Nelson City Council
te kaunihera o whakatū

Council

9 August 2018

REPORT R9387

Nelson Tasman Land Development Manual

1. Purpose of Report

1.1 To seek approval for the draft Nelson Tasman Land Development Manual (NTLDM) and associated draft Plan Change 27 to the Nelson Resource Management Plan (NRMP) be provided to the public, statutory stakeholders and iwi partners for feedback under the Local Government Act 2002(LGA) and clause 34 First Schedule Resource Management Act 1991 (RMA).

1.2 To seek delegations for a joint Nelson and Tasman Council Hearing Panel to hear feedback, provide direction to the working group on any amendments required as a result of that feedback, and make recommendations to Council.

1.3 A similar report with the same recommendation is being presented to Tasman District Council on 9 August 2018 as alignment in decision making is required to support the consultation, consideration and adoption process across both Councils.

2. Summary

2.1 The review of the Nelson City Council Land Development Manual 2010 (LDM) has been an extensive across team and across local authority project with significant stakeholder engagement. A Steering Group comprising Councillors from both Nelson and Tasman Councils as well as survey and contract industry stakeholders has guided the review.

2.2 This has resulted in the production of a draft Nelson Tasman Land Development Manual (NTLDM) for the Nelson and Tasman regions providing consistency and alignment for the construction and vesting of, and works on, Council assets. The NTLDM contains both mandatory standards and good practice. Associated guidance notes for Bio-retention (rain gardens), Wetlands, and Coastal and Freshwater Inundation have also been developed.

2.3 This report seeks Council approval to undertake two consultation processes concurrently under the Local Government Act 2002 and the Resource Management Act 1991.

2.4 The NTLDM is a Council policy document which is sought to be adopted under the LGA. To commence that process, the draft NTLDM is proposed to be released for public feedback from 13 August to 28 September 2018 under the Local Government Act 2002. It is accompanied by three draft practice notes to assist in the implementation of the standards and good practice, on which public feedback is also sought.

2.5 The LDM is also an externally referenced document to the NRMP which means it has legal effect as if it is part of the Plan. The reference to the LDM 2010 needs to be updated to refer to the NTLDM once adopted, and draft Plan Change 27 has been prepared to update that reference. This report seeks that the intention to change the LDM reference in the NRMP from the 2010 LDM to the proposed Nelson Tasman Land Development Manual 2018 be consulted on under clause 34 of the First Schedule RMA. This provides for the public to provide comments on the intention to externally reference the new mandatory standards which will have legal effect as if they are part of the Plan.

2.6 Following the receipt and hearing of public feedback under the LGA, recommendations for changes will be made to the Council prior to seeking adoption of the NTLDM under the LGA. Following the receipt of comments on plan change 27, recommendations will be made to Council to commence public notification of the change under the RMA. Both processes will occur concurrently and with Tasman District Council to ensure alignment is achieved.

3. Recommendation

That the Council

<u>Receives</u> the report Nelson Tasman Land Development Manual (R9387) and its attachment/s (A2013438, A2013398, A2013457, A2013449, A1988205); and

<u>Approves</u> the draft Nelson Tasman Land Development Manual (A2013438), draft practice notes (A2013398, A2013457, A2013449) and draft plan change to the Nelson Resource Management Plan (A1988205) for release on 13 August 2018 for public feedback under the Local Government Act and public comment under clause 34 First Schedule Resource Management Act; and

<u>Delegates</u> the hearing of feedback under section 78 of the Local Government Act and comments under clause 34 First Schedule of the Resource Management Act to a joint hearing panel comprising Councillors Lawrey and McGurk as members of the Steering Group plus Councillor…………………… together with three

Tasman District Council Councillors (Councillors King and Bryant plus one other).

<u>Delegates</u> to the hearing panel the power to make recommendations to the Nelson and Tasman Councils to adopt or amend the Nelson Tasman Land Development Manual and associated practice notes.

4. Background

4.1 The Nelson City Council Land Development Manual 2010 (LDM) provides minimum standards and guidance for work undertaken on Council assets, or subdivision and development that results in the vesting of assets in Council. These standards are incorporated into the Nelson Resource Management Plan and reviewed every 3-5 years.

4.2 As part of the public consultation and stakeholder engagement process for the LDM in 2009, stakeholders suggested to Council that an aligned LDM between the two Councils should be pursued.

4.3 Over the last three years officers from both Nelson and Tasman Councils have been working on a joint set of standards known as the Nelson Tasman Land Development Manual (NTLDM).

4.4 The Planning and Regulatory Committee agreed on 12 March 2015, in response to report A1317664, to progress the joint Nelson Tasman Land Development Manual with Tasman District Council, making the following resolutions:

Resolved PR/2015/015

THAT the report Land Development Manual Review (R4261) and its attachments (A1365598) be received;

AND THAT the Committee nominate Councillors Ward and McGurk to be members of the Land Development Manual Steering Group;

AND THAT the attached draft Terms of Reference are adopted by the Planning and Regulatory Committee for finalisation at the first Steering

Group meeting after which they will be confirmed by the Mayor and the Chair of Planning and Regulatory;

AND THAT those nominated Councillors provide regular reports back to the Planning and Regulatory Committee on progress with the Land Development Manual alignment and review;

AND THAT where possible both Tasman District Council and Nelson City Council use the same Hearing Commissioners to hear and make recommendations on submissions;

AND THAT a draft aligned Land Development Manual be brought back to the Planning and Regulatory Committee for consideration by December 2015.

4.5 A Steering Group comprising two elected members from each Council and two industry representatives was established and has been providing direction to officers on issues raised in the review as well as alignment matters.

5. Discussion

5.1 The NTLDM is one tool or method which assists the community in achieving the vision of a Smart Little City and the mission to leverage resources to shape an exceptional place to live, work and play. As such the NTLDM:

- Takes a regional approach to the design of residential and business areas which provides consistency and certainty to the Nelson and Tasman communities and the developers and contractors that operate within the Regions, creating a more efficient process and lifting Council performance; and
- Ensures the quality of assets that vest in Council are of a standard that the community can depend on and that the community can benefit from critical infrastructure providing safe and smart transport, water, wastewater, stormwater, flood protection and reserves and open space; and
- Provides a means to give effect to our resource management plans to ensure that development results in a healthy environment and resilient community.

5.2 The current LDM 2010 lifted the bar significantly from the previous 2003 Engineering Standards. The current LDM represents best practice in terms of low speed high amenity neighbourhoods, and was ahead of its time in this respect. Since then there has been greater national emphasis on freshwater and the effects of assets that vest as part of development on freshwater. The NTLDM provides greater emphasis on stormwater quality, quantity and habitat protection and enhancement.

5.3 The NTLDM is a method, or rather a collection of methods, to give effect to the rules in Nelson and Tasman's resource management plans. The

LDM itself does not require particular outcomes, the "stick" or rules that require developers to ensure their designs represent best practice urban design, and give effect to the requirements of the NPS Freshwater are in the resource management plans. For example, it is the Nelson Plan that will specify what water quality and quantity requirements are. The NTLDM provides a range of approved methods that are able to be used by developers to achieve them. The NTLDM is a means of compliance with the rules in the Plan.

5.4 The Draft NTLDM has been the subject of an extensive collaborative effort across several teams within the two Council's, and with stakeholder representatives. The process has resulted in the completion of a draft that has aligned minimum standards, good practice, as well as a number of procedures and administration processes across the two Council's.

