District Plan Review

Natural Hazards Chapter

Draft - March 2014

Christchurch City Council

Christchurch City Council

Chapter 5 – Natural Hazards

Attachment – Proposed Definitions/Glossary

5.1 Natural Hazards Objectives:

5.1.1 Objective - Reduced risk

Reduced risk to people, property, infrastructure and the environment from the effects of natural hazards, including:

(a) Flooding from rivers, lakes and the sea;
(b) Liquefaction during earthquake shaking;
(c) Cliff collapse, rockfall or boulder roll, and mass movement;
(d) Tsunami;
(e) Coastal erosion;
(f) Exacerbation of these hazards through climate change and sea level rise;
(g) Multiple hazards consisting of combinations of the above.

5.1.2 Objective- Awareness of natural hazards

Increased public awareness of the range and scale of natural hazard events that can affect the District.

5.1.3 Objective – Repair of earthquake damaged land

Repair of earthquake damaged land used for residential purposes is facilitated as part of the recovery.

5.2 General Natural Hazards Policies:

5.2.1 Policy – Avoid development where there is unacceptable risk to life

Avoid new subdivision, use and development, particularly new urban zonings, where:

(a) there is unacceptable risk of loss of life or serious injury in the event of a natural hazard occurrence, or

(b) other potential adverse effects arising from a natural hazard event are serious, and

(c) the natural hazard cannot be mitigated to an acceptable level.

5.2.2 Policy – Critical infrastructure

To avoid critical infrastructure locating in areas affected by significant natural hazards unless there is no reasonable alternative location, and the infrastructure can be designed, maintained and managed to function immediately after natural hazard events.

5.2.3 Policy – Restrict land use to avoid or mitigate hazards

Apply different levels of control on subdivision, use and development in areas at risk of natural hazards, depending on the level of risk, to ensure that the adverse effects of natural hazards are avoided or adequately mitigated.

5.2.4 Policy – Precautionary approach

Adopt a precautionary approach to subdivision, use and development where:

(a) there is uncertainty as to likelihood and scale of a natural hazard; or

(b) there are multiple natural hazards, with potential cumulative effects, or

(c) there is potential for serious or irreversible effects from a natural hazard.

5.2.5 Policy –Worsening, adding or transferring hazard

Ensure that subdivision, use and development, or hazard mitigation proposals do not:

(a) worsen the adverse effects of any known natural hazard,

(b) create a new hazard, or

(c) transfer or increase risk of loss or damage to other people, property, infrastructure or the environment.

5.2.6 Policy – Natural features providing hazard resilience

Ensure that natural features which assist in avoiding or reducing the effects of natural hazards, such as natural ponding areas, coastal dunes, wetlands, waterway margins and riparian vegetation, are protected from subdivision, use and development.

5.2.7 Policy - Awareness of natural hazards

Ensure people are informed about the natural hazards that they, their properties and surrounding areas are subject to.

5.3 Policies for Flooding:

5.3.1 Policy – High flood hazard

Avoid developing new residential units, other habitable buildings, buildings for concentrations of people and additions to those buildings, in areas where there is a high flood hazard.

5.3.2 Policy – Flood protection works

(a) Avoid activities locating where they could undermine the integrity of the Waimakariri River primary stopbank system.

(b) Restrict activities locating where they could undermine the integrity of the Waimakariri River secondary stopbank system.

(c) Ensure that activities located near stopbank systems do not exacerbate or transfer flood risk elsewhere.

5.3.3 Policy - Protection of flood storage and overflow areas

(a) Maintain the flood storage capacity and function of natural floodplains, wetlands and rural ponding areas, including the Hendersons Basin, Cashmere Stream Floodplain, Hoon Hay Valley, Cashmere-Worsleys Ponding Area, Cranford Basin, and Lower Styx Ponding Area.

(b) Limit filling activity that could transfer risk to other properties in urban areas at risk of flooding in a major flood event.

5.3.4 Policy - Flood damage mitigation by raising floor levels

(a) Reduce potential flood damage by ensuring floor levels for new buildings or additions to buildings are above flooding predicted to occur in a major flood event, including an allowance for sea level rise.

(b) Provide for variations in minimum floor levels and their application based on major flood events only in the Waimakariri Stopbank Floodplain, within the Open Space 3D (Clearwater) zone, and around Te Waihora (Lake Ellesmere) and Wairewa (Lake Forsyth).

5.3.5 Policy – Repair of earthquake damaged land

To facilitate recovery by enabling property owners to make immediate repairs to earthquake damaged land for residential purposes in areas subject to flooding where these repairs will have minimal adverse effects.

5.4 Policies for Geotechnical Risks including Liquefaction:

5.4.1 Policy - Liquefaction susceptibility

(a) In flat areas of the District, ensure that geotechnical site suitability is assessed, including liquefaction susceptibility, before new areas are zoned for urban activities, or subdivision, use and development take place.

(b) Ensure that the level of assessment undertaken for subdivision reflects the potential scale and significance of the liquefaction hazard that could occur during ground shaking, acknowledging that some areas are more susceptible to these hazards than others.

5.4.2 Policy – Mitigation of geotechnical risks on flat land

(a) Ensure subdivision, use and development is able to occur where geotechnical risks have been appropriately identified and assessed and can be adequately remedied or mitigated.

(b) Avoid subdivision, use and development, where geotechnical risk is such that the site not suitable for the uses proposed and mitigation would be ineffective.

5.5 Policies for Slope Instability Areas on the Port Hills and in Banks Peninsula

5.5.1 Policy – Areas subject to unacceptable risk to life-safety from potential cliff collapse

Avoid subdivision, use and development at the top of and/ or base of cliffs in areas of the Port Hills subject to an intolerable risk to life-safety from the effects of cliff collapse.

5.5.2 Policy – Areas potentially affected by rockfall or boulder roll

(a) Avoid subdivision, use and development in areas of the Port Hills subject to an intolerable risk to life-safety from the effects of rockfall or boulder roll.

(b) Control subdivision, use and development in areas of the Port Hills subject to a heightened risk to life-safety from the effects of rockfall or boulder roll, where the life-safety risk can be reduced to a tolerable level.

5.5.3 Policy – Areas potentially affected by mass movement

(a) Avoid subdivision, use and development in areas of the Port Hills subject to an intolerable risk to life-safety from the effects of mass movement.

