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CIVIL ▲ STRUCTURAL ▲ FOUNDATION

Sawrey Consulting Engineers
Document No: 43405_1
Project: 9755

McKenzie Baths
79 Udy Street Petone, Lower Hutt
Initial Seismic Assessment (ISA) of facility building

for

Hutt City Council

Prepared by: Structural Engineer

Reviewed by: Structural Engineer

Date: 18 December 2019
Revision: 1

ENGINEERING YOUR TOMORROW TODAY

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Client: **Stephen Keatley – Strategic Assets & Project Manager, HCC**
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1 Executive Summary

Hutt City Council has engaged Sawrey Consulting Engineers Ltd to assess the seismic performance of the McKenzie Baths facility building. We propose to carry out an ISA (Initial Seismic Assessment) of the building.

The Initial Seismic Assessment (ISA) procedure is described in Part B of the guideline document, *The Seismic Assessment of Existing Buildings - Technical Guidelines for Engineering Assessments*, *July 2017*. The assessment was carried out after reviewing the original structural drawings and completing a site visit on Thursday 5 December 2019. The assessed potential earthquake rating is 50%NBS (IL2), which gives it a seismic 'Grade C' potential earthquake risk.

2 Introduction

The Earthquake Prone Building (EPB) methodology is used to identify earthquake-prone buildings, and has been produced by the Ministry of Business, Innovation and Employment in accordance with the Building Act 2004. This ISA meets the requirements of an engineering assessment as prescribed in the EPB methodology.

The ISA is considered to provide a relatively quick, high-level and qualitative measure of the building's performance. A more reliable result will be obtained from a Detailed Seismic Assessment (DSA). A DSA could find structural aspects of concern that have not been identified from the ISA. Alternatively, a detailed structural assessment may show that structural aspects of potential concern identified in this ISA may have in fact been addressed in the design of the building.

3 Background to the ISA and Its Limitations

The ISA procedure was developed in 2006 by the New Zealand Society for Earthquake Engineering (NZSEE) and updated in 2017 as a result of experience from the Canterbury earthquakes of 2010/11. It is a tool to assign a percentage of New Building Standard (%NBS) rating and associated grade to a building as part of an Initial Seismic Assessment of existing buildings.

The ISA enables building owners and managers to review their building stock as part of an overall risk management process.

Characteristics and limitations of the ISA include:

- An ISA assessment is primarily concerned with life safety. It does not consider the susceptibility of the building to damage, and therefore to economic losses.
- It tends to be somewhat conservative, identifying some buildings as earthquake prone, or having a lower %NBS score, with subsequent detailed investigation may indicate is less than actual performance. However, there will be exceptions, particularly when potential critical structural weaknesses (CSWs) are present that have not been recognised from the level of investigation employed.

- An ISA can be undertaken with variable levels of available information: e.g. exterior only inspection, structural drawings available or not, interior inspection, etc. The more information available, the more representative the ISA result is likely to be. The ISA records the information that has formed the basis of the assessment and consideration of this is important when determining the likely reliability of the result.

- It is an initial, first-stage review. Buildings or specific issues which the ISA process flags as being problematic or as potentially critical structural weaknesses need further detailed investigation and evaluation. A Detailed Seismic Assessment is recommended if the seismic status of a building is critical to any decision making.

- The ISA assumes that buildings have been designed and built in accordance with the building standard and good practice current at the time. In some instances, a building may include design features ahead of its time, leading to better than predicted performance. Conversely, some unidentified design or construction issues not picked up by the ISA process may result in the building performing not as well as predicted.

- It is a largely qualitative process and should be undertaken or overseen by an experienced engineer. It involves considerable knowledge of the earthquake behaviour of buildings, and judgement as to key attributes and their effect on building performance. Consequently, it is possible that the %NBS derived for a building by independent experienced engineers may differ.

- An ISA may over-penalise some apparently critical features which could have been satisfactorily taken into account in the design.

- An ISA does not take into account the seismic performance of non-structural items such as ceilings, plant, services or general glazing that are not considered to present a significant life safety hazard.

The ISA is a useful tool to identify potential issues and expected overall performance of a building in an earthquake. However, the process and the associated %NBS rating and grade should be considered as only providing an indication of the building's compliance with current code requirements. A detailed investigation and analysis of the building will typically be required to provide a definitive assessment.

This ISA has been based on a review of drawings and an inspection of both the interior and exterior of the building and can be considered to be a comprehensive assessment at the ISA level. The rating determined is greater than or equal to 34%NBS and therefore, if approved by the TA, the building should not be considered as earthquake prone.

4 Building information

Table 1. Building Information	
Building Name/ Description	McKenzie Baths Petone. Facility building.
Street Address	79 Udy Street, Petone, Lower Hutt
Territorial Authority	Hutt City Council
No. of Storeys	Single storey
Area of Typical Floor (approx.)	Approximately 280m2 (29.8m x 9.5m)
Year of Design (approx.)	1964 – with a major renovation in 2012
NZ Standards designed to	NZSS 95:1955 Model Building Bylaw
Structural System including Foundations	Light weight timber truss roof with reinforced concrete 2-way frame and reinforced concrete masonry infill walls with shallow concrete foundations with slab on grade.
Does the building comprise a shared structural form or shares structural elements with any other adjacent titles?	No
Key features of ground profile and identified geohazards	The site is generally flat and has a Moderate/High Liquefaction potential. Source: 'Combined earthquake hazard map – Hutt Valley GWRC.
Previous strengthening and/ or significant alteration	There are no signs of previous strengthening. The building had a refurbishment in 2012.
Heritage Issues/ Status	Not a heritage listed building. Source: HCC District Plan 14F.
Other Relevant Information	Original structural drawings etc were not sighted. Comment was passed on site that the building was initially designed to be 2-storey. However, there are no calculations/ drawings/ design statements available indicating this.

