Data Collation Gap Analysis Report

Wellington Regional Climate Change Impact Assessment

Prepared for Wellington City Council
Prepared by Beca Limited

10 August 2023

Contents

Revision History

Revision Nº	Prepared By	Description	Date
1	Lucas Everitt, Henry Carthew	Phase 1 Data Report - Final to Client	25/05/2022
2	Azura Patterson-Ng, Erin Connolly, Henry Carthew	Phase 2 Data Report (Detailed Assessment Gap Analysis) – Draft for internal review	03/08/2023

Document Acceptance

Action	Name	Signed	Date
Prepared by	Azura Patterson-Ng / Erin Connolly		10/08/2023
Reviewed by	Henry Carthew		11/08/2023
Approved by	Cushla Loomb		11/08/2023
on behalf of	Beca Limited		

Executive Summary

The Beca-led team, including domain leads, have undertaken a review of data available to inform the Wellington Regional Climate Change Impact Assessment (WRCCIA). The review of data has been an iterative process with two main stages including:

1) Initial data assessment and methodology development for the WRCCIA.
2) Detailed assessment of selected risks

This report briefly outlines the methodology undertaken by our team to assess the spatial and non-spatial data that was shared by the councils and available to the project team. Significant gaps or challenges that were identified in this process are documented, along with an identification of some recommended next steps.

Owing to the significant quantity and variability of the received data, the focus of the initial data assessment was on identifying GIS layers and information relating to two key components of the risk assessment:

1) **elements at risk** and
2) **exposure** across the Wellington Region (Figure 1).

Key to the check of the data during the initial data assessment is whether it is available across the whole region and the completeness of elements at risk able to be assessed should they be selected for the detailed assessment. A register is provided in Appendix C with analysis of the data undertaken by our GIS team and domain leads (built and natural environment, human, economic and governance) during the initial data assessment. The register discusses key layers that could be used in the WRCCIA to inform exposure, along with any high-level points or information to look for within attribute tables that might inform sensitivity and adaptive capacity as it relates to vulnerability of an element at risk as per the risk framework (Figure 1 below).

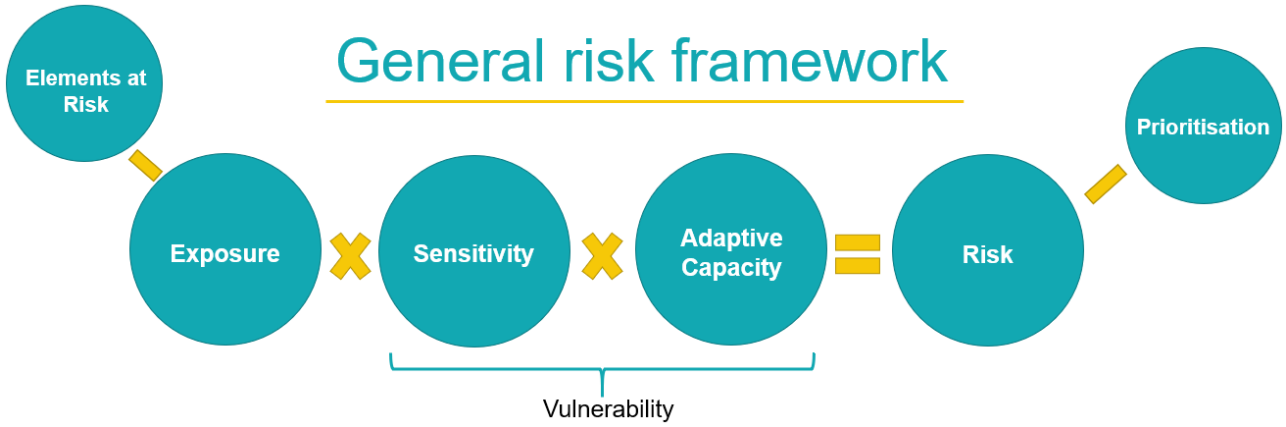


Figure 1. Risk Assessment Framework. Adapted from MfE (2021) Guide to Local Climate Change Risk Assessments

The assessment of data as it relates to vulnerability was undertaken in the Detailed Assessment stage (following the selection of risks prioritised for the detailed assessment).

During the initial data assessment it became evident that there is a lot of information relating to the built environment. However significant gaps were identified in relation to the other domains, particularly economic and human domains.

The Detailed Assessment stage of data review focussed on the availability and suitability of data needed to support the particular risks selected to do a consistent and detailed analysis of impacts that can be used to

provide information to support a regionally consistent impact assessment. The focus was to identify spatially available information to allow a quantified assessment of risks and impacts where possible.

Further to the gaps identified in the initial data assessment stage, there were a number of significant gaps identified in the Detailed Assessment stage to support a consistent impact assessment across the region. For example, there is no coastal erosion spatial information available for Wellington City and detailed coastal erosion information collated for the Kapiti Coast (Takutai Kapiti) was determined as not a suitable data set to be used as part of this process[1]. The approach to identifying and mapping coastal erosion, including how future climate projections have been included in the information, varies to such an extent across the region that we consider this a high priority area for future work. By collecting this information, a significant climate hazard for many of the parts of the region can be assessed further and a regional prioritisation undertaken to guide future adaptation planning.

Other gaps in climate hazards for the risks selected for Detailed Assessment includes landslides. GNS Science has undertaken work as part of the SLIDE project using HIRDS information to inform rainfall induced landslide (RIL) areas. However data through this project on landslides susceptibility is only available for the Wellington City area at this time. We understand that there is ongoing work programmed as part of the SLIDE project to expand the RIL across the entire Wellington region. There is regional landslide information available for earthquake induced landslides but this was not considered by technical specialists to accurately reflect the climate change potential risks (that are associated with rainfall).

In regards to the flood data, it was identified during the initial data gaps stage that there is regionally available flood information from Greater Wellington Region Council. However, there is more detailed flood information available from Wellington Water for Wellington City, Porirua City, Hutt City and Lower Hutt. In addition, Kapiti Coast District Council has more detailed flood modelling data. Upon a detailed review of this data and consideration for use in the regional impact assessment, including consistency of future climate scenarios and timeframes and information such as depth/velocity, it was decided that the GWRC flood data combined with the WWL dataset was the best available information to support the regional climate impact assessment and provide a consistent future view of potential impacts.

Other climatic hazards such as temperature, rainfall, dry spells are available from NIWA as regionally consistent spatial datasets.

Elements at risk for the risks selected for Detailed Assessment are widely available across the region through existing district plan data sets (and regional datasets for natural environment features). However, there are limits to the level of detail of this information that have hindered the exposure and vulnerability assessment and resulting impact analysis. For example, there is a lack of data on building floor levels across the region which as meant that assumptions have had to be made in regards to potential impacts. The Final WRCCIA Report documents the assumptions and limitations of the impact assessment further.

The digital risk and impact viewer developed as part of the WRCCIA has been configured using existing software in use by the various councils across the Wellington region (ESRI ArcGIS Online). In this way, future spatial data collated (for example on coastal erosion) can be incorporated in the viewer at a future date, allowing the assessment to be expanded over time.

[1] As advised by Kapiti Coast District Council

Part A – Initial Data Gap Analysis

Project Phase 1 (Data Gap Analysis May 2022)

1 Methodology

The methodology for the data assessment is as follows:

1.1 Data Information Request

An information request was sent to the client GIS and governance teams that identified potentially useful datasets which would help to identify and understand elements at risk across the Wellington Region. The request was informed by Domain themes and Elements as directed by the National Climate Change Risk Assessment (NCCRA):

Human | Natural Environment | Economy | Built Environment | Governance

The council teams shared over 200 datasets of potentially relevant information into a shared folder for assessment. This included spatial datasets (shared through an ArcGIS Online group) and non-spatial data (shared through a Sharepoint site). Our domain leads also contributed additional datasets that they hold or are aware of.

1.2 Initial Data Review

An initial, high-level review of the information provided was undertaken, which focused on organising the data into groupings relevant to the NCCRA domains (as above) and reviewing whether anything is available for the various elements and climate risk indicators. This was followed by a workshop with the clients GIS teams to understand if there was additional data they were aware of beyond what was provided.

1.3 Data Consolidation

A spreadsheet of the datasets for each Domain was generated to record responses from the Domain leads, this included both the spatial and non-spatial information that was provided by the council teams.

As an additional tool to assess the spatial data, an interactive map viewer was generated for each of the Natural, Human and Built Environment Domain themes. Map viewers for Economic and Governance domains were not generated as datasets were predominantly non-spatial and often found to be integrated with the spatial data of the other domains.

The map viewers can be accessed using the following links (note that a login to WCC GIS will be required to view these):

- Natural Environment Domain
- Human Domain
- Built Environment Domain
- Climate Hazards Domain

1.4 Data Analysis

The map viewers and the Domain spreadsheets were used as a tool for the Domain leads to assess the data with a focus on commenting on:

- Spatial coverage – National, Regional, TLA or other
- Type of dataset – Point, line, polygon, grid, etc.
- Priority – Usefulness and usability
- Alternative or additional information sources

The Beca-led team worked through the information with each Domain lead to populate the spreadsheet with relevant commentary on the above points. The collated data sets were appraised for whether they would:

- be sufficient to guide qualitative scoring of climate hazard exposure at regional/district scale, and
- provide insights at a finer resolution within the detailed risks assessment step.

The Governance assessment considered the governance and strategy contents listed in Appendix A.

The existence and applicability of climate projection data to support assessment of Climate Hazard impacts was reviewed by representatives from NIWA. The list of climate hazards was drawn from the primary and secondary climate drivers from the NCCRA. This initial assessment is presented in Appendix B.

2 Data Analysis

Commentary on the listed datasets and information collated and reviewed for the initial assessment stage for Natural, Human and Built Domains can be found in Appendix C, along with a high-level identification of preferred datasets.

Identified data gaps or specific requests or queries of information of the councils are shown in Table 1 below. The comments indicate whether the WRCCIA team consider, at the initial analysis stage, the information gap is urgent or not urgent (based on potential implications for impact assessment). This consideration considered the ease of inclusion or potential workarounds for the information.

Key	
	Needs further investigation
	Nice to have

Table 1. Data gaps identified by domain leads.

Natural Domain	Team Responsible	Priority	Comments
Additional data considered helpful can be requested from Department of Conservation. We consider this request is best coming from council.	Council GIS Leads		WCC – not urgent
Is there regional threat status documents for indigenous species in Wellington? Otherwise, national status designations can be used.	Council Ecology Leads		Not urgent
Built Domain			
Standardised zoning maps across the region (e.g. Residential, Commercial, Industrial) to inform building use types.	Council Planning Team		Not urgent
Private infrastructure assets which support the region; electricity supply assets (poles, underground cables; e.g. from Wellington Electricity), telecommunications services (cabinets, exchanges, underground, e.g. Chorus, Spark), port and marina assets (e.g. Centreport).	Council GIS or Beca		
Unified set of coastal protection structures (private, council) across the region.	Council GIS		
Human Domain			
Data that shows the number of medical facilities per population. We note that this could be generated by overlaying medical facilities and population datasets if found at later stages to be important for the detailed assessment	Council GIS Leads		
Economic Domain			
Additional data from the councils regarding the value of assets (e.g., QV data used for determining rates; separated for the value of land, and of dwelling).	Council Rates Databases		Access to rates database – high priority
Spatial information about the sectoral breakdown of economic activity. Possibly able to be obtained from each council in the aggregate (i.e. not broken down geographically within councils).	Council GIS Leads		
There are likely further asset value datasets that might be useful, with respect to public infrastructure. We will contact Waka Kotahi and others to see if we can source.	Beca		
Additional key datasets from alternate sources such as LINZ, StatsNZ etc.	Beca		

Insurance information	May not be available		
Governance Domain			
How the Councils fund maintenance/whether they have a record of cleaning up after climate events and capital costs of protection works across coasts, rivers, other damage from pluvial flooding. Drought costs (these will be both council and council area based (or regional) and MPI or other Government agency costs. This may also include costs to outdoor Council workers e.g. hours lost to heat? Alternatively, it would be good to know if a system exists to gather this sort of information.	Council Project Leads		
How the councils monitor risks to council business (this may not yet be monitoring climate change risks). This would give an idea of how councils currently manage risks / who is responsible / how risk information is kept. (e.g. is it regularly reported and accessible for reporting? / who is the steward and how frequently do councils have risks reported to them?)	Council Project or Risk Management Leads		
The effectiveness of how councils work with iwi Māori and what the risk of litigation is and impact on adaptive capacity if councils do not regularly engage and partner with iwi Māori. This information likely to come through talking to the Māori groups and/or the councils. There may be a difference in perception which in itself could be a risk.	Council and Beca Mana-Whenua Engagement Leads		

Identified data gaps in the climate change hazards information are included in Table 2 below. Generally, information on the direct atmospheric changes (temperatures, winds, rainfall) are spatially available and comprehensive as per NIWA and GWRC's recent investigations and publications. However, there are still some research outputs and projections which are non-spatial.

We note that much of the fluvial and coastal hazard assessment information is only available at varied model resolutions and with inconsistent coverage around the region. This is because specific studies have been commissioned for a specific purpose (e.g. specific modelling of a single catchment flood hazard compared to a region-wide flooding assessment). This will result in inconsistencies in hazard exposure identification where, for example, a coarse model shows a property is inundated, but a fine model does not.