(b) Control subdivision, use and development in areas of the Port Hills subject to a heightened risk from the effects of mass movement, where there is a potential for damage to property and infrastructure.

5.5.4 Policy – Hazard mitigation works for slope instability in the Port Hills and across Banks Peninsula

(a) Avoid hazard mitigation works at the top of and/or base of cliffs in areas of the Port Hills where cliff collapse is likely to destroy or significantly damage the mitigation works, or create a safety hazard.

(b) Control hazard mitigation works for land instability across the remainder of the Port Hills and Banks Peninsula, to ensure that hazard mitigation proposals:
   (i) are effective; and
   (ii) do not worsen any existing natural hazard; and
   (iii) do not transfer or increase risk of loss or damage to other people, property, infrastructure or the environment.

5.5.5 Policy – Slope Instability on the Remainder of the Port Hills and Banks Peninsula

Across the remainder of Port Hills and Banks Peninsula, require proposals for subdivision, use and development to be assessed by a geotechnical expert, to evaluate the level of risk to people and property from slope instability hazards, and allow subdivision, use and development where risk can be reduced to an acceptable level.

5.6 Interim Policy for Coastal Hazards (to be further considered in Stage 2 of the DPR)

5.6.1 Policy – Climate Change and Sea Level Rise

(a) Avoid intensification of built development in areas that are projected to be subject to flooding and/ or inundation as a result of the effects of climate change, including sea level rise.

(b) Limit intensification of development in locations where the effects of climate change including sea level rise, are likely to result in decreasing levels of service from drainage or other infrastructure.

5.7 Policy - Multiple Natural Hazard Areas

Where multiple natural hazards have been identified on a site and result in an elevated overall risk profile, adopt a precautionary approach to subdivision, use and development.

5.8 Flood Hazard Rules

5.8.1 Residential Zones –Activities and Earthworks in Flood Management Areas

5.8.1.1 Permitted activities

The activities listed below are permitted in all residential zones where the site or part of the site is located in a Flood Management Area subject to compliance with: **(i) activity status rules and any standards specified elsewhere in the Plan for that activity, and** **(ii) the standards specified in this rule 5.8.1.1**	**Standards**
P1 New buildings located within the Fixed Minimum Floor Level Overlay, unless specified in Rules P3-P6.	a. Minimum floor levels shall be the higher of: (i) flooding predicted to occur in a 1 in 200 year rainfall event concurrent with a 1 in 20 year tidal event, including sea level rise (Option 1: 0.5m) (Option 2: 1.0m) plus 400mm freeboard, as predicted by the relevant CCC model and version identified in the Table below; or (ii) flooding predicted to occur in a 1 in 200 year tidal event concurrent with a 1 in 20 year rainfall event, including sea level rise (Option 1: 0.5m) (Option 2: 1.0m) plus 400mm freeboard, as predicted by the relevant CCC model and version identified in the Table below; or (iii) 11.8m above CCC Datum. NB: The models identified in (i) and (ii) above will be subject to rolling review on a 5 yearly basis. *This information will be moved to the Section 32 report in subsequent versions.* The Council administers these models and the permitted activity minimum finished floor level can be obtained from the Council.
P2 Additions to existing buildings which increase the ground floor area of the building located within the Fixed Minimum Floor Level Overlay, except those specified by P4-P6.	

Hydrologic and Hydraulic Models Used to Provide Minimum Floor Levels

FMA Catchment	Model	Version
Styx	**Styx River Hydrologic and Hydraulic Model**	**R004**
Avon	**Avon River Hydrologic and Hydraulic Model**	**D13**

	Heathcote	**Heathcote River Hydrologic and Hydraulic Model**	**2012Design**

P3	Additions to existing buildings that do not increase the ground floor area of the building.	(i) Nil
P4	Additions which do not increase the ground floor area of the building by more than 25m² in any continuous ten year period.	(i) Nil
P5	Garages of 40m² or less in area, and any other accessory building of 25m² or less in area.	(i) Nil
P6	Decks, swimming pools, and unenclosed buildings without floors.	(i) Nil
P7	Filling for residential building platforms only to the extent necessary to achieve the minimum floor levels specified for P1 and P2 in Rule 5.8.1.1 for new buildings and for additions to buildings.	(i) Nil
P8	Filling or excavation associated with the maintenance of flood protection and bank erosion protection works; and the maintenance of existing drains or ponds.	(i) Nil
P9	Filling or excavation associated with permitted utilities, or their replacement, repair or maintenance.	(i) Nil
P10	Filling in the Cashmere-Worsleys Ponding Area to enable a subdivision to comply with 8.2.10 Subdivision chapter.	(i) Nil
P11	Any other filling or excavation.	(1) A maximum height of 0.3m of fill above ground, and 0.6m depth of excavation below ground, and (2) A maximum volume of filling above ground level of 10m³ per site, and a maximum cumulative volume of filling and excavation of 25m³ per site, in each case within any continuous period of ten years.

Irrespective of anything to the contrary in this Plan, recession plane breaches created by the need to raise floor levels to meet the minimum floor level standards set in Rule 5.8.1.1 are exempt from compliance with Rule 14.2.3.7, Rule 14.3.3.6 and Rule 14.9.3.5. Recession plane breaches in excess of those created by the need to raise floor levels are not exempt from these rules. NB: these exceptions will be transferred to the relevant places in the Residential Chapter.

For filling or excavation (before 31 December 2018) for repair of land used for residential purposes and damaged by earthquakes, see Rule 5.8.2.