5.5 This has been necessary to achieve alignment of practice between the two Council's for the benefit of customers. For example, along the way the NTLDM has resulted in the alignment of both Council's datum's, where previously there were three completely different approaches across the Region. A single consistent nationally recognised datum has been adopted.

5.6 A first draft NTLDM was released to stakeholders for comment in mid-2016, and a stakeholder workshop on the significant changes to the LDM was well attended. Stakeholders provided feedback that there was a need for a greater understanding of the implications of the proposed stormwater chapter.

5.7 A second stakeholder workshop was held in August 2016 on the stormwater section and minimum ground and floor levels in response to sea level rise and flood hazards. This resulted in officers receiving feedback from stakeholders that the expectations of the draft section were too high, and would impose costs on development that would affect feasibility. Stakeholders were also concerned that a response to these issues should be Council wide, starting with resource management plans and Council's own asset management plans.

5.8 Under the direction of the Steering Group, the officer working group from Nelson and Tasman Councils have been reworking the stormwater section, along with the practice notes and the general format/usability of the NTLDM over the last year to address these issues. The NTLDM now provides a good balance between the need to ensure cost effective development and making available the means to achieve the requirements of the National Policy Statement on Freshwater. Industry representatives are now supportive of the draft NTLDM and practice notes as being ready for public consultation.

5.9 Iwi feedback has been sought and considered during the drafting process. Formal Iwi consultation under the Frist Schedule Resource Management Act (RMA) will be sought at the same time as the release of the draft under the LGA.

5.10 Officers now recommend that the draft NTLDM, associated draft plan changes and practice notes are consulted on with the community and this next step is supported by the NTLDM Steering Group.

Council Workshop

5.11 Both Nelson and Tasman Councils have had a separate Council workshop on the draft NTLDM, Tasman on 13 June 2018 and Nelson on 26 June 2018. The purpose of the workshops was to ensure that both Councils were familiar with the draft NTLDM, practice notes and plan changes before report R9387 formally seeks approval to release the drafts for public comment on 13 August 2018.

5.12 The Nelson Council Workshop raised the following matters that officers, together with officers from Tasman District Council, have considered and provide a response as follows:

5.12.1 **Alignment of the LDM with Nelson's Smart Little City Vision, key priority areas and outcomes sought.**

The purpose of the NTLDM is set out in section 1.1, as follows:

The purpose of the NTLDM is to provide standards and guidance for the design, construction, maintenance, repair and replacement of:

- *network assets and infrastructure that are or will be owned by the Councils; and*
- *some private assets that connect to public assets.*

The standards aim to ensure the effective and efficient provision of infrastructure and environmental requirements.

The performance outcomes that the Councils seek to achieve are:

a) A standard of service that ensures the health, safety and wellbeing of people and communities;

b) Network assets and infrastructure that are designed to avoid or minimise risks associated with natural hazards and climate change effects, with particular regard for lifeline networks;

c) The delivery of services to levels set out in the Long Term Plan (LTP);

d) Assets and infrastructure that meet obligations for the sustainable management of natural and physical resources;

e) The delivery of environmental outcomes that are consistent with the objectives of the RMPs;

f) *The effective and efficient provision of network utilities and infrastructure, with Network Utility providers responsible for telecommunications, electricity and transportation;*

g) *Network infrastructure that is affordable over the whole-of-life of the asset; and*

h) *Innovative water sensitive design and good urban design solutions, where network performance and cost effectiveness goals can be met.*

This purpose permeates throughout the chapters in the NTLDM. For example Chapter 5 Stormwater requires as a mandatory matter that:

The design of stormwater management systems shall be consistent with water sensitive design (WSD), using natural processes and soil media to provide sustainable stormwater management. The design shall aim to:

a) *protect and enhance the values and functions of the natural ecosystems;*

b) *address stormwater effects as close as possible to the source;*

c) *mimic natural systems and processes for stormwater management;*

d) *support interdisciplinary planning and design where practical; and*

e) *WSD practises shall be considered during the initial design and planning.*

5.12.2 **Berm Planting**

Officers have made changes to the Streetscaping section 4.15 of the NTLDM to make it clear that berms can be vested in Council with either a grass or planted cover. Wording has also been added to make it clear that Council considers planting is desirable in section 4.15.3.1 as follows:

> *Planting of berms and service strips is encouraged where it can meet the requirements in 4.15.3.2 below, and is for the purpose of achieving a high amenity low speed environment, enhancing amenity and streetscape in higher density developments and/or accommodating low impact stormwater devices.*

Section 4.15.7.2 which restricted the amount of berm planting to 25%, has been deleted in favour of the existing requirement for a planting plan to be approved by the Engineering Manager prior to vesting planted berms in Council.

5.12.3 Alignment with the GPS

While the Government Policy Statement on Land Transport (GPS) is very recent in comparison to the NTLDM review process, the basic principles of the GPS are fundamental to the NTLDM thinking. These being safety, active transport, connectivity, and design led urban structure. Section 4.2 of the NTLDM contains performance outcomes consistent with the GPS and section 4.2.2 details the design led approach to transportation.

5.12.4 Shared paths

The use of footpaths is determined nationally by the NZ Road Rules not the NTLDM. The Land Transport (Road User) Rule 2004 prohibits the riding of cycles on a footpath or on a lawn, garden, or other cultivation forming part of a road (11.11). Mobility scooters and wheeled recreation devices are permitted on a footpath. The definition of a wheeled recreation device excludes a bicycle.

There has been a petition that has gone through the Select Committee process to change the rules to "allow children up to and including 12 years of age or year 8 (with accompanying adults), seniors over 65, and vulnerable users (such as those with mental of physical disabilities)" to use the footpath. To date, whilst the Select Committee recommended Government adopt this rule, it has not yet been adopted.

The NTLDM applies to new roads in greenfield areas. Council does not generally use the NTLDM standards for the creation of 'shared' or 'home' zones (roads where all users share the lane), or for upgrading existing hillside roads in Nelson which are all designed on a site specific basis. The NTLDM requires that new greenfield subdivisions and the local roads that they create be designed to provide for on road cycling in a slow speed high amenity environment.

5.12.5 Parks levels of service

Parks levels of service between Nelson and Tasman are expressed in a different manner in 10.3.3.6 and 10.3.3.7 as per the asset management plans, but after further investigation by officers are actually similar. Nelson City Neighbourhood Parks are to be provided within 800m walking distance (approximately 10 minutes walk). Tasman District Council's Urban Open Space Amenity Reserves are to be located within 500 metres or 10 minutes walking distance of properties in the residential zone.

Draft NTLDM

5.13 The draft NTLDM updates the LDM, and is more of a significant change for Tasman District Council than it is for Nelson City Council. The NTLDM is based on the Nelson City Council LDM and generally the majority of the changes to achieve alignment have been made by Tasman District Council.

5.14 There are minimal areas where alignment between the two Councils was unable to be achieved due to differences in asset management levels of service. For instance, the minimum requirements for stormwater system design capacity of primary systems in Nelson City Council is a Q15, whereas Tasman District Council requires design to a Q10, both allowing for climate change.

5.15 The draft NTLDM has been structured so as to separate mandatory requirements from good practice. Mandatory requirements are the minimum standards that are required to be achieved for different development activities, and are referenced in rules in the NRMP. Good practice contains design advice and considerations that the applicant can consider during the development design process. Much of the good practice advice is needed to assist with achieving the design outcomes contained in the NTLDM and to assist the applicant in selecting mandatory standards relevant to the situation, site, speed environment or freshwater environment.