Table 2. Climate Hazard data gaps analysis

Climate hazard	Team Responsible	Priority
Gridded climate indicator data – gaps at coast. The downscaled climate projections from NIWA (available in GWRC viewer) are at 5 km grids with gaps in coverage at coastal areas. Filling the gaps is important to providing regional coverage of climate hazards for the assessments. The data will be interpolated by NIWA to cover all land area within the region.	NIWA	
Sea-level rise and salinity stresses on brackish and aquifer systems and coastal lowland rivers.	NIWA, GNS, Council Hazards teams	
Increasing coastal erosion of cliffs and beaches. Inconsistent regional coverage of coastal erosion hazard projections (e.g. compare KCDC and Wairarapa availability).	Council Hazards teams	
Marine heatwaves: more persistent high summer sea temperatures	NIWA	
Ocean chemistry changes: nutrient cycling and pH changes. Projections not available.	NIWA	
Red – Needs further investigation Orange – Nice to have		

Part B – Detailed Assessment Data Gap Analysis

Project Phase 2 – Detailed Assessment (June 2023)

3 Data Overview

The table below provides an overview of each of the elements at risk and the climate drivers which were selected for the Detailed Assessment. The Data was assessed for its spatial extent, its suitability for an impact assessment (i.e. containing metadata to inform vulnerability) and whether it can be manipulated to be consistent across the region (noting a key outcome from the WRCCIA is a consistent regional view of climate impacts). Recommendations on further work to undertake a complete assessment of these is included in Table 4 (climate hazards) and Section 6.

The table below provides an overview of what was included as part of the Detailed Assessment, including whether it is suitable to show spatially in the impact viewer tool.

Table 3: Detailed Assessment risks and extent they were able to be assessed in the impact viewer tool.

Risk ID(s)	Domain	Risk Statement	Included in final Detailed Assessment/Impact viewer tool	Reason for not including (if applicable)
BD32	Built	Risk to **buildings and facilities** (public and private) due to increasing **coastal erosion**: cliffs and beaches	No – impact viewer tool Yes – qualitative assessment	Coastal erosion hazards have been defined very differently across districts and some districts did not have any suitable information available. This issue was identified in the Phase 1 Data Gaps analysis (**Error! Reference source not found.**). For example, data to support future scenarios was only available for Porirua and Kapiti Coast however the future scenarios were not regionally consistent as KCDC has probabilistic estimates of erosion potential across multiple SLR scenarios (refer to KCDC Takutai Kapiti webpage) however Porirua has a single +1m SLR scenario for isolated areas. District-scale gaps in coastal erosion hazard knowledge include present and future erosion potential for Wellington City, Lower Hutt (Petone to Eastbourne) and the three Wairarapa coastal councils. The gaps comprise a large portion of the populated coastal areas and communities, including known erosion risk areas (refer Qualitative Assessment). Reporting regional climate change risks and impacts from coastal erosion from this incomplete dataset would produce an inconsistent view of risks across the region.

Risk ID(s)	Domain	Risk Statement	Included in final Detailed Assessment/Impact viewer tool	Reason for not including (if applicable)
				Resolving this data gap should be a priority step in future assessments given the high potential risk from coastal erosion. Refer further detailed comments in Climate Drivers section below.
BD87	Built	Risk to **transport** (road and rail) due to **increasing landslides** and soil erosion	Partial – impact viewer tool Yes – qualitative assessment	Relevant data to use for assessing landslide risk was explored including earthquake induced landslides (SLIDE) however this was deemed to not be appropriate for a climate change study at GNS Science land slide specialists recommendation. A rainfall induced landslide (RIL) model has been completed by GNS Science however this only covers the Wellington City boundary for three present day extreme rainfall events (50, 100 and 250-year ARI). These rarer extreme rainfall events at present day were assessed as being equivalent to future extreme events based on the NIWA predictions of future extreme rainfall in HIRDS. WCC coverage is used in the spatial impact assessment but there is no information for the other districts for this risk and so a qualitative assessment only is undertaken. GNS Science have stated that expanding coverage of the same model for the western area of the Wellington Region is possible with a little work, and that more extensive work is required to do the same mapping for the eastern Wairarapa hill country. GNS Science have stated they would also be able to incorporate NIWA's HIRDS predictions of future rainfall events with climate change to the RIL models in future. However we also understand that there may be future work planned to upscale the Wellington information to a national scale. The One Network Road Classification (ONRC) dataset including road hierarchy and vehicle numbers for the Wellington Region was sought from Waka Kotahi but not received for use on the WRCCIA. As landslide information was only available in the Wellington City area the Wellington City road categorisation dataset was used which contained attribution consistent with the ONRC. If the

Risk ID(s)	Domain	Risk Statement	Included in final Detailed Assessment/Impact viewer tool	Reason for not including (if applicable)
				landslide information was expanded to the rest of the region the ONRC dataset would be required (or similar alternative datasets from each council containing ONRC classification and ADT numbers).
BD30	Built	Risk to **buildings and facilities** (public and private) due to **coastal and estuarine flooding:** increasing persistence, frequency and magnitude	Yes	There were some limitations in the data to inform vulnerability of the different types of buildings and facilities such as building floor levels and building construction materials. Assumptions and limitations to this assessed risk is included in the WRCCIA Final Report.
BD33	Built	Risk to **buildings and facilities** (public and private) due to **increasing landslides** and soil erosion	Partial	Relevant data to use for assessing landslide risk was explored including earthquake induced landslides (SLIDE) however this was deemed to not be appropriate for a climate change study at GNS Science land slide specialists recommendation. A rainfall induced landslide (RIL) model has been completed by GNS Science however this only covered the Wellington City boundary for three present day extreme rainfall events (50, 100 and 250-year ARI). These rarer extreme rainfall events are approximated to future extreme events based on the NIWA predictions of future extreme rainfall in HIRDS. WCC coverage is used in the spatial impact assessment but there is no information for the other districts for this risk and so a qualitative assessment only is undertaken. GNS Science have stated that expanding coverage of the same model for the western area of the Wellington Region is possible with a little work, and that more extensive work is required to do the same mapping for the eastern Wairarapa hill country. GNS Science have stated they would also be able to incorporate NIWA's HIRDS predictions of future rainfall events with climate change to the RIL models in future. Completing the assessment for these areas may be commissioned and added to the digital tool following this study. There were some limitations in the data to inform vulnerability of the different types of buildings and facilities such as building floor

Risk ID(s)	Domain	Risk Statement	Included in final Detailed Assessment/Impact viewer tool	Reason for not including (if applicable)
				levels, building construction materials and occupancy and demographics of the buildings. Assumptions and limitations to this assessed risk is included in the WRCCIA Final Report.
BD29	Built	Risk to **buildings and facilities** (public and private) due to **river and pluvial flooding:** changes in frequency and magnitude in rural and urban areas	Yes	Flooding data within Wellington Region is available from a variety of studies from Wellington Water, GWRC and some individual district councils more detailed flood modelling (e.g. KCDC). This flood mapping covers most of the region but the various models are not consistent in resolution, inclusion of future climate scenarios, inclusion of metrics used for the risk assessment such as flood depth, or inclusion of protection measures and stormwater infrastructure (i.e. some data factors in flood mitigation and others do not). These inconsistencies mean that some flood risks will be overstated in some areas (where protection not factored in for example) and therefore resulting impacts would be inconsistently viewed across the region. The differing future climate projections used for flood modelling also mean that significant manipulation of data or assumptions would need to be made to compare 'apples with apples' when predicting future climate impacts across the region. For these reasons, and on the advice of GWRC, we adopted an approach to include local flood model results (consolidated WWL) with the GWRC Regional Flood Exposure model (which align in regards to how future flood risks are treated). It is noted that the more detailed flood modelling available in some areas (such as Kapiti) can still be used in localised flood risk planning and the WRCCIA viewer tool will highlight where this information is available. This approach meets the project objectives by allowing a regional perspective of the increasing risk from climate change on flooding hazards and a consistent regional view of potential future flood impacts

Risk ID(s)	Domain	Risk Statement	Included in final Detailed Assessment/Impact viewer tool	Reason for not including (if applicable)
				The approach also allows improved resolution of building exposure from flood depths (as this information is not available from some data sets such as the Greater Wellington priority rivers flood modelling data). See further details in the table below.
HD84, HD85, HD86	Human	Risk to **cultural heritage** due to climate change hazards (with a focus on **flooding, sea level rise, coastal erosion**)	No – impact viewer tool Yes – qualitative assessment	There is existing cultural heritage information in the form of existing sites mapped in district/city plans. However, in the absence of involvement from mana whenua this has not been discussed, including how it is used in the impact viewer tool. Based on experience in other regions, there are likely to be significant sites that are not part of these layers and only known to mana whenua. There are limitations on coastal erosion data (as described above and shown in Table 2. A qualitative assessment is provided.Table 2. Climate Hazard data gaps analysis
HD29, HD30, HD31	Human	Risk to **social cohesion** due to climate change (with a focus on **flooding, sea level rise, coastal erosion**)	Partial – impact viewer tool Yes – qualitative assessment	Social cohesion is complex and comes down to the specific attributes of particular communities. Communities are also not 'static' as that adds to the complexity of measuring impacts, especially potential future impacts. Given this, a qualitative assessment will provide the most useful measure of potential social cohesion impacts. However some relevant information that could be used to assess social cohesion has been included in the impact assessment viewer including the location of community facilities such as schools, hospitals, aged care facilities, supermarkets and religious facilities.
HD48, HD49, HD50	Human	Risk to **existing inequities** due to climate change (with a focus on **flooding, sea level rise, coastal erosion**)	Yes	There is no specific data available on inequities that exist within Wellington regional communities. Indicators such as quality of housing, socio-economic indices and others from census have been included in the impact assessment viewer however they do not provide the complete picture.

Risk ID(s)	Domain	Risk Statement	Included in final Detailed Assessment/Impact viewer tool	Reason for not including (if applicable)
				Given this, a qualitative assessment will provide the most useful measure of potential impacts on existing inequities.
Relates to ND67	Natural	Risk to **vulnerable coastal ecosystems** (dunelands, saltmarshes) due to coastal squeeze (caused by existing infrastructure, **storm surge, and sea level rise**)	No – impact viewer tool Yes – qualitative assessment	There are existing datasets of vulnerable coastal ecosystems including saltmarsh, dunelands, estuaries and marine mammal haulouts. There is also information available spatially of 'hard infrastructure' such as roads and buildings. However there is no information in literature on the potential impacts or 'indicators' of impacts for when the viability of these ecosystems may be affected (i.e. what sea level depths may impact the ecosystem) which made it difficult to assess impacts in a spatial manner. A qualitative assessment is provided rather than a spatial quantification.
Relates to ND26	Natural	Risk to **critically endangered forest types** (all warm forest) due to changes in **mean annual rainfall**	No – impact viewer tool No – substituted for temperature	The location and definition of critically endangered forest types was identified spatially however the interaction between rainfall and the impact changes in rainfall has on the forest types was difficult to assess due to a lack of suitable climate indicators that are comparable with the water deficit thresholds published in ecological literature. This meant that potential changes in forest distribution in response to changes in evaporation transpiration and rainfall could not be quantified with existing data. However, through a literature review temperature changes impacts on forest types was determined and existing datasets for temperature allows that information to be shown spatially. A qualitative assessment has been provided in the impact viewer tool.
ED13, ED23, ED33	Economic	Risk to **primary industries** (pastoral farming, horticulture, viticulture) due to more and longer **dry spells and drought**	No – impact viewer tool Yes – qualitative assessment	The location and definition of various primary industry was identified spatially however the economic impact of drought was could not be assessed due to a lack of data connecting reduced PED (experienced during dry spells and drought and the available

<table>
<tr><th>Risk ID(s)</th><th>Domain</th><th>Risk Statement</th><th>Included in final Detailed Assessment/Impact viewer tool</th><th>Reason for not including (if applicable)</th></tr>
<tr><td></td><td></td><td></td><td></td><td>climate hazard dataset) with productivity of primary industries and therefore economic impact of dry spells and drought.
A qualitative assessment has been provided.</td></tr>
<tr><td>ED79, ED80</td><td>Economic</td><td>Risk to insurance coverage and credit provision due to increasing fire–weather conditions; storminess</td><td>No – impact viewer tool
Yes – qualitative assessment</td><td>Insurance data unavailable and so it is not possible to show or quantify impacts in the impact viewer tool.
There is no available fire-weather data.
A qualitative assessment has been provided.</td></tr>
<tr><td>ED4</td><td>Economic</td><td>Risk to forestry due to increasing fire–weather conditions: harsher, prolonged season</td><td>No – impact viewer tool
Yes – qualitative assessment</td><td>The location and definition of forestry areas is available spatially however the interaction between forestry and fire weather could not be assessed due to a lack of suitable data sources for fire-weather. The most promising information source was the CMIP 6 data set from Climate Prescience models evaluated for the latest AR6 climate change projections. The peer-reviewed paper shows spatial maps, with some information tabulated for fire weather season length for highly vigorous surface wildfire weather conditions in Wellington:
<table>
<tr><td></td><td colspan="2">Wellington City</td><td colspan="2">Wellington Region</td></tr>
<tr><td>Period</td><td>2005-2035</td><td>2065-2095</td><td>2005-2035</td><td>2065-2095</td></tr>
<tr><td>RCP2.6</td><td>13 days</td><td>14 days (+1 day, +8%)</td><td>11 days</td><td>11 days (+0 days, +0%)</td></tr>
<tr><td>RCP4.5</td><td>13 days</td><td>15 days (+2 days, +15%)</td><td>11 days</td><td>13 days (+2 days, +18%)</td></tr>
<tr><td>RCP6.0</td><td>14 days</td><td>15 days (+1 days, +7%)</td><td>11 days</td><td>14 days (+3 days, +27%)</td></tr>
</table></td></tr>
</table>

Risk ID(s)	Domain	Risk Statement	Included in final Detailed Assessment/Impact viewer tool	Reason for not including (if applicable)
				<table><tr><td>RCP8.5</td><td>13 days</td><td>17 days (+4 days, +31%)</td><td>11 days</td><td>17 days (+6 days, +55%)</td></tr></table> GIS files of fire weather indices were not available and so this risk is assessed qualitatively.
	Economic	Opportunity for **forestry** due to international influences from climate change and **greenhouse gas mitigation preferences**	No – impact viewer tool Yes – qualitative assessment	Current pastoral land could be considered as sites for potential forestry and these have been mapped spatially however it is difficult to consider the complexity of this risk spatially. This risk is assessed qualitatively.
ED116	Economic	Risk to **manufacturing (industrial land)** due to climate change (with a focus on **flooding**, and **sea level rise**)	Partial – impact viewer tool. Yes – qualitative assessment	There is data available spatially for industrial buildings/zones and this has been utilised to better quantify exposure (links to buildings/facilities risks above). However there is no specific economic data available for buildings identified at risk and so economic impacts are assessed qualitatively.