5 Assessment information

Table 2. Assessment Information	
Consulting Practice	Sawrey Consulting Engineers Ltd
CPEng Responsible, including: • Name • CPEng number • A statement of suitable skills and experience in the seismic assessment of existing buildings	Professional Structural Engineer since 1980 with 30+ years of experience in the seismic assessment of existing buildings. Attendance at seismic assessment seminars over this time including the most recent series. Assessment of earthquake damaged buildings in Canterbury and Wellington.
Documentation reviewed, including: • date/ version of drawings/ calculations • previous seismic assessments	Documentation obtained from Hutt City Council website: • Original architectural drawings by Porter and Martin 1964. • McKenzie Pool Redevelopment by LHT Design 2012. No previous seismic assessments available.
Geotechnical Report(s)	No reports found/provided.
Date(s) Building Inspected and extent of inspection	Thursday 5 December 2019. External and internal inspection.
Description of any structural testing undertaken and results summary	None
Previous Assessment Reports	No reports found/provided.
Other Relevant Information	Changes were made in 2012 to the internal reinforced concrete masonry walls, and the building was extended slightly to the west.

6 Summary of Engineering Assessment Methodology and Key Parameters Used

Table 3. Summary of Engineering Assessment Methodology and Key Parameters Used	
Occupancy Type(s) and Importance Level	Public building considered as IL2
Site Subsoil Class	The Proceedings of the Ninth Pacific Conference on Earthquake Engineering,14-16 April 2011, "NZS 1170.5:2004 site subsoil classification of Lower Hutt" D. Boon, N.D. Perrin, G.D. Dellow & R. Van Dissen indicate a Site Subsoil Class of "D/E".
<u>For an ISA:</u>	
Summary of how Part B was applied, including: • Key parameters such as μ, S_p and F factors • Any supplementary specific calculations	A ductility of 2.00 is assumed for the reinforced concrete 2-way frame. An Sp factor of 0.70 was used as per Part B of the guidelines, BA.2 – Structural performance factor. The F factor used was F = 2.50. Supplementary calculations were not considered necessary for this building.
Other Relevant Information	None

7 Assessment Outcomes

Table 4. Assessment Outcomes		
Assessment Status (Draft or Final)	Final	
Assessed *%NBS* Rating	50%NBS	
Seismic Grade and Relative Risk (from Table A3.1)	34-66%NBS Alpha Rating: C Approx. risk relative to a new building: 5-10 Times Greater Life-safety risk description: Medium risk	
For an ISA:		
Describe the Potential Critical Structural Weaknesses	The CSW's for an ISA are any aspect of the building that scores less than 100%NBS, in this case it relates to the concrete masonry block walls out-of-plane.	
Does the result reflect the building's expected behaviour, or is more information/ analysis required?	The %NBS result does reflect the expected building behaviour. However, we recommend that further assessment is carried out for the concrete masonry block walls out-of-plane.	
If the results of this ISA are being used for earthquake prone decision purposes, and elements rating <34*%NBS* have been identified:	**Engineering Statement of Structural Weaknesses and Location** The main CSW is the reinforced concrete masonry block walls out-of-plane.	***Mode of Failure and Physical Consequence*** **Statement(s)** Reinforced concrete masonry block walls out-of-plane.
Recommendations (*optional for EPB purposes*)	Further assessment of the reinforced concrete masonry block walls out-of-plane.	

8 Seismic Restraint of Non-Structural Items

During an earthquake, the safety of people can be put at risk due to non-structural items falling on them. These items should be adequately seismically restrained, where possible, to the NZS 4219:2009 "The Seismic Performance of Engineering Systems in Buildings".

An assessment has not been made of bracing of the ceilings, services and plant. We have also not checked whether tall or heavy furniture has been seismically restrained. These issues are outside the scope of this initial assessment but could be the subject of another investigation.

9 Conclusion

The ISA assessment for this building gives an overall score of 50%NBS (IL2), which corresponds to a 'Grade C' building, as defined by the NZSEE building grading scheme. This is above the threshold for Earthquake Prone Buildings (34%NBS) and below the threshold for Earthquake Risk Buildings (67%NBS) as defined by NZSEE and the New Zealand Building Code.

We trust this letter of the initial seismic assessment and settlement issues meets your requirements. We would be pleased to discuss further with you any issues raised in this report. Please do not hesitate to contact us if you would like clarification of any aspect of this letter.

Report prepared by: Structural Engineer	Report reviewed by: Structural Engineer

Appendix 1 ISA Form

Initial Evaluation Procedure (IEP) Assessment

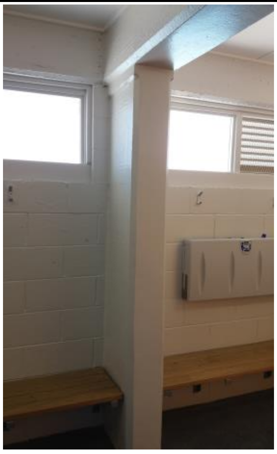
WARNING!! *This initial evaluation has been carried out solely as an initial seismic assessment of the building following the procedure set out in the "The Seismic Assessment of Existing Buildings" Technical Guidelines for Engineering Assessments, July 2017. This spreadsheet must be read in conjunction with the limitations set out in the accompanying report, and should not be relied on by any party for any other purpose. Detailed inspections and engineering calculations, o r engineering judgements based on them, have not been undertaken, and these may lead to a different result or seismic grade.*

