stormwater runoff through permanent on-site stormwater management systems e.g. vegetated swale, on-site rain garden, pond, sandfilter or stormwater detention tanks.

Standalone Houses		
(1)	At least 75% of the site (not including area under roof) meets the above criteria.	0.5 point
	OR	
	At least 75% of the site (not including area under roof) meets the above criteria AND The first 10mm of any storm event is retained on-site. Permeable areas and on-site infiltration systems meet this by default. For other stormwater systems see guidance.	1 point
OR		
(2)	At least 90% of the site (not including area under roof) meets the above criteria.	1 point
	OR	
	At least 90% of the site (not including area under roof) meets the above criteria. AND The first 10mm of any storm event is retained on-site. Permeable areas and on-site infiltration systems meet this by default. For other stormwater systems see guidance.	2 points
Terraced Houses and Apartments		
(1)	At least 50% of the site (not including area under roof) meets the above criteria.	0.5 point
	AND	
	At least 50% of the site (not including area under roof) meets the above criteria. AND The first 10mm of any storm event is retained on-site. Permeable areas and on-site infiltration systems meet this by default. For other stormwater systems see guidance.	1 point
OR		

(2)	At least 75% of the site (not including area under roof) meets the above criteria.	1 point
	AND	
	At least 75% of the site (not including area under roof) meets the above criteria. AND The first 10mm of any storm event is retained on-site. Permeable areas and on-site infiltration systems meet this by default. For other stormwater systems see guidance.	2 points

Roof stormwater runoff

Up to 2 points are awarded where the stormwater associated with the roof is effectively managed on site with either a living roof or system designed to capture stormwater runoff through permanent on-site stormwater management systems e.g. vegetated swale, on-site rain garden, pond, sandfilter or stormwater detention tanks.

All Typologies		
(1)	Equivalent to at least 20% of the total roof area.	0.25 point
OR		
(2)	Equivalent to at least 40% of the total roof area.	0.5 point
	OR	
	Equivalent to at least 40% of the total roof area, AND The first 10mm of any storm event is retained on-site. Living roofs and any on-site infiltration systems meet this by default. For other stormwater systems see guidance.	1 point
OR		
(2)	Equivalent to 80% (or more) of the total roof area.	1 point
	OR	
	Equivalent to 80% (or more) of the total roof area, AND The first 10mm of any storm event is retained on-site. Living roofs and any on-site infiltration systems meet this by default. For other stormwater systems see guidance.	2 points

Data Entry

Use scorecard tab.

Assessment

The Homestar Assessor is to assess the permeability of the site and/or the provision and estimated effectiveness of the onsite stormwater management systems and award points where these are deemed to comply with the Credit Criteria above. This should be done by reviewing the site plan or

visually checking the site and calculating the total percentage of permeable area as well as checking for the inclusion of permanent on site stormwater management systems**.**

Paving cannot be considered permeable unless it meets the requirements set out in the guidance below. Where the dwelling being certified is located in a larger building, and therefore shares a common building and common site with other dwellings, an overall site approach may be taken for this credit and the results applied to each dwelling within the building.

The Homestar Assessor cannot award any points for onsite stormwater management systems if they have any doubt that the systems will be able to effectively manage the site's stormwater during **one third of the one in two year storm, 24hr duration** event (taking into account regional climate). Note that local authorities may require peak flow attenuation of larger storm events on some sites and this must be complied with in addition.

Assessors can use the http://hirds.niwa.co.nz/ website to determine the amount of rainfall generated in the 2yr, 24hr duration rainfall event at that location. Then divide this figure by 3 then multiply this figure by the roof area and the run off coefficient of the roof (see WAT-2 for details). The result is considered as an approximation of the rainwater volume which will be collected by roof area in the 1/3 of a 2 year storm.

Additionally, points are awarded for retaining the first 10mm of any storm event on site. This is to reduce the overall volume of stormwater run-off into receiving systems.

Site stormwater runoff

The amount of permeable area within a site is determined by firstly subtracting the roof area and associated eaves from the total site area. Living roofs and associated eaves are also subtracted from the total site area as roofs are considered under the 'roof stormwater runoff' component of this credit. All impermeable surfaces such as concreted driveways are then subtracted from the remaining site area and a percentage of compliant area is calculated.

The roofs of sheds, garages and carports separate to the main dwelling may be subtracted from the total site area before calculating the percentage of permeable area on site, but they must then be included in the total roof area.

The following list outlines common surfaces that are to be considered impermeable:

- Concreted driveways and car parks
- Concreted footpaths
- Decks (including wooden decks where there are no gaps between timber planks)
- Paved patio areas (refer to permeable paving in section below)
- Swimming/spa pools
- Separate sheds, garages and roofed car ports.

Types of areas that are considered to be permeable or designed to capture stormwater runoff for infiltration for the purposes of this credit include but are not limited to:

- **Vegetative landscape** e.g. grass and garden (excluding living roofs as these are considered under the 'roof stormwater runoff' component of this credit);

- **Permeable paving** including porous above ground materials with a six-inch porous sub-base, e.g. open pavers, pebbles; and
- **Specific impermeable surfaces** (e.g. concrete driveway) designed to direct stormwater runoff towards an appropriate permanent on site stormwater management system e.g. vegetated swale, on-site rain garden, pond, sandfilter or stormwater detention tanks.

Estimation of Onsite Stormwater Management System Effectiveness

When estimating the effectiveness of onsite stormwater management systems the Homestar Assessor must consider the following:

- **Detention tanks**
  These must be sized appropriately depending on the catchment area they serve. Rainwater tanks may be used as detention tanks. However, they must be designed as specific dual-purpose tanks where the volume above the overflow is considered as the detention volume.
- **Rain gardens**
  These look and function like any other garden except they treat runoff and are specifically designed with a layer of 100mm of mulch, 600mm (minimum) to 1,000mm of planting soil, and planted with both grasses and shrubs. Rain gardens must be sized appropriately depending on the catchment area they serve.
- **Swales**
  These are generally suitable for gradients between one and four percent. On steeper slopes, check dams may be required within the swales to prevent high velocities and subsequent erosion. A piped underdrain can also be incorporated into the design. Vegetative cover of swales generally consists of a dense continuous cover of relatively long grass. The grass should be maintained at a height of not less than 35mm and typically 150mm. Swales must be sized appropriately depending on the catchment area they serve.

Retention of the First 10mm of Storm Event

Historically, stormwater management has focussed on the reduction of peak flows during high intensity storm events (1:50, 1:100). More recently, stormwater approaches have begun to focus on reducing peak flows from more regular storm events (e.g. 1:2) and overall volume reduction through retention (and infiltration or reuse) of stormwater on site, as this has been shown to better reduce downstream erosion.

Additional credits are therefore awarded where sites retain the first 10mm of any storm event on site. This can be achieved by the following methods:

- Living roofs
- Permeable areas including permeable paving
- Swales incorporating gravel underdrains and dams
- Infiltration basins
- soakage pits
- Dual purpose rainwater retention/detention tanks where the rainwater is used in the building in addition to garden watering.

The following cannot be used for the purposes of retaining stormwater on site:

- Rainwater detention tanks without retention volume
- Sandfilters
- Dry/wet ponds without infiltration

Homestar Assessor On-Site Guidance

1. Identify any overland flow paths on or adjacent to the site (also refer to building consent drainage plans if available).
2. Assess the layout of the development in relation to any overland flow paths.
3. Identify the amount of impervious area added to the site post development.
4. Identify the onsite stormwater management systems implemented.
5. Subtract the roof and associated eaves from the total site area. Subtract the area of impermeable surfaces from the remaining area and establish a percentage of compliant area.
6. Estimate the effectiveness of onsite stormwater management systems. The Homestar Assessor must use his/her discretion when ascertaining if the onsite stormwater management systems are effective.

Audit Documentation

Design Rating

Site stormwater runoff
Site plan clearly demonstrating the type and extent of compliant areas e.g. grass/garden or driveway directing stormwater into on site stormwater management system.
Calculation demonstrating the percentage of the site that is permeable.
Evidence that the system will effectively manage the site's stormwater during 1/3 of a 1:2 year storm.
Evidence that the system is able to retain the first 10mm of any storm event.
Roof stormwater runoff
Site plan highlighting the location and size of permanent on site stormwater management systems associated with roof stormwater runoff.
Evidence that the system will be able to effectively manage the site's stormwater during 1/3 of a 1:2 year storm.
Evidence that the system is able to retain the first 10mm of any storm event.

Built Rating

Site stormwater runoff
Photographs referenced to a site plan demonstrating the type and extent of compliant areas e.g. grass/garden or driveway directing stormwater into on site stormwater management system.

Calculation demonstrating the percentage of the site that is permeable.
Evidence that the system will be able to effectively manage the site's stormwater during 1/3 of a 1:2 year storm.
Evidence that the system is able to retain the first 10mm of any storm event.
Roof stormwater runoff
Marked up site plan highlighting the location and size of permanent on site stormwater management systems associated with roof stormwater runoff.
Photograph(s) of permanent on site stormwater management systems associated with roof stormwater runoff.
Evidence that the system will be able to effectively manage the site's stormwater during 1/3 of a 1:2 year storm.
Evidence that the system is able to retain the first 10mm of any storm event.

Background

Stormwater is the water that runs off surfaces such as roofs, roads, driveways and other impermeable surfaces. In urban areas, it typically runs down drains into stormwater pipes or channels and is carried to rivers, lakes or the sea. Stormwater on private property is the responsibility of the property owner and, when not properly managed, can cause the flooding, erosion and pollution of waterways. Residential development results in an increase in the area of impermeable surfaces on a site, e.g. driveways and buildings. In addition, development often results in areas of earth around buildings being compacted, the removal of vegetation and changes in the natural drainage systems.[1]

The purpose of this credit is to encourage on site stormwater management systems that achieve the following objectives:

1. **To prevent downstream flooding**
   An increased impermeable surface within a property both reduces the volume of runoff that infiltrates naturally back into the ground and causes runoff to discharge faster. Without controls in place this can result in peak flows and discharge volumes associated with storm events increasing from a property. This additional flow can cause localised flooding and contributes to wider catchment flooding problems downstream[1].

2. **To prevent increased erosion and change to downstream watercourses**
   Development has the potential to cause a change in the pattern of stormwater discharges to streams. In particular, an increase in impermeable surface areas within a catchment can result in stormwater being transmitted faster to streams. As a result, there are more occurrences in a year of short, high flow events associated with regular rainfall conditions than would have occurred pre-development. This change in stream response to rainfall can result in significant channel erosion, which in turn adversely affects stream habitat[1].

3. **To minimise the potential for increased discharge of contaminants**
   Stormwater runoff generated on impermeable areas, particularly roads, tends to pick up contaminants. These contaminants have the potential to pollute and degrade streams and sensitive coastal receiving environments[1];

This credit also aims to encourage the uptake of both native and exotic living roofs within New Zealand, as these have been shown to help reduce stormwater runoff and provide other benefits to the site. Although not mandatory at this stage, owners are encouraged to use native plants in their living roofs.