4 Detailed Data Review

4.1 Climate Drivers

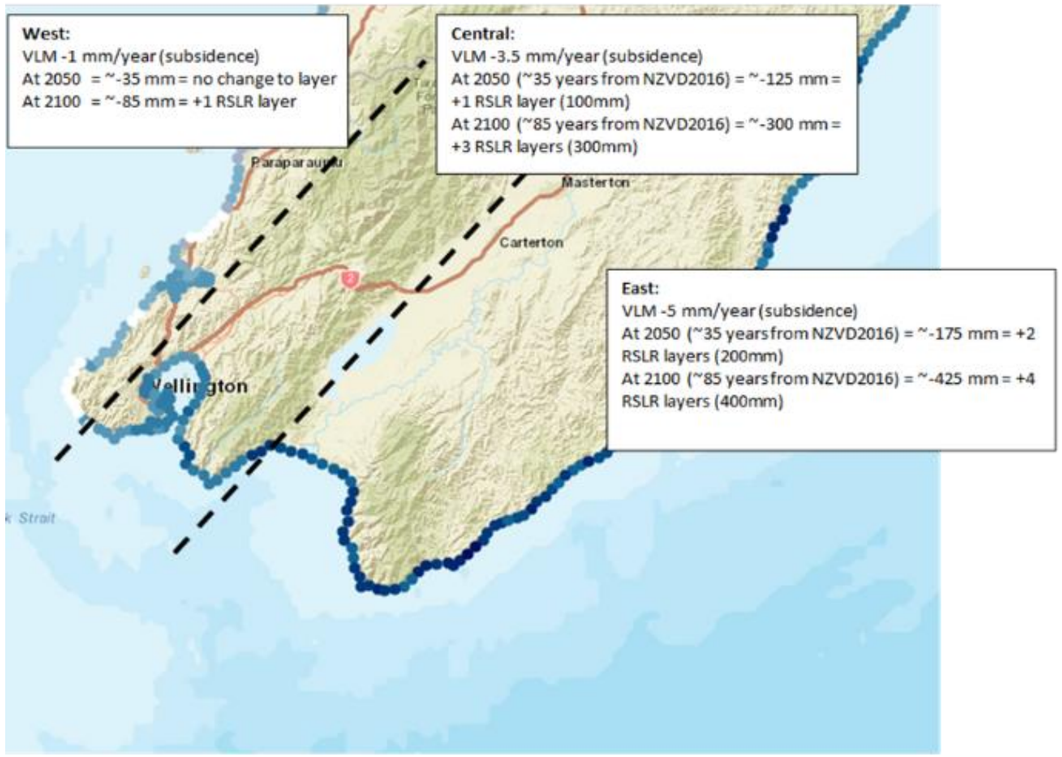
Table 4 below highlights the climate drivers/hazards datasets which were used in the Detailed Assessment along with details related to their selection, exclusion or work arounds.

Table 4. Climate Driver data used in the Detailed Assessment

Climate Driver	Risks to be assessed using data	Data used in Detailed Assessment	Comments	Next steps / Recommendations
Coastal erosion	• Risk to **buildings and facilities** (public and private) due to increasing **coastal erosion**: cliffs and beaches • Risk to **cultural heritage** due to climate change hazards (with a focus on **flooding, sea level rise, coastal erosion**) • Risk to **social cohesion** due to climate change (with a focus on **flooding, sea level rise, coastal erosion**) • Risk to **existing inequities** due to climate change (with a focus on **flooding, sea level rise, coastal erosion**)	We note coastal erosion has been defined very differently across districts with a large imbalance in detail of information available. **This will impact the regional consistency of any risk/impact assessment including coastal erosion (and therefore not able to be relied on for regional adaptation planning).** This issue was anticipated in the Phase 1 Data Gaps analysis (**Error! Reference source not found.**). GIS layers and information considered for coastal erosion includes: • Regional dataset – no regional coastal erosion layers available from GWRC. The NIWA 'Coastal Sensitivity Index' (https://hub.arcgis.com/maps/NIWA::nz-coastal-sensitivity-index-csi-erosion-1/about.) was trialled as providing a regional perspective of potential coastal erosion during the Qualitative Assessment workshops. However, this data is not suitable for detailed spatial risk analysis as it is outdated (circa 2011), does not include any climate change scenarios, and was methodologically too simple for hazards assessment and spatial planning (for example coastal erosion being defined as a line along the coastline). • Wairarapa Councils x3 - Foreshore Protection Area (50 metres inland of MHWS in all areas, with the exception of Riversdale where this Foreshore Protection Area has been specifically mapped based on a local hazard assessment). No SLR allowances hence hazard exposure will not change in time. Known erosion locations around the districts (e.g. Mataikona coastal route, Riversdale, Castlepoint) https://gis.mstn.govt.nz/arcgis/rest/services/ResourceManagementAndPlanning/ManagementAreas/MapServer/6 • KCDC – Takutai Kapiti model results are available from detailed erosion modelling including multiple future scenarios. KCDC requested these dataset not be used within WRCCIA. https://maps.kapiticoast.govt.nz/portal/apps/storymaps/stories/dbc000c7263f4d63b8978047ed0e826b at tie-ins to mid- • PCC – District Plan includes limited coastal erosion hazard layers. These show polygons of potential coastal erosion hazard at 2 timeframes only (present, end century) and only appear to be for localised areas within the district. District Plan: https://eplan.poriruacity.govt.nz/districtplan/property/0/0/141?_fp=true • WCC – Coastal erosion overlays not included within District Plan. NIWA have produced a high level 'proximity' for coastal erosion (30m horizontal and 3m vertical from present day MHWS). Some erosion projections at south coast pocket beaches associate with engineering studies (e.g. Owhiro Bay, Island Bay). No detailed erosion projections at district scale. Known local erosion issues at Lyall Bay adjacent to airport. NIWA report: https://wellington.govt.nz/-/media/your-council/plans-policies-and-bylaws/plans-and-policies/a-to-z/spatial-plan/coastal-hazards-report---august-2021.pdf?la=en&hash=E70B002B5D515679482B867E649FD90D3D74FB5C District Plan: https://eplan.wellington.govt.nz/proposed/property/0/0/33 Owhiro Bay: https://www.owhirobay.org.nz/uploads/1/3/1/2/131212593/%C5%8Cwhiro_bay_coastal_engineering_assessment_110321_ecoast.pdf Island Bay: https://wellington.govt.nz/~/media/your-council/projects/files/island-bay-seawall/coastal-processes-assessment-report.pdf?la=en • HCC – None. No Coastal Erosion layers available. Considerably armoured coastline within urban areas (Eastern Bays, Seaview). Known erosion issues alongside Eastern Bays beaches, dynamic coastal environment at Eastbourne with various erosion/accretion cycles over last century. Unknown erosion trends along south coast (outside harbour). • UHCC - NA (non-coastal council)	Inconsistent datasets across districts. No coastal erosion layers available for HCC, or GWRC. N/A for UHCC. Providing a detailed robust, regionally consistent and justifiable perspective on coastal erosion risks and impacts from climate change is not possible within the scope and timeframes of WRCCIA.	Commission a region wide study which consistently assesses present and future coastal erosion across the region and generates a regional dataset**.** We note that the University of Auckland via the Natures Science Challenges research programme are completing a nationwide 'coastal change' assessment based on satellite and historic aerial photographs. https://resiliencechallenge.nz The results for Wellington Region are anticipated to be available in 2024 (pers. comm. Professor Mark Dickson). The form and usefulness of these outputs for future climate change impact and adaptation programmes is unclear, however their data gathering is likely to be useful for future hazard assessments.

Climate Driver	Risks to be assessed using data	Data used in Detailed Assessment	Comments	Next steps / Recommendations
River and pluvial flooding	• Risk to **buildings and facilities** (public and private) due to **river and pluvial flooding:** changes in frequency and magnitude in rural and urban areas • Risk to **cultural heritage** due to climate change hazards (with a focus on **flooding, sea level rise, coastal erosion**) • Risk to **social cohesion** due to climate change (with a focus on **flooding, sea level rise, coastal erosion**) • Risk to **existing inequities** due to climate change (with a focus on **flooding, sea level rise, coastal erosion**) • Risk to **manufacturing (industrial land)** due to climate change (with a focus on **flooding**, and **sea level rise**)	Flooding hazards mapping within the Wellington Region is available from a variety of studies by Wellington Water, GWRC and some individual district councils detailed flood modelling (e.g. KCDC). However, the various models are not wholly consistent in resolution, inclusion of future climate scenarios, or level of detail such as inclusion of protection measures (stormwater network, stopbanks). For the purpose of this gaps report, the flood modelling sources have been grouped as follows: - Local-scale flood models. These have been developed by WWL or individual councils for predominantly urban catchments to simulate stormwater flooding hazard extents for district plans and other planning purposes. The local-scale models cover most, but not all, catchments within WCC, PCC, HCC, HCC, UHCC but excludes KCDC and the 3 Wairarapa Councils. KCDC are underway developing their own model. We understand this dataset will be similar to WWL but this is not available yet, and flood depth information was not available from the previous KCDC model results (flood depth is necessary for the detailed assessment of potential impacts). - Sub-regional priority catchments flood models available on GWRC public GIS server. Coverage is of only those catchments where GWRC provide flood risk management advice for GWRC flood protection schemes including some tributary rivers. Specific catchments and rivers include Otaki River, Waikanae River, Hutt River and tributaries, Porirua Stream, Wainuiomata River, Ruamahanga River and tributaries within Wairarapa Valley, and some smaller Wairarapa Rivers (Whareama River, Awhea River). https://mapping.gw.govt.nz/gw/floods/ - Regional flood exposure models (released 2023, modelled by T+T for GWRC) developed as a high-level model for the purpose of understanding flood exposure across the region. https://www.gw.govt.nz/your-region/emergency-and-hazard-management/flood-protection/flood-hazard-advice/regional-flood-hazard-assessment/ The local, sub-regional and regional flood maps were produced using a range of different hydrodynamic flood inundation modelling software and methods over recent years. For this assessment: - The Wellington Water flood models were consolidated together from the multiple sub-catchment model results across the councils. The common model simulations available were a 1% AEP events which includes a single future climate change scenario (+20% rainfall + 1m SLR). - The local KCDC flood model data was unable to provide flood depths within the project timeframe and KCDC are developing another detailed flood model but this is not due until the end of 2024. - The sub-regional GWRC rivers mapping includes detailed modelling of the only major rivers which GWRC manage flood hazards (e.g. Hutt, Otaki), with inconsistent coverage of catchments and climate change scenarios across the region. The flood modelling method differs from the other models, with the model outputs not including depth of flood waters. - The GWRC Regional Flood Exposure covers the whole region. However, we understand the methodology does not resolve protective features of stormwater networks to the same extent as the WWL and GWRC models. This also includes 1% AEP events and a climate change scenario (RCP6.0 and 8.5) at mid-century and end-century timeframes. On the advice of GWRC and based on the objectives of the WRCCIA to provide a regionally consistent impact assessment we adopted an approach to include local flood model results (consolidated WWL, excluding KCDC as noted above) with the GWRC Regional Flood Exposure model. This approach meets the project objectives by allowing a regional perspective of the increasing risk from climate change on flooding hazards, and allows improved resolution of potential building and transport impacts through use of flood depths in the exposure calculation. **Limitations.** Flood hazard maps developed using higher resolution modelling methods are considered to provide a more accurate representation of flood hazard areas, however until the entire region is modelled in a single consistent manner, there will be differences such as: ▪ Input parameters (e.g. rainfall, surface roughness) at the time of model development.	No single regionally consistent dataset available which covers all areas to the same level of detail. Highest detail in the local urban catchments models, but widest spatial coverage in GWRC regional flood exposure model to allow a regional assessment of risks and impacts.	NIWA are part-way through developing a National Flood Forecasting Tool as a research programme. This may provide an opportunity to work with the various councils to develop regionally consistent flood models at appropriate resolution. Liaison with the NIWA team (Dr Emily Lane) is recommended. However, the form and usefulness of these outputs for future climate change impact and adaptation programmes is unclear.