Street Number & Name:	**79 Udy Street Petone Lower Hutt**	**Job No.:**	**9755_43406-1**
AKA:	**McKenzie Baths**	**By:**	
Name of building:	**Facility Building**	**Date:**	**18/12/2019**
City:	**Lower Hutt**	**Revision No.:**	**1**

Table IEP-1 Initial Evaluation Procedure Step 1

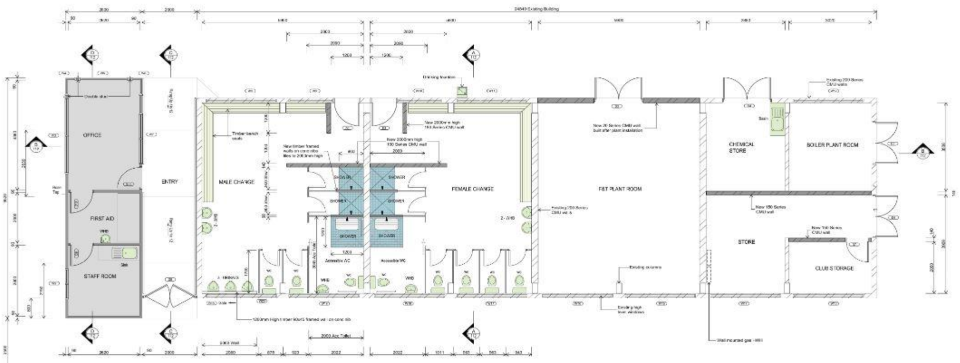
Step 1 - General Information

1.1 Photos (attach sufficient to describe building)



NOTE: THERE ARE MORE PHOTOS ON PAGE 1a ATTACHED

1.2 Sketches (plans etc, show items of interest)



NOTE: THERE ARE MORE SKETCHES ON PAGE 1a ATTACHED

1.3 List relevant features (Note: only 10 lines of text will print in this box. If further text required use Page 1a)

-Single storey public building, built Circa 1964.
-Multiple smaller rooms; office, female and male changing rooms, plant rooms and storage rooms.
-The building had a refurbishment in 2012.
-Reinforced concrete 2-way frame construction with reinforced concrete masonry block infill walls.
-Light weight gable roof with timber trusses.
-Concrete slab on grade and concrete foundations.
-The building appears to be designed for very high loadings based on the size of the reinforced concrete 2-way frame members.

1.4 Note information sources Tick as appropriate

Visual Inspection of Exterior	☑	**Specifications**	☑
Visual Inspection of Interior	☑	**Geotechnical Reports**	☐
Drawings (note type)	☑	**Other (list)**	☐

Various drawings downloaded from Hutt City Council online register - Some original structural drawings from 1964, and Structural refurbishment drawings from 2012.

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name:	79 Udy Street Petone Lower Hutt	Job No.:	9755_43406-1
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Table IEP-2 Initial Evaluation Procedure Step 2

Step 2 - Determination of *(%NBS)* $_b$

(Baseline *(%NBS)* for particular building - refer Section B5)

2.1 Determine nominal *(%NBS)* = *(%NBS)* $_{nom}$

	Longitudinal	Transverse
a) Building Strengthening Data		
Tick if building is known to have been strengthened in this direction	☐	☐
If strengthened, enter percentage of code the building has been strengthened to	N/A	N/A
b) Year of Design/Strengthening, Building Type and Seismic Zone		
Pre 1935	○	○
1935-1965	◉	◉
1965-1976	○	○
1976-1984	○	○
1984-1992	○	○
1992-2004	○	○
2004-2011	○	○
Post Aug 2011	○	○
Building Type:	Public Buildings	Public Buildings
Seismic Zone:	Not applicable	Not applicable
c) Soil Type		
From NZS1170.5:2004, Cl 3.1.3 :	D Soft Soil	D Soft Soil
From NZS4203:1992, Cl 4.6.2.2 : (for 1992 to 2004 and only if known)	Not applicable	Not applicable
d) Estimate Period, *T*		
h_n =	4.5	4.5 m
A_c =	1.00	1.00 m^2

Comment:
Reinforced concrete 2-way frame.

		Longitudinal	Transverse
Moment Resisting Concrete Frames:	$T = \max\{0.09h_n^{0.75}, 0.4\}$	◉	◉
Moment Resisting Steel Frames:	$T = \max\{0.14h_n^{0.75}, 0.4\}$	○	○
Eccentrically Braced Steel Frames:	$T = \max\{0.08h_n^{0.75}, 0.4\}$	○	○
All Other Frame Structures:	$T = \max\{0.06h_n^{0.75}, 0.4\}$	○	○
Concrete Shear Walls	$T = \max\{0.09h_n^{0.75}/A_c^{0.5}, 0.4\}$	○	○
Masonry Shear Walls:	$T \leq 0.4\text{sec}$	○	○
User Defined (input Period):		○	○
	T:	0.40	0.40

Where h_n = height in metres from the base of the structure to the uppermost seismic weight or mass.