References and Further Information

1. Level (residential stormwater control)
   http://www.level.org.nz/water/wastewater/on-site-wastewater-treatment/stormwater-control-and-landscaping/
2. ARC Technical Publication (TP10)
   http://www.arc.govt.nz/plans/technical-publications/technical-publications-1-50.cfm
3. Smarter Homes (residential stormwater control)
   http://www.smarterhomes.org.nz/water/managing-stormwater/
4. NZ Water and Wastes Association (Keep it Clean: Preventing Stormwater Pollution booklet)
   http://www.waternz.org.nz/documents/publications/books_guides/stormwater_booklet.pdf
5. Living Roofs
   http://www.livingroofs.org.nz/page/5-Home

STE-2 Native Planting 2 points

Aim

To encourage and recognise the ecological enhancement of a site through the planting of native species appropriate to that site.

Credit Criteria

Up to two are awarded where it can be demonstrated that 10%, 25% or 50% of the land area (not including area under roof) is vegetated with native species appropriate to that site.

(1)	At least 10% of the land area	0.5 points
(2)	At least 25% of the land area	1 point
(3)	At least 50% of the land area	2 points

Data Entry

Use scorecard tab.

Assessment

First, estimate the percentage of the land area (not including area under roof) that is vegetated with native species appropriate to that site using either of the following assessment pathways.

Assessment Pathways

Whole site approach	Allowed only where dwelling/property is part of a larger development of multiple dwellings that will be managed by a single landlord (e.g. social housing organization or retirement village) or a body corporate (e.g. apartment block) post completion - Consider private and shared land areas within the entire development excluding areas under roofs and common access road ways and footpaths
Single site approach	Used in all cases where a whole site approach does not apply - Consider the land area within private property boundary not under roof

Secondly, review the site/landscape plan or visually inspect the site for areas vegetated with native species. Finally, perform a calculation to determine what area of the site is covered in native species considering the following requirement

- Any driveways or other outdoor paved areas within the property boundary of each specific dwelling should be included in the total land area
- Where plants are located in a clearly designated garden bed that is predominantly planted with native plants, then the area of the entire garden bed may be counted

- When plants are located in a standalone space (i.e. a tree in a lawn) then use the drip line of the plant. In a Design Rating, the drip line of a plant is to be estimated as the size that the plant will be when the dwelling is being assessed for the Built Rating. In a Built Rating, the drip line is what is observed on site at the time of certification, not the size the plant may grow to at some time in the future.
- Permanently fixed pots and planters on balconies and terraces may be counted towards this credit using either the area within drip line or the area of the planter or pot

Site-Appropriate Native Species

Homestar Assessors are expected to be able to differentiate between native and exotic species with the aid of the resources in the References and Further Information section below, in particular the relevant resources published by the local Council.

There are two primary issues to be considered when deeming whether a native species is appropriate to a given site:

- **Regional biodiversity:** Local flora and fauna evolve to depend on certain species being present and owners are encouraged to provide suitable 'regional' habitat through appropriate native planting. The Homestar Assessor is encouraged to use the local Council's guidelines on which native species are appropriate to the region where this information is available.
- **The likelihood of a specimen's survival without a significant amount of maintenance:** Native plants adapted to local conditions are likely to require less maintenance such as watering in order to survive. Local native plants are likely to be more suited to the soils and climate of that region.

Where the local Council does not provide guidance on which native species are appropriate to the region, the Homestar Assessor is to take the following steps:

1. The Homestar Assessor is to decide which of the following categories the site fits into:

    - **Sub-tropical:** Warm summer. Mild winter with rare frost. Auckland, Northland, Coromandel and east coast areas to Tauranga and Mount Maunganui excluding inland areas which have frequent frosts[10].
    - **Temperate:** Warm summer, cool wet winter. Occasional frosts. North Island - Hamilton and western coastal areas as far as Wellington. Rotorua and all east coast areas from Bay of Plenty south. South Island - Nelson and West Coast areas south to Greymouth. Picton and east coast south through Christchurch, Dunedin to Invercargill[10].
    - **Semi-alpine:** Warm summer. Cold winter with frosts. Taupo, parts of Waikato in shadow of the mountains, Wairarapa. Inland areas of Otago, Canterbury and all Southern Lakes areas[10].

2. The Homestar Assessor is then to ascertain whether the species present on the site are appropriate to the region using the resources in the References and Further Information section below. The Homestar Assessor is also to consider the appropriateness of species when a site is coastal as opposed to inland within one of the three categories listed above.

Overhanging Native Specimens

If an appropriate native specimen overhangs the subject site but its base resides in an adjoining property, the drip line of the specimen can contribute to the percentage of the land area covered by appropriate native species unless there are pest species within the drip line at ground level on the subject site. This is because the specimen is likely to be of a significant size, is more likely to remain in perpetuity and may also be protected by the local Council.

When specifying or advising on appropriate planting, other factors for consideration also include:

- Shading: Good planting should avoid negatively impacting solar gain, while appropriate use of deciduous plants near north-facing windows can provide beneficial summer shading.
- Damage to paint/walls of house: Avoid placing large trees and shrubs too close to the house
- Ventilation: Keep foundation vents clear
- Water consumption: Consider the likely water consumption of the chosen landscaping. For example, native ground cover and shrubs will consume less water than lawn.

Audit Documentation

Design Rating

Confirm on Pro-Forma of Credit Compliance following verification using either:
Site/landscape plan with calculation demonstrating the percentage of the site vegetated with appropriate native species OR
Specification extracts showing percentage of the site to be vegetated with appropriate native species.

Built Rating

Confirm on Pro-Forma of Credit Compliance following verification on site.

Background

Since human settlement, New Zealand has one of the worst records of native biodiversity loss in the world[4]. More than 80% of New Zealand's native plant species are not found anywhere else in the world and they support a habitat for many insects and birds that are unique to this country[4]. Fire, land clearance, over exploitation of resources and the introduction of plants and animals have had a cumulative negative effect on native biodiversity. As a result, about 1,000 of our known animal, plant, and fungi species are considered threatened[4] and an increasing number are now threatened with extinction.

Every year, several hundred new plant species arrive in New Zealand[4]. Nearly 2,000 exotic plant species are now established in the wild. In urban Auckland, four new species go wild each year[4]. There are now more introduced plant species growing wild in New Zealand than native plant species[7]. Only seven species of invasive weeds have been successfully eradicated from New Zealand[7].

The purpose of this credit is to reward residential development that has a limited impact on the local ecology and/or enhance the site through the re-introduction of native species.

References and Further Information

Native species

Refer to the local Council website for a list of commonly grown native species within the region.

1. NZ Plant Conservation Network (native plant/tree identification)
   http://nzpcn.org.nz/page.asp?conservation_restoration_native_gardening_native_plants

2. Department of Conservation – Plant Me Instead (relevant publication)
   http://www.doc.govt.nz/publications/conservation/native-plants/plant-me-instead/

3. The Native Plant Centre (native plant/tree identification)
   http://www.nznativeplants.co.nz/

4. NZ Biodiversity Website
   https://www.biodiversity.govt.nz/index.html

Pest species

Refer to the local Council website for a list of common pest species within the region.

5. Ministry of Agriculture and Fisheries (MAF) – National Pest Plant Accord (pest identification)
   http://www.biosecurity.govt.nz/files/pests/plants/nppa/nppa-accord-manual.pdf

6. Landcare Research (pest identification tool)
   http://www.landcareresearch.co.nz/research/biosystematics/plants/nppakey/

7. Weedbusters Website
   http://weedbusters.co.nz/about_weedbusters/index.asp

8. Department of Conservation
   http://www.doc.govt.nz/conservation/threats-and-impacts/weeds/

Climatic zones

9. National Institute of Water and Atmospheric Research
   http://www.niwa.co.nz/education-and-training/schools/resources/climate/overview

10. Garden Grow
    http://www.gardengrow.co.nz/zones/

STE-3 Neighbourhood Amenities 4 points

Aim

To encourage and recognise the building of dwellings on previously developed sites in areas that allow for walking, cycling and/or public transport thereby reducing dependency on private vehicles.

Credit Criteria

Up to four points are awarded where it can be demonstrated that the site is either:

(1)	Located within 800 metres of key amenities	Up to 2.0 points
(2)	Located within 800 metres of at least 1 public transport services terminal and transport services available every weekday	1 point
(3)	A site that has previously experienced development	1 point

A previously developed site is defined as that which is or was occupied by a permanent structure (excluding agricultural or forestry buildings) and associated fixed surface infrastructure (i.e. urban land uses such as transport, utilities, residential and commerce and community services).

Data Entry

Use scorecard tab.

Assessment

Key amenities

For the purposes of this credit the following in Table 24 are considered to be key amenities. Note that only one item from each line may be claimed as a key amenity where more than one type is grouped together. For example, a chemist and a medical centre cannot be considered as two separate key amenities. The exceptions to this rule are that more than one education facility can be counted if within 800 metres, e.g. a childcare facility and a school can be counted as two separate key amenities and private fruit trees and vegetable gardens command multiple points as indicated in the tables below.

0.25 points are awarded for each of the following key amenities up to a maximum of 2 points for all types of dwellings.

Key Amenities	
Public amenities	**Communal* amenities**
Café / restaurant / takeaways	Playground area
Chemist / medical centre	Open landscaped areas for active play
Community centre	Food growing area

Dairy / service station	Gym (provided within development)
Designated cycleway	Outdoor dining
Educational facility	
Fitness centre / gym	
Marae	**Private site amenities**
Place of worship	Fruit trees (0.25 points per fruit tree up to a maximum of 1 point)
Post office	Vegetable garden (0.25 points per 0.5 m^2 per dwelling up to a maximum of 1 point)
Public library	
Public park / domain / sports field	
Supermarket / superette	

Table 24: Key Amenities for STE-3 Neighbourhood Amenities

Communal Amenities

Communal amenities are shared facilities provided by a developer of multi-unit residential housing. Unlike public amenities, the scale and quality of the facilities are in the control of the developer and therefore the following must be met as a minimum:

a. Playground area

Review the drawing(s) and specification(s) or visually check for the presence of playground facilities located within the site. This includes items such as climbing apparatuses, balance beams, ropes, swings, flying foxes, etc. Playground areas are to be exclusively for play and must be fenced off. They must be sufficiently large to allow play by groups of up to 20 children and must be sized accordingly. Playgrounds must include rubber tiles or equivalent to ensure the safety of children in the event of a fall.

b. Open landscaped areas for active play

Review the Drawing(s) and specification(s) or visually check for the presence of open areas, located within the site, for group and/or individual play such as areas for running, jumping chasing, ball games, sporting activities and areas for wheeled types such as bike pathways. Landscaped areas for active play must be a minimum of 25% of the total site area, excluding the area under roof.

c. Food growing area

Review the drawing(s) and specification(s) or visually check for the presence of areas designated for communal food growing. In order for an area to be considered as “designated vegetable garden” space, it must either be planted with vegetables, be bare earth or be covered in mulch at the time of assessment. Raised vegetable gardens are also acceptable, however the structure and soil must be in place at the time of assessment.

d. Gym

Review the Drawing(s) and specification(s) or visually check for the presence of a gym that includes, as a minimum, three separate facilities for exercise.

e. Outdoor dining

Review the Drawing(s) and specification(s) or visually for the presence of an outdoor dining area that at a minimum allows for two separate dinner parties of minimum 6 people. Signage should be in place explaining the communal nature of the facility, and how to use and maintain it appropriately. The following must be provided: seating and tables, sun-shading and lighting.

