109 These assessments were done just before the NPS-UD was published, so did not fully account for its new objectives and policy direction. However, Council staff found the assessment for proposed density around Wellington City's suburban centres fitted well with NPS-UD Policy 3(d).

110 This is consistent with my advice in the Stream 1 S42A report paras 379 and 381, and my supplementary planning evidence para 37.

111 *On the premise that the City Centre walking catchment is limited where it intersects with Hay Street on account of steepness and/or safety considerations, where in Mr Wharton's opinion would be a defensible boundary in the lower part of the Street? Similarly, Bolton Street, Aurora Terrace, Everton Terrace, Devon Street and Raroa Road.*

112 For safety matters unrelated to slope, such as footpath condition and lighting, I do not support limiting walkable catchments based on these matters, because they can be changed comparatively easily with path upgrades. If an area zoned for high density is redeveloped with denser larger buildings, Council priorities and development contributions are typically allocated to improve the pedestrian level of service for these new residents.

113 For steepness, I rely on the evidence from Ms Hammond and Professor Mandic in Appendix 2 and 3 of this Reply. From their extensive analysis, I advise that the sections of Hay Street, Bolton Street, Aurora Terrace, Everton Terrace and Devon St that are between the City Centre Zone boundary and the 15 minute walkable catchment from that boundary are all walkable. This is because:

- The street sections are all walkable from an exercise science perspective.

APPENDIX 1 – TAWA PROPERTIES IN WALKABLE CATCHMENTS BUT ADJACENT TO THE PORIRUA STREAM

The maps below the Evaluation identify the Tawa properties that are within the NPS-UD Policy 3(c)(i) walkable catchments, but are adjacent to the Porirua Stream according to the criteria in para 151, so are recommended to be zoned Medium Density Residential Zone (11 m height) and not High Density Residential Zone.

RMA Section 32AA and NPS-UD clause 3.33 Evaluation of the new qualifying matter

162 This analysis relates to using NPS-UD Policy 4 to modify the direction in Policy 3(c)(i) for the specific properties identified in red above. It adds to the existing Section 42A assessment on Policy 3(c)(i) walkable catchments in Tawa, and is at a relatively low level of detail (RMA Section 32AA (1)(c)) because of the scale and significance of the change.

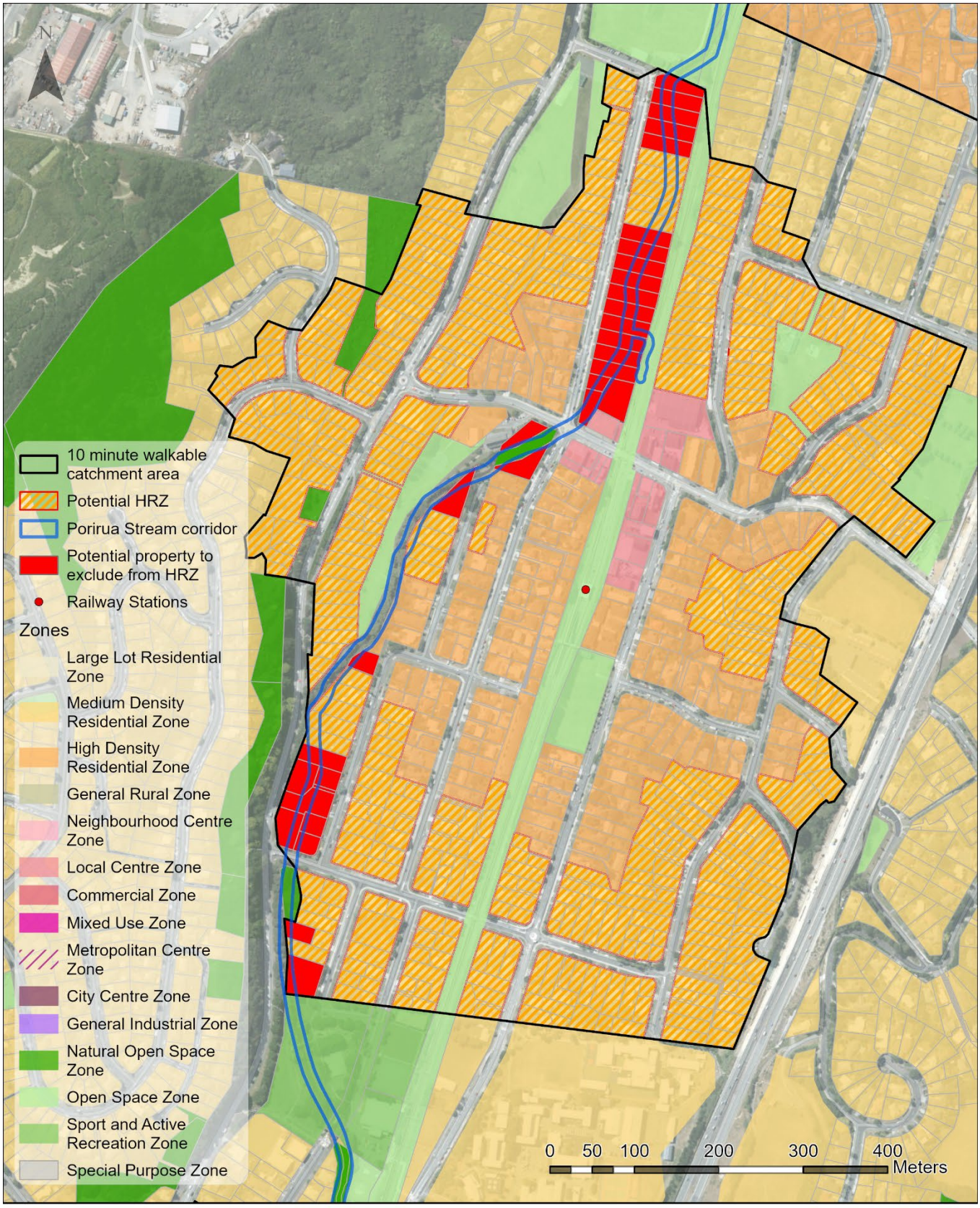
163 The proximity of these properties to the Porirua Stream corridor make them incompatible with the direction to enable at least six stories. The Porirua Stream has the highest flood flow adjacent to medium and high density residential housing areas in Wellington City. There is ongoing channel erosion and adjacent flooding risk. Greater Wellington Regional Council, and many in the community, want to enhance the riparian margins and overall ecology in and adjacent to the Stream.