			Longitudinal	Transverse
e) Factor A:	Strengthening factor determined using result from (a) above (set to 1.0 if not strengthened)	**Factor A:**	1.00	1.00
f) Factor B:	Determined from NZSEE Guidelines Figure 3A.1 using results (a) to (e) above	**Factor B:**	0.03	0.03
g) Factor C:	For reinforced concrete buildings designed between 1976-84 Factor C = 1.2, otherwise take as 1.0.	**Factor C:**	1.00	1.00
h) Factor D:	For buildings designed prior to 1935 Factor D = 0.8 except for Wellington and Napier (1931-1935) where Factor D may be taken as 1.0, otherwise take as 1.0.	**Factor D:**	1.00	1.00
(%NBS) $_{nom}$ **= AxBxCxD**		***(%NBS)*** $_{nom}$	3%	3%

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Initial Evaluation Procedure (IEP) Assessment

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Table IEP-2 Initial Evaluation Procedure Step 2 continued

2.2 Near Fault Scaling Factor, Factor E

If $T \leq 1.5$sec, Factor E = 1

		Longitudinal	Transverse
a) Near Fault Factor, *N(T,D)* (from NZS1170.5:2004, Cl 3.1.6)	N(T,D):	1	1
b) Factor E = 1/N(T,D)	Factor E:	1.00	1.00

2.3 Hazard Scaling Factor, Factor F

a) Hazard Factor, *Z*, for site

Location: Hutt Valley-south of Taita Gorge — Refer right for user-defined locations

Z = 0.4 (from NZS1170.5:2004, Table 3.3)

Z_{1992} = 1.2 (NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))

Z_{2004} = 0.4 (from NZS1170.5:2004, Table 3.3)

b) Factor F

For pre 1992	=	$1/Z$
For 1992-2011	=	Z_{1992}/Z
For post 2011	=	Z_{2004}/Z

	Longitudinal	Transverse
Factor F:	2.50	2.50

2.4 Return Period Scaling Factor, Factor G

a) Design Importance Level, I

(Set to 1 if not known. For buildings designed prior to 1965 and known to be designed as a public building set to 1.25. For buildings designed 1965-1976 and known to be designed as a public building set to 1.33 for Zone A or 1.2 for Zone B. For 1976-1984 set I value.)

b) Design Risk Factor, R_o

(set to 1.0 if other than 1976-2004, or not known)

c) Return Period Factor, R

(from NZS1170.0:2004 Building Importance Level)

Choose Importance Level ○ 1 ◉ 2 ○ 3 ○ 4 (Longitudinal); ○ 1 ◉ 2 ○ 3 ○ 4 (Transverse)

d) Factor G = IR_o/R

	Longitudinal	Transverse
I =	1.25	1.25
R_o =	1	1
R =	1.0	1.0
Factor G:	1.25	1.25

2.5 Ductility Scaling Factor, Factor H

a) Available Displacement Ductility Within Existing Structure

Comment:

A ductility of 2.00 is used for the reinforced concrete 2-way frame

μ = 2.00 (Longitudinal); 2.00 (Transverse)

b) Factor H

		Longitudinal	Transverse
		k_μ	k_μ
For pre 1976 (maximum of 2)	=	1.57	1.57
For 1976 onwards	=	1	1
Factor H:		1.57	1.57

(where kμ is NZS1170.5:2004 Inelastic Spectrum Scaling Factor, from accompanying Table 3.3)

2.6 Structural Performance Scaling Factor, Factor I

a) Structural Performance Factor, S_p

(from accompanying Figure 3.4)

Tick if light timber-framed construction in this direction ☐ ☐

	Longitudinal	Transverse
S_p =	0.70	0.70
b) Structural Performance Scaling Factor = $1/S_p$ — Factor I:	1.43	1.43

Note Factor B values for 1992 to 2004 have been multiplied by 0.67 to account for Sp in this period

2.7 Baseline *%NBS* for Building, $(\%NBS)_b$

(equals $(\%NBS)_{nom}$ x E x F x G x H x I)

Longitudinal	Transverse
20%	**20%**

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Table IEP-3 Initial Evaluation Procedure Step 3

Step 3 - Assessment of Performance Achievement Ratio (PAR)

(Refer Appendix B - Section B3.2)

a) Longitudinal Direction

potential CSWs | **Effect on Structural Performance** (Choose a value - Do not interpolate) | **Factors**

3.1 Plan Irregularity

Effect on Structural Performance ( ) *Severe* ( ) *Significant* (•) *Insignificant* — **Factor A** 1.0

NA

3.2 Vertical Irregularity

Effect on Structural Performance ( ) *Severe* ( ) *Significant* (•) *Insignificant* — **Factor B** 1.0

NA

3.3 Short Columns

Effect on Structural Performance ( ) *Severe* ( ) *Significant* (•) *Insignificant* — **Factor C** 1.0

Short columns present but blockwork runs past columns.

3.4 Pounding Potential

(Estimate D1 and D2 and set D = the lower of the two, or 1.0 if no potential for pounding, or consequences are considered to be minimal)

a) Factor D1: - Pounding Effect

Note:
Values given assume the building has a frame structure. For stiff buildings (eg shear walls), the effect of pounding may be reduced by taking the coefficient to the right of the value applicable to frame buildings.

Factor D1 For Longitudinal Direction: 1.0

Table for Selection of Factor D1	Severe	Significant	Insignificant
Separation	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Alignment of Floors within 20% of Storey Height	( ) 1	( ) 1	(•) 1
Alignment of Floors not within 20% of Storey Height	( ) 0.4	( ) 0.7	( ) 0.8

Comment

b) Factor D2: - Height Difference Effect

Factor D2 For Longitudinal Direction: 1.0

Table for Selection of Factor D2	Severe	Significant	Insignificant
	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys	( ) 0.4	( ) 0.7	(•) 1
Height Difference 2 to 4 Storeys	( ) 0.7	( ) 0.9	( ) 1
Height Difference < 2 Storeys	( ) 1	( ) 1	( ) 1

Comment

Factor D 1.0

3.5 Site Characteristics - *Stability, landslide threat, liquefaction etc as it affects the structural performance from a life-safety perspective*

Effect on Structural Performance ( ) *Severe* ( ) *Significant* (•) *Insignificant* — **Factor E** 1.0

Flat site prone to liquefaction

3.6 Other Factors - *for allowance of all other relevant characterstics of the building*

For ≤ 3 storeys - Maximum value 2.5
otherwise - Maximum value 1.5.
No minimum.