Private site Amenities

Review the landscape plan or visually check the site for the designated vegetable garden(s) and food producing tree(s)/vine(s).

a. Fruit trees

For the purposes of this credit, food producing plants/vines/trees that are based in movable pots cannot be considered. Similarly, raised beds should only be considered 'permanent' when they are large enough so that it is unlikely that the current owner/tenant would remove them if they were to move to another house.

b. Vegetable garden

There is potential for grassed/landscaped areas or structures that the owner/tenant intends to convert into vegetable garden space to remain in perpetuity and not be used as a vegetable garden space. Therefore, in order for an area to be considered as designated vegetable garden space it must either be planted with vegetables, be bare earth or be covered in mulch at the time of assessment. Raised vegetable gardens are also acceptable, however the structure and soil must be in place at the time of assessment.

Public transport services

Public transport services are defined as any bus, train, and tram or ferry service going in any direction from a stop within 800m of the site and available every weekday.

The proximity of public transport stops and hubs within 800m walking distance shall be confirmed during the site visit. The Homestar Assessor shall discuss the walking route(s) suggested by Google Maps (or similar) with the owner/tenant (if able) because Google Maps (or similar) tend to rely on roads only. There may be other pathways that are available and commonly used. The acceptance of alternative pathways is at the discretion of the Homestar Assessor.

Previously Developed

Use a website such as Google Earth to locate an aerial photograph of the site showing the most recent development on the site prior to the proposed dwelling. This point may be assumed for existing dwellings.

Walkscore® Website

The Walkscore® website can be used to determine the number of key amenities located within 800 metres of the site. View the available amenities and note those shown as within 800m. More amenities types can be found using the following terms in the 'Search Nearby' option.

Use the map of the area provided on the page to apply common sense when looking under each category e.g. is there an area of green on the map that could be a park yet is not listed. Record the

key amenities located within 800 metres of the site. Confirm the existence of these key amenities and discuss your list of key amenities with the owner/tenant to ensure accuracy (if able).

The Walkscore® website is not 100% accurate. Therefore, it is important that the Homestar Assessor discusses the key amenities identified within 800m with the owner/tenant. In particular, the Walkscore® website may not identify the following:

- Small neighbourhood parks
- New cafes
- New Zealand specific education facilities e.g. wananga
- Places of worship other than churches
- Designated cycle ways.

If the Walkscore® website does not identify known key amenities within approximately 800 metres, then the Homestar Assessor can use the Google Maps walking distance facility to ascertain the exact distance between the site and the key amenity.

The Homestar Assessor shall also discuss the walking route(s) available between the site and the key amenities and public transport stops/hubs in the area because the owner/tenant may be aware of alternative routes to those used in the Walkscore® website and Google Maps walking distance facility. The acceptance of alternative pathways is at the discretion of the Homestar Assessor.

Audit Documentation

Design Rating

Key amenities
Location plan showing all amenities within 800m walking distance from the dwelling.
Public transport services
List of public transport terminals that are available within 800m walking distance and documents demonstrating that transport services are available every weekday.
Previously Developed
Aerial photograph showing most recent development.

Built Rating

Key amenities
Location plan showing all public amenities within 800m walking distance from the dwelling. Photograph(s) showing the presence of compliant communal amenities.
Public transport services
List of public transport terminals that are available within 800m walking distance and documents demonstrating that transport services are available every weekday.
Previously Developed
Aerial photograph showing most recent development.

Background

New Zealand has one of the highest levels of per capita car ownership in the world. It is clear that New Zealanders use their cars as their main mode of transport and often there is only one person in the car at any one time.

Other transport options must be provided for and encouraged in order to prevent continued growth of transport related greenhouse gas emissions, urban air and water pollution, as well as social impacts such as traffic congestion.

This credit encourages dwellings to be located within close proximity of amenities that owners/tenants commonly use in an attempt to reduce the number of short trips made in private vehicles.

The 800 metre threshold for key amenities was based on what an average person could walk in the space of approximately ten minutes[5]. The list of key amenities used in this credit are those that are considered to be most regularly frequented and, therefore, result in private vehicle use if located beyond a ten-minute walk from the dwelling.

There is considerable evidence that denser developments of apartments and terraced houses encourage both the provision and the use of alternatives to the car. However, to make them more attractive and make up for the loss of private outdoor space, it is important for denser developments to also provide communal amenities (such as outdoor space and opportunities for food growing).

References and Further Information

1. Walkscore®
   http://www.walkscore.com/

2. Google Maps

   http://maps.google.co.nz/

3. Ministry for the Environment

   http://www.mfe.govt.nz/issues/transport/

4. New Zealand Transport Strategy 2008
   http://www.transport.govt.nz/ourwork/Documents/NZTS2008.pdf

5. NZTA Pedestrian Planning and Design Guide 2009
   http://www.nzta.govt.nz/resources/pedestrian-planning-guide/

STE-4 Cycling 2 Points

Aim

To encourage and recognise the reduction of greenhouse gas emissions and improved resident wellbeing through provision of safe and convenient access to cycling.

Credit Criteria

Up to two points are awarded for provision of secure cycling facilities and convenient and safe access to cycle ways. These points may be achieved through any combination of the features listed under the following three components, provided at least one point is achieved for the provision of cycle parking.

(1)	Provision of safe and secure cycle parking facilities for residents and visitors	Up to 2 points
(2)	Convenient and safe access to a dedicated cycleway (if full points are not pursued under provision of cycle parking)	Up to 1.0 point
(3)	Provision of additional amenities to encourage cycling uptake by residents (if full points are not pursued under provision of cycle parking)	Up to 1.0 point

Data Entry

Use the scorecard.

Assessment

(1) Cycle Parking Facilities

Up to two points are available where the project provides dedicated, covered, well-lit and secure bicycle parking facilities for the exclusive use of residents and visitors to the property. Points are awarded based on the number of cycle parking spaces provided.

These facilities may include bicycle storage lockers, lockable cages, surveillance cameras, cycle-friendly elevators, racks or access restricted parking stations.

Any cycle rack not in a fully enclosed access restricted area must allow the frame and at least one wheel to be secured.

For standalone or terraced homes, wall-mounted bicycle stands within a secure, covered space such as a garage is also appropriate.

Standalone and Terraced Houses and Apartments	
Provision of secure and covered parking facilities with no less than: 1 resident parking space per 1, 2, or 3 bedroom dwelling 2 resident parking spaces per 4 bedroom or larger dwelling At least 1 visitor park per every 10 dwellings up to 20 parks	1 point
Additional 25% spaces above requirement for 1 point for resident parks	1.5 points
Provision of secure and covered resident parking facilities with no less than 1 space per bedroom of each dwelling plus at least 1 visitor park per 10 dwellings up to 20 parks.	2 points

(2) Access to Cycleways and Public Transport

0.5 point is available where each of the following accessibility criteria is met. Points are available here only **IF** at least 1 point is achieved for provision of parking facilities.

There is a cycleway within 800m of a property entrance.	0.5 point
There is a cyclist accessible public transport station within 800m of property entrance.	0.5 point

(3) Additional Amenities

0.5 points are available for each of the following additional items that encourage cycling by presenting it as a safe and convenient option, **IF** at least 1 point is achieved for sufficient parking facilities.

There is a safe, designated cyclist friendly street crossing point within 50m of the main cyclist entrance to the property.	0.5 point
Designated cycling or shared pedestrian and cycling path between property access and parking facilities OR Driveway designated as pedestrian and cyclist priority with 10 KMH maximum speed limit, complete with signage	0.5 point
Secure lockers provided to store cycling gear that is adjacent to and accessible from the parking facilities.	0.5 point
Designated e- bike charging points WITHIN cycle parking/ storage facilities that At a minimum equal the lesser of either 10 spaces or 20% of the total number of cycle parking spaces available, AND Can be used while the bicycle is secured to a parking bay	0.5 point

A workshop area with shelves, lighting and power outlets that can be used to carry out maintenance work on bicycles	0.5 point

Suitable Cycle Parking facilities

There are a range of cycle parking /locking facilities that would comply with this credit. These range from cycle racks to enclosed storage lockers and cages. In order to be acceptable, the facilities should have all of the following attributes:

Secured against theft: It should be possible to have the bicycle secured within a lockable enclosure (cage) or have the frame and both wheels secured to a rack using a U-bolt lock. Both cages and racks should be securely fastened to the building structure or ground so that the entire rack /cage cannot be easily removed.

Accessible: A cycle park should have step free access such that the rider does not need to carry the bicycle to the storage facility. There should also be clear signage for the cycle parking facility and signage to direct riders to the cycle park if it is not visible from the main entrance

Safe for riders: The park should be located in an area that is well lit and/or under video surveillance. In addition, if access to the cycle park for pedestrians or cyclists (between dwelling or property entrance to parking facility) requires crossing one or more vehicle roadways, ensure that there is a designated crossing point that is well lit, and visible clearly to motorists.

Cycleways

These may be completely separate paths dedicated for cyclists (they may also allow foot traffic) or they may be sections of a road with vehicular traffic or a footpath set aside for cyclists. In all cases, the cycle way must be clearly demarcated and separated from vehicular traffic by clear road markings as a minimum, but ideally by a physical barrier.

Cycle-friendly Crossings

These may or may not have cyclist crossing signals, however the ramps as well as the crossing itself should be constructed so that a cyclist may ride their bike safely from one side of the street to the other. This may include consideration for suitable construction of ramps and traffic islands, lighting, and avoiding placement of manholes and other trip hazards along the crossing.

Accessibility of Public Transport Amenities to Cyclists

To be considered 'accessible' to cyclists, public transport terminals such as bus stops or train stations should have either step free access to the boarding area /platform from access routes used by the cyclist. While a bus stop on a footpath that can be used by cyclists will comply, a ramp or lift large enough to accommodate a bicycle maybe required for a train station where the platform is above or below street level. In addition, the transport terminal should include secure and if possible covered cycle parking facilities and /or at least one of the public transport modes served by the terminal should allow cyclists to take their bicycles on board. Access to cycle parking should also be step-free.

Audit Documentation

Design Rating

Cycle Parking Facilities
Site Plan showing the location and number of cycle parking facilities. Specification showing the type of parking facility provided.
Access to Cycleways and Public Transport Network
Site plan or map showing distance from property to dedicated cycleway or cycle friendly road and location of any connected amenities.
Additional Amenities
Site plan or map where provided additional amenities are marked.