5.8.1.2 Restricted Discretionary Activities

The activities listed below are restricted discretionary activities in all residential zones where the site or part of the site is located in a Flood Management Area.	
RD1 New buildings located within the Fixed Minimum Floor Level Overlay which do not meet the standards set out in Rule 5.8.1.1 – P1 above and are not permitted by P3, P4, P5 or P6 set out in Rule 5.8.1.1. *Any application arising from this rule will not require written approvals shall not be publicly or limited notified.*	**The Council's discretion shall be limited to the following matters:** 1. The setting of the minimum floor level of the building. 2. The frequency at which any proposed building or addition is predicted to be flooded and the extent of damage likely to occur in such an event. 3. Any proposed mitigation measures, and their effectiveness and environmental impact, including any benefits associated with flood management. 4. The effects of the scale and nature of building and its location in relation to neighbouring buildings, including effects on privacy of neighbouring properties as a result of the difference between minimum and proposed floor levels, and effects on streetscape. 5. Noise, traffic, dust and vibration effects during works. 6. Effects on access, character and amenity and sites of archaeological and cultural value, including: (a) Any adverse effects or benefits for public access, natural character, amenity values or ecology of waterways and wetland areas. (b) Effects on sites of archaeological value including consideration of the need to impose an Accidental Discovery Protocol
RD2 New buildings not located within the Fixed Minimum Floor Level Overlay and not permitted by P3, P4, P5 or P6 set out in Rule 5.8.1.1. *Any application arising from this rule will not require written approvals shall not be publicly or limited notified.*	
RD3 Additions to existing buildings located within the Fixed Minimum Floor Level Overlay, which increase the ground floor area of the building, but which do not meet the standards set out in Rule 5.8.1.1 – P2 and are not permitted by P4-P6 set out in Rule 5.8.1.1. *Any application arising from this rule will not require written approvals and shall not be publicly or limited notified.*	
RD4 Additions to existing buildings not located within the Fixed Minimum Floor Level Overlay, which increase the ground floor area of the building, but are not permitted by P4-P6 set out in Rule 5.8.1.1. *Any application arising from this rule will not require written approvals shall not be publicly or limited notified.*	
RD5 Filling or excavation not a permitted activity under P8-P10 set out in Rule 5.8.1.1, or filling or excavation which	1. The effects of filling or excavation on flooding, waterways, groundwater and natural ground levels either on or off site, including:

exceeds the standards in P11 set out in Rule 5.8.1.1.	(a) Any likelihood of exacerbation of flooding, erosion, or siltation either upstream or downstream of the site. (b) Any adverse effects on other properties from disturbances to surface drainage patterns. (c) Effects on flood storage capacity and function in the immediate area, and any wider effects on the flood storage in the catchment; and any effects on existing stormwater and flood protection works. (d) Any implications for groundwater and the water table, on or off site. (e) Any benefits associated with flood management. 2. Any proposed mitigation measures, and their effectiveness and environmental impact. 3. The effects of the scale and nature of the filling or excavation, and location in relation to neighbouring sites, including: (a) Effects on privacy of neighbouring properties and effects on streetscape. (b) The stability of adjoining land, and its susceptibility to subsidence or erosion upon excavation or filling taking place. 4. Effect on access, character, ecology and amenity and sites or archaeological and cultural value, including: (a) Any adverse effects or benefits for public access, natural character, or ecology of waterways and wetland areas. (b) Any adverse effects on amenity values including dust nuisance, visual impact, noise, vibration and traffic associated with the filling or excavation. (c) Effects on sites of archaeological value including consideration of the need to impose an Accidental Discovery Protocol.

5.8.2 Repair of land used for residential purposes damaged by Earthquakes within a Flood Management Area (provisions previously introduced under s27 Canterbury Earthquake Recovery Act to the Operative Plan).

5.8.2.1. Permitted activities

The activities listed below are permitted activities in Flood Management Areas provided the activity:

1. complies with all of the Activity Standards set out in a. to j. below
2. occurs in the Suburban Residential (except for the Suburban Residential Zone on the corner of Hendersons and Sparks Road) , Medium Density Residential and New Neighbourhood zones only
3. is commenced prior to the expiry date of this rule on 31 December 2018

Activity		Activity Standards
P1	Any filling or excavation activity undertaken to repair land used for residential purposes and damaged by the earthquakes, where any site or part of a site is located within a Flood Management Area unless specified by P2 below.	(a) Any filling, excavation or disturbance of soils shall not exceed the criteria in Table 1 or 2 below. (b) There shall be no filling, excavation or disturbance of soil as a permitted activity within: (i) 3m from any utility waterway to be piped; (ii) 5m from any open utility waterway; (iii) 7m from any environmental asset waterway; (iv) 10m from any other waterway; and (v) 20m from Mean High Water Springs except where works within these riparian area setbacks are permitted under the Canterbury Regional Council rules for repair to earthquake damaged land in or where the earthworks are authorised by a land use consent granted by the Canterbury Regional Council. (c) All filling, excavation or disturbance of soil: (i) is not within the dripline of a listed heritage or notable tree; or (ii) does not alter the finished ground level by more than 0.25m within 5m of the dripline of a listed heritage or notable tree; or (iii) is not within an Ecological Heritage Site; or (iv) is not at or within 5m of a listed heritage item, including items of significance to tangata whenua, where the heritage item is on the same site. (d) All filling, excavation or disturbance of soil greater than 10m^3 in volume and 0.6m in depth or within the waterway setbacks at (b) (above) shall be undertaken in accordance with the Erosion and Sediment Control Guidelines for Small Sites and Section 6.1 of the Erosions and Sediment Control Guidelines (both prepared by Environment Canterbury). (e) All filling, excavation or disturbance of soil
P2	Any filling or excavation activity undertaken to repair land used for residential purposes and damaged by the earthquakes involving soil mixing, aggregate piers, or grout, where any site or part of a site is located within a Flood Management Area.	

	greater than 0.3m in depth shall be in accordance with New Zealand Standard NZS 4431:1989 Code of Practice for Earth Fill for Residential Development. Certification is not required except as specified at (g). (f) All filling, excavation or disturbance of soil is to be undertaken in accordance with New Zealand Standard NZS 6803:1999 Acoustics – Construction Noise and DIN 4150 1999-02 Structural Vibration. (g) For filling, excavation or disturbance of soil completed under Table 2, PS-4 certification completed by a suitably qualified and experienced charted geotechnical engineer must be provided to the Council within 3 months of the land repair being completed. This shall include as-built plans of the works. (h) Land repair works involving mixing or insertion of grout shall not involve: i. mixtures with a flow time greater than 30 seconds when tested in accordance the grout flow test at NZS 3112: Part 1:1986 (Test 3) or a flowable concrete/ grout including cement and inert additives which exceed a diameter of 300mm when tested in accordance with inverted cone test where at NZS 3112: Part 1:1986 (Test 11) except for in-situ mixing; or ii. pressurised injection of grout into the ground. (i) Where grout is deposited into land: (i) using in-situ mixing the grout shall be mixed evenly through the augured soil column and the percentage of grout within the augured soil column shall not exceed 20%; or (ii) Where grout is deposited into land using methods other than in-situ mixing, the percentage of cement in the dry grout mixture shall not exceed 30%. (j) Land repair materials shall consist only of: (i) soil, gravel, rocks, concrete, sand, silt (such as exists on site already), or clean, inert material; or (ii) cement and/ or bentonite grout including inert additives.