164 Enabling at least six stories near to the Stream channel would significantly increase overall flooding and erosion risk to the new residents in high density housing, would limit options to widen and plant the stream banks to manage flooding and increase riparian ecological integrity, and would increase costs of removing buildings where needed for flood protection or to avoid flood risk.

165 The 30 m metric identified in this Right of Reply would ensure that High Density Residential Zone properties adjacent to the Porirua Stream are deep enough to enable six-storey buildings to be set back from the Stream channel.

166 Fifty-three residential properties are identified in red in the maps below. Property Economics' latest assessment (December 2022 email) found that no apartments are commercially realisable in Tawa's residential areas, based on current construction costs and property prices. This may change in the future, but indicates that the effects of this qualifying matter on overall development capacity in Wellington City is less than minor.

167 The main cost of this measure would be to limit future high density development options for landowners with properties close to Porirua Stream without the depth to enable appropriate location of these buildings away from the Stream. The main short-term benefit will be to be consistent with an overall approach that development close to the Stream should be avoided or designed and located to mitigate flooding, improve stream accessibility for flood works, and to improve the riparian ecology. The main long-term benefit would be to reduce costs for future generations to manage Porirua Stream flooding and improve its ecology.



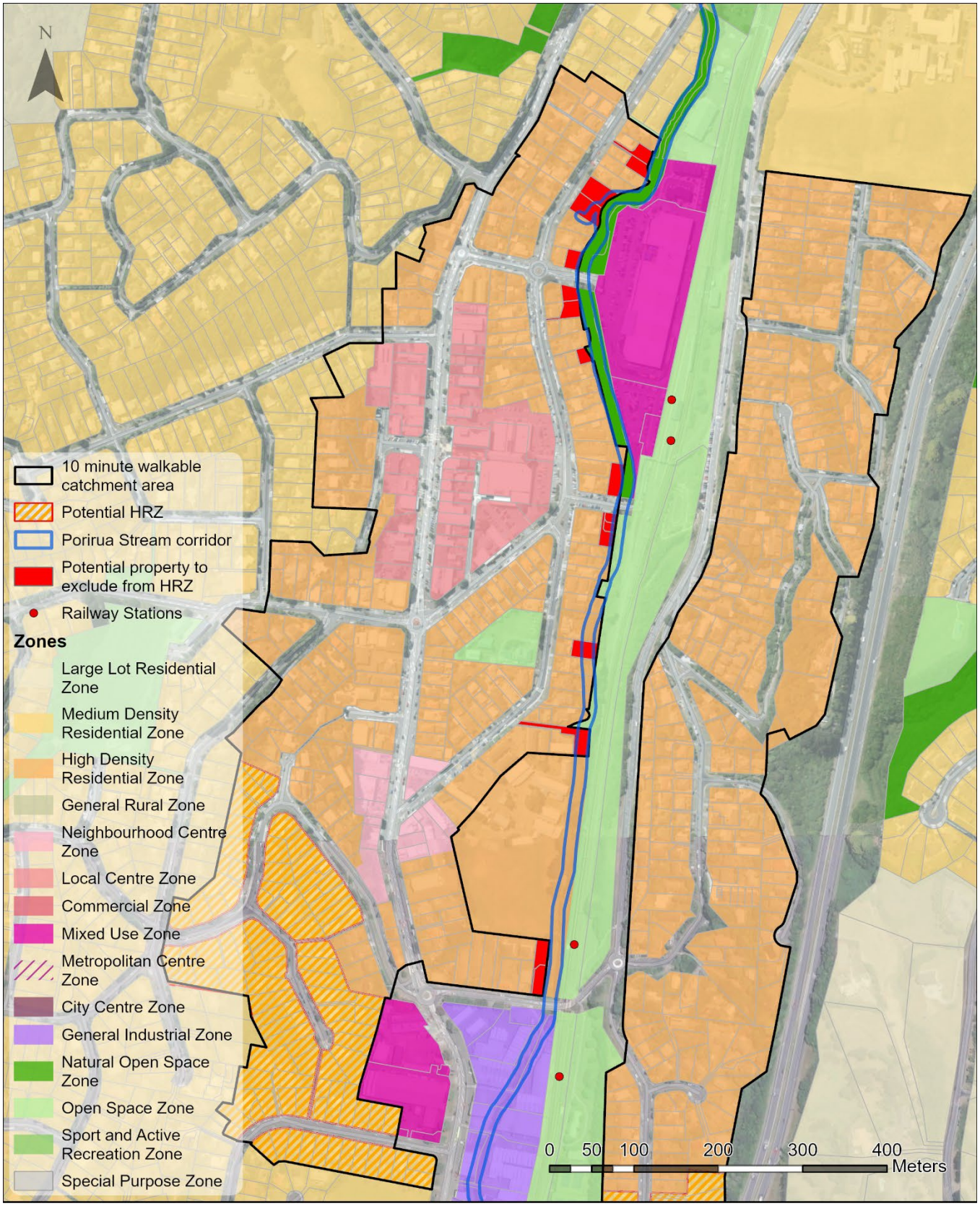
Linden Railway Station and High Density Residential Zone

This map shows the Potential High Density Residential Zone (HRZ) within the 10 minute walkable catchment from Linden railway station. Properties within the Porirua Stream corridor that are residentially zoned are excluded from the HRZ

Basemap credits: Esri Community Maps Contributors, LINZ, Stats NZ, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS, Porirua City Council, Maxar