Built Rating

Cycle Parking Facilities
Site Plan showing the location and number of cycle parking facilities. Photograph of installed parking facilities
Access to Cycleways and Public Transport Network
Google Earth or other site plan or map showing distance from property to dedicated cycleway or cycle friendly road and location of any connected amenities
Additional Amenities
Site plan, photographs or map of provided additional amenities

Background

Cycling is now the fastest growing mode of transport in several cities and towns across New Zealand. Cycling is a convenient way to get around as well as a popular recreational activity with a range of environmental, health and social benefits. The importance of cycling for sustainable urban communities has been recognized resulting in a major growth of cycling infrastructure throughout New Zealand in recent years. The current Auckland Unitary Plan mandates cycle parking facilities for residential developments of 20 or more dwellings. It is expected that this will become common place elsewhere in New Zealand in the future.

References and Further Information

1. Cycle parking design guide, Greater Manchester Police
   http://designforsecurity.org/assets/downloads/Cycle_Parking.pdf

2. Benefits of Investing in Cycling, New Zealand Transport Agency
   http://nzta.govt.nz/walking-cycling-and-public-transport/cycling/benefits-of-investing-in-cycling/

INNOVATION

INN Innovation 10 Points

Aim

To recognise and encourage the uptake of building initiatives which significantly reduce the environmental impact of the dwelling.

Credit Criteria

Up to ten points are awarded at the discretion of the New Zealand Green Building Council (NZGBC), where it is demonstrated that, either:

(1)	A design feature, technology or strategy results in a quantified environmental benefit which significantly exceeds an existing Homestar benchmark (**INN – 1**).	Up to 10 points
OR		
(2)	A design feature, technology or strategy, which is not recognised under the existing Homestar benchmarks, provides a significant environmental benefit (**INN – 2**).	Up to 10 points

Data Entry

Use scorecard tab.

Assessment

More than one innovative feature, technology or strategy per project can be rewarded innovation points. The number of points awarded per innovation is dependent on the significance of the innovation, which is at the discretion of the NZGBC.

Each innovation will be assessed against the following criteria:

- The significance of the quantified environmental benefit.
- Whether the delivery of the innovation included investigative and/or experimental activities.

The NZGBC will not award innovation points unless it is demonstrated that the proposed environmental benefit is significant and realistic. The innovation must not have adverse effects on the resource use, environmental impact or health of the dwelling or occupants. Refer to the Innovations register available on the NZGBC website under Homestar.Innovations.

All innovations (as determined by the NZGBC) will be listed publicly on the Homestar website.

Project Limit of Innovations

Where a design feature, technology or strategy is awarded an innovation point, and the initiative is not currently recognised within Homestar, up to 100 projects will be eligible for an innovation point if they incorporate the same initiative.

Innovation Challenges

NZGBC will periodically publish Innovation Challenges that will address specific issues where NZGBC and industry have identified the potential or need for innovation. Innovation Challenges will also be issued to capture features that are outside the scope of the Homestar® tool but which are encouraged in residential developments. These will be published on the NZGBC website. Projects may target Innovation Challenges as long as they remain published.

Audit Documentation

Design and Built Rating

For all projects, to apply for an innovation
Completed Innovation Request Form (refer to NZGBC website).
Drawings/diagrams/photos and other supporting documentation as appropriate.
For all projects, with the assessment submission
Drawings/diagrams/photos and other documentation as outlined in the innovation award letter.

The Innovation Submission Template can be downloaded from the NZGBC website. Innovations should be submitted for approval prior to project submission, regardless of whether you are targeting a new innovation, an existing innovation challenge or a previously approved innovation.

If you are targeting an existing innovation challenge or a previously approved innovation, please state this clearly on the submission form and include the innovation number as per the summary on the NZGBC website. You may include multiple existing or previously approved innovations in one submission form. Make sure to include a short description of what is provided (if appropriate, including a drawing/ photo or specification extract to show what is included). You do not need to justify why it should get points as this is already established.

Include the response letter from the NZGBC in the project submission with the evidence specified on the innovation challenge summary, previously approved innovation summary, or the innovation response letter from the NZGBC.

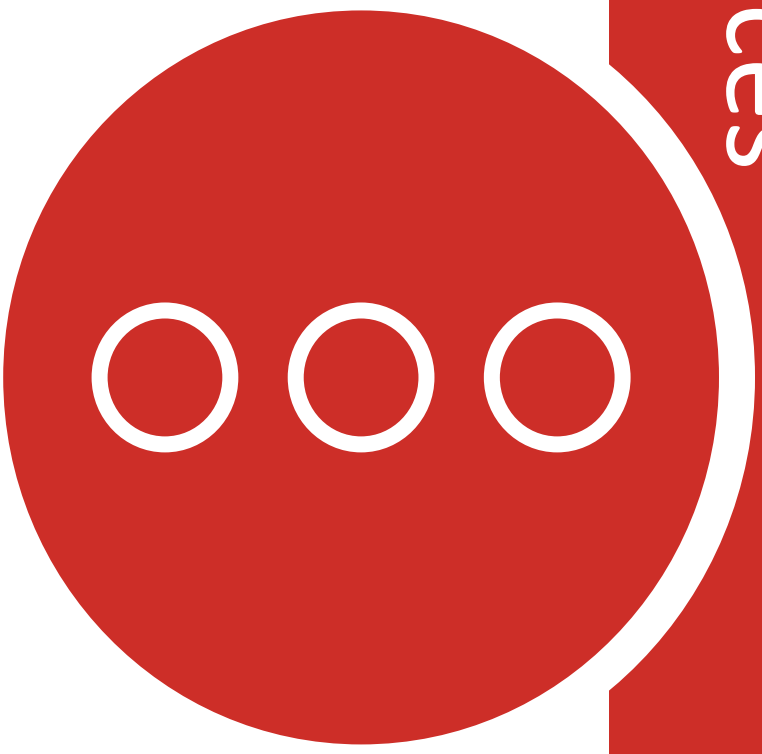
Background

The majority of benchmarks within the Homestar credits are stretch targets that are intended to raise the performance of the New Zealand residential sector. It is important that Homestar recognises and rewards those dwelling owners who include design features, technologies and strategies that exceed the highest relevant benchmark within Homestar. It is also important that Homestar encourages and rewards innovative design features, technologies and strategies that are not benchmarked within the existing framework. This innovation credit is included in Homestar to allow such recognition and expedite the awareness and uptake of new design features, technologies and strategies throughout the New Zealand residential sector.

References and Further Information

1. New Zealand Green Building Council
   www.nzgbc.org.nz

Appendices



Appendix A: Compiling a Submission

Audit Submission Guidelines

A good submission is the key to a successful Homestar audit process. The quality of the submission affects the Homestar auditor's ability to understand how the project meets the Credit Criteria in the Homestar Technical.

The following provides a brief summary of key issues to consider when compiling a submission.

Essential Components of a Submission

1. Requirements

- Please submit using Dropbox, a file transfer site, by sending a link to the submission to homestar@nzgbc.org.nz. Please name the submission with the Homestar code, assessment type, and audit round e.g. AKD123BR1. No hard copy is accepted.
- The appropriate template submission folder filing structure is available for download from the Assessor Resources page on the NZGBC website. Please file documentation within the appropriate credit/category folder.
- Please use high quality colour scanning to maintain coloured highlighting and legibility of small text/details on plans.
- Important note: the maximum size of each PDF file accepted is 10Mb.

2. Administration

Be sure to check the following before submitting:

- No invoices are outstanding
- No Technical Questions are outstanding (these should be submitted and assessed prior to full submission)
- You have read and followed the Submission Tips document within the template submission folder
- If you are submitting for a Built Rating, you have obtained the official addresses of each dwelling from the project owner and completed the Dwelling Registry in the submission folder.

Documentation Guidelines

The following provides specific guidance on the different types of documentation required in the Audit Documentation Requirements of the Homestar Technical Manual:

General

Submission for each credit includes all documentation stipulated in the Homestar Technical Manual i.e. does not indicate “information to follow”. Appendices for each credit may be included, but they must be included within the credit folder and be clearly referenced and highlighted.	☐
Credits claimed ‘NA’ (not applicable) include the required supporting documentation.	☐
All relevant communication with the NZGBC is included (e.g. Technical Questions relevant to the project) in the applicable credit folder.	☐
All inputs are consistent throughout the submission. Cross-check related credits are using the same values.	☐

Specifications

All specification extracts are easily identifiable as project related. Headers and footers are retained when extracting sections of specifications. If the header or footer does not reference the dwelling, Assessors are able to submit the cover sheet and contents page of the specification with each Credit.	☐
Assessors should be wary of labelling specifications as ‘Homestar Issue’ or similar as this implies that the specification has been specifically created for the Homestar submission and differs to the contractually binding specification that will be used in reality. Specifications should also not be in draft format.	☐
Relevant parts of the specification are highlighted to facilitate navigation.	☐

Reports, Letters, Contracts and Schedules

Only relevant sections of reports are submitted, and all relevant wording is highlighted.	☐
All reports, letters and contracts shall explicitly refer to the project and be on letterhead and/or signed where appropriate, in particular when they confirm a commitment.	☐
Ensure that a complete schedule of products (including the percentages where applicable) is provided where required e.g. MAT-1, MAT-2.	☐
All statements confirming compliance use wording directly from the Homestar Technical Manual for clarity.	☐
If the documented solution is complex or uncommon, diagrams and an explanation are provided to assist the assessment/audit.	☐

Drawings/Plans

Relevant elements of drawings shall be highlighted/clouded in colour to make it easier for the Auditors to find the relevant details, especially small items.	☐
All drawings and schematics must be clear, concise, scaled, and easily identified as official contractual documents for the specific project.	☐
All drawings and schematics shall have a title bar, date, revision date and be signed (if relevant).	☐
Design projects: Drawings are NOT in draft form (i.e. Preliminary, Homestar Submission Issue, For Information Only etc.). Construction Issue and Tender drawings are acceptable. Certified projects: Drawings are As Built (preferred) or For Construction (accepted).	☐
Please ensure that all plans are orientated correctly for viewing i.e. landscape or portrait as appropriate.	☐

Products and Materials

For products and materials that are demonstrating compliance through an eco-label, the certificate provided must be **current** and from an eco-label that is recognised for the targeted credit as listed on the NZGBC website.	☐
The relevant product must be highlighted on the certificate where the certificate rates more than one product. Product names certified should match the product names specified or an explanation should be provided.	☐

General Submission Guidance

- Please provide all of the audit documents requested in the Homestar Technical Manual e.g. if the Homestar Technical Manual requests three documents be submitted, then all three documents must be submitted for the points to be verified.
- Any variance from the credit and/or assessment criteria requires the submission of a Technical Question. The Technical Question form can be downloaded from the NZGBC website. Technical Questions must be processed before submittal for audit, not as part of the audit.
- Only submit documentation that is requested in the audit documentation i.e. submit only extracts from specifications but ensure that they are easily identifiable as related to the specific project and are contractually binding.
- Please submit a complete set of information for each Credit i.e. documentation required by more than one Credit should be submitted for each within each credit folder.

Consistency Throughout Your Submission

- Please ensure that area figures are consistent throughout the submission.
- All inputs shall be consistent throughout the submission

Beware of Common Mistakes

- It is very common for the correct type of documents to be submitted but they do not explicitly demonstrate what is required by the audit documentation. Please read the wording of the Homestar Technical Manual carefully and ensure that all requirements are met.
- Documents are often submitted without explicit reference to the subject dwelling and do not clearly demonstrate that they are contractually binding.
- When long documents are provided without the relevant information highlighted, auditors will request you highlight the relevant information and resubmit at Round 2.