Table 1: Standards where the land repair and earthworks are not designed, supervised or certified by a suitably qualified or experienced chartered geotechnical engineer

	Column A Max. Volume (Cumulative)	**Column B** Max. depth (m)	**Column C** Max. depth of fill (m) [below ground level]	**Column D** Fill (m) [above ground level]	**Column E** Setback from boundary
P1	50m^3/site	0.6	0.6	0.3 max. depth; and 10 m^3 /site max. volume	Setback from boundary must be equivalent to or greater than the depth of filling or excavation.
P2	10m^3	1.0	1.0	0.3m max. depth	

Table 2: Standards where the land repair and earthworks are designed, supervised or certified by a suitably qualified and experienced chartered geotechnical engineer

	Column A Max. Volume (Cumulative)	**Column B** Max. depth (m)	**Column C** Max. depth of fill (m) [below ground level]	**Column D** Fill (m) [above ground level]	**Column E** Setback from boundary
P1	250m^3/site	2.0	2.0	0.3 max. depth; and 10 m^3 /site max. volume	Nil
P2	250m^3, where not more than 50m^3 may be grout	4.0	4.0	Nil	1.5m

5.8.2.2. Restricted discretionary activities

The activities listed below are a restricted discretionary activity. Discretion to grant or decline consent or impose conditions is restricted to the matters for discretion identified below.		
Activity		**The Council's discretion shall be limited to the following matters:**
RD1	Any filling or excavation undertaken to repair land used for residential purposes damaged by earthquakes that does not comply with P1 or P2 set out in Rule 5.8.2.1. *Any application arising from this rule will not require written approvals and shall not be publicly or limited notified.*	The matters for discretion reserved for RD5 set out in Rule 5.8.1.2.

5.8.2.3. Exemptions to Rules 5.8.2.1 and 5.8.2.2:

(i) Works involving the establishment, repair or replacement of any permitted utilities or the maintenance of existing drains or ponds by a utility operator.

(ii) Works permitted by a building consent do not require resource consent under Rules 5.8.2.1 or 5.8.2.2 where;

(a) they comply with criteria in column D of Tables 1 and 2 controlling fill above ground level in Flood Management Areas; or

(b) they are designed, supervised and certified by a suitably qualified and experienced chartered geotechnical engineer, including where they exceed the criteria at columns A, B, C or E of Tables 1 and 2; or

(c) they comply with criteria 5.8.2.1.(b) – (j).

(iii) Testing or investigation preceding land repairs or remediation as a result of land damaged by earthquakes are permitted provided it meets the criteria at rule 5.8.2.1 (b), (c), (e), (f), (h) and (i).

(iv) filling or excavation associated with the maintenance of flood protection works.

(v) post holes for the erection of fences or for permitted or approved buildings and signs.

(vi) planting holes for trees and plants.

5.8.2.4. For the avoidance of doubt, where the earthworks are associated with the repair of land damaged by earthquakes and used for residential purposes in the zones listed in Rule 5.8.2.1:

(i) Rule 5.8.2 substitutes all other earthworks rules in this Plan.

***Advice Notes**:*

(i) For the purposes of this rule, "repair land used for residential purposes damaged by earthquakes" does not include repair of land on the Port Hills or Banks Peninsula. It does include all other residential land whether or not an EQC payment has been made and residential land which was unimproved when damage occurred.

(ii) Those intending to do land repair earthworks are responsible for complying with the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (2011). Such persons should contact the Christchurch City Council or Environment Canterbury to find out whether their land has been used for hazardous activities which might trigger the need for compliance with the NES.

(iii) Those intending to do land repair works should check that the works they intend to undertake do not compromise the insurance of their land in the event of future seismic events, including with EQC.

(iv) Any vegetation removed during land repairs should not be replaced with pest species as listed in Appendix 1 to the Infrastructure Design Standard (Part 10). The Council prefers that replanting occurs in accordance with its Streamside Planting Guideline to ensure bank stability is not compromised.

(v) Information regarding the disposal of excavated material and the Standards and Guidelines referenced in the rule is available from the Council.

(vi) Measurement of volume shall include only areas which have been disturbed, including by filling, excavation, soil mixing or injection of materials. Soil above or between these areas which remain undisturbed does not form part of the allowable volume, including where those undisturbed soils are compacted or otherwise altered by the works.

(vii) For the purposes of this rule, the building consent platform extends to a maximum of 2.5m from the exterior wall of an enclosed structure or support structures of open structures.

(viii) The injection of grout under pressure should be undertaken by competent practitioners in line with current best practice guidelines. The practitioner should be aware of buried services when undertaking works.

5.8.3 Commercial and Industrial zones - Activities and Earthworks in Flood Management Areas

5.8.3.1 Permitted Activities

The activities listed below are permitted in all commercial and industrial zones where the site or part of the site is located in a Flood Management Area subject to compliance with : **(i) activity status rules and any standards specified elsewhere in the Plan for that activity, and** **(ii) the standards specified in this Rule 5.8.3.1**	**Standards**
P1 New buildings located within the Fixed Minimum Floor Level Overlay, unless specified in P3 and P4 as set out in Rule 5.8.3.1.	(a) Minimum floor levels shall be the higher of: (i) flooding predicted to occur in a 1 in 200 year rainfall event concurrent with a 1 in 20 year tidal event, including sea level rise (Option 1: 0.5m) (Option 2: 1.0m) plus 400mm freeboard, as predicted by the relevant CCC model and version identified in Table 1; or (ii) flooding predicted to occur in a 1 in 200 year tidal event concurrent with a 1 in 20 year rainfall event, including sea level rise (Option 1: 0.5m) (Option 2: 1.0m) plus 400mm freeboard, as predicted by the relevant CCC model and version identified in Table 1; or (iii) 11.8m above CCC Datum NB: The models identified in (i) and (ii) above will be subject to rolling review on a 5 yearly basis. *This information will be moved to the Section 32 report in subsequent versions.* The Council administers these models and the permitted activity minimum finished floor level can be obtained from the Council.
P2 Additions to existing buildings located within the Fixed Minimum Floor Level Overlay, which increase the ground floor area of the building unless specified in P4 in Rule 5.8.3.1.	