Draft Plan Change 27

5.16 The LDM 2010 is an externally referenced document in the NRMP. Replacing it with the NTLDM requires a plan change. Draft plan change 27 seeks to replace all references to the LDM with the NTLDM. Some consequential changes are also required which are the removal of access crossing specifications from the Appendices in the NRMP as they are now included in the NTLDM, and redrafting the building over drains rule in all zones so it functions without NTLDM standards.

Draft Bioretention and Wetlands Practice notes

5.16 The purpose of the stormwater section is to guide the design and construction of stormwater management network assets in the Nelson and Tasman Districts. Standards of stormwater management need to protect people and property, water health including freshwater habitats, amenity values, and provide whole-of-life affordability.

5.17 New mandatory standards to address stormwater quality and quantity include a first flush of stormwater discharge required for large sites (over $5000m^2$) and groundwater recharge is required where supported by soil quality. Good practice sections and Practice Notes are also provided to assist with the design and use of natural stormwater treatment devices. These solutions may be required in areas of water and habitat sensitivity, and/or areas where there are capacity restrictions within the existing network and as a result of NPS Freshwater requirements in both Nelson and Tasman Plans. This approach is supported by the stakeholder representatives on the Steering Group.

Draft Inundation Practice Note

5.18 Currently the LDM provides a standard for minimum ground and floor levels based on the controlled activity rules in the Nelson Resource Management Plan and the requirements for freeboard in the Building Act. The current standard for minimum ground level is a one size fits all approach for the whole of the City and is based on the 2003 Ministry for the Environment (MfE) guidance on sea level rise (planning for a 0.3m rise).

5.19 This guidance has since been updated by the MfE 2009 guidance of planning for a mean sea level rise of 0.8m up to 2100, and now the 2017 MfE Guidance. The NZ Coastal Policy statement also requires that Council consider the impacts of sea level rise out 100 years, or to 2100.

5.20 Subdivision and development controls in relation to flood and inundation hazard are implemented through the RMA 1991 (for natural hazards and subdivisions) and the Building Act 2004 (for floor levels). The requirements of these two Acts differ.

5.21 As a consequence of the updated guidance and statutory requirements a one size fits all minimum standards approach is no longer able to be taken to minimum ground and floor levels. Until now there has been no guidance (other than MfE national guidance) for building and resource consent applicants to assess what an appropriate ground and/or floor level might be for any development proposed.

5.22 Currently officers advise applicants that they need to engage their own specialist consultant to determine an appropriate ground and/or floor level to include with their application which Council offers assess on its merits. All subdivision and development in a flood or inundation overlay is discretionary, and officers have full discretion to assess whether or not a particular application mitigates the effects of flooding or inundation to an appropriate degree. This results in a range of approaches as determined by the applicants appetite for risk, the intended use of the development (for habitation or not), the physical characteristics of the site, insurance requirements, and whether a subdivision is involved.

5.23 This process is both time intensive for the applicant and Council officers, and results in applicants incurring significant costs, before they can even determine if development of a site is feasible. The process also offers no transparency. It also requires applicants to engage an expert to obtain readily available national guidance and modelling data and to interpret that advice, when that information is held by Council and is able to be provided by officers.

5.24 The Inundation Practice note codifies national guidance and local modelling to provide a consistent and transparent methodology intended to guide surveyors, architects, and engineers in preparing building and resource/subdivision consent applications in areas potentially subject to coastal, tidal and freshwater inundation and flooding across the Nelson Tasman regions.

5.25 The practice note does not identify where development can and cannot occur, nor does it provide solutions in terms of how to respond to hazards. It simply provides information to enable the calculation of a minimum ground and floor level for a range of scenarios to meet statutory requirements and guidance. In every situation there are a number of local area factors that mean a one size all approach cannot be applied. Applicants will still need to engage an expert to assist in determining a suitable hazard response, however all available data, modelling and advice is now provided for them in a step by step practice note. This will reduce costs for the applicant, reduce time assessing applications by officers and provide transparency in terms of how each solution has been derived.

5.26 Applicants are not required to use the practice note, it is there to provide guidance and transparency about how Council evaluates ground and floor levels in response to national guidance, the Building Act and RMA. Officers can consider any other evaluation or methods proposed by an Applicant just as is current process.

6. Options

6.1 Council has the option of seeking public feedback and comment on the draft NTLDM, draft plan change and draft practice notes as the next step in the process to formalising the adoption of the NTLDM as Council's engineering standards and as an externally referenced document in the NRMP. Officers recommend Option 1, to seek feedback on the draft prior to entering into a formal plan change process under the RMA as the best option.

Option 1: Seek public feedback and comment on draft NTLDM, plan change and practice notes and signal intention to adopt the NTLDM as Council policy and as an externally referenced document. Delegate the hearing of feedback and direction to officers for amendments to a hearing panel comprised of Nelson and Tasman Councillor's.	
Advantages	Provides the public with an informal opportunity to provide feedback and have it considered by Council outside the RMA process. Provides the public with the opportunity to read and understand the package of NTLDM, draft plan change and practice notes together in an integrated manner. Generally considered good practice, while not a special consultative procedure Council has obligations under section 78 of the Local

	Government Act to seek and consider feedback on policies and standards to be adopted. Required under clause 34 Frist Schedule RMA to seek public comments on any document intended to be externally referenced as part of the Plan. Provides an opportunity for the community to present their feedback to Councils delegated hearings panel. Provides opportunity for officer to respond to feedback and make amendments under the direction of delegated Councillors.
Risks and Disadvantages	Providing a draft for feedback, considering that feedback and making appropriate amendments reduces risks that the community does not support the proposed NTLDM. Adds time to the adoption process.
Option 2: Notify Plan Change and adopt LDM	
Advantages	May reduce the time it takes to adopt the NTLDM
Risks and Disadvantages	Does not meet the requirements of section 78 of the Local Government Act creating a risk of legal challenge. The community may not support all or part of the NTLDM and their feedback is unable to be responded to in an administratively efficient manner once the plan change is notified and the LDM adopted.
Option 3: Do nothing – abandon the draft NTLDM process	
Advantages	Frees up officer resource
Risks and Disadvantages	The LDM 2010 is overdue for its 5 yearly review, not updating minimum standards and best practice means that the land development industry is restricted in its ability to be innovative and respond to environmental requirements. The process of reviewing and aligning the LDM with Tasman District Council has strong support from stakeholders. Abandoning the review is unlikely to be supported by stakeholders and undermines confidence in the organisations ability to work together to address development issues. Could add costs and time constraints to development and housing supply, if standards

	become outdated and applicants seek case by case assessment for alternate design and technology. A review and update of standards would be required in the near future.

7. Conclusion

7.1 The draft NTLDM is proposed to be released for public feedback from 13 August to 28 September 2018 under the Local Government Act 2002. It is accompanied by three draft practice notes to assist in the implementation of the standards and good practice, on which public feedback is also sought.

7.2 The LDM is an externally referenced document to the NRMP, and draft Plan Change 27 has been prepared to update that reference. The intention to change the LDM reference in the NRMP from the 2010 LDM to the proposed Nelson Tasman Land Development Manual 2018 is proposed to be consulted on under clause 34 of the First Schedule RMA. This provides for the public to provide comments on the intention to externally reference the new mandatory standards which will have legal effect as if they are part of the Plan.