Climate Driver	Risks to be assessed using data	Data used in Detailed Assessment	Comments	Next steps / Recommendations
		▪ Inclusion/exclusion physical features (e.g. stopbanks, culverts, bridges) that influence flood hazard characteristics. ▪ Residual flood hazards (e.g. stopbank failures) are often excluded in modelled flood scenarios. ▪ Inconsistent inclusion of the influence of climate change (e.g. rainfall and sea level rise), or land use change on flood hazard characteristics in modelled flood scenarios.		
Sea level rise/coastal inundation	• Risk to buildings and facilities (public and private) due to **coastal and estuarine flooding**: increasing persistence, frequency and magnitude • Risk to **cultural heritage** due to climate change hazards (with a focus on **flooding, sea level rise, coastal erosion**) • Risk to **social cohesion** due to climate change (with a focus on **flooding, sea level rise, coastal erosion**) • Risk to **existing inequities** due to climate change (with a focus on **flooding, sea level rise, coastal erosion**) • Risk to **vulnerable coastal ecosystems** (dunelands, saltmarshes) due to coastal squeeze (caused by existing infrastructure**, storm surge, and sea level rise)** • Risk to **manufacturing** (industrial land) due to climate change (with a focus on **flooding, and sea level rise)**	Coastal inundation has been defined very differently across districts with a large imbalance in detail of information available. GIS layers and information considered for coastal inundation includes: • WCC – District Plan Inundation Hazard overlay – high resolution storm and wave modelling by NIWA in 2021 for the open coast areas. Simple bathtub mapping within the Harbour. Includes specific relative SLR scenarios. https://gis.wcc.govt.nz/arcgis/rest/services/DraftDistrictPlan/DraftDistrictPlan/MapServer/11 • PCC - District Plan layers 1% AEP at present day and with a single +1m SLR scenario. https://data-pcc.opendata.arcgis.com/datasets/PCC::coastal-hazard-current-inundation-pdp/explore • KCDC – Detailed probabilistic coastal inundation modelling via Takutai Kapiti mapping project. Note, the initial request from KCDC was to only use the Takutai Kapiti layers for the assessment. However, this request was changed (June 2023) to revert the KCDC area to be consistent with the rest of the region to address the risk of providing regionally inconsistent information and meet project objectives. https://takutaikapiti.nz/articles/takutai-kapiti/ • Wairarapa Councils x3 - Foreshore Protection Area (50 metres inland of MHWS in all areas, with the exception of Riversdale where this Foreshore Protection Area has been specifically mapped based on a local hazard assessment). No SLR allowances hence hazard exposure will not change in time. Known erosion locations around the districts (e.g. Mataikona coastal route, Riversdale, Castlepoint) 1. https://gis.mstn.govt.nz/arcgis/rest/services/ResourceManagementAndPlanning/ManagementAreas/MapServer/6 • GWRC regional storm surge and MHWS viewer https://mapping1.gw.govt.nz/GW/SLR/ • HCC – Limited Inundation mapping available. • UHCC – NA (non coastal) To use only these datasets would impact the regional consistency of any risk/impact assessment (and therefore not able to be relied on for regional adaptation planning). This issue was anticipated in the Phase 1 Data Gaps analysis (**Error! Reference source not found.**). Further, only the KCDC and WCC results explicitly account for vertical land motion (as recently available from NZSeaRise research programme). However, project partner NIWA provided their latest coastal inundation with SLR layers which have recently also been released publicly (May 2023). These maps provide the1% AEP + wave setup storm event, and include 0.1m SLR increments from 0-2m above present day (i.e. 20 layers with each layer related to a 0.1 m increment of SLR. This information is regionally consistent; however it does not include VLM which is the slow uplift or subsidence of the region not associated with earthquakes. VLM is available from NZ Sea Rise. Following the latest MfE (2022) interim guidance on coastal hazards and climate change, the SLR layer can be adjusted to account for local VLM by adjusting 'up' a 0.1m layer (for subsidence where SLR gets worse) or 'down' a 0.1 m layer (for uplift). The combined SLR + VLM is the *Relative SLR.* The SLR layer for each RCP/timeframe (mid/end century, RCP 4.5 and 8.5) was adjusted up/down to account for VLM based on 3 broad groups of regional subsidence across region as indicated below (-1mm/year: East, -3mm/year: Central, -5mm/yr: West – images from NZSeaRise). This approach was agreed with GNS Science as suitable for region and district scale assessments. Overall, the inclusion of VLM at the mid-century timeframe adds between 0 (west) and 2 (east) layers to the SLR mapping, increasing to 1 (west) and 4 (east) at the end century timeframe.	Regionally inconsistent when only looking at council-specific datasets. More detailed data available for KCDC and WCC than for other districts. NIWA and GWRC have regionally consistent results. NIWA results considered best available and selected but with adjustment for vertical land motion.	Commission extension to NIWA/GWRC inundation modelling results which consistently treats vertical land motion using information at the scale provided (2km intervals) by NZSeaRise. Where possible, align with KCDC Takutai Kapiti mapping scenarios. Note a different approach is likely appropriate for open coast compared to sheltered waters (e.g. WCC).

Climate Driver	Risks to be assessed using data	Data used in Detailed Assessment	Comments	Next steps / Recommendations
				
Landslides	• Risk to transport (road and rail) due to increasing **landslides** and soil erosion • Risk to buildings and facilities (public and private) due to increasing **landslides** and soil erosion	Rainfall induced landslides (RIL) data exists for Wellington City as part of the SLIDE project*. An assessment into other potential data sources for landslides was undertaken, including using Earthquake Induced Landslides (EIL) data (that exists for the whole region). The models differ in that the EIL model considers landslides triggered by the Peak Ground Acceleration from the national Seismic Hazard model, for the given return interval. The RIL model considers landslides generated in response to the 24hr rainfall from HIRDS, for the given return interval. The EIL model is based on the predicator variables of: Elevation, Slope Angle, Local Slope Relief, Curvature, Geology, Distance to Fault and Ground-Shaking (PGA). The RIL model is based on the predicator variables of: Elevation, Slope Angle, Local Slope Relief, Aspect, Geology, Land Cover and Rain plus Soil Moisture. Based on the overlap between the predicator variables (e.g. Elevation, slope angle, Local Slope Relief and geology), the models will predict similar areas that are more prone to landslides. However, the EIL and RIL model outputs will start to diverge when other factors, such as distance to fault and land cover come into play. Simplistically this means that, EIL generated landslides will preferentially occur in areas where higher ground shaking coincides with steeper slopes in weaker ground, compared to RIL, which will occur in areas where higher rainfall coincides with steeper slopes in weaker ground. Overall it was considered inappropriate to use EIL for the WRCCIA as, although the EIL model will give a general indication of areas that may be more susceptible to landslides in general, it does not take into account the rainfall patterns which are the variable of most interest for future climate projections. It would also be skewed toward larger scale slope movements triggered in proximity to known active faults. Therefore the SLIDE dataset was used for the assessment but the results are limited to the Wellington City area.	Appropriate RIL risk data is only available for the Wellington City area.	We understand the SLIDE project is being expanded and upscaled so that it can be applied nationally. We recommend that the remainder of the Wellington region is completed using the SLIDE project methodology and the data included in future versions of the impact viewer tool.

Climate Driver	Risks to be assessed using data	Data used in Detailed Assessment	Comments	Next steps / Recommendations
		**Townsend, D.B.; Massey, C.I.; Lukovic, B.; Rosser, B.J.; de Vilder, S.J.; Ries, W.F.; Morgenstern, R.; Ashraf, S.; Jones, K.E.; Carey, J.M. 2020 SLIDE (Wellington) : geomorphological characterisation of the Wellington urban area. Lower Hutt, N.Z.: GNS Science. GNS Science report 2019/28. [194] p.; doi: 10.21420/CHRR-4G41*		
Temperature change/rainfall	• Risk to **critically endangered forest types** (all warm forest) due to changes **in mean annual rainfall [replaced with temperature]** • Risk to **critically endangered forest types** (all warm forest) due to changes **in mean annual temperature** • Risk to **primary industries** (pastoral farming, horticulture, viticulture) due to more and longer **dry spells and drought** • Risk to **insurance coverage and credit provision** due to increasing **fire–weather conditions; storminess** • Risk to **forestry** due to increasing **fire–weather conditions**: harsher, prolonged season	Greater Wellington Regional Council holds data on future climate change projections for the region from work commissioned by NIWA and completed in 2017. The Climate Change mapping (*https://mapping1.gw.govt.nz/gw/ClimateChange/*) provides future projections for the region over a mid-century (2031-2050) and end-century (2081 – 2100) timeframe for a number of climate indicators including hot days (over 25 degrees), potential evapotranspiration deficit (PED) days over 300mm, mean temperature, dry days and wet days. Four climate scenarios are provided (RCP 2.6, RCP 4.5, RCP 6.0 and RCP 8.5). The resolution of this data is 5km x 5km and there are some gaps in coastal areas. Given the regional consistency of this information, the availability of information for the selected scenarios for the impact assessment and timeframes, this data has been used for the assessment associated with these risks. PED data and rainfall data available for the region were found to not be comparable with the moisture gradient thresholds assessed as potentially causing an impact for critically endangered forest types (warm forests) and so this climate driver was replaced with mean annual temperatures instead. This approach was confirmed with GWRC ecologist.	We are aware of fire-weather data held by Climate Prescience however there was a cost for the acquisition of this data and so it was not pursued within the scope of the WRCCIA project. However, it is considered that utilising available information on dry days and extreme heat as an indicator of potential fire weather is suitable for a qualitative assessment for the WRCCIA.	Given there was gaps in the data at a number of coastal areas around the Wellington region (due to the resolution of the model), as part of the WRCCIA NIWA extrapolated data to provide complete coverage.

4.2 Elements at Risk

The following table identifies the data used to demonstrate the elements at risk in the impact viewer tool and identifies any suggested further work.

Table 5. Element at Risk data used in Detailed Assessment

Domain	Element at Risk	Data Used	Future data work required / Recommendations
Built	**Buildings and Facilities**	LINZ Building Outlines with attributes to identify: • High level zone (source: council district plans grouped into residential, rural, commercial, mixed use, recreation, industrial, other) • Public/Private (source: LINZ ownership data) • Childcare facility Y/N (source: MoE) • School Y/N (source: MoE) • Hospital Y/N (source: MoH) • Aged care facility Y/N (source: MoH) • Religious facility (source: OpenStreetMap) • Supermarket (source: LINZ)	Consolidate built environment data sources into building and property specific information, drawing from ratings database, LINZ, central government department and other datasets. Arrange for consistent terminology, metadata and definitions to facilitate regionally consistent information. Key focus to be on building characteristics and uses which inform the parameters of sensitivity and adaptive capacity.
Built	**Transport (road and rail)**	Road Category dataset for Wellington City including One Network Road Classification and average daily traffic movements: • State Highway • High Volume • National • Regional • Arterial • Primary Collector • Secondary Collector • Access • Low Volume Wellington Region Road Priorities Network including road prioritisation for detour assessment • Priority 1 • Priority 1 Alternative • Priority 2 • Priority 3 • Priority 4 KiwiRail Track Centreline (with tunnels removed).	Generation of a consistent road dataset for the Wellington Region which contains good information which can be used to determine vulnerability and impact. Some manual work has been completed to link the Wellington Region Road Priority network information on detour routes to the WCC Road Category dataset and average annual daily traffic numbers in WCC data. If the methodology was expanded to the remainder of the region this manual linking would be required. Investigation into a road dataset which highlights ‘single point access roads’ where there is no alternative way to access a particular community should a road be cut off. This would be useful for determining human and social cohesion impacts. Further work to source or update a rail dataset which contains attribution on the types (E.g. freight, passenger) and number of daily/weekly movements.
Human	**Cultural heritage**	Wellington Natural Resources Plan 2019 • Schedule B - Ngā Taonga Nui a Kiwa • Schedule C - Sites with significant mana whenua values • Schedule E - Sites with significant historic heritage values Marae locations (Te Kāhui Māngai - TKM) This assessment has only used existing data contained in the Wellington Natural Resources Plan 2019 to identify sites of significance. There has been no engagement with mana whenua to identify new sites and/or re-verify the sites contained in the Natural Resources Plan 2019. Therefore, the sites identified are non-exhaustive and do not necessarily represent all potential sites of significance in the region nor the views of mana whenua.	
Human	**Social cohesion**	LINZ Building Outlines with attributes below • High level zone (source: council district plans grouped into residential, rural, commercial, mixed use, recreation, industrial, other) • Public/Private (source: LINZ ownership data) • Childcare facility Y/N (source: MoE) • School Y/N (source: MoE) • Hospital Y/N (source: MoH via LINZ) • Aged care facility Y/N (source: MoH) • Religious facility (source: OpenStreetMap) • Supermarket (source: LINZ)	

		Parks, Reserves and Open space zones from each district's district plan. GWRC Regional Parks	
Human	**Existing inequalities**	EHINZ Social vulnerability indicators based on 2018 Census: • Percentage of renters • NZ Deprivation index • Percentage of crowded households • Percentage of damp and mouldy houses • Percentage of 65+ older adults • Percentage of young children (under 5) • Percentage of school age children (5-17) • Percentage of unemployed people • Percentage of people able to work from home (derived)	We note that these datasets are indicators only of potential vulnerability.
Natural	**Vulnerable coastal ecosystems**	• Scientific dunelands 2022 (supplied by Roger Uys GWRC) • Coastal turf communities (supplied by Roger Uys GWRC) • Lake margins (supplied by Roger Uys GWRC) • Estuaries (supplied by Roger Uys GWRC) • Saltmarshes as identified by DoC ("Coastal marine habitats and marine protected areas in the New Zealand Territorial Sea: a broad scale gap analysis" report of 2011.)	
Natural	**Critically endangered forest types**	Singers Forest Classification • WF1, Titoki, ngaio forest • WF2, Tōtara, matai, ribbonwood forest • WF6, Tōtara, matai, broadleaved forest [Dune Forest] • WF8, Kahikatea, pukatea forest	
Economic	**Primary Industries**	Landcover database • Orchard, Vineyard or Other Perennial Crop • Short-rotation Cropland • High Producing Exotic Grassland • Low Producing Grassland New Zealand business demography statistics: February 2022 (Stats NZ) • A01 Agriculture Category	
Economic	**Forestry**	Landcover database • Deciduous Hardwoods • Exotic Forest • Forest – Harvested New Zealand business demography statistics: February 2022 (Stats NZ) • A03 Forestry and Logging category	
Economic	**Manufacturing**	Industrial zoned land (Council District Plans) New Zealand business demography statistics: February 2022 (Stats NZ) • C Manufacturing category	

5 Key Data Gaps and Recommendations

The initial review of data, undertaken by the Beca team and associated domain leads, has resulted in the identification of key gaps in the data available to inform the Wellington Regional Climate Change Impact Assessment. The Detailed Assessment stage involved a deeper interrogation of datasets for use in the detailed impact assessment and this highlighted further gaps or inconsistencies in available data.

There are some key gaps that we have recommended should form part of future work programmes. For example, coastal erosion data in absent in some areas and where it is available it is defined differently across districts. This type of inconsistency makes it difficult to use the data at a regional level without significant further work. Similarly, there is no regionally consistent data set available for river and pluvial flooding, and therefore two sets of data have been combined for use in the WRCCIA but this is not without it's limitations.

There is good information of climate indicators such as hot days (over 25 degrees), potential evapotranspiration, dry days, etc from work undertaken for the GWRC by NIWA in 2017. This climate change mapping (to a grid level of 5 x 5 km) was extrapolated during the WRCCIA to cover gaps that existed at the coast.