Hydrologic and Hydraulic Models Used to Provide Minimum Floor Levels

FMA Catchment	Model	Version
Styx	**Styx River Hydrologic and Hydraulic Model**	R004
Avon	**Avon River Hydrologic and Hydraulic Model**	**D13**
Heathcote	**Heathcote River Hydrologic and Hydraulic Model**	**2012Design**

P3	Additions to existing buildings that do not increase the ground floor area of the building.	(i) Nil
P4	Additions which do not increase the ground floor area of the building by more than 25m^2 in any continuous ten year period.	(i) Nil
P5	Filling for commercial and industrial building platforms only to the extent necessary to achieve the minimum floor levels specified in P1 and P2 in Rule 5.8.3.1, for new buildings and for additions to buildings.	(i) Nil
P6	Filling or excavation associated with the maintenance of flood protection and bank erosion protection works; and the maintenance of existing drains or ponds.	(i) Nil
P7	Filling or excavation associated with permitted utilities, or their replacement, repair or maintenance.	(i) Nil
P8	Any other filling or excavation.	1. A maximum height of 0.3m of fill above ground, and 0.6m depth of excavation below ground, and 2. A maximum volume of filling above ground level of 20m^3 per site, and a maximum cumulative volume of filling and excavation of 50m^3 per site in each case within any continuous period of ten years.

5.8.3.2 Restricted Discretionary Activities

The activities listed below are restricted discretionary activities in all commercial or industrial zones where the site or part of the site is located in a Flooded Management Area.		
RD1	New buildings located within the Fixed Minimum Floor Area Overlay which do not meet the standards specified for P1	**The Council's discretion shall be limited to the following matters:** 1. The setting of the minimum floor level of the

	as set out in 5.8.3.1 and are not permitted by P3 or P4 of Rule 5.8.3.1. *Any application arising from this rule will not require written approvals and shall not be publicly or limited notified.*	building. 2. The frequency at which any proposed building or addition is predicted to be flooded and the extent of damage likely to occur in such an event. 3. Any proposed mitigation measures, and their effectiveness and environmental impact, including any benefits associated with flood management. 4. The effects of the scale and nature of building and its location in relation to neighbouring buildings, including effects on privacy of neighbouring properties as a result of the difference between minimum and proposed floor levels, and effects on streetscape. 5. Noise, traffic, dust and vibration effects during works. 6. Effects on access, character and amenity and sites of archaeological and cultural value, including: (a) Any adverse effects or benefits for public access, natural character, amenity values or ecology of waterways and wetland areas. (b) Effects on sites of archaeological value including consideration of the need to impose an Accidental Discovery Protocol
RD2	New buildings not located within the Fixed Minimum Floor Area Overlay and are not permitted by P3 or P4 of Rule 5.8.3.1. *Any application arising from this rule will not require written approvals and shall not be publicly or limited notified.*	
RD3	Additions to existing buildings located within the Fixed Minimum Floor Area Overlay which increase the ground floor area of the building, but which do not meet the standards specified for P2 set out in Rule 5.8.3.1 and are not permitted by P4 of Rule 5.8.3.1. *Any application arising from this rule will not require written approvals and shall not be publicly or limited notified.*	
RD4	Additions to existing buildings not located within the Fixed Minimum Floor Area Overlay which increase the ground floor area of the building and are not permitted by P4 of Rule 5.8.3.1. *Any application arising from this rule will not require written approvals and shall not be publicly or limited notified.*	
RD5	Filling and excavation not a permitted activity under P5, P6, or P7 set out in Rule 5.8.3.1 above; or filling and excavation which exceeds the standards in P8 of Rule 5.8.3.1.	1. The effects of filling or excavation on flooding, waterways, groundwater and natural ground levels either on or off site, including: (a) Any likelihood of exacerbation of flooding, erosion, or siltation either upstream or downstream of the site. (b) Any adverse effects on other properties from disturbances to surface drainage patterns. (c) Effects on flood storage capacity and function in the immediate area, and any wider effects on the flood storage in the

	catchment; and any effects on existing stormwater and flood protection works. (d) Any implications for groundwater and the water table, on or off site. (e) Any benefits associated with flood management. 2. Any proposed mitigation measures, and their effectiveness and environmental impact. 3. The effects of the scale and nature of the filling or excavation, and location in relation to neighbouring sites, including: (a) Effects on privacy of neighbouring properties and effects on streetscape. (b) The stability of adjoining land, and its susceptibility to subsidence or erosion upon excavation or filling taking place. 4. Effect on the reasonable use of the site. 5. Effects on access, character, ecology and amenity and sites of archaeological and cultural value, including: (a) Any adverse effects or benefits for public access, natural character, or ecology of waterways and wetland areas. (b) Any adverse effects on amenity values including dust nuisance, visual impact, noise, vibration and traffic associated with the filling or excavation. (c) Effects on sites of archaeological value including consideration of the need to impose an Accidental Discovery Protocol.

5.9 Liquefaction Rules

5.9.1 Restricted Discretionary Activities – Liquefaction Assessment Area 1

The activities listed below are restricted discretionary activities in any zone within the area shown on the Planning Maps as "Liquefaction Assessment Area 1" and are subject to compliance with any standards specified elsewhere in the Plan for that activity.

Note for clarification: liquefaction is a process that can occur during strong earthquake shaking which causes loss of stiffness and strength in generally loosely consolidated fine grained water saturated soils and can result in localised flooding and ground damage from lateral spreading, settlement, ground

cracking, sand boils and deposition of sediment.

The above definition will be included in the Definitions Section of the Plan in due course.

For all resource consent applications under Rule 5.9.1 a geotechnical assessment is required to be undertaken by a Chartered Professional Engineer with competence in geotechnical engineering. Assessments must provide the relevant information set out in Clause 5.11 for resource consents in areas of liquefaction potential, and address the relevant matters set out below to which discretion is restricted.

The above information will be included in a separate section of the Plan in due course.