7.3 Delegations are sought for a joint Nelson and Tasman Council Hearing Panel to hear feedback, provide direction to the working group on any amendments required as a result of that feedback, and make recommendations to Council.

7.4 Following the receipt and hearing of public feedback under the LGA, recommendations for changes will be made to the Council prior to seeking adoption of the NTLDM under the LGA. Following the receipt of comments on plan change 27, recommendations will be made to Council to commence public notification of the change under the RMA. Both processes will occur concurrently and with Tasman District Council to ensure alignment is achieved.

Lisa Gibellini
Team Leader City Development

Attachments

Attachment 1: A2013438 Draft Nelson Tasman Land Development Manual *(Circulated separately)* ⇨

Attachment 2: A2013398 Draft Nelson Tasman Inundation Practice Note ⇩

Attachment 3: A2013449 Draft Biotretention Practice Note ⇩

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Attachment 4: A2013457 Draft Wetland Practice Note ⇩

Attachment 5: A1988205 Draft Plan Change 27 ⇩

Important considerations for decision making

1. Fit with Purpose of Local Government

The NTLDM provides minimum standards for the creation of good quality infrastructure that ensures statutory compliance, health safety and wellbeing of the Nelson and Tasman community, and considers affordability over its life cycle.

2. Consistency with Community Outcomes and Council Policy

The LDM is consistent with the community outcomes and will assist Council to achieve them, particularly "Our urban and rural environments are people friendly, well planned and sustainably managed" and "Our infrastructure is efficient, cost effective and meets current and future needs".

3. Risk

The recommendation seek to release a draft NTLDM and associated practice notes and draft plan change for public feedback. This process reduces risk by ensuring the Council gives consideration to the views and preferences of persons likely to be affected by, or to have an interest in, the matter as required under the Local Government Act 2002.

4. Financial impact

There is no financial impact of release a draft for public feedback, all costs are covered within existing budgets.

5. Degree of significance and level of engagement

This matter is of low to medium significance because the NTLDM does not significantly change levels of service but it does result in alignment of standards across the region and the implementation of best practice standards for land development. Officers consider that releasing a draft NTLDM and associated plan change and practice notes for public feedback is commensurate with the nature and scale and likely interest level of updating the standards. In addition the NTLDM is an externally referenced document to the Nelson Resource Management Plan and as such will be subject to the formal public notification processes required in the RMA1991.

6. Inclusion of Māori in the decision making process

Maori have not been specifically consulted in relation to the NTLDM. Preliminary consultation has been undertaken with Iwi during the development of the draft firstly as part of the Nelson Plan Iwi working Group, then a draft NTLDM was circulated to all Iwi in November 2017 and feedback from some Iwi was received in February and March 2018. The working group and Steering Group considered the feedback and made a series of changes to the NTLDM to address concerns raised.

Formal consultation with iwi authorities under section 3B of the First Schedule will occur concurrently with the release of the draft for public feedback.

7. Delegations

The Planning and Regulatory Committee has the responsibility for reviewing the Land Development Manual and making a recommendation to Council. Report R9388 referred all powers of the Planning and Regulatory Committee in relation to seeking public feedback on the draft NTLDM and plan change to Council for consideration.

Inundation Practice Note:

Calculating minimum ground and/or floor levels for subdivision, new buildings and major alterations

Tasman District Council and Nelson City Council

17 July 2018

A2013398

For further information or guidance on this practice note, please contact the relevant Council:

Nelson City Council
Civic House
110 Trafalgar Street
Nelson

Phone: 03 546 0200
Email: enquiry@ncc.govt.nz

Tasman District Council
Richmond Office
189 Queen Street
Richmond

Phone: 03 543 8400
Email: info@tasman.govt.nz

Statutory Status: This practice note has been developed in support of the Nelson-Tasman Joint Land Development Manual (2018) and provides an acceptable approach for determining minimum ground and/or floor levels under the Resource Management Act 1991 and the Building Act 2004.

A2013398

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DEFINITIONS

Annual exceedance probability (AEP)	The Annual Exceedance Probability is the chance or probability of a natural hazard event (such as storm tide) of a particular size or greater occurring or being exceeded annually and is usually expressed as a percentage.
Climate change effects (CCE) factor	A minimum allowance for climate change effects, including sea level rise and more intense rainfall.
E1 E1 AS or VM	The clause of the Building Code relating to "Surface Water" that relates to the protection of Residential and Communal Building from inundation in the 2% AEP event. The Acceptable Solution or Verification Method under the Building Code which provides a pathway to demonstrate compliance with E1.
Freeboard allowance	A freeboard allowance is added to the calculated flood level to result in a minimum ground and/or floor level to account for any uncertainties associated with historical data and hydraulic assessments.
Inundation	Freshwater or seawater entry to land or buildings
Local adjustment (LA) factor	Takes account of local, site or project specific matters e.g. existing hazard mitigation, topographical effects, design life of buildings, etc.
Land Development Manual (LDM)	Joint Nelson City and Tasman District Councils' manual that specifies engineering design and construction standards.
Mean sea level (MSL)	An average level for the surface of the sea from which heights such as elevations may be measured. For the Tasman and Golden Bays this is defined as being 3.195m below Reference Mark N1 (AC4T) as defined by the NZVD2016 Datum.
Mean high water springs 6 (MHWS-6)	Refers to the level equalled or exceeded by the highest 6% of all predicted tides relevant to Tasman and Golden Bays, ranging between 1.86m - 1.93m NZVD2016 (MSL 2020 projection), or between 1.72m - 1.79m NZVD2016 (MSL 2008-17)
New Zealand Vertical Datum (NZVD2016)	New Zealand Vertical Datum 2016 as per standard LINZS25009.
Major alteration	The Building Act 2004 does not provide a definition of 'major alteration' of a building but in determining a threshold Council will consider factors such as (a) intended use and degree of design and construction complexity; (b) size of the alteration; (c) increase in building footprint and percentage of site coverage. Refer to Determination 2017/055 for more information.
Reduced level (RL)	Reduced level in surveying refers to equating elevations of survey points with reference to a common assumed datum. It is a vertical distance between survey point and adopted datum plane (NZVD2016). Thus it is considered as the base elevation which is used as reference determine heights or depths.
Storm surge	Storm surge is the rise in seawater level caused solely by a storm; this can be caused by wind and wave action and low barometric pressure.
Storm tide	Storm tide is the observed seawater level during a storm.
Wave runup	Wave runup is the maximum vertical extent of wave uprush on a beach or structure above the mean level of the sea
Wave setup	Wave setup is the increase in mean water level due to the presence of breaking waves. Also includes the increase in the mean water level against the shore due to wind blowing across a water body.

1 Introduction

1.1 Purpose

This practice note explains the methodology to determine minimum ground and/or floor levels for subdivision, new buildings and major alterations in areas identified as being subject to seawater and/or freshwater inundation within the Nelson and Tasman districts.

The document comprises of two key parts:

- **Section 2**: a 'how to' guide which summarises the processes and information required to determine minimum ground and/or floor levels.
- **Sections 3-7**: supporting information which provides further explanation for the methodology used and other factors which should be considered when determining levels including building servicing, building use and hazard tolerance, and Building Act 2004 s73 hazard notices.