Factor F 2.5

Record rationale for choice of Factor F:

The building appears to be designed for higher than normal loadings and therefore the maximum F factor is used.

3.7 Performance Achievement Ratio (PAR)
(equals **A x B x C x D x E x F**)

PAR
Longitudinal **2.50**

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Table IEP-3 Initial Evaluation Procedure Step 3

Step 3 - Assessment of Performance Achievement Ratio (PAR)

(Refer Appendix B - Section B3.2)

b) Transverse Direction

Factors

potential CSWs — **Effect on Structural Performance** **(Choose a value - Do not interpolate)**

3.1 Plan Irregularity

Effect on Structural Performance ○ *Severe* ○ *Significant* ◉ *Insignificant* **Factor A** 1.0

NA

3.2 Vertical Irregularity

Effect on Structural Performance ○ *Severe* ○ *Significant* ◉ *Insignificant* **Factor B** 1.0

NA

3.3 Short Columns

Effect on Structural Performance ○ *Severe* ○ *Significant* ◉ *Insignificant* **Factor C** 1.0

Short columns present but blockwork runs past columns.

3.4 Pounding Potential

(Estimate D1 and D2 and set D = the lower of the two, or 1.0 if no potential for pounding, or consequences are considered to be minimal)

a) Factor D1: - Pounding Effect

Note:
Values given assume the building has a frame structure. For stiff buildings (eg shear walls), the effect of pounding may be reduced by taking the coefficient to the right of the value applicable to frame buildings.

Factor D1 For Transverse Direction: 1.0

Table for Selection of Factor D1	Severe	Significant	Insignificant
Separation	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Alignment of Floors within 20% of Storey Height	○ 1	○ 1	◉ 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

Comment

b) Factor D2: - Height Difference Effect

Factor D2 For Transverse Direction: 1.0

Table for Selection of Factor D2	Severe	Significant	Insignificant
	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys	○ 0.4	○ 0.7	◉ 1
Height Difference 2 to 4 Storeys	○ 0.7	○ 0.9	○ 1
Height Difference < 2 Storeys	○ 1	○ 1	○ 1

Comment

Factor D 1.0

3.5 Site Characteristics - *Stability, landslide threat, liquefaction etc as it affects the structural performance from a life-safety perspective*

Effect on Structural Performance ○ *Severe* ○ *Significant* ○ *Insignificant* **Factor E** 1.0

Flat site

3.6 Other Factors - *for allowance of all other relevant characterstics of the building*

For ≤ 3 storeys - Maximum value 2.5 otherwise - Maximum value 1.5. No minimum.

Factor F 2.50

Record rationale for choice of Factor F:

The building appears to be designed for higher than normal loadings and therefore the maximum F factor is used.

PAR

3.7 Performance Achievement Ratio (PAR)
(equals **A x B x C x D x E x F**)

Transverse **2.50**

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Initial Evaluation Procedure (IEP) Assessment

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Table IEP-4 Initial Evaluation Procedure Steps 4, 5, 6 and 7

Step 4 - Percentage of New Building Standard *(%NBS)*

		Longitudinal	Transverse
4.1	**Assessed Baseline *%NBS (%NBS)*** $_b$ (from Table IEP - 1)	20%	20%
4.2	**Performance Achievement Ratio (PAR)** (from Table IEP - 2)	2.50	2.50
4.3	**PAR x Baseline *(%NBS)*** $_b$	50%	50%
4.4	**Percentage New Building Standard *(%NBS)* - Seismic Rating** (Use lower of two values from Step 4.3)		50%

Step 5 - Is *%NBS* < 34? NO

Step 6 - Potentially Earthquake Risk (is *%NBS* < 67)? YES

Step 7 - Provisional Grading for Seismic Risk based on IEP

Seismic Grade C

Additional Comments (items of note affecting IEP based seismic rating)

The seismic rating from this ISA is considered conservative (the building is penalised based on its age) and it is possible t hat a higher %NBS rating would be achieved with a DSA.

Relationship between Grade and *%NBS* :

WARNING!! *This initial evaluation has been carried out solely as an initial seismic assessment of the building following the procedureset out in "The Seismic Assessment of Existing Buildings" Technical Guidelines for Engineering Assessments, July 2017. This spreadsheet must be read in conjunction with the limitations set out in the accompanying report, and should not be relied on by any party for any other purpose. Detailed inspections and engineering calculations, or engineering judge ments based on them, have not been undertaken, and these may lead to a different result or seismic grade.*

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name:	79 Udy Street Petone Lower Hutt	Job No.:	9755_43406-1
AKA:	McKenzie Baths	By:	
Name of building:	Facility Building	Date:	18/12/2019
City:	Lower Hutt	Revision No.:	1

Table IEP-5 Initial Evaluation Procedure Step 8

Step 8 - Identification of potential Severe Structural Weaknesses (SSWs) that could result in significant risk to a significant number of occupants

8.1	Number of storeys above ground level	1
8.2	Presence of heavy concrete floors and/or concrete roof? (Y/N)	N

Potential Severe Structural Weaknesses (SSWs):

Note: Options that are greyed out are not applicable and need not be considered.