Date: 13/04/2023
Credit: City Insights GIS Team

Absolutely Positively Wellington City Council
Me Heke Ki Pōneke



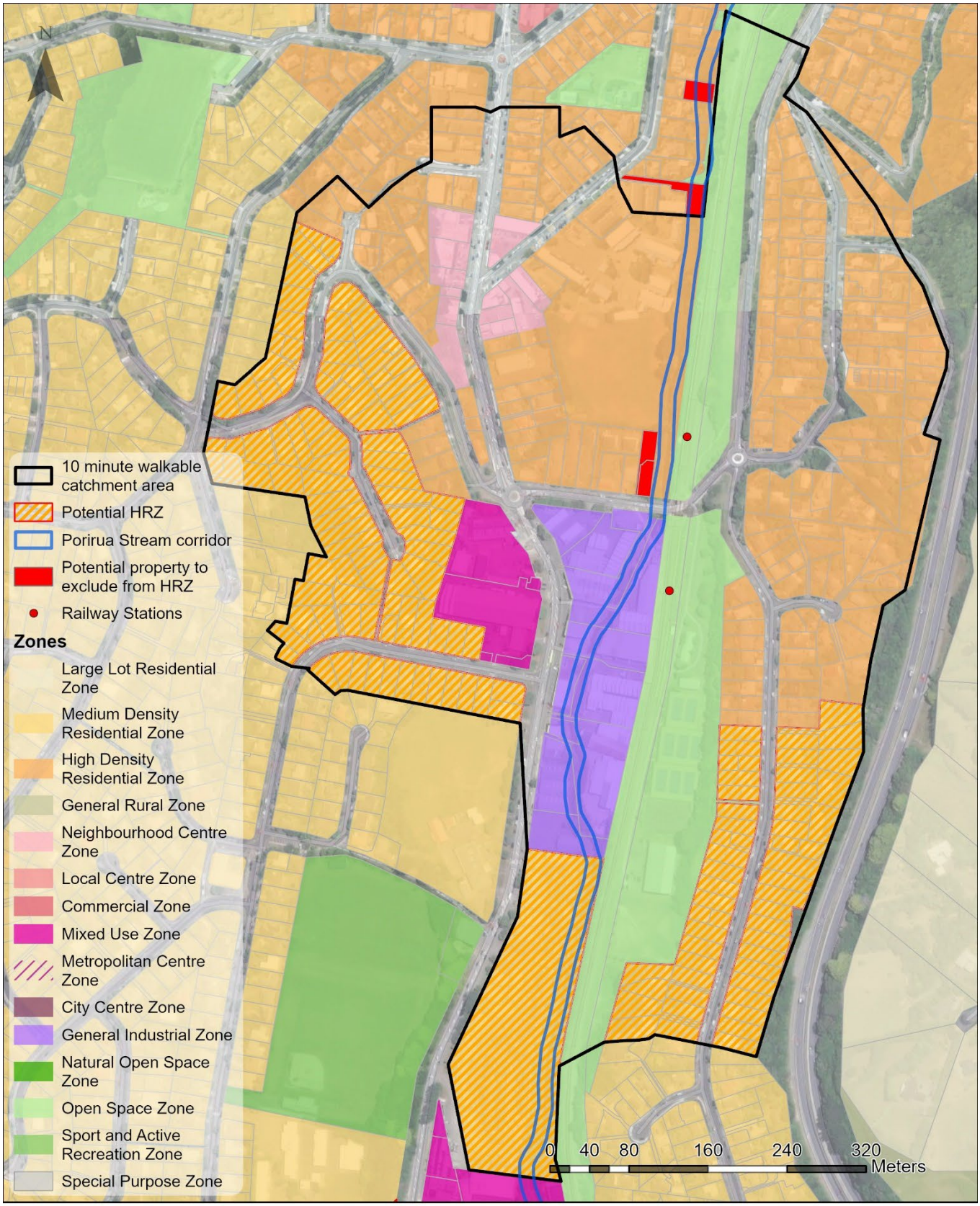
Tawa Railway Station and High Density Residential Zone

This map shows the High Density Residential Zone (HRZ) within the 10 minute walkable catchment from Tawa railway station. Properties within the Porirua Stream corridor that are residentially zoned are excluded from the HRZ.

Basemap credits: Esri Community Maps Contributors, LINZ, Stats NZ, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS, Maxar

Date: 13/04/2023
Credit: City Insights GIS Team

Absolutely Positively Wellington City Council
Me Heke Ki Pōneke



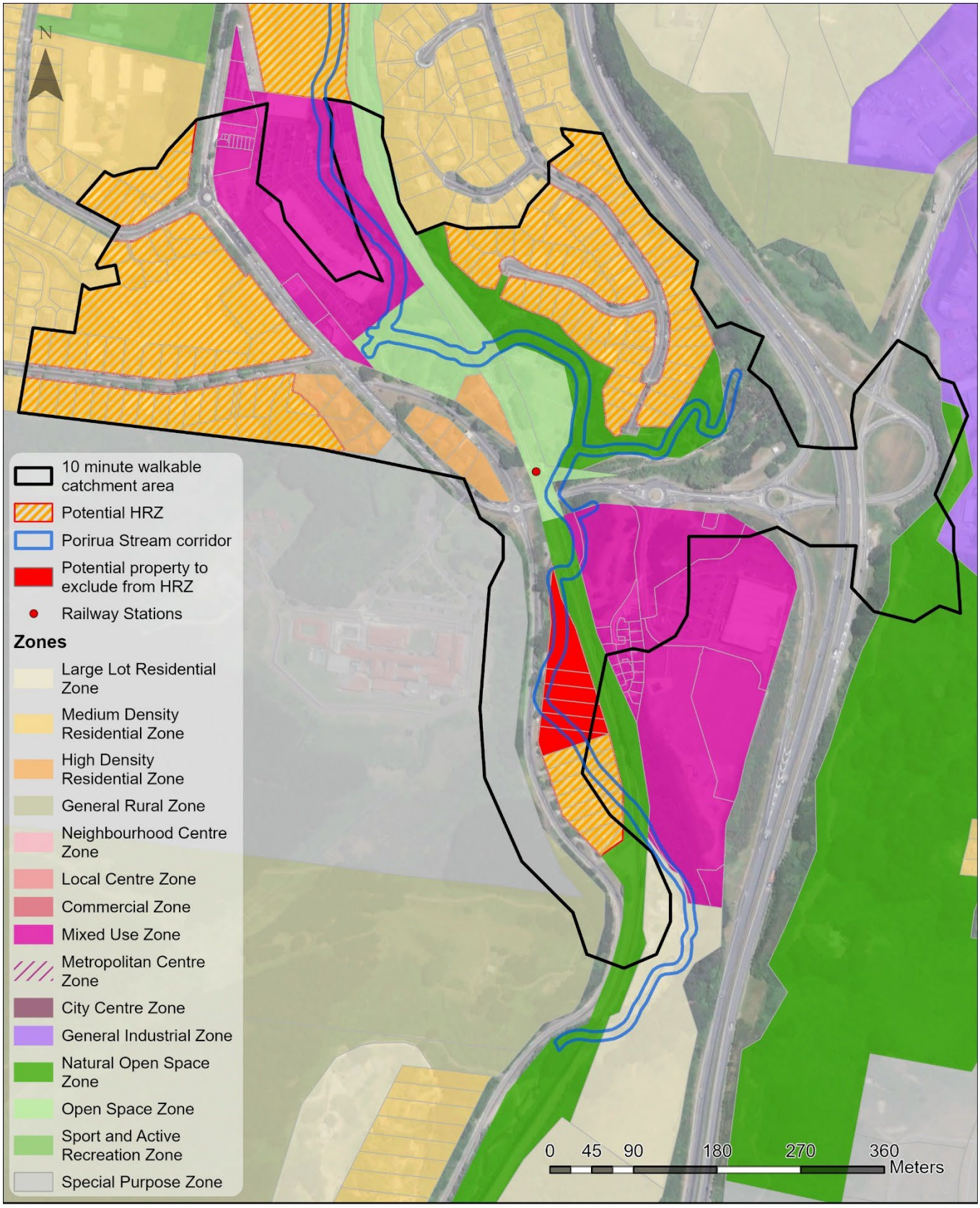
Redwood Railway Station and High Density Residential Zone