RD1	Any subdivision which creates an additional vacant lot or lots *Any resource consent application arising from this rule will not require written approvals and shall not be publicly or limited notified.*	**The Council's discretion shall be limited to the following matters:** 1. All matters which control has been reserved over for controlled activity subdivision in Chapter 8 (Subdivision). 2. The nature and extent of the liquefaction hazard identified for the site. 3. Techniques proposed for mitigation of the effects of any liquefaction hazard identified, including but not limited to: (a) Measures proposed for ground strengthening and foundation design, and the ability of these proposals to be incorporated into the subdivision consent as conditions. (b) Any geotechnical setbacks provided in relation to size of any waterway or waterbody, or alternatively, ground strengthening or other proposed engineering or geotechnical solutions to address any identified potential for lateral spread. 4. The layout of the subdivision with respect to the extent of liquefaction hazard, including: (a) The proposed location of earthworks, servicing and building platforms in regard to the liquefaction hazards identified including, where appropriate: (i) the location of services and buildings where there is liquefaction susceptibility variability across the site; and (ii) the ability to relocate services affected by liquefaction to more desirable locations. 5. The overall suitability of the site for the range of uses anticipated, given the nature and extent of any geotechnical constraints identified and mitigation measures proposed. 6. Potential environmental effects of any mitigation measures on adjoining sites.

RD2	Any activity located on a site of 1500m^2 or more, qualifying as a restricted discretionary activity under any of the following rules: • Enhanced Development Mechanism – Rule 14.10.2 RD1, RD2; • Community Housing Redevelopment Mechanism – Rule 14.11.2 RD1, RD2; • Residential Suburban Zone – Rule 14.2.2.3 RD7, RD8, RD10; • New Neighbourhood Zone – Rule 14.9.2.3 RD9. • Residential Banks Peninsula Zone – Rule 14.4.2.3 RD3, RD4. • Residential Conservation Zone – Rule 14.5.2.3 RD6 Resource *consent application(s) arising from this rule in respect to the Enhanced Development Mechanism or the Community Housing Development Mechanism will not require written approvals and shall not be publicly or limited notified.* *The above rule will be included in the Residential Section of the Plan in due course.*	**The Council's discretion shall be limited to the following matters which are in addition to those matters of discretion stated for these activities elsewhere in this Plan:** 1. The nature and extent of the liquefaction hazard identified for the site. 2. The siting and layout of buildings, car parking areas, access and services proposed for the site, including the ability to locate buildings and services on land of lesser liquefaction potential where there is variability across the site. 3. Techniques proposed for mitigation, including, but not limited to, measures for ground strengthening and foundation design. 4. The effectiveness and environmental impact of any mitigation measures proposed.

Note: See Clause 5.11 for additional information requirements in respect to liquefaction potential, for all applications for subdivision, and for all resource consent applications for land use activities where a geotechnical report is required.

5.10 Port Hills and Banks Peninsula Slope Instability Rules

5.10.1 Activity Status for Port Hills and Banks Peninsula Slope Instability Management Areas

The activities listed below have the activity status listed within each slope instability management area, and are subject to compliance with any standards specified elsewhere in the Plan for that activity.

For all resource consent applications under Rule 5.10.1 a geotechnical assessment is required to be undertaken by a suitably qualified and experienced geoprofessional, providing the relevant information set out in clause 5.11.4 for resource consent applications in slope instability management areas, and addressing the relevant assessment matters below.

For applications under Rule 5.10.1, a geoprofessional means a suitably experienced geotechnical engineer, or engineering geologist, with experience permitting an appropriate grade of membership in the relevant professional body.

For the purposes of the design of rockfall protection structures, the geoprofessional must be a Chartered Professional Engineer with specific experience in the investigation, design and/or construction of rockfall

protection structures, who has registered with the Christchurch City Council and possesses suitable insurance policies and relevant qualifications, skills and experience to provide advice on rockfall protection structures. *The above information will be included in a separate section of the Plan in due course.*						
	Slope Instability Management Areas					
Activity	**Cliff Hazard**	**Rockfall Hazard-1**	**Rockfall Hazard-2**	**Mass Movement Hazard 1**	**Mass Movement Hazard Areas 2 & 3**	**Remainder of Port Hills and Banks Peninsula Slope Instabilty Management Areas**
1. Subdivision	NC1	NC2	D1	NC3	D2	RD1
2. Earthworks except as provided in 3 & 4 below	NC4	NC5	D3	NC6	D4	P1 – refer to subdivision and earthworks rules in Chapter 8
3. Hazard mitigation works, including earthworks associated with those works	NC7	D5	D6	NC8	D7	RD2
4. Hazard mitigation works to protect infrastructure* including earthworks associated with those works.	D8	D9	D10	D11	D12	RD3
5. Demolition of buildings	D13	D14	D15	D16	D17	P2
6. Repair of roads and other infrastructure*	D18	P3	P4	D19	P5	P6
7. Any building or structure not listed in 1 to 6 above.	PR1	NC9	D20	Activity status to be determined following further geotechnical review work	D21	Refer zone rules
8. Any other activity not otherwise listed	NC10	NC11	D22	NC12	D23	Refer zone rules

in this table.						
Any resource consent application arising from RD1, RD2 and RD3 set out in Rule 5.10.1 above will not require written approvals and shall not be publicly or limited notified.						
Key: P = Permitted; RD = Restricted Discretionary; D = Discretionary; NC = Non-complying; PR = Prohibited						

* For the purposes of this rule, infrastructure includes water mains, sewage mains, pump stations and reservoirs, power networks and substations, and telecommunications networks, but does not include services from the street to residential units.
This definition will be included in the Definitions Section of the Plan in due course.

Note: See Clause 5.11.4 for additional information requirements for all resource consent applications within Port Hills and Banks Peninsula Slope Instability Management Areas.

5.10.2 Remainder of Port Hills and Banks Peninsula Slope Instability Management Areas - RD1, RD2 and RD3 Matters for Discretion

Council's discretion shall be limited to the following matters:

1. In respect to subdivision applications: All matters which control has been reserved over for controlled activity subdivision in Chapter 8.
2. The nature and extent of the risk posed by the natural hazard, both on and off site.
3. The nature and scale of any existing or proposed works, their design and effects.
4. Hazard mitigation measures, effects on risk levels and monitoring.
5. Drainage and sediment control measures.
6. Suitability of proposed building platforms and access to the site.
7. The visual impact of any proposed earthworks or hazard mitigation/ protection works.