Occupancy not considered to be significant - no further consideration required

Risk not considered to be significant - no further consideration required

The following potential Severe Structural Weaknesses (SSWs) have been identified in the building that could result in significant risk to a significant number of occupants:

1. None identified

2. Weak or soft storey (except top storey)

3. Brittle columns and/or beam-column joints the deformations of which are not constrained by other structural elements

4. Flat slab buildings with lateral capacity reliant on low ductility slab-to-column connections

5. No identifiable connection between primary structure and diaphragms

6. Ledge and gap stairs

IEP Assessment Confirmed by ______ **Signature**

______ **Name**

______ **CPEng. No**

WARNING!! *This initial evaluation has been carried out solely as an initial seismic assessment of the building following the procedureset out in "The Seismic Assessment of Existing Buildings" Technical Guidelines for Engineering Assessments, July 2017. This spreadsheet must be read in conjunction with the limitations set out in the accompanying report, and should not be relied on by any party for any other purpose. Detailed inspections and engineering calculations, or engineering judgements based on them, have not been undertaken, and these may lead to a different result or seismic grade.*

Appendix 2 Calculations/Additional Information

accordance with the preferred method described in NZS 1170.5:2004, Part 5.

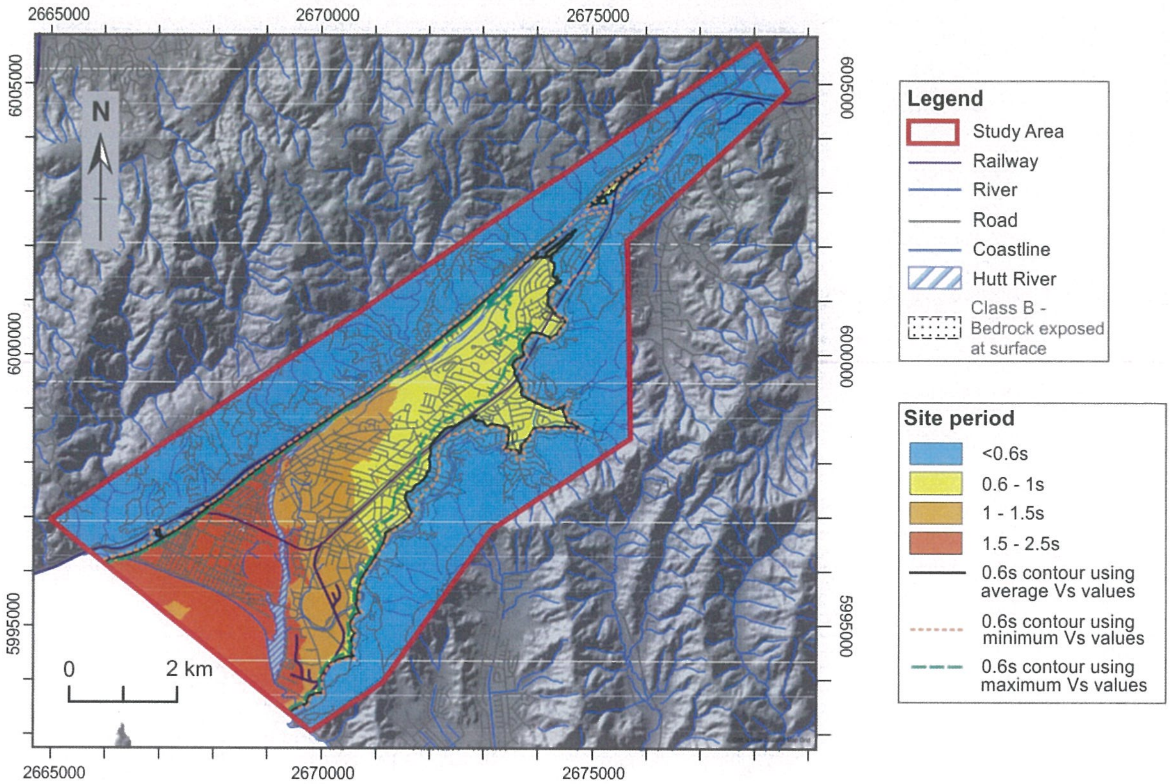


Figure 3: Low-amplitude natural period (site period).