Appendix B: Energy Modelling Protocol

Introduction

This document has been prepared to provide guidance for projects assessed under the Homestar rating tool who wish to undertake modelling as an alternative calculation approach to EHC-1 Whole House Thermal Comfort and/or EHC-2 Efficient Space Heating. The process of carrying out the modelling to contribute to these two credits, is described in this guide.

Modelling should be carried out by a trained and experienced professional and will be reviewed by the NZGBC during audit.

For Design Rated projects, the energy modelling does not have to be redone for the Built Rating if no changes have been to the building design or equipment since that submission. However, the original documentation for this credit must be included in the Homestar Built audit documentation for reference, and a signed document must be provided stating that no changes were made from design stage.

The model that is produced by these guidelines is intended to be used for determining compliance with Homestar EHC-1 and EHC-2 only. Actual running energy will depend on design decisions, construction factors, and homeowner behaviours.

Energy Modelling Protocol

Approach

Energy modelling should be carried out using the protocol described below. This report must clearly describe the modelling process for the building in accordance with the protocol, and include supporting documentation as described below.

Modelling must be undertaken for each individual dwelling unit; any adjacent units shall also be modelled for thermal effects in the case of attached dwellings.

Modelling Requirements

The following Table lists the input variables and the requirements and parameters for modelling. Also listed is the supporting data which must be provided with the report to demonstrate that the modelled building (as summarised in the energy modelling report) is the submitted documented design.

Variable	Variable Requirements	Documentation Required
Modelling Software	The software must be of the dynamic thermal modelling type or per ISO13790 with the ability to model thermal mass effects. AND Software must be able to either calculate ground temperatures from slab geometry or	Confirmation that the software meets either BESTEST or ANSI/ASHRAE Standard 140-2004 performance criteria or ISO 13790. Brief description of the software package, including thermal

	use ISO13370 to estimate ground impacts on heat loss. AND Must be capable of modelling representative building attributes, building elements. AND Must be capable of modelling all inputs described in this guide. AND Must have been validated to BESTEST AND/OR ANSI/ASHRAE Standard 140-2004 AND/OR ISO13798	calculation method. If building has slab on ground in conditioned space software must be able to either calculate ground temperatures from slab geometry and climate / ground data or use ISO13370 to estimate ground impacts on heat loss.
Weather File	Must be hourly or monthly weather data for the site based on either IWEC or NIWA climate region data. Where no IWEC weather file is available for the region this should be highlighted to the NZGBC during project registration. If the site differs from the weather station by more than 100m adjust temperatures by reducing them proportionally by 0.6°C for each 100m of altitude gain.	Hourly weather or processed monthly file used. Weather station location. If weather station is not site location justification as to how the weather file used is representative of the local climate for the building (to be checked by NZGBC during audit). Note 100m of altitude gain typically results in 0.6°C decrease in average temperature.
Site Orientation	The building must be modelled in the same orientation as shown on site plan drawings.	Relevant drawings showing building orientation. Details of how this was represented in the model.
Building Overshadowing	Include the effect of overshadowing from the surrounding environment.	Drawings showing elements of the surrounding environment causing overshadowing (buildings, trees), with heights marked. Details of how this was represented in the model.
Building Geometry	The model geometry must accurately represent the building geometry. It is good practice to use the exterior of the building thermal envelope as the surface to be used.	Plan and Elevation drawings Details of how this was represented in the model.
Thermal Bridges	For simplification if the exterior dimensions of the thermal envelope are used to calculate the energy consumption of the building and no thermally conductive (L>0.3 W/mK) elements penetrate the insulation layer, an allowance for thermal bridges of 5 kWh/m2 per year is to be added to the heating energy calculation based on the useful or Treated Floor Area(TFA). Alternately thermal bridges in excess of 0.01 W/mK can be modelled in a 2D heat transfer package and accounted for per ISO10211:2007.	Details of how this was represented in the model.
Modelled Spaces	Must account for the entire conditioned	Details of the modelled

	space in the dwelling unit. Surfaces adjacent to conditioned spaces outside the unit can be modelled as adiabatic or not included in the model; surfaces adjacent to unconditioned spaces benefit can be taken into account per ISO6496 calculator for unconditioned spaces, or the unconditioned space can be modelled.	(conditioned) building area and zoning also describing the dwelling's conditioned area.
Building Thermal Envelope and Construction	The model must reflect the constructions of the building. Include any floor coverings. Account for thermal mass where it is exposed to the zone. Where any simplifications have been made provide details of these and justification. Timber framing must use 22% timber fraction for 600mm spacing of studs and 25% for 400mm spacing unless framing is designed to reduce timber content and verification is provided.	Drawings, materials schedule or specification extracts showing all thermal envelope materials and location. Calculations of overall R-values for constructions. Details of how the building thermal envelope has been modelled.
External Surface Solar Reflectance	Use 0.3 as solar reflectance or Exterior absorptivity of 0.7 or optionally as specified.	How solar reflectance has been obtained for each surface material Details of how this was represented in the model.
Windows, Glazed Doors and Skylights	The model must accurately reflect the glass and frame area of the building. If non-rectangular windows are specified, they may be changed to rectangles provided the glass area is kept constant. The opening area of windows should also be entered into the model, where applicable.	Elevation drawings showing all glazing to the above grade perimeter external wall area. These must include sufficient detail to show opening area. Details of how this was represented in the model.
Glazing and Skylight G-value	Glass supplier's data sheet with g-value or (centre of glass) SHGC (or Shading Coefficient converted to g-value using g-value=0.87*SC)	Materials schedule or specification extracts listing glazing Shading Coefficient, Solar Heat Gain Coefficient or Solar Factor and the resulting glazing G-value Details of how this was represented in the model.
Natural Ventilation Openings	During the cooling season, openable windows and doors that can be fixed open must be modelled in a simplified manner as 2 ACH (24/7) if single sided ventilation or 4 ACH (24/7) if more than 30% of openable area is on an opposite or adjacent façade or on a different floor (of the same dwelling).	Specification extracts listing window opening sizes and control mechanism. Details of how this was represented in the model.
Fixed Shading	The model must accurately reflect the building shading.	Relevant drawings showing all fixed external shading devices. Details of how this was represented in the model.
Conditioned Spaces	Heating and Cooling to all spaces inside the thermal envelope. Buildings that exceed 25°C for more than 10% of annual hours (876 hours per year) must be modelled with active cooling and model it's	Floorplan showing thermal envelope. The entire conditioned space is assumed to be heated and/or cooled.

	usage to maintain the building below 25°C at all times. Auto-sizing of AC or heat pump is permitted if they have an inverter compressor.	
Design Space Temperature	Heating – 20°C Cooling – 25°C. Note this matches the Heating Energy definition in the H1 Acceptable Solution / Verification Method by MBIE 2017 version.	Details of how this was represented in the model.
Heating and Cooling Operating Schedule	24 hours per day, 7 days per week Cooling can be reduced or eliminated by use of passive cooling, see natural ventilation section for documentation requirements.	Details of how this was represented in the model.
General Infiltration	If measured air leakage is to be used is should be tested per ISO 9972 Method 2. The measured air leakage via a blower door at 50Pa can be converted to a general infiltration rate by dividing by 20. For example, this means that a building measured at 6 ACH at 50Pa would have general infiltration of 0f 0.3 ACH throughout the year. Note that although the 1/20th rule is an estimate it is accepted as a reasonable approximation internationally. Buildings not subject to air leakage testing should be assumed to have a general infiltration rate of 0.3 ACH.	Details of how this was represented in the model.
Chimney Infiltration	Open chimneys are not permitted in Homestar rated homes in Version 4.	
Metal Flued Heater Infiltration	Include airflow for infiltration from metal flued heaters. None/1/2/3/4 flued heaters to be considered as 0/20/40/60 m3/hr of infiltration continuously. For simplification the infiltration can be modelled by conversion to an air change rate, to be included with the infiltration rate.	Details of how this was represented in the model.
Passive Vents or Trickle Vents in Windows,	Model these explicitly as openings in the façade if they exist.	Specification extracts listing opening sizes and control mechanisms. Details of how this was represented in the model.
Bathroom Exhaust	For simplification the exhaust can be modelled by conversion to an air change rate, to be included with the infiltration rate. For intermittent operation model fan operation using 17% of the measured or specified fan air flow rate continuously (i.e.8760 hours per year). For continuous extract model the design/ commissioned flow rate.	Documentation of fan flow rates if actual data is used. Details of how this was represented in the model.
Kitchen Exhaust	For simplification the exhaust can be modelled by conversion to an air change rate, to be included with the infiltration rate. For intermittent operation model using 4% of	Documentation of fan flow rates if actual data is used. Details of how this was represented in the model.

	the measured or specified fan air flow rate continuously (i.e.8760 hours per year). For continuous extract model the design/ commissioned flow rate.	
Mechanical Supply Ventilation	Where mechanical ventilation has been provided, e.g. through a central supply air system to an apartment building, model this air rate and supply temperature. Used commissioned data if available.	Specifications showing air rate supplied. Details of how this was represented in the model.
MVHR	Where balanced mechanical ventilation with heat (or enthalpy) recovery has been installed model the typical flow rate and manufacturer supplied efficiency. Include fan power measured at commissioning if available.	Specifications showing heat (or enthalpy) recovery efficiency. Unit must be installed indoors unless manufacturer has provided efficiencies with outdoor install. Commissioning data including fan power measured if available. Ventilation design diagram showing air distribution through the dwelling with supply/extract locations and flow rates planned.
Internal Loads (Plug, Lighting and Occupancy)	For dwellings with internal floor area: • less than 25m^2 use IHG=4.1 W/m^2 as a constant internal load; • more than 25m^2 use IHG= (2.1 W/m^2xInternal Floor Area+50 W)/(Internal Floor Area in m^2). For multi-unit dwellings the formula may be applied across the building as a whole rather than each individual dwelling.	Details of how this was represented in the model.

Table 25:Energy Modelling Protocol

Appendix C: ALF and Schedule Method Guidance

Thermal Envelope and Calculating R-Values

Thermal envelope

When following the calculation method, **only the thermal envelope of the house needs to be considered.** This is the division between the outside (i.e. unconditioned and uninsulated) area of the house and the inside (i.e. conditioned and usually insulated) area of the house. This division is shown below in Figure 6 by the blue line, which follows the insulation in the ceiling (sloping for skillion roof) and along the concrete slab on ground (whether the slab is insulated or not). If there is no insulation - for example in the walls - the thermal envelope defaults to the line between the inside and outside of the house.