This practice note provides guidance to support Nelson City Council and Tasman District Council's administration of the Building Act 2004 and New Zealand Building Code, the natural hazards provisions in the Councils' resource management plans and the Nelson-Tasman Joint Land Development Manual. It provides a standard approach to be used by Council staff and development industry professionals during building and resource consent processes.

The Councils' resource management plans set out the policy framework to assess development on land subject to inundation hazards and include other plan considerations such as design, neighbourhood amenity, access and servicing. Some areas of Nelson and Tasman districts are not suitable for new development due to inundation hazards. In other locations, raising ground and/or floor levels may provide appropriate mitigation and this practice note documents the process used to determine minimum levels.

1.2 Summary of Seawater Inundation Calculation and Freshwater Inundation Process

Seawater Inundation Calculation

The information contained within this practice note enables the calculation of minimum ground and/or floor levels in coastal locations subject to seawater inundation. Section 2 (Figure 3) outlines the 8 steps required to calculate a minimum ground and/or floor level based on the following information:

- identification of the **development setting** such as greenfield subdivision, intensification, non-habitable assets, etc.
- consideration of what **seawater inundation information** is available from Council.
- a **'storm tide adjustment factor'** that includes storm surge and wave set up for all properties, and wave runup for those properties within 30m of the coast.
- a **'climate change effects factor'** which takes into account effects of sea level rise based on recent Ministry for the Environment (MfE) guidance.
- a **'freeboard'** requirement which also accounts for any uncertainties associated with historical data and the hydraulic assessments. The freeboard will vary depending on the type development and any local adjustment factors.
- **'local adjustment factors'** which may increase or decrease the levels after considering additional factors such as exposure to coastal effects due to particular local topographic features or coastal barriers; risks of inundation from impounded sea water and/or freshwater, or risks from overland flow of seawater.
- consideration of **Building Act 2004 requirements** and s73 hazard notices.

Freshwater Inundation Process
The practice note also outlines the general process to determine minimum ground and/or floor levels in areas subject to freshwater inundation. Locations that are subject to freshwater inundation are not restricted to a specific distance to the coast or a river. There are many factors that contribute to potential risks of freshwater inundation and these need to be considered for any site at any location.

The methodology is broadly similar to the seawater inundation calculation, although the data sources for determination of inundation water levels are variable and include flood records and computer model simulations (which include a tidal boundary condition). Section 2 (Figure 4) outlines the 6 step process which includes:

- consideration of what **freshwater inundation or floodwater flow information** is available from Council. This information should consider any site specific **'local adjustment factors'** such as particular local topographic features or barriers; risks of inundation from impounded freshwater, or risks from overland flow of water.
- the need for a **site specific assessment** in circumstances where Council does not hold sufficient information or where particular local adjustment factors may apply.
- identification of **flood levels for a 2% or 1% annual exceedance probability (AEP) event**, dependant on subdivision or building requirements.
- a **'freeboard'** requirement which also accounts for any uncertainties associated with historical data and the hydraulic assessments. The freeboard will vary depending on the type development and any local adjustment factors.
- consideration of **Building Act 2004 requirements** and s73 hazard notices.

1.3 Combined Seawater and Freshwater Inundation

Some sites in the Nelson and Tasman districts may be subject to both seawater and freshwater inundation. In these locations both the seawater calculation, the freshwater process and a combination of the two should be applied to determine which of the three inundation scenarios poses the greatest exposure to inundation hazard. The highest value of the three levels calculated will determine the minimum ground and/or floor level.

1.4 Inundation hazards and scope of practice note

Development near the coast or a seawater body, such as a harbour or estuary influenced by tides, is potentially subject to coastal hazards. Such hazards include inundation from waves and/or storm surge, impounded seawater, or combinations of wave effects, impounded sea and fresh water flooding. In addition to these, sea level and rainfall intensity are projected to increase as a result of changes to the climate. However, due to a variety of earth processes (e.g. tectonic motion, subsidence and seismic activity), relative sea level change at different locations may differ from the national or regional norm.

Beyond coastal influences, inundation can occur from incident rainfall, capacity exceedance in established watercourses and infrastructure networks, ponding behind embankments and causeways, and secondary flowpaths that only occur during significant rain or blockage of the normal route of stormwater.

This practice note outlines the approach to determine minimum finished ground and/or floor levels for new development and buildings in areas identified as being subject to inundation. It considers different hazard scenarios for either seawater and/or freshwater inundation. It does not cover all other potential sources of inundation such as groundwater, tsunami, and dam break (in certain areas).

There are many variables in relation to the coast and watercourses in terms of topography, land

and beach composition and profiles, as well as building types and designs. Therefore, a site specific assessment of the proposed development taking into account specific hazard influences (by applying local adjustment factors) may still be required. Council can advise further in such situations.

Note that properties indicated as not being subject to inundation under this practice note methodology may still be at risk from inundation hazards in more extreme or unpredictable weather events than allowed for. A pragmatic approach to mitigating hazard exposure in events exceeding the design guidelines is recommended, consistent with acceptable risk.

1.5 Exceptions

Circumstances will arise when the standardised approach as outlined in this practice note may not be preferred. Such scenarios should be treated as exceptions, requiring a site specific assessment which Council will consider on a case-by-case basis.

1.6 Councils' inundation information

Both Councils have ongoing programmes of work to model inundation hazards and are obliged to make existing natural hazard information available to the public, under the Local Government Official Information and Meetings Act 1987 and the Building Act 2004. Check with each Council for the most up to date information available. Updates to this practice note may be undertaken as inundation information is refined and/or new modelling datasets are developed.

Seawater inundation
Both Councils are using a 'coastal calculator tool' developed by NIWA (updated to include data to April 2018) to determine the seawater inundation hazard potential at various places around the Tasman and Golden Bay coastlines. This calculator assesses wave runup and wave setup elevations and shoreline structure overtopping rates for a variety of datum, beach slope, storm-tide event probability and sea level rise settings. Calculations show that coastal influences on the level setting process progressively increase below the reduced level of 6m (NZVD2016), particularly within 30m of MHWS-6. In addition, freshwater inundation may be a contributing or even dominant threat to a building or development.

A number of seawater inundation hazards reports are available as listed in Appendix 2 References. For further information please contact the relevant Council.

Freshwater inundation
Flood levels vary spatially and temporally and can be determined through hydrological and hydraulic modelling processes which include a number of assumptions and model inputs.

NCC has undertaken modelling of inundation extents associated with all major rivers and streams in the district. The modelling includes a number of scenarios to the year 2120 for a 1% AEP event and takes into account the effects of climate change on sea level rise and rainfall intensity. The outputs of this modelling can be viewed on NCC's website.

TDC has undertaken similar studies in some urban areas, with further modelling and mapping continuing and planned to be undertaken for other urban drainage areas and rivers. Available information includes floodplain modelling data for the coast adjacent to Takaka township, the Mapua-Ruby Bay coastal plain and historic records of flooding in the Waimea, Takaka, Motueka, Aorere delta and a number of minor river systems. This historical data generally maps the extent of particular flood events, from which flood depth can sometimes be inferred using LiDAR contour data, and in some instances flood heights are noted.

Both Councils' inundation modelling work programmes include secondary flowpath modelling. Where this modelling has yet to be undertaken, secondary flow paths will be considered as a 'local adjustment factor' (refer to Section 3.6.3). Council will be able to advise on what information is held to help inform the calculation of minimum ground and/or floor levels in these situations.