There is good information available on the different elements at risk. However this data lacks the richness for a detailed impact assessment of spatially varying impacts. For example, whilst there is information on the location of buildings and facilities across the region, there was no data consistently available data on building floor levels, building condition/age, etc that would be regionally consistent indicators of potential vulnerability. Furthermore a range of datasets needed to be bought together for the assessment to add contextual information to the building footprints (such as identifying schools from MoE and hospitals from MoH). As this analysis was completed for the WRCCIA the resulting dataset is a static representation at a point in time. Therefore as new schools or hospitals are identified (for example) this analysis will need to be rerun to maintain relevance. There may be benefit in building up and maintaining a spatial layer of buildings with the contextual information added for the region that can be used across purposes.

Large data gaps have meant that the assessment may be biased towards areas where there is existing good spatial data available and for hazards that have previously been well assessed. However, care needs to be taken on not over emphasising these as key risks for the region (data bias).

Considerable data limitations in the human domain have meant that the detailed assessment of selected human risks is based on knowledge of the SME, the cascading discussion session undertaken during WRCCIA, expert judgement and the National Climate Change Risk Assessment (MfE 2020) and recent IPCC working group two report (Lawrence et. al., 2022). To leave out the social domain due to lack of data would have left potential considerable risks and impacts unreported. There are limitations to the use of census or other data as a measure of vulnerability as it is complex and comes down to the specific attributes of particular communities. For example, a low socio-economic community is not necessarily a more vulnerable community.

The data gaps have meant that a number of assumptions have had to be made and the impact assessment has largely been qualitative.

We suggest that further work is completed through local level adaptation planning on the characteristics of the various communities to inform vulnerability, such as key local connections, particular values/places of importance and the nature of housing. Reviewing how communities have responded to past events, such as significant flooding, can provide some indication to inform this more detailed planning at a local level.

The natural environment and how it will respond to future climate change remains a largely under studied area and negative impacts to the natural domain are harder to classify. Changes to an ecosystem are not

inherently “positive” or “negative,” and require a definition of what is valued (e.g. biodiversity) and the baseline against which change will be measured. The dynamics of complex systems like ecosystems can make it difficult to predict the full extent of climate-related risks and impacts. While the initial exposure and vulnerability of coastal ecosystems to sea-level rise can be estimated, for example, the downstream ecological impacts are much harder to predict. Whilst there has been work undertaken on salt marsh by GWRC, how salt marsh and other important ecosystems and species will respond and potentially be impacted upon under future climate scenarios should be investigated further.

A

Appendix A – Strategy and Governance Information

Strategy and Governance

Council	Related work
Wellington City Council	• Te Atakura – First to Zero Strategy Draft District Plan • 2021 NIWA Sea Level Rise Projections for District Plan • 2021 NIWA Coastal Hazards evidence for District Plan Resilience Strategy Digital Twin Bloomberg Global Mayor's Challenge Makara Beach storymap WCC_Flood_Hazard_Combine
Masterton District Council	• Asset Management Plans consider climate change impacts • NIWA/GW climate change projections and impacts • the Wellington region coastal vulnerability assessment, June 2019 • Flood maps • Critical infrastructure maps **Long Term Plan 2021-31 (PDF, 11MB)** **Wairarapa Economic Development Strategy** **Parks and Open Spaces Strategy** **MDC Wellbeing Strategy – Introduction (PDF, 3MB)** **Cultural Development Strategy (Our People, Our Land) 2018 (PDF, 3MB)** **Economic Development Strategy (Our People, Our Land) 2018 (PDF, 5MB)** **Environmental Development Strategy (Our People, Our Land) 2018 (PDF, 5MB)** **Social Development Strategy (Our People, Our Land) (PDF, 5MB)** **Education Development Strategy (Our People, Our Land) (PDF, 6.13MB)**
Carterton District Council	Ruamāhanga Climate Change Strategy 2021 Ruamāhanga Climate Change Strategy 2020 • Preliminary work on the climate related risks assessment and mitigation measures (LTP 20201-31) • GIS from planning teams • SWDC: managed retreat identified in spatial plan
South Wairarapa District Council	Ruamāhanga Climate Change Strategy 2021 Ruamāhanga Climate Change Strategy 2020 • Preliminary work on the climate related risks assessment and mitigation measures (LTP 2021-31) • GIS from planning teams • SWDC: managed retreat identified in Spatial Plan ▪ Infrastructure Strategy ▪ Financial Strategy ▪ Financial Assumptions and Statements ▪ Significant Activities and Levels of Service ▪ Schedule of Fees and Charges ▪ Summary of Environmental Scan Water pipe repair
Upper Hutt City Council	**Long Term Plan 2021 – 2031** • Upper Hutt Natural Hazards Map • Plan Change 42 – Mangaroa and Pinehaven Flood Hazard Extents • NIWA Wellington Region climate change extremes and implications report • GWRC/NIWA Wellington region climate change projections and impacts report • Further information may be available from our GIS team and Planning department on request. Sustainability Strategy 2020 Upper Hutt Natural Hazards Map Plan Change 42 – Mangaroa and Pinehaven Flood Hazard Extents NIWA Wellington Region climate change extremes and implications report GWRC/NIWA Wellington region climate change projections and impacts report **Open Space Strategy** **Land Use Strategy** **Arts Culture and Heritage Strategy** **Sustainability Strategy** **Affordable Housing Strategy**

Hutt City Council	• Preparing Coastal Communities for Climate Change (June 2019) • Infrastructure at risk work carried out for LGNZ • A climate change focussed document to support the development of the LTP **Long Term Plan for 2021-2031** • Lower Hutt Climate Change Strategy 2022 • HCC Infrastructure Strategy 2015-45 • **Central City Transformation Plan sections** • **CBD Making Places project concept summary** (PDF 107 KB) • **CBD 2030 vision** (PDF 2 MB) • **Environmental Sustainability Strategy** • **Infrastructure Strategy** • **Leisure and Wellbeing Strategy** • **Urban Growth Strategy** • **Annual Economic Profile for Lower Hutt 2021 (PDF 1.1 MB)** • **Lower Hutt - summary infographic 2021 (PDF 121kb)** • RiverLink and video - te ati awa , Flood Protection • Hutt River Floodplain Management Plan • Living with the River • Flooding Hazard Factsheet
Kāpiti Coast District Council	• NIWA/GW climate change projections and impacts (used for LTP 2021 as basis for assessing risks) • Preparing Coastal Communities for Climate Change (aka the Wellington region coastal vulnerability assessment, June 2019). Note: the variables that have been used to measure risk in this report could also be used to map vulnerability across the rest of the region, particularly in relation to flooding, ponding, and groundwater. • The 'Takutai Kāpiti: community-led coastal adaptation' project has procured updated science from Jacobs, which is about to be released. 6 'Coastal hazard susceptibility and vulnerability assessment for the Kāpiti Coast District coastline' 2**022** [PDF, 12 MB] 7 'Coastal hazard susceptibility and vulnerability assessment for the Kāpiti Coast District coastline' methodology **2022** [PDF, 32.51 MB] 8 Jacobs' presentation on 'Coastal hazard susceptibility and vulnerability assessment for the Kāpiti Coast District coastline' report **2022** [PDF, 1.56 MB] Te Moemoeā o te tāngata whenua Kāpiti Adaptation Strategies to Climate Change impacts on Māori Communities in Aotearoa: Horowhenua – Kāpiti, Dr Huhana Smith Whakarongotai o te moana, whakarongotai o te wā – Kaitiakitanga plan for Te Ātiawa ki Whakarongoai Traditional Māori weather and Climate forecasting poster (Te Reo version) https://takutaikapiti.nz/ https://takutaikapiti.nz/articles/reports-and-studies/ - Annotated Bibliography • An annotated bibliography with an extensive summary of existing coastal research for the Kāpiti Coast District from 1951 to 2019 is available on the Takutai Kāpiti website. • NIWA drafted Kāpiti Land Sea Boundary (mean high water springs) in June 2019, but this report has not been released. • Council holds the current DP flood maps, all natural hazard risk layers, and culturally significant sites in its GIS system. • Several asset management risk reports have been carried out in the past 10 years for specific activities, such as: • Outer Wellington Shared Services (KDCD, UHCC, PCC) - Assessment of potential earthquake loss to three water infrastructure. AON, August 2019. • SKM 2006 assessment of sewer affected by groundwater • 2011 report on asbestos-cement water supply pipes • GWRC continues to procure various pieces of work related to water quality and quantity for the Kāpiti Coast, particularly in relation to the whaitua process • The Waikanae Ki Uta ki Tai (from mountains to sea) knowledge committee is currently in the process of compiling summaries of existing reports. • Jacobs coastal susceptibility report for Takutai Kapiti – methodology • KCDC LTP • KCDC District Plan • **Infrastructure strategy 2021** • **Financial strategy 2021** • **Carbon and energy management plan** • **Climate Emergency Action Framework** • **Coastal Strategy** • **Community Facilities Strategy** • **Economic Development Strategy and Implementation Plan 2020–23** • **Growth Strategy | Te Tupu Pai** **and** Map – our approach to enabling sustainable growth for easy reference. Find out how this strategy was developed. • **Stormwater Management Strategy 2008**

	• **Sustainable Transport Strategy** • **Waste Minimisation Education Strategy** • **Water Matters - Sustainable Water Management Strategy**
Porirua City Council	• Porirua City Council Climate Change Strategy • Jim Dahm coastal hazard assessment and Maps for the PDP • Wellington Water's pluvial flood hazard assessments and maps for the PDP (and other parts of the Region) • Flood maps • Proposed District Plan - ecology, landscapes & notable trees; coastal hazards & resilience; and flood modelling.
Greater Wellington Regional Council	GWRC GWRC Climate Change Models Wairarapa Water Resilience Strategy Regional Natural Hazards Management Strategy Regional SLR Trends 2012 Regional SLR Update 2018 Regional Land Transport / Public Transport assessment referred to in GW response to minister under CCRA–TBC • Wairarapa Water Resilience Strategy • Regional storm tide analysis and modelling including projected coastal inundation risk due to sea level rise • Climate Change and Variability Report Wellington Region 2017 • Wellington Region climate change extremes and implications 2019 • Preparing Coastal Communities for Climate Change 2019 • Research sitting under the Regional Natural Hazards Management Strategy • GWRC desktop assessment of GW assets at risk to natural hazards and climate change impacts • GWRC survey response to Minister for Climate Change under ZCA request for adaptation plan information • Wairarapa Water Resilience Strategy • Regional sea level trends analysis reports: http://www.gw.govt.nz/assets/Climate-change/Sea-Level-Variability-and-Trends-in-the-Wellington-Region2012.pdf • https://mapping1.gw.govt.nz/gw/slr/Sea_Level_Trends_in_the_Wellington_Region_Update_2018.pdf • Regional storm tide analysis and modelling including projected coastal inundation risk due to sea level rise • Regional Land Transport / Public Transport assessment referred to in GW response to minister under CCRA–TBC • Flood Protection Vulnerability Assessment 2021 (TBC) • GWRC review of mana whenua values statements (TBC) Whaitua https://www.gw.govt.nz/environment/climate-change/what-we-are-doing/regional-climate-plan/ https://www.gw.govt.nz/assets/Documents/1970/01/FINAL-WellNCC-projectionsimpacts.pdf https://www.gw.govt.nz/assets/Documents/2017/06/Climate-Change-and-Variability-report-Wlgtn-Regn-High-Res-with-Appendix.pdf https://www.gw.govt.nz/assets/Documents/2021/11/GWRC-2020-extremes-appendix-FINAL.pdf https://www.gw.govt.nz/assets/Documents/2021/11/GWRC-NIWA-climate-extremes-FINAL3.pdf https://www.gw.govt.nz/assets/Documents/2021/10/WairarapaCCFinalReport.pdf https://www.gw.govt.nz/environment/environmental-data-hub/climate-monitoring/ https://www.gw.govt.nz/assets/Documents/2021/11/WhaituaClimateChangeprojectionsMarch2020.pdf Climate Resilience Programme: Erosion and flood protection works
WRGF	https://wrgf.co.nz/
HDC	• Horowhenua District Council have recently completed a Climate Change Risk Assessment with Horizons Regional Council
Iwi	Te Rūnanga o Toa Rangatira: • Te Rūnanga o Toa Rangatira (Te Rūnanga) is preparing a climate change strategy that will cover the whole rohe, especially our core territories of Porirua, Kapiti, Te Whanganui a Tara and Te Tau Ihu. The strategy will form part of our Iwi Environmental Management Plan (IEMP) and Poutiaki Plan. This links climate change into the wider context of iwi environmental planning and Treaty Settlement implementation and fisheries management. A fundamental issue for Ngāti Toa Rangatira is that our vulnerable marae and coastal lands returned under the Settlement are at risk from climate change. • Te Rūnanga has submitted a funding application to Proposal for Kāhui Māori Deep South Challenge. This funding application will build our knowledge about the impact of climate change in Raukawa Moana (both Te Upoko o te Ika and Te Tau Ihu). A good portion of this research will involve the coastal lands and seas within Greater Wellington region.