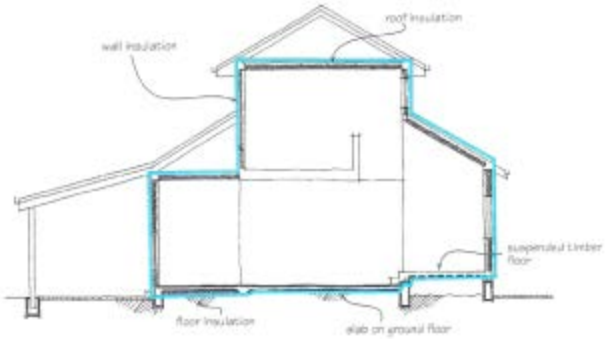


Figure 6: division between outside and inside of house

Measuring the Thermal Envelope

Roof

In line with NZBC H1, roof area is measured internally; do not consider the area of soffits.

- Trussed roof with a horizontal ceiling - the plan view area of ceiling over conditioned space can be used.
- Skillion or sloping roof - the area of the sloped section should be used.

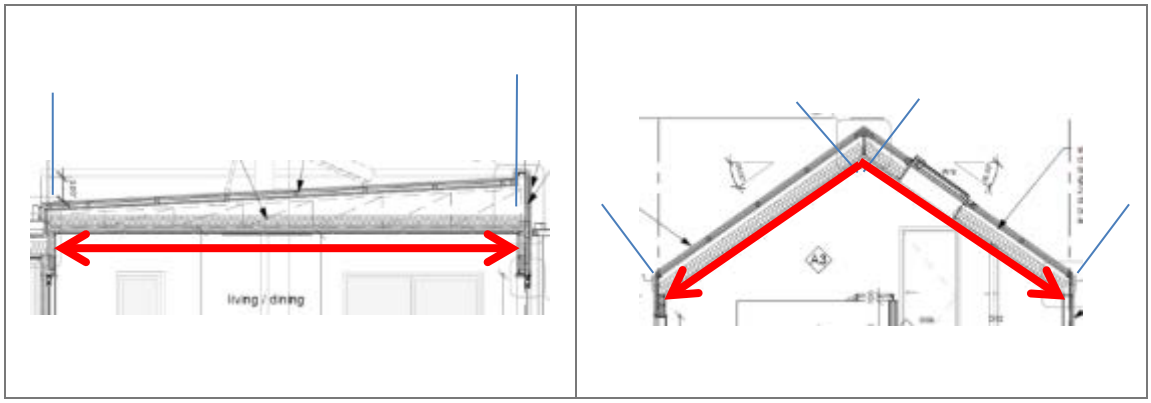


Figure 7: Measuring roof area

Walls

Wall length and height is measured internally (internal wall to internal wall, floor to ceiling).

- Wall lengths can be combined for each orientation.
- If the wall construction type is not available from the drop down, choose the custom option from the drop down and enter its construction system R value in the appropriate column.
- Custom R values should be built up from either www.design-navigator.co.nz or by using the BRANZ *House Insulation Guide*.
- For attached dwellings if there is a cavity between the wall of the dwelling being assessed and that of the adjoining dwelling, then the wall needs to be treated as an external wall.
- For dwellings with exposed concrete or masonry walls with insulation on the exterior, the project may choose to include the thickness of the concrete or masonry component of these walls within the thermal envelope (and thus in the conditioned area). This is due to the heat regulating effects of thermal mass contained within concrete and masonry walls which may be included as a design feature. Note that in this case the masonry/ concrete section must be excluded when calculating the overall wall construction R-value (refer to EHC-6). In all other cases, the thermal envelope is at the internal edge of the external wall.

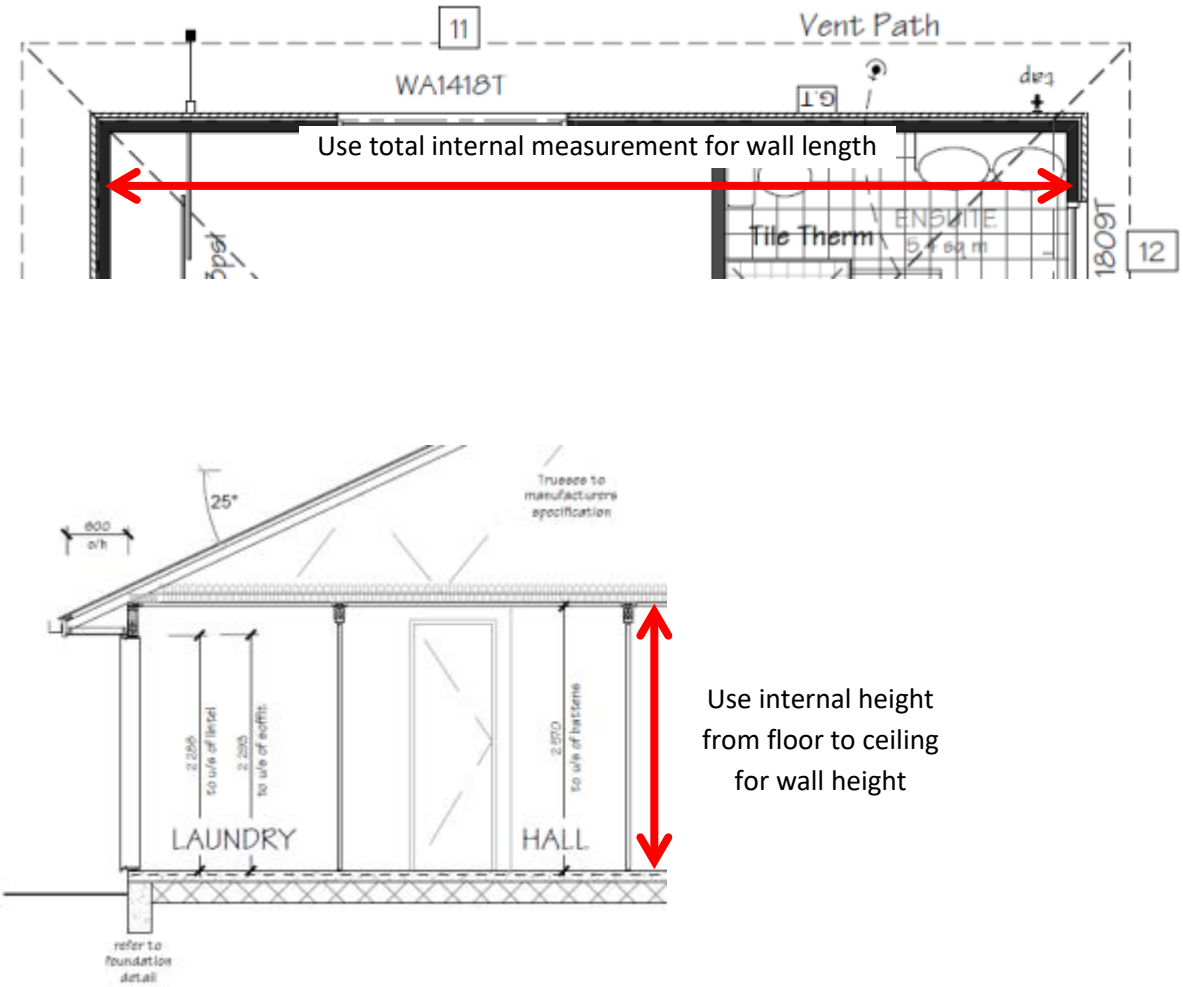


Figure 8: Measuring wall length and height

Windows

Glazing size is measured using the total dimensions of the window frame.

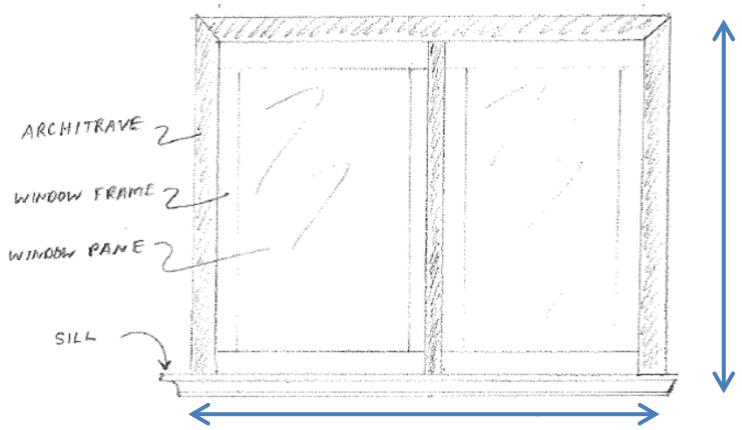


Figure 9: measuring glazing size

Floor

All floors measured as the conditioned area minus the thickness of the external walls.

Calculating R-Values

Slab

For solid concrete slabs, ALF or the excel calculator can be used to calculate the R-value OR use method for waffle pods below. If the core is air-filled, treat as if solid concrete.

For waffle pod slabs with solid polystyrene cores, select the custom R value option and then use either:

(i) The BRANZ House Insulation Guide (5th Ed.) R values table OR
(ii) NZS 4214: 2006

See Appendix D for guidance on calculating with garages or similar unconditioned spaces.

Suspended Timber and Other Floors

When analysing suspended timber or other floors consider the height at which the floor sits above ground. When measuring perimeter heights:

- For suspended timber floors, use the average height of the wall around the subfloor (i.e. crawl space) above the natural (or when finished) ground level.
- For pole houses, enter the average natural (or when finished) ground level height if there is no actual wall around the perimeter.
- In cases where part or all of the house on the ground floor is an unconditioned space such as a garage or store room, the upstairs floor above this space become part of the floor of the thermal envelope and in this case use the height of the floor below (including any ceiling space) as perimeter height.

Walls

Wall length is measured internally (floor to ceiling).

- Wall lengths can be combined for each orientation
- If the wall construction type is not available from the drop down, choose the custom option from the drop down and enter its construction system R value in the appropriate column.
- Custom R-values should be built up from either www.design-navigator.co.nz or by using the BRANZ *House Insulation Guide*.
- For attached dwellings if there is a cavity between the wall of the dwelling being assessed and that of the adjoining dwelling then the wall needs to be treated as an external wall.

ALF Protocol

The following guidance is to be used for the following areas when using ALF **instead of** that which is provided in the ALF help file.

Climate

Select 24-hour heating at 20°C.

Slab on Ground

In the **overall** section, enter the total slab area (not just conditioned slab area).

Walls and Windows

Window Shading: Shading describes the external shading of the window by eaves, plants or other obstacles. Orientation of the window is already factored in the tool and, as such should not be considered when determining shading.

Use the following table to determine shading for ALF:

ALF window shading selection	Description
A lot	Window is shaded for a large portion of the day; approximately 70% shaded.
Some	Window is partially shaded; approximately 50% shaded.
A little	Window is minimally shaded such as from eaves; approximately 30% shaded.
None	Window is not shaded at all; less than 30% shaded.

Mass

Do not enter any thermal mass for either floors or walls in this section.