1.7 Resource Management Act 1991 and Building Act 2004

The Resource Management Act 1991 and Building Act 2004 are the two key pieces of legislation which empower councils to manage the risk of inundation hazard in relation to new development and land use.

Resource Management Act 1991 (RMA 1991)
Under the RMA 1991, councils are required to recognise and provide for the management of significant risks from natural hazards as a matter of national importance (s6(h)) and to have particular regard to the effects of climate change (s7(i)).

National instruments prepared under the RMA 1991 place requirements on councils. The New Zealand Coastal Policy Statement 2010 (NZCPS) details existing national objectives and policies for coastal natural hazards. Policy 24 requires councils to identify coastal areas that will be potentially affected by coastal hazards over *at least* 100 years. Policy 25 sets the policy framework for planning decisions for land use and development in areas potentially affected by coastal hazards, with an emphasis on avoidance and reduction of risks.
It is anticipated that Government will develop national direction in the form of a National Policy Statement or National Environmental Standards on natural hazards which will provide further guidance to councils and their communities on natural hazards management. This practice note may need updating at that time.

Councils must give effect to the NZCPS and other national direction through their regional policy statement, regional plans and district plans. The operative suites of resource management plans for the two districts set out the management regimes for dealing with risks from natural hazards and include controls on the use of land for the purpose of the avoidance or mitigation of natural hazards.

When considering an application for resource consent, Council must have regard to any actual and potential effects on the environment of allowing the activity, including the effects arising from natural hazards (s104).

Council may refuse or grant a subdivision consent subject to conditions if there is a significant risk from natural hazards (s106). Any assessment of the risk from natural hazards requires a combined assessment of:
(a) the likelihood of natural hazards occurring (whether individually or in combination); and
(b) the material damage to land in respect of which the consent is sought, other land, or structures that would result from natural hazards; and
(c) any likely subsequent use of the land in respect of which the consent is sought that would accelerate, worsen, or result in material damage of the kind referred to in (b) above.

Conditions attached to subdivision consents granted may include the protection of the land and any adjacent land against natural hazards including inundation (s220).

For any new subdivision and development, an applicant will need to demonstrate that newly formed allotments contain adequate space for buildings which are not subject to material damage from inundation in response to a 1% AEP design event (refer to Section 2.3). Furthermore, it will need to be demonstrated that in achieving this there are no adverse effects (raised flood levels, diversion of flood flows and/or secondary flood routes) that occur on adjacent or surrounding property in response to this design flood event. Other resource management plan considerations such as amenity and servicing also need to be incorporated into design and decision making processes.

For other development (on existing titles) subject to the RMA 1991, the practice note process will be the same as for subdivision and development as described above. However, the full application of this process may be modified on a case by case basis where the development is of a limited duration and consequently will not be subject to long term projected climate change effects.

Building Act 2004 (BA 2004) and the New Zealand Building Code (Building Code)

The BA 2004 manages natural hazards in relation to the construction and modification of buildings. Council is required to take into account certain natural hazards, including inundation, when determining whether to grant building consents on land subject to specified natural hazards, with certain exceptions (under s71-74). The emphasis in the management of natural hazards is to encourage people to avoid situations in which they or their property could be at risk. Sections 71-74 of the BA 2004 regarding building on land subject to natural hazards and the application of hazard notices on property titles are discussed in detail under Section 6.

E1 of the Building Code requires buildings and site work to be constructed to protect people and other property from the adverse effects of surface water. Performance E1.3.2 requires that surface water, resulting from an event having a 2% AEP, shall not enter housing, communal residential and communal non-residential buildings.

2 How to Determine Minimum Ground and/or Floor Levels

2.1 Introduction

This section provides a summary guide of how to determine minimum ground and/or floor levels for subdivision, new buildings and major alterations. It applies to areas identified as being subject to seawater and/or freshwater inundation within the districts of Nelson City Council and Tasman District Council. It should be read in conjunction with the supporting information and explanation contained in Sections 3-7.

2.2 Development considerations

If you wish to develop your property, or you are a developer or agent acting on behalf of a landowner, there are a number of preliminary planning and development matters that you should consider as part of any building design. This will depend on the nature and location of the property, the type of development proposed, and any legal and resource management plan requirements.

If the development site is (or may be) located in an area subject to inundation, it is recommended that you consider the potential impacts of the development proposal within and beyond the site. Speak to the relevant Councils' Duty Planner and hazards information staff as they can assist you in making informed decisions about your proposal and the resource consent process.

General matters that you should consider include:

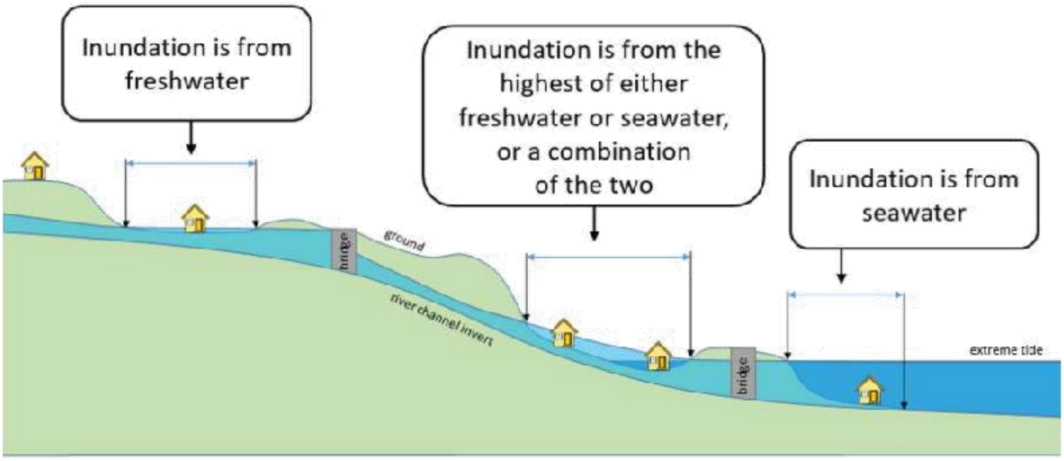
- The choice of foundation design. Raising the ground level to mitigate inundation hazard may not be allowable due to potential adverse effects on your own or neighbouring land from floodwater diversion or floodwater storage removal.
- Preserving future options with respect to adapting to unknown or increasing hazard exposure. For example, a pile foundation design allows for adaption to any increase in erosion or inundation hazards via further house elevation, relocation within the site or removal from the site.
- Functionality of the building and vulnerability of activities proposed within the building.
- Identifying if your site needs to be serviced for on-site stormwater and wastewater disposal over some or all of the lifetime of the building.
- Building access and use, particularly during an inundation event.
- Other resource management plan requirements including design, neighbourhood amenity, and landscape considerations.

It should also be noted that building design and location on site may have implications for obtaining or retaining inundation insurance.