B

Appendix B – Initial Assessment of Climate Hazard Information

	Hazard (arising from climate change)	Primary climate-related variables	Secondary climate-related variables	Relevant existing GIS layers *Italics = NIWA layer in GWRC viewer*
1	**Higher mean temperatures: air and water**	• Higher day and night temperatures • Higher mean water (freshwater and marine) temperatures	• More heatwaves and warm spells • Fewer frosts or cold days	1. *Hot days > 25 degrees* 2. *Cold nights* 3. *Mean temperature* 4. *Mean min temp* 5. *Mean max temp* 6. *Diurnal temp range* 7. *Snow days* 8. *Frost days* 9. *Warm nights* 10. *Cold days* 11. *Extreme hot days* 12. *Heatwave days* 13. *Extreme heatwave days* 14. *GDD 10 (and 5)* 15. Ocean chemistry (CCII project- https://niwa.co.nz/sites/niwa.co.nz/files/RA2-MarineCaseStudySynthesisReport.pdf)
2	**Heatwaves**: increasing persistence, frequency and magnitude	• Higher day and night temperatures • Increase in persistence of maximum daily temperatures above 25°C	• Changes in seasonal winds • Humidity changes from changes in cloudiness	• *Heatwave days* • *Extreme heatwave days* • *Hot days* • *Extreme hot days* • *Mean min temp* • *Mean max temp* • *Windy days* • *Relative humidity*
3	More and longer dry spells and drought	• Low seasonal rainfall • Change in seasonal wind patterns • Interannual variability (eg, ENSO) – not available in GIS	• Higher day and night temperatures	• *PED* • *PED >300mm* • *Soil moisture deficit days* • *Dry days* • *3, 5, 10 day dry spells* • *Mean rainfall* • *Windy days* • *Mean min temp* • *Mean max temp*
4	**Changes in climate seasonality** with longer summers and shorter winters	• Fewer frosts or cold days • Higher day and night temperatures • Changes in seasonal rainfall	• Changes in seasonal wind	• *Mean temperature* • *Mean min temp* • *Mean max temp* • *Mean rainfall* • *Windy days* • *Solar radiation* • *Relative humidity*

				• *Frost days* • *Cold days* • *Cold nights*
5	Increasing **fire–weather** conditions: harsher, prolonged season	• Low seasonal rainfall • Change in seasonal wind patterns • Increase in persistence of maximum daily temperatures above 25°C • Humidity changes from changes in cloudiness	• Higher day and night temperatures • Interannual variability (eg, ENSO)	• *Mean rainfall* • *Mean temperature* • *Relative humidity* • *PED* • *PED>300mm* • *Dry days* • *3, 5, 10 day dry spells* • *Hot days* • *Extreme hot days* • *Heatwave days* • *Extreme heatwave days* • *Mean max temp* • *Mean min temp*
6	Increased **storminess and extreme winds**	• Increase in storminess (frequency, intensity) including tropical cyclones • Changes in extreme wind speed	• Changes in wind seasonality • Interannual variability (eg, ENSO) • Increase in convective weather events (tornadoes, lightning)	• *99th percentile rain days* • *Heavy rain days >25mm* • *Rain days >10mm* • *Rain days >20mm* • *Rain days >30mm* • *3, 5, 10 day wet spells* • *Windy days* • *99th percentile wind speed* • HIRDS datasets
7	Change in **mean annual rainfall**	• Higher or lower mean annual rainfall in sub-national climate zones • Changes in seasonal winds	• Humidity changes from changes in cloudiness	• *Mean rainfall* • *Wet days* • *Dry days* • *Windy days* • *Relative humidity*
8	Reducing **snow and ice cover**	• Higher day and night temperatures • Changes in rainfall seasonality • Change in seasonal wind patterns • Receding snowline • Reduced snow and glacier cover • Earlier snow melt	• Increase in avalanches • Interannual variability (eg, ENSO)	• *Snow days* • *Mean rainfall* • *Mean temperature* • *Mean max temp* • *Mean min temp*
9	Increasing **hail** severity or frequency	• Increase in hail severity or frequency • Increase in convective weather events (tornadoes, lightning)	• Humidity changes from changes in cloudiness	• *Relative humidity* • *Extreme hot days* • HIRDS datasets (rain not hail) • Mullan 2011 paper

10	**River and pluvial flooding**: changes in frequency and magnitude in rural and urban areas	• Changes in extremes: high intensity and persistence of rainfall • Increase in hail severity or frequency • Interannual variability (eg, ENSO) • Increased storminess and wind • Relative sea-level rise (including land movement) • Rising groundwater from sea-level rise	• Humidity changes from changes in cloudiness • Changes in rainfall seasonality • Change in seasonal wind patterns • More and longer dry spells and droughts (antecedent conditions)	• Wellington Water – Rain on Grid flood model • All flood layers all councils at whatever Resolution that it is available. (to be assessed further at detailed stage) • *Total Rainfall* • *Wet days over 1 mm per day* • *Wet days over 25 mm per day* • *99th percentile of daily rainfall* • *Rain days >10mm* • *Rain days >20mm* • *Rain days >30mm* • *3, 5, 10 day wet spells* • *HIRDS datasets* • *Windy days* • *99th percentile wind speed* • *PED* • *PED>300mm* • *3, 5, 10 day dry spells* • *Dry days*
11	**Coastal and estuarine flooding**: increasing persistence, frequency and magnitude	• Relative sea-level rise (including land movement) • Change in tidal range or increased water depth • Permanent increase in spring high-tide inundation • Rising groundwater from sea-level rise • Changes in extremes: high intensity and persistence of rainfall • Increase in storminess (frequency, intensity) including tropical cyclones	• Changes in waves and swell • Changes in extreme wind speed • Changes in sedimentation (estuaries and harbours)	• GWRC layers or updated NIWA layers • NZ sea rise data aggregated up to district scale (with narrative with GNS). Then use GWRC viewer with adjusted SLR increment to be RSLR proxy for inundation. • *99th percentile of daily rainfall* • *Rain days >10mm* • *Rain days >20mm* • *Rain days >30mm* • *3, 5, 10 day wet spells* • *Windy days* • *99th percentile wind speed* • Extreme sea-level flooding for ARI 2, 5, 10, 20, 50, 100, 200, 500, 1000-year scenarios + sea-level rise increments • MHWS-10 flooding scenarios + sea-level rise increments

12	**Sea-level rise and salinity stresses on brackish and aquifer systems** and coastal lowland rivers	• Relative sea-level rise (including land movement) • Permanent and episodic (low river flow) saline intrusion • Low seasonal rainfall • Rising groundwater from sea-level rise • Permanent increase in spring high-tide inundation	• Changes in sedimentation (estuaries and harbours) • Interannual variability (eg, ENSO)	• GWRC layers or updated NIWA layers? • NZ sea rise data aggregated up to district scale (with narrative with GNS). Then use GWRC viewer with adjusted SLR increment to be RSLR proxy for inundation. • *Mean rainfall*
13	Increasing **coastal erosion:** cliffs and beaches	• Relative sea-level rise (including land movement) • Changes in waves and swell • Changes in extreme rainfall: high intensity and persistence • Changes in sedimentation from catchment run-off • Increased storminess and extreme winds • Interannual variability (eg, ENSO)	• Rising groundwater from sea-level rise • Changes in rainfall seasonality • Change in seasonal wind patterns	• GWRC layers • *Mean rainfall* • *99th percentile of daily rainfall* • *Rain days >10mm* • *Rain days >20mm* • *Rain days >30mm* • *3, 5, 10 day wet spells* • *Windy days* • *99th percentile wind speed*
14	Increasing **landslides and soil erosion**	• Changes in extreme rainfall: high intensity and persistence • Changes in rainfall seasonality • More and longer dry spells and droughts (antecedent conditions)	• Interannual variability (eg, ENSO)	• Mean rainfall • *99th percentile of daily rainfall* • *Rain days >10mm* • *Rain days >20mm* • *Rain days >30mm* • *3, 5, 10 day wet spells* • PED • PED>300mm • 3, 5, 10 day dry spells • Dry days • *Windy days* • *99th percentile wind speed* • GWRC/WCC landslides potential layers
15	**Marine heatwaves:** more persistent high summer sea temperatures	• Higher mean ocean temperatures • Increase in persistence of maximum daily temperatures eg, above 25°C • Change in seasonal wind patterns	• Interannual variability (eg, ENSO) • Changes in waves and swell	• SST projections • Marine heatwave projections • Heatwave days • Extreme heatwave days • Hot days • Extreme hot days •

		• Ocean circulation changes		
16	**Ocean chemistry changes:** nutrient cycling and pH changes	• Changes in ocean nutrient cycling – upwelling and carbon • Ocean acidification (pH decreasing) • Higher mean surface-water temperatures • Change in seasonal wind patterns	• Ocean circulation changes • Interannual variability (eg, ENSO)	• Munida (Otago) ocean acidification transect: https://www.stats.govt.nz/indicators/ocean-acidification • SST projections

C

Appendix C – Natural, Built and Human Domain Data Analysis

			Key	Recommended Dataset for Use
				Dataset does not cover entire region
				Recommended Additional Datasets
Layer	**Description**	**Type**	**Coverage**	**Comments**
Indigenous and Taonga Species				
VME_inverts	South Pacific Regional Fisheries Management Organisation Vulnerable Marine Ecosystem dataset. Vulnerable marine ecosystems (VMEs) are any ecosystem that are highly vulnerable to one or more kinds of fishing activity or other disturbance, and are identified by the vulnerability of their components. Here ten benthic invertebrate taxa that are regarded as indicators of VMEs.	Point	National	This layer would be better suited to Coastal Ecosystems
Schedule F2 - Indigenous Bird Habitat	Habitats for indigenous birds in rivers, lakes and the coastal marine area. GWRC - Sites were identified and assessed using a review of existing information and expert opinion, using the criteria in Policy 23 of the Regional Policy Statementfor the Wellington Region and contained in more detail in McArthuret al (2015). McArthur N, Robertson H, Adams L, Small D. (2015), A review of coastal and freshwater habitats of significance for indigenous birds in the Wellington region. Greater Wellington Regional Council, Publication No. GW/ESCI-T-14/68, Wellington.	Polygon	Regional	Specific values will need to be looked up on a case by case basis in in McArthur et al (2015) as there is little attribute data attached.
High Macroinvertebrate community health	Waterbodies (rivers, streams and their tributaries and Lake Wairarapa) predicted to have high macroinvertebrate community index (MCI) health scores based on the extent of indigenous vegetation cover in the catchment for indigenous freshwater ecosystems within the Greater Wellington Region.	Line	Regional	This might be better suited to 'Freshwater Ecosystems'
Schedule F1c - Lakes with Significant Aquatic Plants	Lakes with significant aquatic plant communities. GWRC - These lakes were identified using LakeSPI (an index of ecological condition), based on scuba surveys and desktop assessment, using the criteria in Policy 23 of the Regional Policy Statement for the Wellington Region and contained in more detail in Perrie et al (2014). Perrie A, Greenfield S, Beaglehole J. (2014). Rivers and lakes with significant indigenous ecosystems. Greater Wellington Regional Council, Publication No. GW/EP-G-14/93, Wellington.	Polygon	Regional	This might be better suited to 'Freshwater Ecosystems'
Schedule F1b - Inanga Spawning Habitat	Known rivers and parts of the coastal marine area with inanga spawning habitat	Polygon	Regional	To assess impacts we would need to understand how far upstream the upper limit of the saltwater wedge would be moving
New Zealand Freshwater Fish Database	Survey data showing freshwater fish records across new zealand.	Point	National	Administered by NIWA. Data will need to be exported
eBird	Citizen science data on bird species distribution.	Point	Other	Administered by Cornell Lab of Ornithology. Data will need to be exporte
Department of Conservation Bat Database	Bat presence/absence records for NZ. Would need to be requested from DOC as data is not publically available.	Point	National	Administered by DoC. Data will need to be requested
Department of Conservation Herpetofauna Database	Lizard presence/absence records for NZ. Would need to be requested from DOC as data is not publically available.	Point	National	Administered by DoC. Data will need to be requested
National Level Monitoring - Birds (acoustic recorders)	DOC acoustic recorder bird monitoring data	Point	National	Administered by DoC. Data will need to be requested
National Level Monitoring - Birds (observer counts)	DOC observer count bird monitoring data	Point	National	Administered by DoC. Data will need to be requested
Non-migratory Freshwater Fish Distribution	Known habitat fragments of non-migratory freshwater fish species	Polygon	Regional	Administered by DoC https://www.arcgis.com/home/item.html?id=0a8fe178906944a08a9d3ef3e0d133d5
Migratory Fish Habitat	Waterbodies (rivers, streams and their tributaries and Lake Wairarapa) with habitat for six or more indigenous migratory fish species within the Greater Wellington Region	Line	Regional	GWRC - these species are named in Schedule F1.Schedule F1 replicates Table 16 of the Regional Policy Statement for the Wellington Region, based on Warr et al (2009), and updated with recommendations in Perrie et al (2014). Perrie A, Greenfield S, Beaglehole J. (2014). Rivers and lakes with significant indigenous ecosystems. Greater Wellington Regional Council, Publication No. GW/EP-G-14/93, Wellington.Warr S, Perrie A and McLea M. (2009). Selection of rivers and lakes with significant indigenous ecosystems. Greater Wellington Regional Council, Publication No. GW/EP-G-09/29, Wellington.
Predicted fish distributions	Predictions of fish species occurrence	Line	National	Source: Freshwater Ecosytems of New Zealand FENZ_Rivers_2010.gdb - P:\421\4210000\0-Technical Reference\Ecology\GIS layers\NZ\Freshwater\FENZ (Freshwater Ecosystem of NZ)
Department of Conservation - Marine mammal records			National	Administered by DoC. Data will need to be requested
Biosecurity				
Intervention Level Monitoring - Small mammals	Small mammal monitoring data	Point?	National	Administered by DoC. Data will need to be requested
National Level Monitoring - Mammals	Mammal monitoring data	Point?	National	Administered by DoC. Data will need to be requested
SanctuaryPointLocations	Pest free sanctuaries	Point	National	Administered by Predator Free NZ https://www.arcgis.com/home/item.html?id=349c86185f504583bbd9a3c99fef9ec5
Pest Free Islands	Predator free islands	Polygon	National	Administered by Predator Free NZ https://www.arcgis.com/home/item.html?id=349c86185f504583bbd9a3c99fef9ec5
Pest species distribution			Regional/Local	Data potentially available through Predator Free Wellington, Predator Free NZ or GWRC? Would need to be specifically requested from the Predator Free groups
Freshwater Ecosystems				
Wairarapa Moana Wetlands	Wairarapa Moana Wetlands Boundaries	Polygon	Local	Provides little valuable information other than extent GWRC/Boffa Miskell
Natural Resources Plan - Schedule F3 - Significant Natural Wetlands	Wetlands featuring in the natural resources plan of significance.Wetlands in footprint of Pekapeka expressway removed 25/02/2015	Polygon	Regional	Specific values will need to be looked up on a case by case basis as there is little attribute data attached apart from significance criteria GWRC - Schedule F3
Natural Resources Plan 2019 - Schedule A - Outstanding Waterbodies	Outstanding waterbodies in the Wellington region including lakes, rivers and wetlands with biodiversity values for indigenous species	Polygon	Regional	Specific values will need to be looked up on a case by case basis as there is little attribute data attached apart from significance criteria
REC2 - Rivers	REC2 (River Environment Classification, v2.5) The River Environment Classification (REC) is a database of catchment spatial attributes, summarised for every segment in New Zealand's network of rivers.	Line	National	Version number to be checked. Description says this is v2.5. v5 is the latest version NIWA