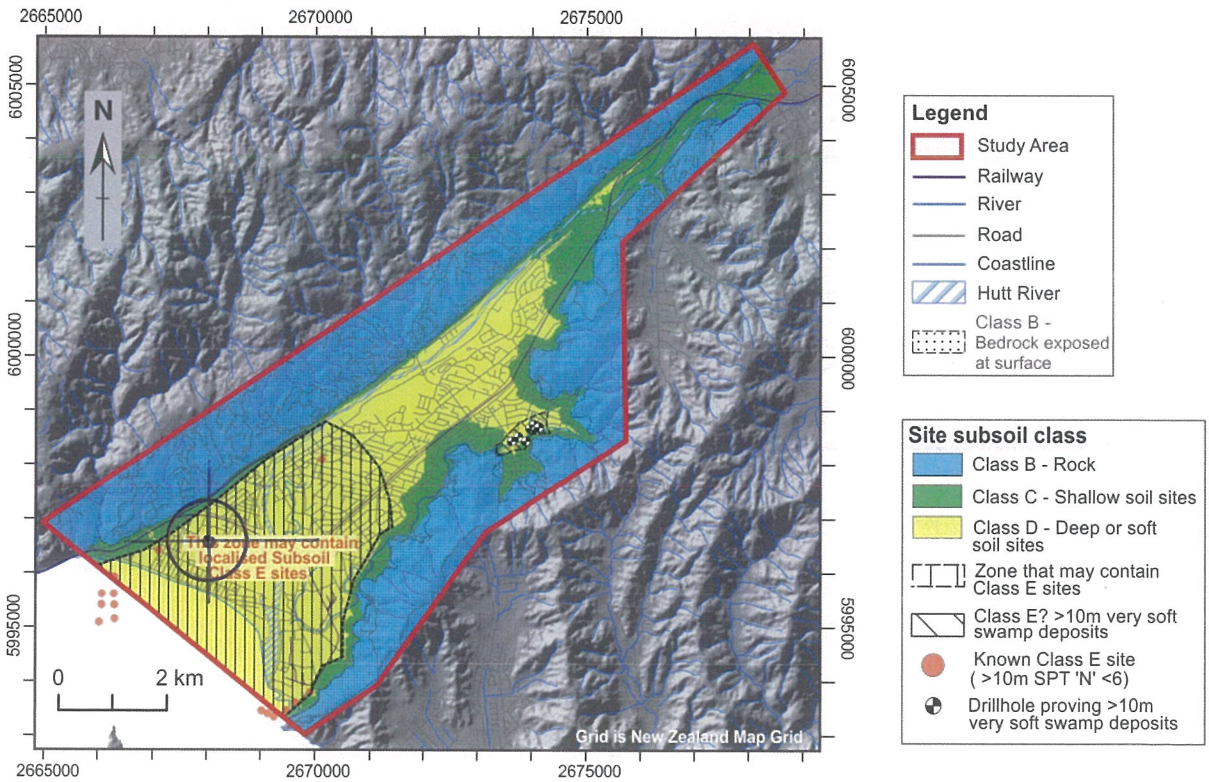
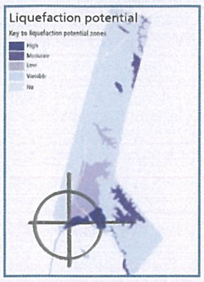
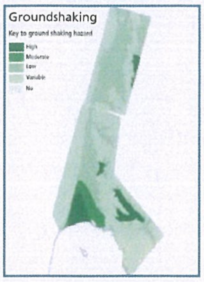
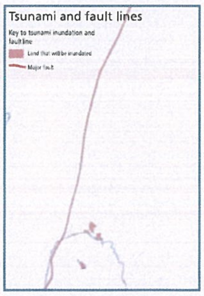


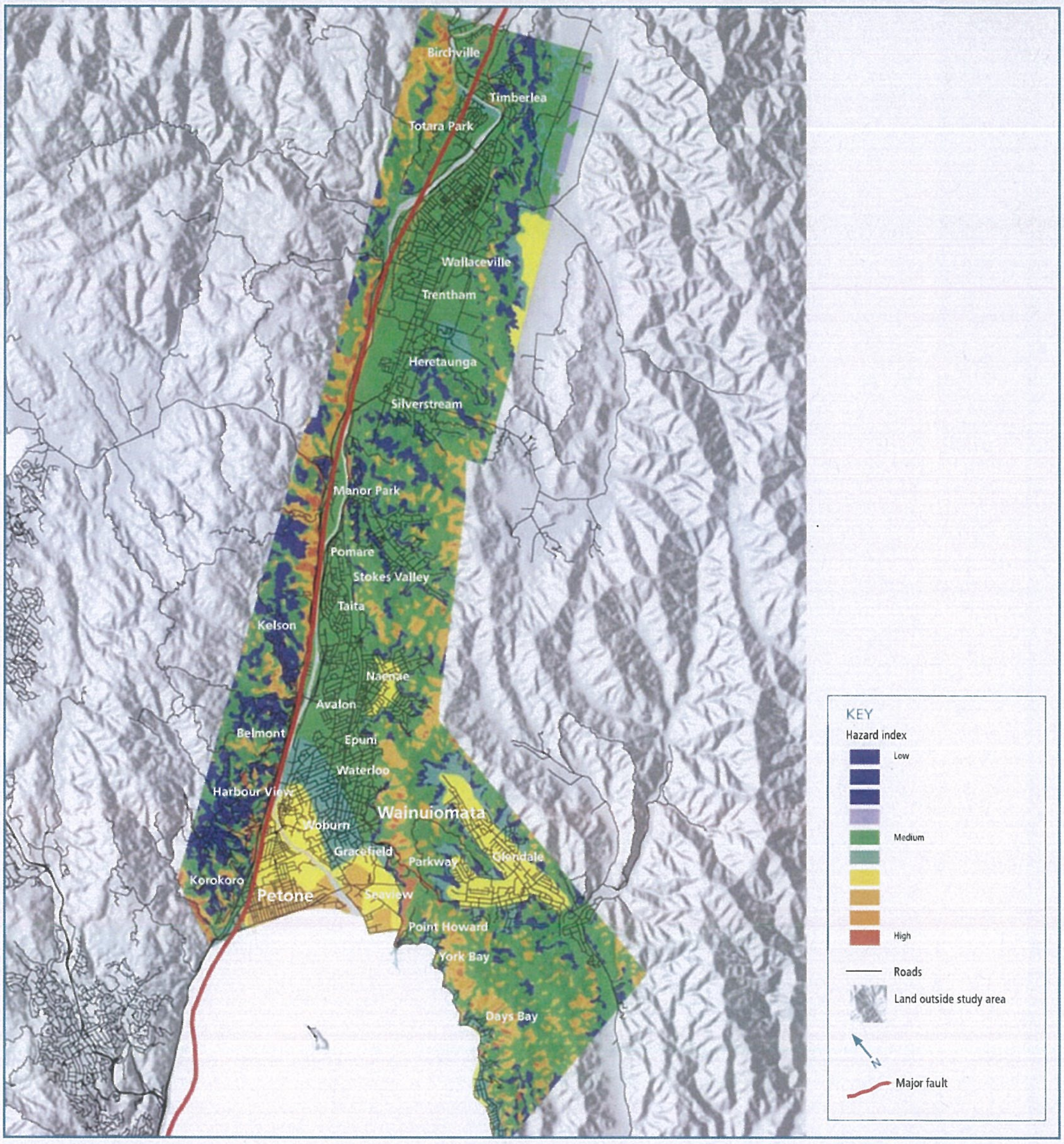
Figure 4: Site subsoil class in Lower Hutt as determined by the methods described in NZS1170.5:2004, Clauses 3.1.3.2 to 3.1.3.6.