This map shows the Potential High Density Residential Zone (HRZ) within the 10 minute walkable catchment from Redwood railway station. These HRZ areas are in addition to the HRZ areas around Tawa railway station. Properties within the Porirua Stream corridor that are residentially zoned are excluded from the HRZ.

Basemap credits: Esri Community Maps Contributors, LINZ, Stats NZ, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS, Maxar

Date: 13/04/2023
Credit: City Insights GIS Team

Absolutely Positively Wellington City Council
Me Heke Ki Pōneke



Takapu Railway Station and High Density Residential Zone

This map shows the Potential High Density Residential Zone (HRZ) within the 10 minute walkable catchment from Takapu railway station. Properties within the Porirua Stream corridor that are residentially zoned are excluded from the HRZ.

Basemap credits: Esri Community Maps Contributors, LINZ, Stats NZ, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS, Maxar

Date: 13/04/2023
Credit: City Insights GIS Team

Absolutely Positively Wellington City Council
Me Heke Ki Pōneke

APPENDIX 2 – SANDRA MANDIC EVIDENCE ON WALKABILITY OF STEEP STREETS

This evidence is to support Mr Wharton's response to the Panel's question 5(g) in Minute 11:

> *On the premise that the City Centre walking catchment is limited where it intersects with Hay Street on account of steepness and/or safety considerations, where in Mr Wharton's opinion would be a defensible boundary in the lower part of the Street? Similarly, Bolton Street, Aurora Terrace, Everton Terrace, Devon Street and Raroa Road*

Factors Related to Walking for Transport

1. Walking for transport is influenced by a wide range of individual, social, environmental and policy factors. People's willingness to walk for transport in any setting – such as Wellington City – is influenced by an interplay of those factors. Therefore no single factor such as topography/slope or safety by itself will determine individual's willingness to walk to transport.

2. Proximity to urban destinations is an important motivator for people to walk.[21]

3. Walkable distance for walking for transport vary across studies with average distance ranging from 0.8 km to 2 km.[22,23] Some researchers argue that it is feasible for most people to walk up to 15-20 minutes which translates into a distance of 1.6 km.[24]

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[21] Tsiompras AB and Photis YN. What matters when it comes to "Walk and the city"? Defining a weighted GIS-based walkability index. Transportation Research Procedia. Volume 24, 2017, Pages 523-530 https://doi.org/10.1016/j.trpro.2017.06.001

[22] Neves A and Brand C. Assessing the potential for carbon emissions savings from replacing short car trips with walking and cycling using a mixed GPS-travel diary approach. Transportation Research Part A. 2019; 123:130–146. DOI: https://doi.org/10.1016/j.tra.2018.08.022

[23] Cole R, Turrell G, Koohsari MJ, Owen N, and Sugiyama T. (2017). Prevalence and correlates of walkable short car trips: A cross-sectional multilevel analysis. Journal of Transport & Health, 4, 73-80. https://doi.org/10.1016/j.jth.2016.11.007

[24] Neves A and Brand C. Assessing the potential for carbon emissions savings from replacing short car trips with walking and cycling using a mixed GPS-travel diary approach.

4. There is no universal consensus on what constitutes a walkable distance since walkable distance varies depending on people's characteristics such as their age, gender, fitness / exercise capacity, characteristics of the environment (such as topography) and the purpose of walking (walking for transport or walking for recreation).[25]

5. Most previous studies that examined walkable distance for transport in urban areas did not consider the effect of topography slope on the decision to walk and walking distance.

6. Recent research by Rahman A (2022)[26] conducted developed the terrain-sensitive walkability model which showed that topography (measured as number of contour lines) was negatively correlated with pedestrian counts in Sydney (Australia). However, this research had limited availability of pedestrian surveys to validate and further finetune the proposed walkability index and did not have information about age, gender or health status of pedestrian survey respondents.