Current wetlands typology	FENZ - current extent of wetlands and human pressures (2010).	Polygon	National	Source: Freshwater Ecosytems of New Zealand FENZ_Wetlands_2010.gdb - P:\421\4210000\0-Technical Reference\Ecology\GIS layers\NZ\Freshwater\FENZ (Freshwater Ecosystem of NZ)
Current wetlands sites	FENZ - current extent and distribution of wetland types (2010)	Polygon	National	Source: Freshwater Ecosytems of New Zealand FENZ_Wetlands_2010.gdb - P:\421\4210000\0-Technical Reference\Ecology\GIS layers\NZ\Freshwater\FENZ (Freshwater Ecosystem of NZ)
Predicted invertebrate distributions	Predictions of macroinvertebrate species occurrence	Line	National	Source: Freshwater Ecosytems of New Zealand FENZ_Rivers_2010.gdb - P:\421\4210000\0-Technical Reference\Ecology\GIS layers\NZ\Freshwater\FENZ (Freshwater Ecosystem of NZ)
River predictors	Contains an extended set of environmental attribute data that describes environmental conditions across all New Zealand's rivers and streams	Line	National	Source: Freshwater Ecosytems of New Zealand FENZ_Rivers_2010.gdb - P:\421\4210000\0-Technical Reference\Ecology\GIS layers\NZ\Freshwater\FENZ (Freshwater Ecosystem of NZ)
River pressures	Describes spatial variation in human pressures on riverine biodiversity, estimated using the best nationally available datasets (2010)	Line	National	Source: Freshwater Ecosytems of New Zealand FENZ_Rivers_2010.gdb - P:\421\4210000\0-Technical Reference\Ecology\GIS layers\NZ\Freshwater\FENZ (Freshwater Ecosystem of NZ)
River flow data				NEW???
Lake extent	LINZ lake polygons	Polygon	National	https://data.linz.govt.nz/layer/50293-nz-lake-polygons-topo-150k/
Lakes in Schedule F1	Lake with threatened/ at risk fish habitat	Polygon	Regional	NEW. Could also go in 'Endangered Species'
Groundwater level/water table data				NEW???
Substrate/Soil type		Polygon		NEW. Relevant to wetland type and their response to climate change. May also be useful for Terrestrial ecosystems S-map maybe?
Water quality monitoring data		Point		NEW.
Underlying geology		Polygon		NEW. May also be useful for Terrestrial ecosystems
Coastal Ecosystems				
Natural Resources Plan 2019 - Schedule F4 - Indigenous Biodiversity Coastal	Sites with significant indigenous biodiversity values in the CMA	Polygon	Regional	GWRC - Sites were identified with existing information and expert opinionandusing the criteria in Policy 23 of the Regional Policy Statementfor the Wellington Region and contained in more detail in:MacDiarmidet al (2012); Oliver & Beaglehole (2014); Todd et al (2014). MacDiarmid A, Nelson W, Gordon D, Bowden D, Mountjoy J and Lamarche G. (2012),Sites of significance for indigenous marine biodiversity in the Wellington region. Report prepared for Greater Wellington Regional Council by NIWA.Oliver M, Beaglehole J. (2014),Coastal sites and habitats with significant indigenous biodiversity values in the Wellington region: Technical memo to support Schedules F4 and F5 of the draft Natural Resources Plan.Todd M, Kettles H, Graeme C, Sawyer J, McEwan A, Adams L. (2014),Estuarine systems in the lower North Island: ranking of significance, current status and future management options. Department of Conservation, Wellington (in prep).
Natural Resources Plan 2019 - Coastal Marine Area and Rivermouth Boundaries	Coastal Marine Area and River Mouth boundaries	Line	Regional	GWRC - These boundaries were agreed to for the Regional Coastal Plan for the Wellington Region 2000 and the delineations that appear in this map conform to those agreements. All other rivers and streams not identified are defined using the RMA 1991 definition, as measured from the line of the Mean High Water Springs either side of where the waterbody enters the sea.
MPA Policy habitats of the Territorial Sea	Coastal Marine Habitat types	Polygon	National	NEW. Coarse scale, more detailed regional info may be available through GWRC or NIWA Administered by DoC https://www.arcgis.com/home/item.html?id=ab9d7519a4c94f57afc89ede9e72103e
Beach exposure	Exposure – the degree to which the shoreline is exposed to wave and swell energy	Line	National	NIWA - https://www.arcgis.com/home/item.html?id=2e2f8ea5ea31453e808b36b2a1ca43a0 - The geomorphic variables were sourced from the New Zealand coastal type classification scheme and GIS mapping procedures that were previously created for Coastal Explorer using advice from expert panels including regional council staff, knowledgeable locals, university staff and consultants from throughout New Zealand. The coast was mapped and referenced against panel knowledge using information from a wide variety of sources including: 1:50,000 topographic maps, aerial photographs, Google Maps and Google Earth, RNZN hydrographic charts, various publications and reports, New Zealand Land Resources Inventory (NZLRI), the National Land Cover Data Base (LCDB), and the Estuarine Environment Classification database. In assembling the coastal and beach type information, site visits were made to many beaches to obtain information that could not be collected from existing sources, and parts of the coast were flown by light aircraft to obtain oblique aerial photographs
Terrestrial Ecosystems				
Akatarawa Forest	Akatatawara Forest Boundary	Polygon	Local	Provides little valuable information other than extent
Pakuratahi Forest	Pakuratahi Forest Boundary	Polygon	Local	Provides little valuable information other than extent
Regional Parks	Regional Parks Boundaries	Polygon	Regional	Provides little valuable information other than extent
Plantation Forests - Western Area	Western Area Managed Plantation Forests	Polygon	Local	Uncertain about relevance. Fire hazard risk likely to increase? Wilding pine spread potentially exacerbated by changes in climate?
Plantation Forests - Eastern Area	Eastern Area Managed Plantation Forests	Polygon	Local	Uncertain about relevance. Fire hazard risk likely to increase? Wilding pine spread potentially exacerbated by changes in climate?
Ecological Sites (WCC)	Ecological sites for Wellington City	Polygon	Local	No attributes attached. Need better understanding of what the polygons represent
Backyard Taonga - Draft Significant Natural Areas (WCC)	Draft Significant Natural Area - descriptions and values	Polygon	Local	Includes information relevant to a number of elements (indigenous and Taonga spp., freshwater ecolosystems, terrestrial ecosystems, endangered species)
Landcare Research NZ Land Cover Database	Thematic classification of New Zealand's land cover.	Polygon	National	Need to ensure this is most up to date version (v5.0)
Singers Forest Classification - Current Forest Extent	This layer delineates the existing forest ecosystems for the Wellington region as mapped by Nick Singers using the national ecosystem classification system. A process to determine which forests were regionally threatened was then completed using IUCN criteria	Polygon	Regional	https://www.arcgis.com/home/item.html?id=adc731cf488a4ed09b875c0ee5ed2b84. Data is based on work done by Nick Singers with Geoff Rogers for the Department of Conservation in 2014.
DoC Public Conservation Land?				NEW but might be outside of scope?
Key Native Ecosystems	Key Native Ecosystems as defined using GWRC Biodiversity Management Areas database	Polygon	Regional	GWRC - https://mapping.gw.govt.nz/arcgis/rest/services/GW/Our_Environment_P/MapServer/11
Soil moisture/water availability				NEW???
LENZ level 4 polygons	Land Environments of New Zealand (LENZ) is a classification of fifteen climate, landform, and soil variables chosen for their relevance to biological distributions.	Polygon	National	MfE - https://data.mfe.govt.nz/layer/52358-land-environments-new-zealand-lenz-level-4-polygons-2009/
Council green asset network	Locations and extent of parks and green space	Polygon	Regional/Local	Various councils

Threatened Environment Classification	Shows how much native (indigenous) vegetation remains within land environments, and how past vegetation loss and legal protection are distributed across New Zealand's landscape.	Polygon	National	Landcare Research New Zealand Ltd - https://lris.scinfo.org.nz/layer/48288-threatened-environments-classification-2012/
Endangered Species				
Threatened or At Risk Fish Habitat	Waterbodies (rivers, streams and their tributaries and Lake Wairarapa) with habitat for threatened and at risk indigenous fish species within the Greater Wellington Region	Line	Regional	GWRC - These species are named in Schedule F1.Schedule F1 replicates Table 16 of the Regional Policy Statement for the Wellington Region, based on Warr et al (2009), and updated with recommendations in Perrie et al (2014). Perrie A, Greenfield S, Beaglehole J. (2014). Rivers and lakes with significant indigenous ecosystems. Greater Wellington Regional Council, Publication No. GW/EP-G-14/93, Wellington.Warr S, Perrie A and McLea M. (2009). Selection of rivers and lakes with significant indigenous ecosystems. Greater Wellington Regional Council, Publication No. GW/EP-G-09/29, Wellington.
Threatened and At Risk Plant Data	Threatened plant distribution	Point	National	This is likely available through NVS (https://nvs.landcareresearch.co.nz/Data/Search), although i'm uncertain if we're able to source data only for threatened/at risk plants. DoC and NZPCN may also hold data on threatened plant distribution.
SanctuaryPointLocations	Pest free sanctuaries	Point	National	Administered by Predator Free NZ https://www.arcgis.com/home/item.html?id=349c86185f504583bbd9a3c99fef9ec5
Pest Free Islands	Predator free islands	Polygon	National	Administered by Predator Free NZ https://www.arcgis.com/home/item.html?id=349c86185f504583bbd9a3c99fef9ec5

			Key	Recommended Dataset for Use
				Dataset does not cover entire region
				Recommended Additional Datasets
Layer	**Description**	**Type**	**Coverage**	**Comments**
Community Wellbeing				
Facilities	Community centres, recreation centres, swimming pools, community gardens	Point	Local	Only have data for WCC
Fire Stations	Also picked up through building footprint layer	Point	Regional	Data across the region
Police Stations	Also picked up through building footprint layer	Point	Regional	Data across the region
NZ Places of Worship	Also picked up through building footprint layer	Point	Regional	Data across the region
Community halls and community centers	Also picked up through building footprint layer	Point	Other	No data for Kapiti
Cemetery Outlines	TLA level dataset. Likely picked through building footprint layer to a degree	Polygon	Local	Only have data for WCC
Cafes Bars and Restaurants - Cafes, Bars & Restaurants	TLA level dataset. Likely picked through building footprint layer to a degree	Point	Local	Only have data for UH
Play Areas in Upper Hutt - Major and Neighbourhood Parks	TLA level dataset. Likely picked through building footprint layer to a degree	Polygon	Local	Only have data for UH
Libraries	TLA level dataset. Likely picked through building footprint layer to a degree	Point	Local	Only have data for Hutt City
Preparing Coastal Communities for Climate	Assessing coastal vulnerability to climate change, sea level rise and natural hazard	non	Greater	Councils
Social Cohesion and Welfare				
Kāinga Ora Land		Polygon	Other	Data for Wairarapa? - Queried, no Kainga Ora land in Wairarapa.
Projected Housing Deficit		Polygon	Local	WCC
New Zealand Census 2018 and deprivation index Statistical Area 1		Polygon	Regional	
Population SVI2018	Social vulnerability indicators for natural hazardsGroup Layer	Polygon	National	
Children SVI2018	Social vulnerability indicators for natural hazardsGroup Layer	Polygon	National	
OlderAdults SVI2018	Social vulnerability indicators for natural hazardsGroup Layer	Polygon	National	
HealthStatus SVI2018	Social vulnerability indicators for natural hazardsGroup Layer	Polygon	National	
EnoughMoney SVI2018	Social vulnerability indicators for natural hazardsGroup Layer	Polygon	National	
SocialConnectedness SVI2018	Social vulnerability indicators for natural hazardsGroup Layer	Polygon	National	Interested to interrogate this one further - what does 'immigrant' mean? Is that a recent arrival to the suburb/ city/ country?
Knowledge SVI2018	Social vulnerability indicators for natural hazardsGroup Layer	Polygon	National	
Housing SVI2018	Social vulnerability indicators for natural hazardsGroup Layer	Polygon	National	
FoodWater SVI2018	Social vulnerability indicators for natural hazardsGroup Layer	Polygon	National	Interested to interrogate this one further - how many people without power/ running water have voluntarily chosen that way of living (eg remote hut/ bach)?
Social vulnerability indicators for flooding in Aotearoa New Zealand		non-spatia	National	Councils 2019 - presentation of methodology
Occupational SVI2018	Social vulnerability indicators for natural hazardsGroup Layer	Polygon	National	
Coastal Communities				
Regional Planning P - Coastal Unit Assessment	Regional Planning Coastal Unit Assessment - Wairarapa Coastal Strategy Boffa 2004	Polygon	Local	Only for Wairarapa - places of value in Wairarapa Strategy Doc
Regional Planning P - Coastal Character Areas	Regional Planning Coastal Character Areas - Wairarapa Coastal Strategy Boffa 2004	Polygon	Local	Only for Wairarapa - places of value in Wairarapa Strategy Doc
Education				
Schools		Point	Regional	Missing data from Wairarapa, can be captured below by LINZ data.
Early Childhood Education Centres		Point	National	
LINZ NZ Facilities (School) - Polygon		Polygon	National	From LINZ
Cultural Heritage and Taonga				
Maori sites of significance [NaturalResourcesPlan2019]	Point, line and polygon			Comprehensive Dataset, use with Maori sites of significance [DraftDistrictPlan] below
Maori sites of significance [DraftDistrictPlan]				Wellington City Only
Scheduled Archaeological Sites		Polygon		Wellington City Only
Sports and Recreation				
Sports Fields Picnic Areas (Upper/Lower Hutt)				Only data for Upper Hutt Valley
Stage (Harcourt Park)	TLA level dataset. Likely picked through building footprint layer to a degree	Point		Only data for Upper Hutt Valley
Tables	TLA level dataset. Likely picked through building footprint layer to a degree	Point		Only data for Upper Hutt Valley
Picnic Areas	TLA level dataset. Likely picked through building footprint layer to a degree	Point		Only data for Upper Hutt Valley
BBQ	TLA level dataset. Likely picked through building footprint layer to a degree	Point		Only data for Upper Hutt Valley
Changing Rooms	TLA level dataset. Likely picked through building footprint layer to a degree	Point		Only data for Upper Hutt Valley
Toilets	TLA level dataset. Likely picked through building footprint layer to a degree	Point		Only data for Upper Hutt Valley
Tracks	TLA level dataset. Likely picked through building footprint layer to a degree	Line		Only data for Upper Hutt Valley
Winter Sportsfields	TLA level dataset. Likely picked through building footprint layer to a degree	Polygon		Only data for Upper Hutt Valley
Summer Sportsfields	TLA level dataset. Likely picked through building footprint layer to a degree	Polygon		Only data for Upper Hutt Valley
All-year Sportsfields	TLA level dataset. Likely picked through building footprint layer to a degree	Polygon		Only data for Upper Hutt Valley
Park	TLA level dataset. Likely picked through building footprint layer to a degree	Polygon		Only data for Upper Hutt Valley
Recreation facilities (sports fields, etc)	TLA level dataset. Likely picked through building footprint layer to a degree	Polygon		Wellington City Council
Wellington Sporting and Boat Clubs - Wellington Hall and Club Facilities-Copy	TLA level dataset. Likely picked through building footprint layer to a degree	Point		Wellington City Council
Recreation facilities (sports fields, etc)	TLA level dataset. Likely picked through building footprint layer to a degree	Polygon		Only data for WCC