2.3 Identifying locations subject to seawater and/or freshwater inundation hazards

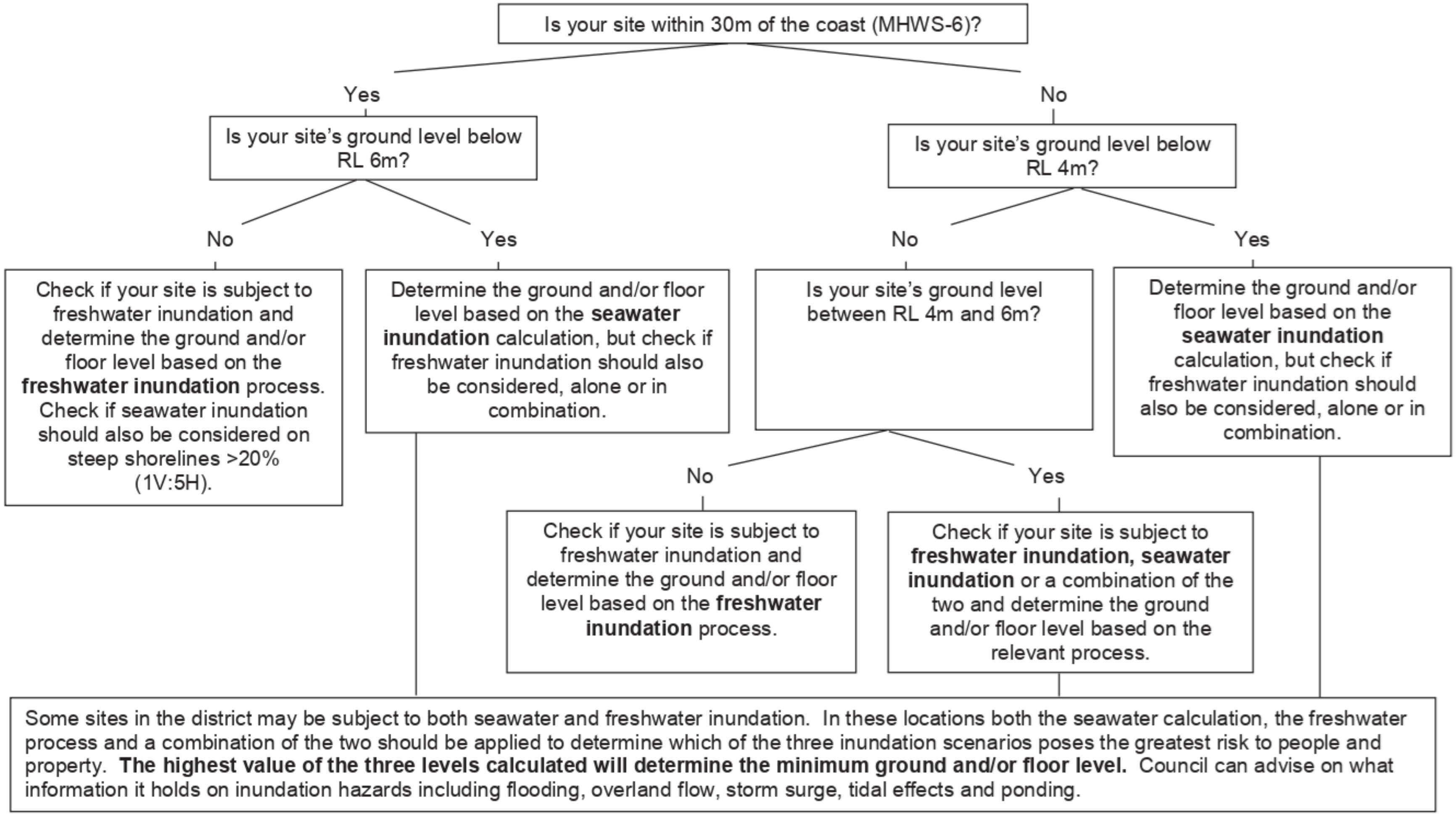
This practice note considers different scenarios from either seawater and/or freshwater inundation as shown in Figure 1.

Figure 1: Locations of where the seawater inundation calculation and/or freshwater inundation process may apply



In coastal locations subject to inundation hazards, both the seawater inundation calculation and the freshwater inundation process relies on ‘reduced level’ (RL) thresholds as a starting point to determine locations that may be subject to these hazards. A RL is a level measured against a specified datum and NZVD2016 Datum is used in this practice note. Figure 2 provides a flow diagram to help determine which type of inundation hazard may be applicable to a specific site, based on RLs and a 30m distance from MHWS-6.

Figure 2: How to determine if your site is subject to seawater and/or freshwater inundation using RL thresholds



In coastal locations within 30m of MHWS-6, the seawater inundation calculation applies below RL 6m. Ground up to at least this level can be affected by seawater inundation depending on shoreline slope or other factors. These areas may also be affected by the influence of freshwater inundation (for example at river mouth locations) and this hazard also needs to be considered both in isolation and in combination with seawater inundation.

Similarly, in low lying areas more than 30m away from MHWS-6, both seawater and/or freshwater inundation may be present and should be considered. If a site's ground level is between RL 4m and 6m, the risk of freshwater and/or seawater inundation hazard may be present (depending on distance from MHWS-6) in isolation or in combination and the higher value of the three levels calculated will determine the minimum ground and/or floor level.

Above RL 6m, freshwater inundation is likely to predominate but also check for the possibility of seawater inundation adjacent to steep shorelines where the upper beach slope is >20%. For more information or guidance on which inundation hazard may be present on your site, please contact the relevant Council.

2.4 Seawater and freshwater inundation design events

The required "design event" sets the context for the assessment of effects under the resource consent and building consent processes and the calculation of ground levels and floor levels (as shown in Table 1).

Under RMA 1991 processes, the design event is a 1% AEP generally over a 100 year planning horizon. This encompasses projections of a 1% AEP event occurring with at least 100 years of projected climate change normally taken into account. This is driven largely by the NZCPS 2010, which indicates that a planning horizon of *at least* 100 years be considered for coastal development (Policy 24 and elsewhere). Given the close inter-relationship between freshwater and river systems and the open coast, this 100 year planning horizon is also adopted for these systems to ensure consistency in application. A planning horizon of *more than* 100 years is specifically considered for subdivision, greenfield developments and major asset infrastructure developments in coastal locations where a sea level rise component applies. This is consistent with the recent MfE guidance as detailed in Section 3.4.2.

E1 of the Building Code requires the avoidance of water entering residential and communal buildings in a 2% AEP event, over the unlimited life of the structure but no less than 50 years.

In coastal settings subject to both seawater and rainfall runoff (freshwater) inundation hazard, consideration of the combined effects of storm-tide and rainfall runoff events is required. This may be a low probability storm-tide event coupled to a higher probability rainfall event (e.g. 1-2% AEP storm tide and 5% AEP rainfall), or the reverse, to determine the most severe appropriate design case. In some specific instances the use of a different design event may be justified and should be treated as a local adjustment factor. All such cases may be treated as exceptions requiring a site specific assessment.

2.5 Seawater Inundation Calculation

Figure 3 summarises the 8 steps required to calculate a minimum ground and/or floor level in coastal locations subject to seawater inundation. The calculation is dependent on the 'development setting' and transitional sea level rise allowances taken from the Ministry for the Environment's guidance on 'Coastal Hazards and Climate Change: Guidance for Local Government' (MfE, 2017). An explanation of each of the factors included in the calculation is provided in Sections 3-7 and should be read in conjunction with this summary.