Ventilation

Windows Cracked Open: select none

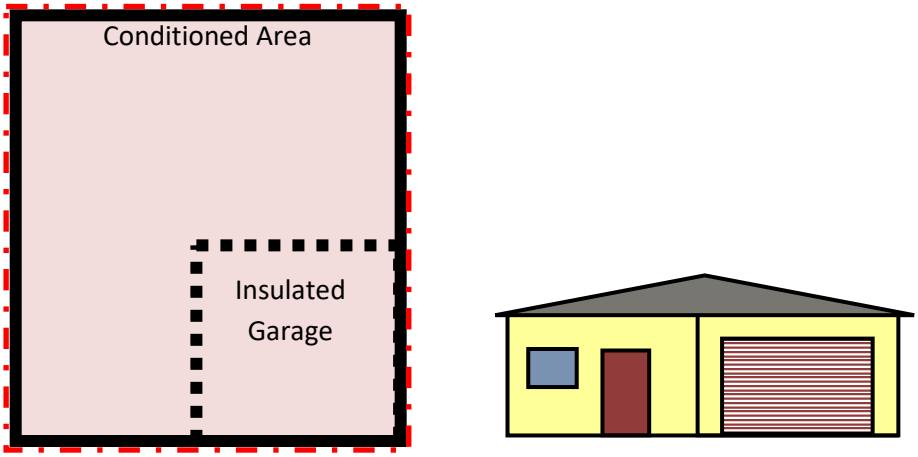
Retrofit Airtightening: select none

Appendix D: Garages and Unconditioned Spaces

Garages and Similar Unconditioned Spaces

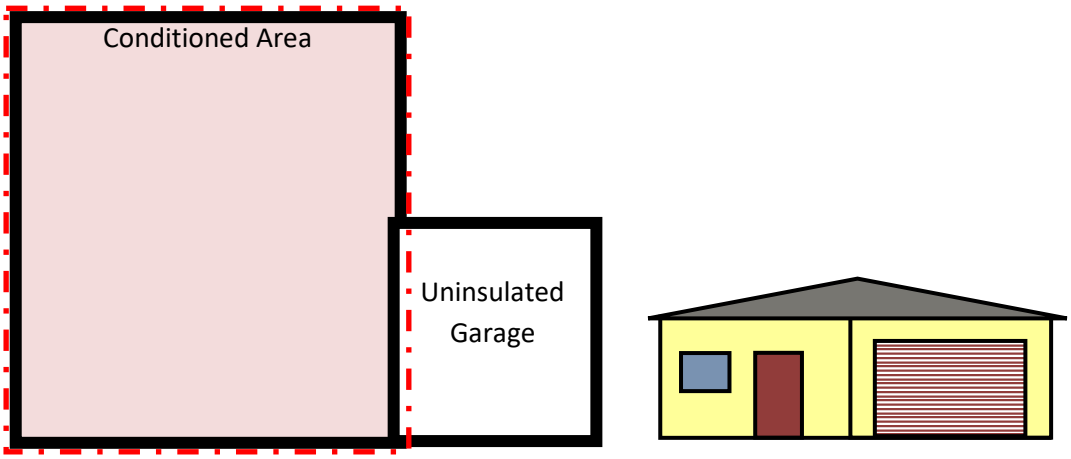
The below scenarios are for garages and similar unconditioned spaces. A garage or an outbuilding (such as a shed) may be built adjacent to the 'conditioned' part of the house, or such a space may occupy either part or all of the ground floor with a 'conditioned' floor above. These spaces may or may not be insulated. The below section outlines possible scenarios for these spaces, and how to treat them:

Scenario 1: Insulated house with attached fully insulated garage



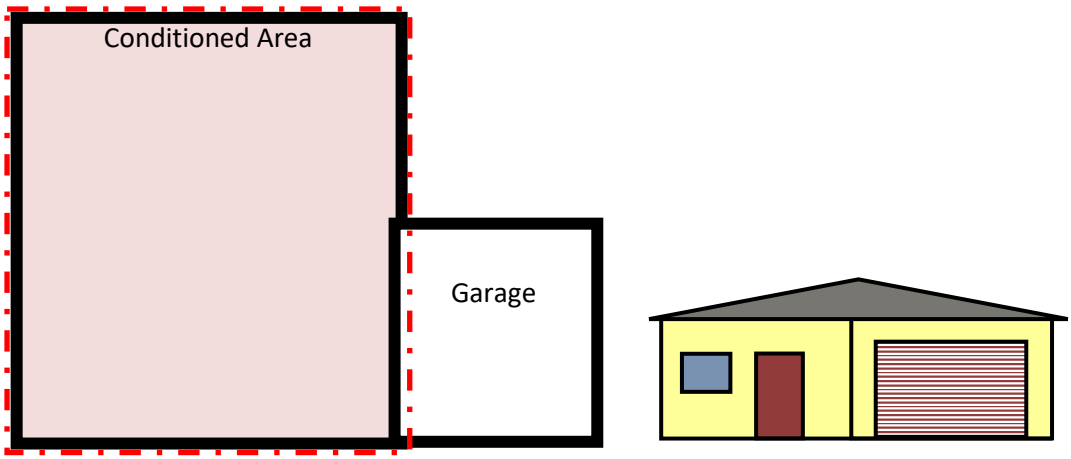
Applies to	Standalone and terraced houses.
Area for R –Value Calculation	Area of whole house including garage.
Perimeter	Perimeter of the house includes the perimeter around garage. For terraced houses see scenario 6
Other Considerations	Conditioned area can either include or exclude the garage but must be consistent with the figure entered into calculator for DRE calculation.

Scenario 2: Dwelling with attached uninsulated garage; no thermal break in the floor between conditioned and unconditioned spaces



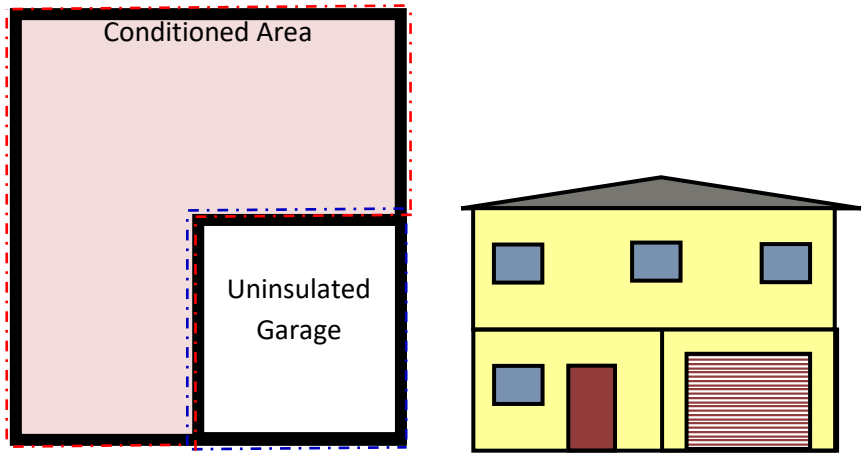
Applies to	Standalone and terraced houses.
Area for R –Value Calculation	Area of house excluding garage. R Value Calculation If there is no floor edge insulation, then R-value is the R value of the uninsulated floor. If there is edge insulation, the effective R-value to be used is the average of the R values of the floor with edge insulation ($R_{insulated}$) and without edge insulation ($R_{uninsulated}$). * Calculate the total perimeter (P) as described below and length along the perimeter that has edge insulation (P_{edge}), and the effective R value is found using: $R_{effective} = R_{insulated} \times \frac{P_{edge}}{P} + R_{uninsulated} \times \frac{P - P_{edge}}{P}$
Perimeter	Perimeter of the house excludes the perimeter around garage but includes the length of wall between the garage and the conditioned part of the house (dotted red line). For terraced houses, perimeter excludes common walls with other conditioned spaces
Other Considerations	* For EHC-7: Moisture Control, the R-value used should be ($R_{uninsulated}$).

Scenario 3: Dwelling with attached garage; thermal break in the floor between conditioned and unconditioned spaces



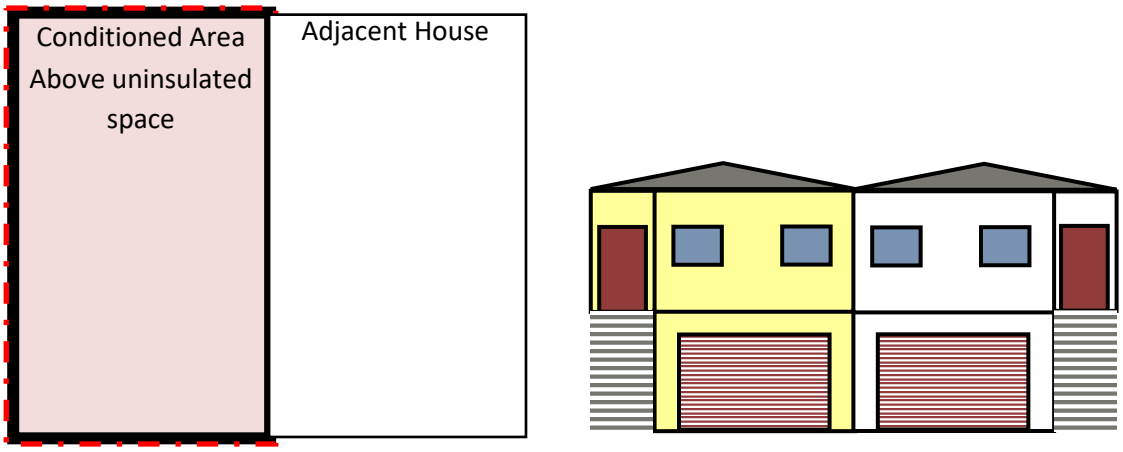
Applies to	Standalone and terraced houses.
Area for R –Value Calculation	Conditioned slab area only - exclude garage. As there is a thermal break in the floor, simply consider the house as if there is no garage or other attached area; treat the thermal break as edge insulation along the boundary with the garage.
Perimeter	Perimeter of the house excludes the perimeter around garage but includes the length of wall between the garage and the conditioned part of the house (dotted red line). For terraced houses, perimeter excludes common walls with other conditioned spaces.
Other Considerations	If the garage is insulated, the conditioned area can either include or exclude the garage but must be consistent with the RAF calculation.