7. Recent research by Jano-Reiss et al.[27] conducted in Jerusalem (Israel) demonstrated a linear negative effect of slope on walking for transport distance. For every 1-unit increase in the percentage of topography slope, distance walked for transport decreased by 43 to 54 meters. In the same study, researchers reported that sociodemographic characteristics such

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Transportation Research Part A. 2019; 123:130–146. DOI: https://doi.org/10.1016/j.tra.2018.08.022

[25] Jano-Reiss M, Anat T and Shlomit F-A. Walkability and Hilly Cities: The Non-Linear Effect of the Slope. Available at SSRN: https://ssrn.com/abstract=4127644 or http://dx.doi.org/10.2139/ssrn.4127644

[26] Ashikur Rahman. A GIS-based, microscale walkability assessment integrating the local topography. Journal of Transport Geography, Volume 103, July 2022, 103405; https://doi.org/10.1016/j.jtrangeo.2022.103405

[27] Jano-Reiss M, Anat T and Shlomit F-A. (2022) Walkability and Hilly Cities: The Non-Linear Effect of the Slope. Available at SSRN: https://ssrn.com/abstract=4127644 or http://dx.doi.org/10.2139/ssrn.4127644

as age and gender were associated with the distance covered in walking for transport trips.

8. No research is available on people's ***willingness*** to walk in Wellington City that also takes into account residents' sociodemographic characteristics and topography.

Walking for Transport Seen Through an Exercise Science Lens

9. Since walking is a form of physical activity, walking at different speeds and steepness of the terrain could be analysed from an exercise science perspective. Exercise science enables calculation of energy expenditure associated with walking and the perceived intensity of walking at different speeds and grade of the terrain.

10. Exercise intensity can be expressed in metabolic equivalents (METs). One MET is the amount of energy that body uses when sitting quietly. One MET corresponds to oxygen consumption of 3.5 ml of oxygen per kilogram of body mass per minute.

11. Based on metabolic equivalents, exercise intensity of various forms of physical activity for adults can be classified into low, moderate and vigorous intensity exercise/activity:

    - Low intensity exercise (less than 3.0 METs),
    - Moderate intensity exercise (3.0 to 6.0 METs) and
    - Vigorous intensity exercise (more than 6.0 METs).

    Low intensity activities require minimal effort, are perceived as "very light" or "light" and can be performed for a long time.

    Moderate intensity activities are those that get an adult moving fast enough or strenuously enough to use three to six times as much energy per minute compared to sitting quietly. Therefore, moderate intensity

exercises for adults range from 3 to 6 METs. Moderate intensity exercise is perceived by individuals as “somewhat hard”. Individuals are still able to hold a conversation while exercising at moderate intensity. Individuals are able to exercise at moderate intensity for a prolonged period of time (such as 30 minutes or longer). Moderate intensity physical activity represents a comfortable exercise intensity for adults.

Vigorous intensity activities have energy expenditure of more than 6 METs. Vigorous activities are perceived by individuals as “hard” or “very hard”. While exercising at vigorous intensity, individuals are breathing deep and rapidly and are not able to hold a conversation. In general, vigorous intensity activities are performed for shorter periods of time than moderate intensity activities (for example, 2 to 5 minutes) and are usually followed by brief periods of moderate or low intensity exercise before body is ready to engage again in another bout of vigorous intensity activity.

12. Both moderate and vigorous intensity physical activities are recommended for adults. The current World Health Organization’s physical activity guidelines[28] state that “all adults should undertake 150-300 min of moderate-intensity, or 75-150 min of vigorous-intensity physical activity, or some equivalent combination of moderate-intensity and vigorous-intensity aerobic physical activity, per week” to meet physical activity recommendations.

13. Compendium of Physical Activities[29] provides energy cost of various physical activities. Energy costs for various forms of walking are

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[28] Bull FC, Al-Ansari SS, Biddle S, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020 Dec;54(24):1451-1462. DOI: 10.1136/bjsports-2020-102955

[29] Ainsworth BE, Haskell WL, Whitt MC, Irwin ML, Swartz AM, Strath SJ, O'Brien WL, Bassett Jr DR, Schmitz KH, Emplaincourt PO, Jacobs Jr DR, Leon AS. Compendium of physical activities: an update of activity codes and MET intensities. Med Sci Sports Exerc. 2000 Sep;32(9 Suppl):S498-504. DOI: 10.1097/00005768-200009001-00009

presented in Table 1. Energy cost of walking ranges from 2.0 METs for walking very slowly (less than 3.2 km/h) on flat surface to 8 METs for walking at the speed of 8 km/h. Energy expenditure for various forms of walking are also colour-coded within Table 1 with blue indicating low exercise intensity, green indicating moderate exercise intensity and yellow indicating vigorous exercise intensity.

Table 1. Energy cost of various forms of walking (source: Compendium of Physical Activities – 2000 Update[9])

Energy cost of activity (in metabolic equivalents (METs)	Activity description
2.0	Walking, less than 2.0 mph (less than 3.2 km/h), level ground, strolling, very slow
2.0	Bird watching
2.5	Walking, 2.0 mph (3.2 km/h), level, slow pace, firm surface
2.5	Walking from house to car or bus, from car or bus to go places, from car or bus to and from the work site
2.5	Walking to neighbour's house or family's house for social reasons
3.0	Walking the dog
3.0	Loading/unloading a car
4.0	Pushing a wheelchair, non-occupational setting
8.0	Walking, 5.0 mph (8.0 km/h)

Exercise intensity of various forms of walking:

* blue = low intensity exercise (less than 3 METs),
* green = moderate intensity exercise (3-6 METs)
* yellow = vigorous intensity exercise (more than 6 METs)

14. A metabolic calculation of energy cost of walking (calculated as oxygen consumption by human body) takes into account both walking speed and grade of the terrain:

    $VO_2 = 3.5 + (0.1 \times speed) + (1.8 \times speed \times grade)$

    where VO_2 is oxygen consumption (calculated in millilitres of oxygen per kilogram of body mass per minute), speed is expressed in meters per minute ($m \cdot min^{-1}$) and grade is percent grade expressed as fraction (e.g., 2% grade = 0.02).[30]

15. Tables 2 and 3 presents metabolic costs of walking for three different walking speeds (very slow: 3.0 km/h; slow: 3.3 km/h; moderate: 4.0 km/h; and fast: 4.9 km/h) at level ground and uphill slopes ranging from 2% to 20%. Metabolic costs of walking were calculated using the metabolic calculation for oxygen consumption (see previous point).

    In Table 2, metabolic costs of walking are presented as oxygen consumption.