Combined earthquake hazard map
Hutt Valley









Earthquake hazard mitigation measures				
Hazard	**Effect on ground**	**Effect on facilities**	**Mitigation options: existing facilities**	**Mitigation options: planned facilities**
Fault movement	Ground disturbances vertically and horizontally over a zone depends on depth to rock below surface. Cracks in land surface.	Upheaval, tearing apart, movement of foundations, severe damage to structures which cross the fault.	1. Verify. 2. Assess impact. 3. Options: a) strengthen to survive b) move facilities from fault zone c) limit damage by providing weak links or isolation	1. Verify. 2. Assess impact. 3. Options: a) construct facilities elsewhere b) incorporate special strengthening c) provide weak links or special isolation to limit damage
Ground shaking	Violent horizontal and vertical motions for up to one minute duration.	Cracking, fracture, collapse of buildings. Breaks in underground services. Deformation of surface infrastructure.	1. Verify. 2. Assess impact. 3. Options: a) strengthen or base isolate b) secure/improve vulnerable parts c) limit damage by providing weak links or isolation.	1. Verify. 2. Assess impact. 3. Options: a) comply with current codes for design and construction b) incorporate strength and resilience c) secure vulnerable parts and contents
Liquefaction	Shaking causes some soils to behave like liquid, causing loss of support to structures above. Such soils may be up to 10m below ground surface. Lateral movement of large soil masses, especially adjacent to rivers. Variable subsidence of ground surface.	Sinking and tilting of structures supported on liquefied material. Severe damage to underground services. Flotation of empty underground tanks and chambers.	1. Verify. 2. Assess impact. 3. Options: a) install piles b) install gravel drains c) drain liquefiable layers d) prepare for quick reinstatement	1. Verify. 2. Assess impact. 3. Options: a) compact ground at site b) install piles and gravel drains c) drain liquefiable layers
Slope failure	A significant soil masses moves bodily down the slope, from few hundred millimetres to many metres. Landslides occur at many different locations.	Ranges from deformation of foundations and structural failures to total destruction of site and all buildings and infrastructure above and below ground.	1. Verify. 2. Assess impact. 3 Options: a) stabilise slope – retaining walls b) stabilise slope – ground anchors c) improve drainage, reduce erosion	1. Verify. 2. Assess impact. 3. Options: a) find a better site b) stabilise slope retaining walls c) stabilise slope – ground anchors d) improve drainage, reduce erosion
Tsunami	Land flooded. Scouring action erodes soil dramatically	Flooding of basements. Undermining/destruction of surface infrastructure. Exposure/damage to underground services. Undermining of foundations. Bodily movement of some structures, equipment, vehicles etc.	1. Verify. 2. Assess impact. 3. Options: a) construct protective sea walls b) shift critical facilities to higher level	1. Verify. 2. Assess impact. 3. Options: a) find a better site b) construct protective sea walls c) design special foundations / dikes d) put critical facilities at high level

Background statement

In recognition of the earthquake hazard in the Region, the Greater Wellington Regional Council has carried out studies on ground surface rupture from active faulting, ground shaking, liquefaction potential and associated ground damage, slope failure and tsunami inundation (Wellington Harbour). Single factor hazard maps have been produced by Greater Wellington for each of these earthquake hazards.

This map sheet is part of a series of four map sheets showing the combined earthquake hazard for the main urban areas in the western part of the Wellington Region. The map series is one of Greater Wellington's natural hazard education and awareness initiatives.

The combined earthquake hazard map is a generalised map of earthquake hazard reflecting possible effects on a typical range of facilities (buildings, roads, services, etc). The methodology has involved broad assessments of many factors which determine the effects of earthquakes.

This map series was prepared for Greater Wellington by Ian R Brown Associates Ltd in association with Kingston Morrison Ltd and Victoria University of Wellington.

Warning

The hazard assessment methodologies developed for each of the earthquake hazard components and the methodology used to combine and present the hazard information impose certain qualifications and limitations on the use of the information. Details on the qualifications and limitations, and assessment methodologies of the component earthquake hazard studies are available from Greater Wellington. The methodology used to combine the various earthquake hazards are described in the Greater Wellington Report on Mapping Methodology and Risk Mitigation Measures WRC/RP-T-96/22.

The information provided on these maps cannot be substituted for a site specific investigation. The site specific potential for and consequent damage from active faulting, amplified ground shaking, liquefaction, slope failure, and tsunami inundation should be assessed by qualified and experienced practitioners.

Bibliographic reference

Greater Wellington Regional Council (1996). Sheet 3 Hutt Valley (1st ed.) Combined Earthquake Hazard Map 1:30000, Pub. No. WRC/RP-T-96/14 Greater Wellington Regional Council, Wellington, New Zealand.

Notes on earthquake hazard mitigation measures

1. Check that the broad indication of hazard from the maps is correct for a particular site. (In many case, this could prove cost-effective towards mitigation.)
2. Obtain professional advice on implications and available countermeasures.
3. Mitigation options shown are in brief general terms. Professional advice will be needed to account for particular circumstances at the site.

Single component hazard maps

These combine to produce the Combined Earthquake Hazard Maps. Maps of the single components (ground shaking, liquefaction and earthquake induced slope failure) are available from the Hazard Analyst at Greater Wellington.

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