5.10.3 Slope Instability Management Areas – D5 to D23 Assessment Matters for Land Use Resource Consents

The land use activities listed above as *Discretionary Activities* will be assessed against the relevant assessment matters below, together with other matters specified in s104 of the Resource Management Act.

(a) The risk to life, property and the environment posed by the natural hazard, either on the site of the activity, or elsewhere such as downhill.

(b) The extent to which hazard mitigation works or conditions on the activity would enable the effects of the hazard, either on site or elsewhere, to be remedied or mitigated.

(c) The suitability of the site for the activities proposed.

(d) Whether or not the work would be carried out under the supervision of a suitably qualified and experienced geoprofessional.

(e) For hazard mitigation measures, whether the works:

(i) can be shown, based on evaluation by a geoprofessional, using best practice methods, to increase the stability of land and/or protect structures and buildings and their occupants;

(ii) can be shown, based on evaluation by a geoprofessional, using best practice methods, to reduce risk to life to a tolerable level, including the extent to which an Annual Individual Fatality Risk of 10^{-4} (1 in 10,000) or better can be achieved;

(iii) will have appropriate monitoring procedures applied, with inspections and maintenance undertaken and reported to the Council.

(f) The extent to which the activity or works will lead to removal of vegetation or topsoil, or modification of ecosystems or natural character, or adverse landscape and visual effects.

(g) The extent to which the activity or works would impact on recreational access, where available, or historical or cultural heritage.

5.10.4 Slope Instability Management Areas – D1toD12 Assessment Matters for Subdivision or Earthworks Resource Consent Applications

Where subdivision or earthworks are listed above as *Discretionary Activities,* they will be assessed against the relevant assessment matters below together with other matters specified in s104 of the Resource Management Act.

(a) The implications of any proposed works on hydrological and geological features, both underlying and surface and on site and on adjoining sites.

(b) The nature, extent and implications of hazards relevant to the site e.g. slope instability or stream bank erosion.

(c) The effectiveness of mitigation measures proposed, and whether they will lower risk to an acceptable level.

(d) Design of proposed works including buildings and retaining walls, and access roads.

(e) The nature of any existing or proposed fill or earthworks, engineering design, and their effects on the stability of the site and adjacent sites.

(f) Effects of development on surface and subsurface drainage patterns and stormwater management.

(g) The adequacy of drainage and sediment control measures; for example, the extent to which the works will retain excavations as soon as possible, drain stormwater into an approved stormwater system, and when excavating, be undertaken outside of periods of water saturation.

(h) The ability of the site to accommodate specific, stable, accessible and serviceable building platforms for each site.

(i) The extent to which the works will lead to removal of vegetation or topsoil, or modification of ecosystems or natural character, or adverse landscape and visual effects.

(j) The extent to which the activity or works would impact on recreational access, where available, or historical or cultural heritage.

5.11 General Procedures - Information Requirements

5.11.1 Information requirements for all plan changes

Liquefaction potential

(a) Plans and accompanying information will be required to show the results of a geotechnical site suitability assessment, in accordance with MBIE guidelines for site investigation density for plan changes, specified in Ministry of Business, Innovation and Employment (December 2012): Part D of "Guidance: Repairing and rebuilding houses affected by the Canterbury Earthquakes": Guidelines for the geotechnical investigation and assessment of subdivisions in the Canterbury region: Minimum requirements for geotechnical assessment for land development ('flatland areas 'of the Canterbury region). This will be required to include an indication of liquefaction susceptibility across the site in terms of performance characteristics. The level of investigation should correspond with the scale and significance of the hazard. Plans and information should:

(i) Identify any areas which require particular ground strengthening or other mitigation measures, and recommendations for such mitigation;

(ii) Identify any areas which should be excluded from built development, because of geotechnical constraints, or which require geotechnical setbacks, including areas near the edges of rivers, streams , lakes, stormwater detention areas and swales where lateral spread is likely to occur;

(iii) Indicate any options and recommended locations for the proposed land use, transport features and other infrastructure recommended by the geotechnical engineer.

(b) All geotechnical reports in respect to liquefaction potential are to be prepared by a Chartered Professional Engineer with competence in geotechnical engineering and should contain all relevant geotechnical information, presented in both a factual and interpretive manner. Council will obtain peer reviews of geotechnical reports.

5.11.2 Additional information requirements for all resource consent applications for subdivision

5.11.2.1 Liquefaction Assessment Area 1

Liquefaction Potential

(a) At subdivision consent stage, detailed liquefaction susceptibility assessment and reporting will be required in accordance with the densities, depth, methods of investigation and reporting specified in Ministry of Business, Innovation and Employment (December 2012): Part D of "Guidance: Repairing and rebuilding houses affected by the Canterbury Earthquakes": Guidelines for the geotechnical investigation and assessment of subdivisions in the Canterbury region: Minimum requirements for geotechnical assessment for land development ('flatland areas 'of the Canterbury region).

(b) Subdivision consent applications will be required to include sufficient information detailing measures to satisfy the Council that liquefaction risk can be avoided, remedied or mitigated, including the potential effects of lateral spread near the edges of rivers, streams, lakes, stormwater detention areas and swales.

(c) Subdivision plans shall show:

(i) Any areas which require particular ground strengthening or other mitigation measures, and recommendations for such mitigation;

(ii) Any areas which should be excluded from built development because of geotechnical constraints, or which require geotechnical setbacks;

(iii) Any features of subdivision layout recommended by the geotechnical engineer, for example any recommended locations for proposed land uses, transport features and other infrastructure as a result of geotechnical constraints.

(d) All geotechnical reports in respect of liquefaction potential will be required to be prepared by a Chartered Professional Engineer with competence in geotechnical engineering and should contain all relevant geotechnical information, presented in both a factual and interpretive manner. Note that the Council will obtain peer reviews of geotechnical reports.

Advice Notes:

(a) Much of Christchurch has highly variable ground conditions within short distances, which means that in many cases the upper end of the minimum range of site investigation density investigations under the MBIE guidelines will be appropriate.

(b) CCC has separate subdivision and additional guidance titled Subdivision Bulletin 23.2. May 2013 "Geotechnical Assessment to Satisfy Section 106 RMA Matters".