[30] Bushman, B. A. Metabolic Calculations in Action Part 2. ACSM's Health & Fitness Journal 24(4):p 5-8, 7/8 2020. | DOI: 10.1249/FIT.0000000000000577 (Available at: https://journals.lww.com/acsm-healthfitness/Fulltext/2020/07000/Metabolic_Calculations_in_Action_Part_2.4.aspx#:~:text=Metabolic%20equations.%201%20Walking%3A%20VO%202%20%3D%203.5,%2B%20%283%20%C3%97%20W%20%C3%B7%20M%29%20More%20items)

Table 2. Metabolic costs of walking expressed as oxygen consumption and metabolic equivalents (METs) for different walking speeds and various uphill slopes

	Walking speed (km/h)			
	Very slow (3.0 km/h)	**Low/slow (3.3 km/h)**	**Moderate (4.0 km/h)**	**Fast (4.9 km/h)**
Energy cost: VO_2 (oxygen consumption) (ml O2/kg/min)*				
% grade (uphill)				
0%	8.5	9.1	10.1	11.6
2%	10.4	11.1	12.5	14.5
4%	12.2	13.1	14.9	17.4
6%	14.0	15.1	17.2	20.3
8%	15.8	17.1	19.6	23.3
10%	17.6	19.1	22.0	26.2
12%	19.4	21.1	24.4	29.1
14%	21.2	23.1	26.7	32.0
16%	23.1	25.2	29.1	34.9
18%	24.9	27.2	31.5	37.8

20%	26.7	29.2	33.9	40.8

In Table 3, metabolic costs of walking are presented using metabolic equivalents (METs) (1 MET corresponds to oxygen consumption of 3.5 ml of oxygen per kilogram of body mass per minute). In this table, energy expenditure for walking at different speed and grades are colour coded based on absolute exercise intensity for adults as follows: blue indicates low exercise intensity, green indicates moderate exercise intensity and yellow indicates vigorous exercise intensity.

Table 3. Metabolic costs of walking expressed as metabolic equivalents (METs) for different walking speeds and various uphill slopes

	Walking speed (km/h)			
	Very slow (3.0 km/h)	**Low/slow (3.3 km/h)**	**Moderate (4.0 km/h)**	**Fast (4.9 km/h)**
Energy expenditure in METs				
% grade (uphill)				
0%	2.4	2.6	2.9	3.3
2%	3.0	3.2	3.6	4.1
4%	3.5	3.7	4.2	5.0
6%	4.0	4.3	4.9	5.8
8%	4.5	4.9	5.6	6.6
10%	5.0	5.5	6.3	7.5
12%	5.6	6.0	7.0	8.3
14%	6.1	6.6	7.6	9.1
16%	6.6	7.2	8.3	10.0
18%	7.1	7.8	9.0	10.8
20%	7.6	8.3	9.7	11.6

Notes: Blue indicates low exercise intensity (less than 3.0 METs).

Green indicates moderate exercise intensity (3.0 to 6.0 METs).

Yellow indicates vigorous exercise intensity (more than 6.0 METs).

16. Based on metabolic costs, walking on flat ground at very slow (3.0 km/h), slow (3.3 km) and moderate speed (4.0 km/h) represent low intensity exercise for most adults.

17. For adults, walking on flat ground at fast speed (4.9 km/h) would be moderate intensity exercise.

18. For most adults, walking on uphill grades up to 12% at very slow speed, up to 10% at slow speed, up to 8% grade at moderate speed and up to 6% grade at fast walking speed would be moderate intensity exercise.

19. Based on results presented in Tables 2 and 3, walking uphill at grade of 14% or higher at very slow speed and at grade of 12% of higher at slow speed would be considered vigorous intensity exercise for most adults. At higher walking speeds, lower grades would result in vigorous exercise intensity: uphill grade of 10% or higher at moderate walking speed and uphill grade of 8% or higher at fast walking speed.

20. It is important to keep in mind that individuals naturally adjust their walking speed to the terrain (i.e., slowing down as the uphill grade increases which also reduces the exercise intensity associated with walking uphill).

21. Exercise intensity of a particular physical activity depends on gender, age and person's fitness or exercise capacity. On average women have lower exercise capacity than men. In both genders exercise capacity peaks between ages of 30 and 50 years and declines afterwards. Percentiles of average exercise capacity (expressed as metabolic equivalents (METs)) for

healthy men and women are presented in Table 4 below (calculated based on data from Kaminski et al. (2021)[31]).

Table 4. Average exercise capacity for healthy men and women expressed as metabolic equivalents (METs) achieved on cardiopulmonary exercise test conducted on a treadmill (calculated based on oxygen consumption data presented in Kaminski et al. (2021)[11])

[31] Kaminski LA, Arena R, Myers J, Peterman JE, Bonikowske AR, Harber MP, Medina Inojosa JR, Lavie CJ, Squires RW. Updated Reference Standards for Cardiorespiratory Fitness Measured with Cardiopulmonary Exercise Testing: Data from the Fitness Registry and the Importance of Exercise National Database (FRIEND) Mayo Clin Proc. 2022. DOI: 10.1016/j.mayocp.2021.08.020

	Percentile of exercise capacity	Age group (years)						
		20-29	30-39	40-49	50-59	60-69	70-79	80-89
Males								
	90	16.7	15.9	14.5	12.4	10.6	8.4	6.5
	80	15.6	14.3	12.9	10.9	9.1	7.4	6.1
	70	14.8	13.3	11.7	9.8	8.2	6.8	5.7
	60	14.0	12.4	10.8	9.1	7.6	6.3	5.3
	50	13.3	11.3	10.1	8.3	7.0	5.9	5.0
	40	12.5	10.6	9.3	7.7	6.5	5.5	4.7
	30	11.4	9.6	8.5	7.0	5.9	4.9	4.6
	20	10.1	8.5	7.6	6.3	5.3	4.5	4.2
	10	8.2	7.1	6.3	5.3	4.5	3.9	3.7
Females								
	90	14.0	12.0	10.8	9.3	7.8	6.5	5.9
	80	12.8	10.6	9.4	8.1	6.9	5.9	5.3
	70	11.9	9.6	8.6	7.5	6.4	5.6	4.9
	60	11.1	8.9	7.9	7.0	6.0	5.2	4.6

50	10.5	8.1	7.3	6.5	5.6	4.9	4.4
40	9.7	7.5	6.8	6.1	5.2	4.6	4.2
30	8.8	6.9	6.2	5.7	4.9	4.3	3.9
20	7.8	6.3	5.6	5.3	4.4	4.0	3.6
10	6.4	5.3	4.9	4.7	3.8	3.5	3.3

22. It is important to note that exercise intensities of 40% to 60% of person's exercise capacity are considered to be moderate intensity exercise for that person (perceived by individuals as "somewhat hard"). Activities between 61% and 80% of person's exercise capacity represent vigorous intensity activities for that person (perceived by individuals as "hard" or "very hard"). Given that exercise capacity declines with age, activities that are moderate intensity for middle-aged individuals can become vigorous intensities activities for older adults.