Wellington Sporting and Boat Clubs - Wellington	TLA level dataset. Likely picked through building footprint layer to a degree	Point		
Hall and Club Facilities-Copy				Only data for WCC
Wellington boat clubs and surf lifesaving	TLA level dataset. Likely picked through building footprint layer to a degree	Point		Only data for WCC
Health				
Aged Care Facility		Point		Data across region
LINZ NZ Facilities (Hospital) Polygon		Polygon		Is there data for hospices? Only one is shown (in the Hutt)
Building Outlines	National building footprints layer. High resolution. Unknown if building floor levels are included.	Polygon	National	Use this as preference for the assessment - this is sufficient for the qualitative region/district scale assessment. Are we able to find building type (residential, commercial etc) Or specific uses (e.g. like the supermarkets) to inform a sub-district assessment if Councils want to take that next step?
Supermarkets	Buildings - supermarket foot prints. Relevant to community as much as buildings	Polygon	National	Useful for quantitative stage if selected
Population Metrics				
Population Density	Polygons by suburb	Polygon	National	All useful information for exposure and vulnerability of certain population groups
Urban Rural	Polygons by suburb	Polygon	National	All useful information for exposure and vulnerability of certain population groups
Usually Resident Population	Polygons by suburb	Polygon	National	All useful information for exposure and vulnerability of certain population groups
Number of Households	Polygons by suburb	Polygon	National	All useful information for exposure and vulnerability of certain population groups
Ethnic group, European, Maori, Pacific Peoples, Asian, MELAA	Polygons by suburb	Polygon	National	All useful information for exposure and vulnerability of certain population groups
end				

Key	Recommended Dataset for Use
	Dataset does not cover entire region
	Recommended Additional Datasets

Layer	Description	Type	Coverage	Comments
Airports and Seaports				
Wellington Airport	Airport Zone from WCC district plan.	Polygon	Local	Extents goes beyond current airport boundary and includes parts of Mirimar Golf Club and Lyall bay industrial areas. Needs updating to include actual WIAL boundary (suggest: https://data.linz.govt.nz/search/?q=airport) . Could also find information on runway extents and buildings.
Kapiti Coast Airport	Airport zone from KCDC district plan	Polygon	Local	Extents goes beyond current airport boundary and includes parts of nearby commercial areas. Needs updating to include actual land boundary (https://data.linz.govt.nz/search/?q=airport). Could also find information on runway extents and buildings.
Hood Aerodrome	Airfield near Masterton	Polygon	Local	Add from linz polygons: https://data.linz.govt.nz/search/?q=airport. See other details at https://mstn.govt.nz/community-4/hood-aerodrome-2/
Centreport	Centreport assets within Wellington Harbour needs to include Pipitea, Mirimar and Seaview parts of the Port	Polygon	Local	Essential to find or create. See Water designation of port zones: https://data-gwrc.opendata.arcgis.com/datasets/749f7cc694394b58a84eea28034f77fd_2/explore. And the draft strategic plan includes: https://gis.wcc.govt.nz/arcgis/rest/services/CDPP/Draft_Spatial_Plan/MapServer/8 or LINZ Wharf edges https://data.linz.govt.nz/layer/50377-nz-wharf-edges-topo-150k/
Marinas	polygon of marina extents in the region	Polygon	Local	Nice to have but not essential. Could come from Linz Wharf edges:https://data.linz.govt.nz/layer/50377-nz-wharf-edges-topo-150k/
Buildings and Facilities				
WRFG Constraints	Constraints Mapping Report	non spatial	National	GWRC (2020) report for spatial planning purposes of areas where new developments should not occur
Building Outlines	National building footprints layer. High resolution. Unknown if building floor levels are included.	Polygon	National	Use this as preference for the assessment - this is sufficient for the qualitative region/district scale assessment. Are we able to find building type (residential, commercial etc) Or specific uses (e.g. like the supermarkets) to inform a sub-district assessment if Councils want to take that next step?
Supermarkets	Buildings - supermarket foot prints. Relevant to community as much as buildings	Polygon	National	Useful for quantitative stage if selected
Aged Care Facilities	Agred care facility poin layer. Unsure of completeness.	Point	National	Useful for quantitative stage. May be useful for social impacts.
District Plan Zones (KCDC)	Multiple layers from District plan. More relevant to other domains.	Polygon	Local	Useful throughout other domains for qualitative assessment. Lots of information specific to this district.
Special Housing Areas (WCC)	Special housing areas within WCC	Polygon	Local	Relevant to housing
District Plan Zones (WCC)	Multiple layers from District plan. More relevant to other domains.	Polygon	Local	Useful throughout other domains for qualitative assessment. Lots of information specific to this district.
District Plan (HCC)	Multiple layers from District plan. More relevant to other domains.	Polygon	Local	Useful throughout other domains for qualitative assessment. Lots of information specific to this district.
Map Image Layer		Polygon	Local	
District Plan (UHCC)	Multiple layers from District plan. More relevant to other domains.	Polygon	Local	Useful throughout other domains for qualitative assessment. Lots of information specific to this district.
District Plan Zones (Wairarapa)	Multiple layers from District plan. More relevant to other domains.	Polygon	Local	Useful throughout other domains for qualitative assessment. Lots of information specific to this district.
Proposed District Plan Zones (PCC)	Multiple layers from District plan. More relevant to other domains.	Polygon	Local	Useful throughout other domains for qualitative assessment. Lots of information specific to this district.
Energy				
Transpower Structures	Transpower towers	Point	National	Includes type of tower (e.g. steel) and number of lines
Transpower Sites	Substations, key buildings (e.g. Cook Strait HVDC)	Point	National	Useful for drill in to details
Transmission Lines	Transpower lines between towers and substations	Line	National	Includes overhead lines and buried cables
Wellington Electricty	Wellington, Porirua, Lower and Upper Hutt provider			Traditionally difficult to obtain from providers due to commercial sensitivity. Can we get this?
PowerCo	Wairarapa provider			Traditionally difficult to obtain from providers due to commercial sensitivity. Can we get this?
Electra	Kapiti Coast provider			Traditionally difficult to obtain from providers due to commercial sensitivity. Can we get this?
Wind turbines	Windmill points from LINZ 1:50	Point	National	Could be opportunity - more with CC wind = more power. Get layer from: https://data.linz.govt.nz/layer/50378-nz-windmill-points-topo-150k/
Electricity generation	Location of generation in Wellington region	Polygon	Local	"The majority of electricity used in Wellington is taken from the national grid at Transpower substations located at Upper Hutt (Birchville), Haywards, Melling, Gracefield, Pauatahanui, Takapu Road (to the east of Linden), Kaiwharawhara, Wilton and Central Park (Mount Cook). The network also receives up to 12 MW of electricity from power generating facilities connected to the distribution network, including two landfill gas stations at Silverstream and Happy Valley, a gas fired cogeneration facility at Wellington Hospital, and a single wind turbine in Brooklyn." https://en.wikipedia.org/wiki/Wellington_Electricity
Vector Gas pipeline	Location of main vector pipes	Line	Regional	Find layer within https://gwrc.maps.arcgis.com/apps/webappviewer/index.html?id=06c8d6c3b3be49d4a4d55a8d4f973ea3
Flood and Coastal Defences				
GWRC pump stations	Wairarapa pump stations only	Point	Regional	https://data-gwrc.opendata.arcgis.com/datasets/GWRC::flood-protection-drainage-scheme-pump-stations/explore
GWRC flood protection information	Need it all - may not use it all. Note also it includes QE2 open space covenant areas - could be useful for other natural environment domains	Multiple	Regional	https://gwrc.maps.arcgis.com/apps/webappviewer/index.html?id=06c8d6c3b3be49d4a4d55a8d4f973ea3
https://gis.mstn.govt.nz/arcgis/rest/services/Services/WaterRaces/MapServer	Overlaps with 3 waters stormwater information. Water races Wairapa	Line	Local	Useful and part of flood defences
Transport (Road and Rail)				
KiwiRail Track Centreline	Kiwirail track centrelines	Line	National	All we need for Kiwirail transport networks. Their Public GIS includes all their other assets (land, stations, bridges, tunnels etc): https://gis.kiwirail.co.nz/maps/?viewer=kiwirailpropertyview
One Network Road Classification	Road networks everywhere	Line	National	Comprehensive. Aligns with basemaps. Doesn't name each road.
Map Image Layer	Layer not loaded in viewer but appears to be duplicate of ONRC			
Public Transport (GWRC)	All GWRC public transport information - down to bus stops. Lines, polygons and points	Polygon	Regional	All GWRC public transport information - down to bus stops.
Map Image Layer	Layer not loaded in viewer but appears to be duplicate of GWRC public transport			

Photo wcc kerbs	WCC kerb assets - plots as polygon but should be line	Polygon	Local	
Ttr contract areas	Unknown. Do not use	Line	Local	
Ttr footpaths	WCC footpats	Line	Local	Could probably find other council kerb and transport asset for completeness, but anything sub-road scale seems secondary (kerbs)
Ttr heavy vehicle route	WCC HV route	Line	Local	
Ttr onstreet parking	WCC parking areas	Line	Local	
Ttr parking spaces	WCC parking areas	Line	Local	
Ttr road carriageway	WCC roads - duplicates ONRC	Line	Local	
Ttr road categories	WCC road categories - superseeded by ONRC	Line	Local	
Ttr street events and road closures	no application	Line	Local	
Solid Waste Management				
Landfill Polygons (LINZ Topo 1:50k)	NZ landfills. Unsure if includes closed or historic landfills.	Polygon	National	National scale. Unsure if includes closed or historic landfills.
Selected Land Use Register (GWRC)	Regional SLUR. Comprehensive for designated land uses. Sub categories show why the site is on the register. May miss distributed contamination (e.g. from historic rail track contamination)	Polygon	National	Regional scale useful
Communications				
Fibre networks (Chorus?)				Traditionally difficult to obtain due to commercial sensitivity.
Underground comms services				Traditionally difficult to obtain from providers due to commercial sensitivity. Likely to be many different providers across the region. All underground data missing, copper, fibre, exchange buildings, roadside cabinets. Need to understand
https://wcc.maps.arcgis.com/home/webmap/viewer.html?useExisting=1&layers=22e8367f456b4642b6708e030e54c1ff	NZ Cell towers	Points	National	already in WCC arcgis?
https://koordinates.com/layer/1502-vodafone-cell-sites/	Vodaphone cell towers	Points	National	Koordinates. Unsure of currency
https://koordinates.com/layer/1503-spark-formerly-telecom-cell-sites/	Spark towers	Points	National	Koordinates. Unsure of currency
https://koordinates.com/layer/1504-2degrees-cell-sites/	2Degrees cell sites	Points	National	Koordinates. Unsure of currency
Three Waters				
KCDC Stormwater	Review of Development Impacts on Stormwater Management	non spatial	KCDC	2006 councils report
3 Waters asset data (and children)	Water, Wastewater and Stormwater from Wellington Water	Line	Local	Wellington Water bounds only. Missing Carterton, Masterton, KCDC
https://maps.kapiticoast.govt.nz/LocalMaps/Viewer/?map=627d29f22676457ca22bc92c19a095cc	Water, waste water and SW for KCDC	Line	Local	KCDC
https://gis.mstn.govt.nz/WairarapaViewer/?map=d6f5378092314eb4ac10c276906e554d	Water, waste water and SW for other Wairarapa Councils	Line	Local	Wairarapa - but seems to overlap Wellington Water at featherson and greytown
https://gis.mstn.govt.nz/arcgis/rest/services/Services/PrivateUtilitySchemes/MapServer	Water services	Line	Local	A private scheme in Wairarapa - still serves the community
Major Infrastructure				
Hospital Facilities	NZ hospitals	Point	National	National hospitals data. Seems to be better looking at the Building outlines with 'use' being Hospital
3 Waters Asset Data				Better information in 3 waters tab
Prisons				Accessible?
Stadiums				Accessible?
Dams	Could we get this?	Polygon	National	https://geospatial.ac.nz/?portfolio_page=nzid
Schools/ministry of ed				Seems to be better looking at the NZ Building outlines with 'use' being School. Has been autoprocessed: https://nz-facilities.readthedocs.io/en/latest/introduction.html