5.11.2.2 Liquefaction Assessment Area 2

Liquefaction Potential

(a) Where land within Liquefaction Assessment Area 2 under the District Plan is to be subdivided, it is likely to require a lesser level of geotechnical assessment than for Liquefaction Assessment Area 1. The level of investigation should be appropriate to the geomorphology of the site, the scale of the proposed development, the importance of the facilities planned for the site, and the level of risk to people and other property arising from structural failure and loss of amenity. A greater level of assessment may be required where:

(i) Visual assessment and reasonable enquiry suggests that the land or parts of the land are subject to the same level and intensity of deep geotechnical investigation as for Liquefaction Assessment Area 1.

(ii) Land is within 200m of the edge of a river, stream, lake, stormwater detention area or swale. In this case the potential effects of lateral spreading should still be specifically considered.

Other geotechnical risks

(b) In all cases subdivision consent applications will be required to include assessment and reporting on normal geotechnical investigations for the purposes of evaluating all other potential geotechnical risks, including information on soil types, static bearing capacities, settlements, stability, and section 106 RMA matters.

5.11.3 Additional information requirements for applications for resource consents for land use activities in flat areas where a geotechnical report is required.

Liquefaction potential

(a) Applicants will be required to supply the results of a detailed geotechnical investigation and interpretation. The level of investigation should correspond with the scale and significance of the liquefaction hazard. Plans and information should:

(i) Identify any areas which require particular ground strengthening or other mitigation measures, and recommendations for such mitigation;

(ii) Identify any areas which should be excluded from built development, because of geotechnical constraints, or which require geotechnical setbacks, including areas near the edges of rivers, streams , lakes, stormwater detention areas and swales where lateral spread is likely to occur;

(iii) Indicate any options and recommended locations for the proposed land use, transport features and other infrastructure recommended by the geotechnical engineer.

(b) All geotechnical reports in respect of liquefaction potential will be required to be prepared by a Chartered Professional Engineer with competence in geotechnical engineering, and should contain all relevant geotechnical information, presented in both a factual and interpretive manner. Council will obtain peer reviews of geotechnical reports.

Advice notes

(a) Where land is within the area shown on the Planning Maps as "Liquefaction Assessment Area 2", or where land has been already been subject to recent significant geotechnical assessment, existing geotechnical information may be adequate for land use consent purposes. Identifying geotechnical issues other than liquefaction potential e.g. the presence of peat, is also part of normal geotechnical investigations.

(b) Land to be used for commercial or other non-residential purposes may require more substantial investigations, ground strengthening, and foundation design measures than for residential lots, depending on the activities proposed and size and weight of the proposed structures.

5.11.4 Additional Information Requirements for Applications for Resource Consents within Port Hills and Banks Peninsula Slope Instability Management Areas:

(a) Plans and accompanying information should show:

(i) The geological and geotechnical constraints across the site including any relationship or effect on areas of actual or potential instability off the site, including the location of any inferred faults.

(ii) The location of the site in relation to the natural hazard, or of the hazard on the site itself; and the location of building platforms in relation to the hazard.

(iii) The nature of the proposed activities on the site, and the impact on other sites potentially affected by the natural hazard, the effect of the hazard on the activity and vice versa.

(b) All geotechnical reports will be required to be prepared by a geoprofessional with competence in geotechnical engineering, and should contain all relevant geotechnical information, presented in both a factual and interpretive manner. The Council will obtain peer reviews of geotechnical reports. For the purposes of the design of rockfall protection structures the geoprofessional must be a Chartered Professional Engineer as set out in Rule 5.10.1.

ATTACHMENT

PROPOSED DEFINITIONS ASSOCIATED WITH NATURAL HAZARDS
There is a definitions chapter for all other definitions

Annual Exceedance Probability (AEP)
means the probability that a flood event of a certain scale will occur in any given year

Annual Individual Fatality Risk
means the probability or likelihood that an individual will be killed at their place of residence in the Port Hills in any one year as a result of cliff collapse, rockfall or boulder roll or mass movement.

Christchurch City Council Datum
means a drainage reference level 9.043m below Mean Sea Level (1937 Lyttelton Datum)

Critical infrastructure
means infrastructure necessary to provide services which, if interrupted, would have a serious effect on the communities within the Christchurch District and which would require immediate reinstatement. This includes any structures that support, protect or form part of critical infrastructure. Critical infrastructure includes:

- Christchurch International Airport;
- Lyttelton Port of Christchurch;
- Gas storage and distribution facilities;
- Electricity sub-stations, networks and distribution installations, including the electricity distribution network;
- Supply and treatment of water for public supply;
- Storm water and sewage disposal systems;
- Telecommunications installations and networks;
- Strategic road and rail networks (as defined in the Canterbury Regional Land Transport Strategy);
- Petroleum storage and supply facilities;
- Public health care facilities, including hospitals and medical centres;
- Fire stations, police stations, ambulance stations and emergency co-ordination facilities
- Defence Force facilities

Habitable building
means any building occupied by persons whether for residential activity or travellers accommodation or hotels.

Hazard mitigation works
means engineering works to prevent and control land instability, rockfalls, boulder roll and the extent of debris travel, and includes the building of rockfall protection structures, the removal and/or relocation of source rock hazards, the mechanical fixing of rocks in-situ and the re-contouring of slopes and/or land.

High flood hazard
means subject to inundation events where the water depth (metres) x velocity (metres per second) is greater than or equal to 1, or where depths are greater than 1 metre, in a 0.2% AEP (1 in 500 year) flood event. (Chapter 11, RPS)

Residential building platform means that area of a site equal to the ground floor area of the residential building plus 1.8m extending at ground level beyond the foundations.

Major flood event

Means either a 1 in 200 year rainfall event concurrent with a 1 in 20 year tidal event, or a 1 in 200 year tidal event concurrent with a 1 in 20 year rainfall event.

Freeboard
means the provision for flood level design estimate imprecision, construction tolerances and natural phenomena (e.g. waves, debris, aggradations, channel transition and bend effects) not explicitly included in the calculations for flood levels.

Filling
Means the placing or disturbance of material upon the surface of the land above natural ground level, or upon land which has been excavated below natural ground level or the placing or disturbance of material into land below natural ground level where excavation has not taken place.

Grout
For the purposes of Rule 5.8.3, grout means a material which consists of water and at least 20% of cement, and which may also contain aggregate, inert additives, or bentonite.

Pressurised injection
For the purposes of Rule 5.8.3, means injection of grout at more than 25 bar at the pump (see advice note viii to rule 5.8.3).