Applying an Exercise Science Lens to Inform Consideration of a Defensible Boundaries for Walking for Selected Wellington City Streets

23. Tables presented in this paragraph show the results of the analysis of the energy expenditure expressed as metabolic equivalents (METs) and exercise intensity as an exercise science perspective to inform consideration of a defensible boundary for walking for Hay Street (Table 6), Bolton Street (Table 7), Aurora Terrace (Table 8), Everton Terrace (Table 9) and Devon Street (Table 10) in Wellington City.

    Raroa Road was not included since this road is located beyond the 15-minute catchment area.

Table 6. Hay Street

Hay Street				
Street segment from the start of the street	Walking time at slow speed of 3.3 km/h (55 m/min)	Slope (% grade)	Metabolic equivalents of walking (METs)	Exercise intensity (based on METs)
1-50 m	1 min	13.6%	6.6	Vigorous
51-100 m	1 min	13.6%	6.6	Vigorous
101-150 m	1 min	14.1%	6.6	Vigorous
		Analysis:		
Total street length considered:	150 meters		Total walking time:	3 minutes

Conclusion:	**Walkable street**
Rationale:	• Street length considered from the start of the street is only 150 metres. • Walking uphill at very slow (3.0 km/h) and slow speed (3.3 km/h) would be vigorous exercise for most adults and would last less than 5 minutes, which is doable for most adults. • Individuals could further reduce exercise intensity of walking up this street by reducing walking speed to below 3 km/h which would not significantly extend the total walking time given the short distance.

Table 7. Bolton Street

Bolton Street				
Street segment from edge of Central City Boundary	Walking time at slow speed of 3.3 km/h (55 m/min)	Slope (% grade)	Metabolic equivalents of walking (METs)	Exercise intensity (based on METs)
1-50 m	1 min	19.7%	8.3	Vigorous
51-100 m	1 min	13.7%	6.6	Vigorous
101-150 m	1 min	16.3%	7.2	Vigorous
151-200 m	1 min	15.2%	6.9	Vigorous
201-206 m	10 sec	12.1%	6.0	Vigorous

Analysis			
Total street length:	206 m	Total walking time:	4 - 5 min

Conclusion:	**Walkable street**
Rationale:	• Only 206 metres of street length from the Central City Boundary up to the end of the 10- and 15-minute walkable catchment. • Walking uphill at very slow (3.0 km/h) and slow speed (3.3 km/h) would be vigorous physical activity for most adults and would last less than 5 minutes, which is doable for most adults. • Individuals could further reduce exercise intensity of walking up this street by reducing their walking speed to below 3 km/h which would not significantly extend the total walking time given the short distance.

Table 8. Aurora Terrace

Aurora Terrace				
Street segment from edge of Central City Boundary	Walking time at slow speed of 3.3 km/h (55 m/min)	Slope (% grade)	Metabolic equivalents of walking (METs)	Exercise intensity (based on METs)
1-50 m	1 min	18.7%	8.0	Vigorous
51-100 m	1 min	26.1%	9.2	Vigorous
101-150 m	1 min	20.4%	8.3	Vigorous
151-197 m	1 min	20.5%	8.6	Vigorous

Analysis			
Total road length:	197 m	Total walking time:	4 min

Conclusion:	**Walkable street**
Rationale:	• Only 200 metres of street length from the Central City Boundary. • Walking uphill at very slow (3.0 km/h) and slow speed (3.3 km/h) would be vigorous physical activity for most adults and would last less than 5 minutes, which is doable for most adults. • Individuals could further reduce exercise intensity of walking up this street by reducing their walking speed to below 3 km/h which would not significantly extend the total walking time given the short distance.

Table 9. Everton Street

Everton Street				
Street segment from edge of Central City Boundary	Walking time at slow speed of 3.3 km/h (55 m/min)	Slope (% grade)	Metabolic equivalents of walking (METs)	Exercise intensity (based on METs)
1-50 m	1 min	17.7%	7.8	Vigorous
51-100 m	1 min	17.7%	7.8	Vigorous
101-150 m	1 min	14.7%	6.9	Vigorous
151-158 m	10 sec	18.9%	8.0	Vigorous
Analysis:				
Total street length:	158 m		Total walking time:	3 - 4 min
Conclusion:	**Walkable street**			
Rationale:	• Only 158 metres of street length from the Central City Boundary. • Walking uphill at very slow (3.0 km/h) and slow speed (3.3 km/h) would be vigorous physical activity for most adults and would last less than 5 minutes, which is doable for most adults. • Individuals could further reduce exercise intensity of walking up this street by reducing walking speed to below 3 km/h which would not significantly extend the total walking time given the short distance.			

Table 10. Devon Street

Devon Street				
Street segment from the start to the 10-min walkable catchment boundary	Walking time at slow speed of 3.3 km/h (55 m/min)	Slope (% grade)	Metabolic equivalents of walking (METs)	Exercise intensity (based on METs)
1-50 m	1 min	4.8%	4.0	Moderate
51-100 m	1 min	19.0%	8.0	Vigorous
101-150 m	1 min	14.2%	6.6	Vigorous
151-200 m	1 min	13.9%	6.6	Vigorous
201-250 m	1 min	14.1%	6.6	Vigorous
251-300 m	1 min	15.0%	6.9	Vigorous
301-350 m	1 min	13.4%	6.3	Vigorous
351-400 m	1 min	12.9%	6.3	Vigorous
401-433 m	1 min	15.1%	6.9	Vigorous

Analysis:			
Total street length:	433 m	Total walking time:	9 min

Conclusion:	**Walkable street**
Rationale:	• Only 433 metres of street length from the Central City Boundary. • Walking uphill at slow speed (3.3 km/h) would be vigorous physical activity for most adults and would last up to 8 minutes, which is doable for most adults.