Scenario 4: Dwelling with uninsulated garage occupying part of ground floor



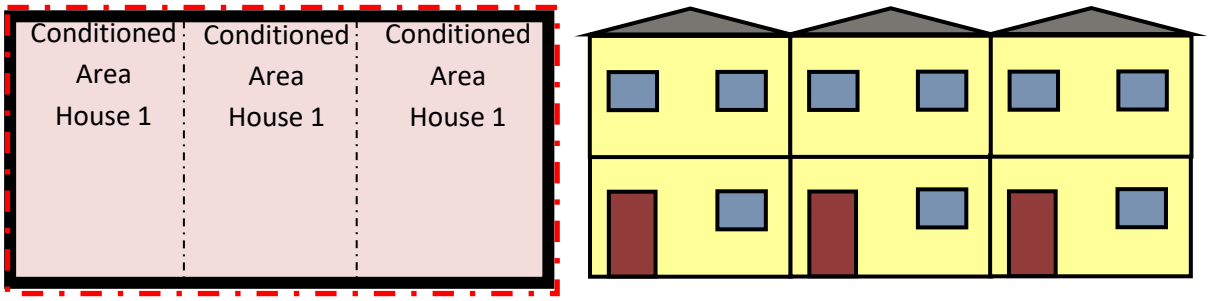
Applies to	Standalone and terraced houses.
Area for R –Value Calculation	Slab area: no thermal break – see scenario 2 thermal break – see scenario 3 Suspended floor area: only floor area above unconditioned space
Perimeter	Slab perimeter: excludes the garage but includes the length of wall between the garage and the conditioned part of the house (dotted red line). Suspended floor perimeter: perimeter of area above unconditioned space. For terraced houses, perimeter excludes the common walls with other conditioned spaces.
Other Considerations	NA

Scenario 5: Dwelling with conditioned space fully on suspended floor with open space or uninsulated garage, carport or other space underneath occupying the entire ground level



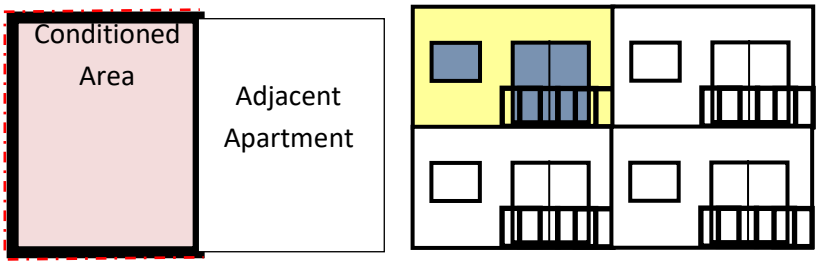
Applies to	Terraced houses and apartments
Area for R –Value Calculation	Conditioned space only – suspended floor.
Perimeter	Perimeter of the house is the entire perimeter of the suspended floor (dotted red line). For terraced houses and apartments, the perimeter excludes common walls with other conditioned spaces.
Other Considerations	The perimeter height is equal to the height from the floor below including any ceiling cavity height.

Scenario 6: Ground floor apartment or house with no unconditioned space sharing the slab



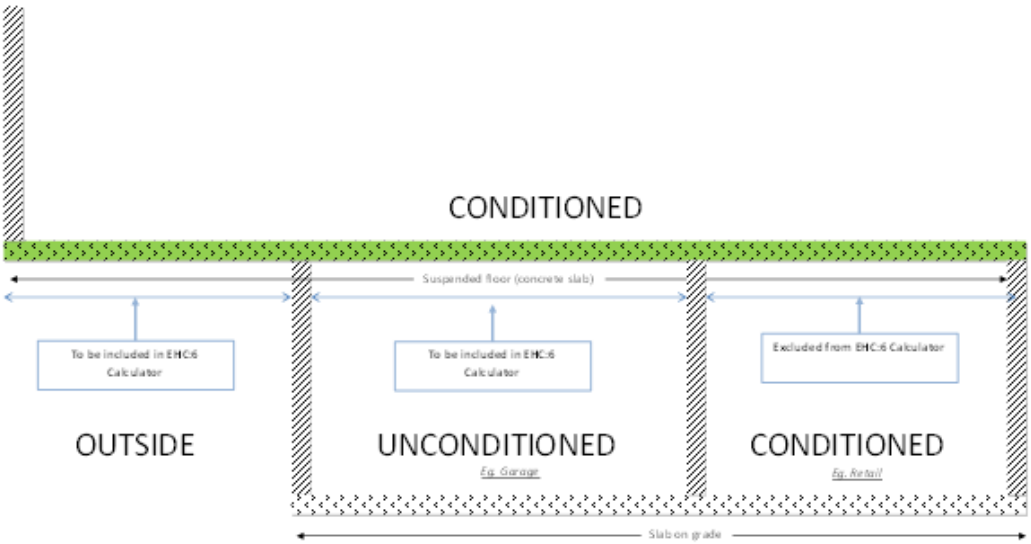
Applies to	Terraced houses and apartments.
Area for R –Value Calculation	Total slab approach: if multiple dwellings share one slab and no uninsulated space is present, then take R-value of total slab and apply to each dwelling.
Perimeter	Total slab approach: perimeter of total slab (dotted red line)
Other Considerations	NA

Scenario 7: Upstairs apartment



Applies to	Apartments
Area for R –Value Calculation	If downstairs space below is conditioned, then use maximum R value of 5 under the custom approach in ALF. To calculate downstairs apartment, refer scenario 6.
Perimeter	Perimeter is the sum of boundaries not adjoining other insulated spaces. Not required for R-value calculation if custom approach is used (dotted red line).
Other Considerations	NA

Scenario 8: Cantilevered floor slab



Applies to	Apartments
Area for R –Value Calculation	Area of floor (slab) above open space and /or enclosed unconditioned paces
Perimeter	Perimeter is the perimeter of the floor excluding any sections shared with floors below other conditioned spaces
Other Considerations	If this “exposed” floor area is not insulated on edge and underneath, then then the possibility of the R-values of adjacent floor sections being derated due to thermal bridging should be considered

Appendix E: Area Weighted Heat Loss Calculation Method Guide

Establishing Eligibility

Standalone: The total glazing area is 50% or less of the total wall area, and the combined area of glazing on the east, south, and west facing walls is 50% or less of the combined total area of these walls.

Terraces and Apartments: The total glazing area is 50% or less of the total floor area

Calculation

The area weighed heat loss calculation is based on NZS4218:2009 section 4.2, however there are several key differences as outlined in following sections. The assessor or designer may use the guidance in this appendix to set up and carryout this calculation. However, note that NZGBC has made freely available an Excel calculator that can be downloaded from the Homestar assessor resources section of the NZGBC website. In addition, the H1 Calculator within the Design Navigator website, has a Homestar compliance section which may be used.

Proposed dwelling

The proposed dwelling element R-values may be determined using NZS4214:2006. Alternatively, these may be obtained from the BRANZ House Insulation Guide or (online) Design Navigator. When determining floor R-values refer to Appendix D to determine the applicable area/perimeter definition. Calculate heat loss of each element by dividing its area by its R-value and sum to obtain total heat loss.

Note that terraces and apartments are analysed as individual dwellings rather than a whole building.

Intertenancy walls can be assumed to have no heat loss (i.e. they are adiabatic) if they are:

- fully filled with insulation or are solid concrete/masonry with no air gaps

OR

- have an unvented (edge sealed) air gap and the perimeter of the air gap is fully filled with insulation

However, in other cases where intertenancy walls include an air gap, they should be assumed to have an effective construction R-value of:

- R2 where ventilated

OR

- R5 where effectively edge-sealed (but not insulated)

Reference dwelling

The reference building R-values are obtained for the appropriate climate zone from table 1 if targeting a 6 Homestar rating or table 2 if targeting a 7 Homestar rating, except for intertenancy walls.

Intertenancy walls can be assumed to have no heat loss in the reference building if the actual building has adiabatic intertenancy walls as described above. In other cases (there is a vented or unvented airgap and no perimeter insulation), the reference building intertenancy walls should be assumed to have an effective construction R-value of R5.

Use the following table to determine how to calculate the building element areas of the reference dwelling. Note that with the exception of intertenancy walls, the table refers to elements exposed to the outside environment only (i.e. no internal walls, floors or ceilings).

Building Element	Standalone	Terraces and Apartments
Floor area	Conditioned floor area of proposed dwelling	Conditioned floor area of proposed dwelling
Roof area	Total roof/ceiling area of proposed dwelling including area of any skylights	Total roof/ceiling area of proposed dwelling including area of any skylights
Total wall (façade) area	Total area of external walls and glazing of the proposed dwelling	Total area of external walls and glazing of the proposed dwelling
Glazing area	30% of total wall area	30% of floor area
Wall area	70% of total wall area	Total wall area minus 30% of floor area. If 30% of floor area > total wall area, the latter is 0
Intertenancy walls	N/A	Same as proposed dwelling

Divide each element area by its corresponding reference R-value to obtain heat loss for that element, then sum to obtain total heat loss for the reference dwelling. Compliance is achieved if the proposed dwelling heat loss is no more than the reference dwelling heat loss.

Intertenancy wall cavity examples

For an intertenancy wall cavity to be considered unvented it needs to be edge sealed along the floor, wall and ceiling (if the ceiling is vented), except for small gaps to allow drainage of any collected water. If all these conditions are not met it would be considered a vented cavity. If there is a situation where this may be unclear, please submit a Technical Question to NZGBC.

The following examples show how a cavity would be edge-sealed or not.

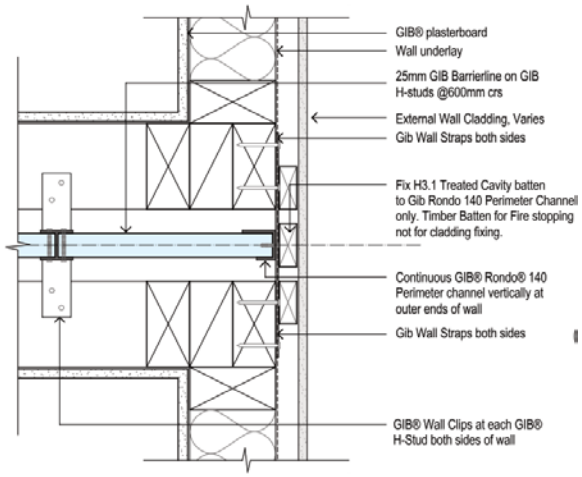


Figure 10: Intertenancy wall with cavity, edge-sealed at wall due to building paper, no edge insulation

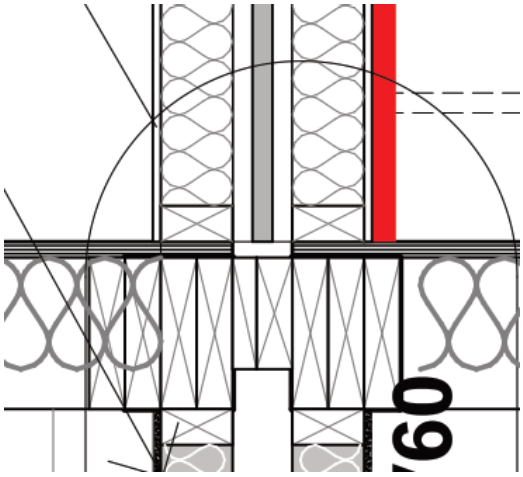


Figure 11: Intertenancy wall with cavity, edge-sealed at floor

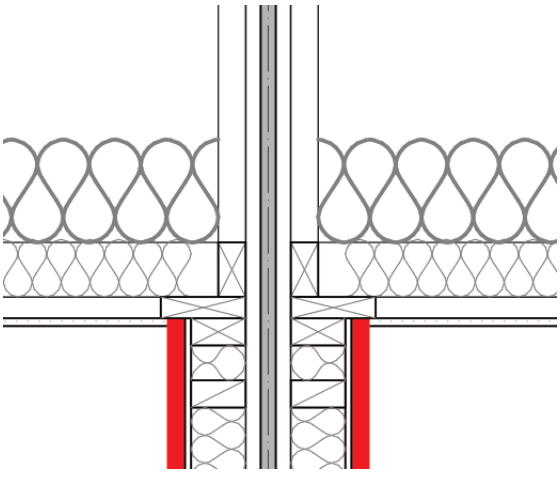


Figure 12: Intertenancy wall with cavity, vented into ceiling, which in turn would be vented to outside

Appendix F: Table of Tables