- Individuals could further reduce exercise intensity of walking up this street by reducing walking speed to 3 km/h or less which would not significantly extend the total walking time given the short distance.

24. The results presented in Tables 7 to 10 show that Hay Street, Bolton Street, Aurora Terrace, Everton Terrace, and Devon Street in Wellington City are walkable streets when analysed through an exercise science lens.

25. Walking uphill on Hay Street, Bolton Street, Aurora Terrace and Everton Terrace at very slow (3.0 km/h) and slow speed (3.3 km/h) would be vigorous intensity exercise for most adults and would last less than 5 minutes, which is doable for most adults. Walking uphill on Devon Street would be also vigorous intensity for most adults and would last less than 10 minutes, which is also doable for adults.

26. Individuals could further reduce exercise intensity of walking uphill by reducing walking speed to below 3 km/h which for short walking distances would not significantly extend the total walking time to reach a destination. The Walkable Catchment Model already accounts for a reduction of speed walking up the steeper slopes.

27. It is important to reiterate that as per recommendations from the World Health Organization[32] both moderate and vigorous intensity physical activities undertaken regularly are recommended for adults to achieve health benefits (see paragraph 14 for further details).

28. It is also important to acknowledge that choice of residential location requires a consideration of and compromises with respect to a wide range of individual and household-related needs and preferences as well as consideration of financial constraints and other factors such as a stage

[32] Bull FC, Al-Ansari SS, Biddle S, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020; 54(24):1451-1462. DOI: https://doi.org/10.1136/bjsports-2020-102955

in life cycle (as summarised by Kajosaari, Hasanzadeh and Kyttä (2019).[33] Therefore, it is likely that some urban residents will be able to choose their neighbourhood environments according to their personal preferences.

29. Finally, walking for transport has multiple health benefits - it contributes to increasing or maintaining physical activity and better mental and physical health[34] - and therefore should be supported and encouraged in urban environments.

Appendix 2 References

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45. The screenshots in Figures 17-19 are derived from Council's 3D Viewshaft viewer and present viewshafts V13 – V15 along with a 3D representation of the height of surrounding buildings based on the proposed maxima in the PDP. What these figures illustrate is that a development built to the suggested 14m height maximum in the MRZ would intrude into VS13, VS14 and VS15.

46. Based on these screenshots it is clear that development above 11m in specific sites in Kelburn risks encroachment into viewshafts VS13 - VS15 due to their close proximity to the Cable Car viewing platform. As such, I have proposed an amendment via my supplementary addendum changes[13] to VIEW-R2.1 and VIEW-R2.2 that excludes MRZ properties in Kelburn located within the VS13 – VS15 overlays from developing to a maximum height of 14m as a permitted activity. In essence, excluding properties in Kelburn within the Viewshaft Overlay VS13-15 from being able to build to the MRZ-S2 maximum height limit. Instead, any such development would require a Discretionary resource consent, with anything up to 11m permitted as of right in alignment with the MDRS.

47. The application of Discretionary Activity status, rather than Restricted Discretionary, to proposals that exceed the 11m maximum height on affected Kelburn properties reflects that the viewshafts they are located beneath are Category 1 (Iconic and Landmark) viewshafts.

48. Whilst I note that the PDP HRZ zoned Kelburn sites within VS13-15 are located further down the hill and at a greater distance to the MRZ zoned sites, I consider that further analysis is needed to understand if development built to the HRZ-S2 21m height limit would intrude into these viewshafts. Without this evidence, I do not consider it is appropriate to allow any development within HRZ sites within the Viewshaft Overlay above 11m as a permitted activity within the

[13] WCC Hearing Stream 3, Viewshafts, Anna Stevens Supplementary Evidence – Appendix A – Viewshaft -Tracked changes (addendum), 2023

the market, developers will take this impact (and cost) into account in determining the residual value they can pay for land. In this way, land values moderate to account for the true costs of infrastructure to adequately service that land, rather than being a cashflow cost upfront on all land regardless of intent to redevelop.

Response to other matters raised at the hearing:

23. I have considered questions from Mr. Schofield in relation to the justification for the recommended amendments made to THW-O3 in my rebuttal supplementary evidence. Having assessed the evidence from Ms. Williams, I recommend an amendment to the wording of the objective to align the objective with the intent of the chapter and the rest of the policy framework as follows. I note that this amendment is made on the basis that the hydraulic neutrality definition and objective/policy wording remain unchanged, i.e. referring to an undeveloped state.

> **THW-O3 Hydraulic Neutrality**
>
> The offsite stormwater peak flows and volumes as a result of subdivision, use and development in urban areas are reduced **as far as practicable** to be at or below peak flows and volumes of each site in an undeveloped state.

24. In relation to Mr. Daysh's question about the difference between the Proposed (PDP) and Draft District Plan's (DDP) versions of the Three Waters chapter, in relation to Hydraulic Neutrality, I note that there was a Hydraulic Neutrality provision framework in the DDP[5] though the term undeveloped state was not used, and the framework only related to large scale and non-residential development.

25. The other matters raised at the hearing that I wish to response to relate to Mr. Stewart and Mr. Lewandowski's presentation on behalf of Stratum Management. Mr. Stewart noted that the definition of undeveloped state would be unworkable for smaller sites within the City Centre Zone as it would make the development cost prohibitive.

26. While I understand the requirement for on-site stormwater management will increase development costs, I direct the panel to Dr. Norman's supplementary evidence for further assessment of the costs to implement Hydraulic Neutrality. But I note that similar to any permitted rule framework, it will not be feasible for all

[5] WCC Draft District Plan, Page 80 – 82.

developments to meet the permitted activity rule, and the consenting pathway intentionally takes into consideration site constraints. Applications made under this rule would also be precluded from public and limited notification in order to provide some certainty to developers.

Date: 28 August 2023