Table 1: Design criteria to determine ground and/or floor levels based on activity and land elevation

Site Location[1]	Joint Probability AEP	Design Event Criteria
Subdivision under RMA 1991		
• <30m and <6m RL	1%	The higher level determined from: a) 1% AEP rainfall/inundation event at or beyond 2120 occurring at the same time as the MHWS-6 tide level elevated by sea level rise*; or b) 1% AEP storm-tide event elevated by sea level rise* occurring with no rainfall; or c) 1% AEP storm-tide event elevated by sea level rise* coincident with a 5% AEP rainfall/inundation event at the year 2120. *Sea level rise in accordance with the development setting in the 2017 MfE guidance.
• >30m and <4.0m RL • >30m and >4m, <6m RL	1%	The higher level determined from: a) to c) above; or d) a 1% AEP rainfall/inundation event at or beyond 2120
• >30m and >6.0m RL	1%	1% AEP rainfall/freshwater inundation event at or beyond 2120.
Development[2] where no subdivision is required under the RMA 1991		
• <30m and <6m RL • >30m and <4.0m RL • >30m and >4m, <6m RL	1%	The higher level determined from a) to d) above
• >30m and >6m RL	1%	1% AEP freshwater inundation event at or beyond 2120
Residential and Communal Buildings[3] on existing title under BA 2004[4]		
<30m and <6m RL	2%	The higher level determined from: e) A RMA process as recorded as a consent notice on the title, or f) 2% AEP rainfall/inundation event occurring at the same time as MHWS-6 by the year 2120; or g) 2% AEP storm-tide event, with sea level and 5% AEP rainfall by the year 2120.
• >30m and <4.0m RL • >30m and >4m, <6m RL	2%	The higher level determined from: e)-g) above
>30m, >6m	2%	2% AEP freshwater inundation event by the year 2120
Other buildings on existing title under BA 2004		
All sites	NA	In the absence of a consent notice on title, no ***requirements*** but encouragement to adopt prudent levels

[1] 30m is in relation to distance inland from MHWS-6.
[2] Comprehensive housing developments or multiple apartments on one title, commercial/industrial developments (e.g. industrial parks with private roads), multiple tenancy buildings.
[3] NZ Building Code E1.3.2 limits the application of the 2% AEP level of protection to housing, communal residential, and communal non-residential buildings.
[4] Properties where land intimately connected to a building that is subject to inundation in a 1% AEP event may require a hazard notice under s73 of the BA 2004. Refer to Section 6 for more information.

Figure 3: Seawater Inundation Calculation

Step 1: Determine your development setting

A	B	C	D
Coastal subdivision*, greenfield developments and major new infrastructure	Changes in land use and redevelopment (intensification)	Land-use planning controls for existing coastal development and assets planning	Non-habitable short-lived assets with a functional need to be at the coast, and either low-consequences or readily adaptable (including services)

Step 2: Inundation Information

Is there seawater inundation information available for your site? Acceptable information includes Council inundation modeling and mapping, or a site specific assessment required by Council. Check with Council on what information is available or acceptable.

No → **Step 3: Identify a Storm Tide Adjustment Factor**
Refer to Table 2 for a location specific value.

Yes → Step 4

Step 4: Add a Climate Change Effects Factor relevant to your development setting

Note: If you are using a council approved model or site assessment, the CCE factor (sea level rise) may already be included depending on the model parameters used. If so, go straight to Step 5.

A	B	C	D
1.5m‡	Adapt to hazards by using the MfE pathways approach	1.0m	0.65m

Step 5: Add Freeboard

Refer to Table 3 for a development specific minimum requirement (based on NZS4404).

Step 6: Consider Local Adjustment Factors

It may be necessary to increase or decrease the ground and/or floor level if the site or building is:

- at risk from impounded sea water or overland flow of sea water
- seawater backflow via pipes, drains and river systems
- exposed to freshwater flooding hazard associated with tidal influence
- located where a topographical effect could reduce/increase the risk (dune, hill, low point)
- located where a coastal barrier affects the risk of inundation (sea wall, tidal gate, causeway)
- located within a secondary flow path

Check with Council on what inundation hazard information is available.

Step 7: Consider Building Act 2004 Requirements

S71-74 of the Building Act applies if you are proposing to build on land subject to natural hazard(s). The land intimately associated with the building or major alteration must be flood free in a 1% AEP event to avoid a s73 notice. Council can advise on when s71-74 may apply and how this can be factored into determining a minimum ground level to avoid a notice.

Step 8: Minimum Ground and/or Floor Level

The elevation that is determined from the above process is the minimum ground and/or floor level required, relative to RL 0m (NZVD2016).

Note: There may be additional freeboard requirements for new buildings and alterations based on E1 or E2 of the Building Code. Council can advise when this may apply.

Notes:
* "Coastal subdivision" will be deemed as subdivision of land below RL 6m.
‡ Avoid hazard risk by using sea level rise over more than 100 years and the H+ scenario (which is a sea level rise of 1.5m for the year 2130 and increases to 1.9m out to the year 2150).

2.6 Storm Tide Adjustment Factor

Within the seawater inundation calculation, the Storm Tide Adjustment Factor (Table 2) provides example values for storm-tide (ST) and wave setup (WS) for specific upper beach slopes of a sandy nature. These factors may apply to properties on land adjacent to the open coast, estuaries and low lying land that is more distant from the shoreline. Additionally, wave runup (WR) may be a factor affecting those properties within 30m of the open coast. The values in Table 2 apply to typical beach slopes at a variety of general locations. These values will need to be checked for each site, as the adjacent beach slope may vary from the generalised beach slope listed in the table at that locality. The maximum value (shaded columns) is the factor generally applied in the seawater inundation calculation for the relevant setting. However, some modification of the maximum ST+WS factor may be possible due to the WS component not being fully developed, particularly within larger estuaries.

Table 2: Storm Tide Adjustment Factor

Select a value from the shaded columns relevant to your site's location.

	Data below assumes SLR = 0.0m and 1% AEP storm-tide event.	**Land adjacent to Estuaries and land >30 from MHWS-6**			**Land adjacent to Open Coast and <30m from MHWS-6**		
Location	Beach Slope Between 2.0m-2.5m (mV:1mH) NZVD2016	**Max. ST & WS**	Storm Tide	Wave Setup	**Max. ST, WR & WS**	Storm Tide	Wave runup (incl. setup)
NELSON							
Oananga Bay	0.16	**3.13**	2.34	0.95	**4.39**	2.34	2.31
Delaware Spit (open coast)	0.08	**2.84**	2.34	0.66	**3.90**	2.34	1.84
Glenhaven to Glenduan	0.20	**3.70**	2.34	1.64	**5.80**	2.34	3.90
Nelson Haven (Tahunanui Beach)	0.06	**2.62**	2.32	0.38	**3.32**	2.32	1.20
TASMAN BAY							
Rabbit Island	0.08	**2.66**	2.29	0.46	**3.39**	2.29	1.28
Ruby Bay-natural	0.16	**2.91**	2.28	0.73	**3.88**	2.28	1.77
Kina Peninsula	0.09	**2.68**	2.27	0.52	**3.46**	2.27	1.41
Motueka Nth	0.12	**2.76**	2.27	0.62	**3.62**	2.27	1.58
Kaiteriteri	0.17	**2.97**	2.27	0.87	**4.10**	2.27	2.11
Marahau Nth	0.16	**2.83**	2.27	0.61	**3.67**	2.27	1.48
Totaranui	0.14	**3.19**	2.27	1.15	**4.74**	2.27	2.85
GOLDEN BAY							
Tata Beach	0.13	**2.73**	2.36	0.66	**3.50**	2.36	1.66
Rototai	0.11	**2.64**	2.35	0.53	**3.28**	2.35	1.36
Paton Rock	0.12	**2.67**	2.36	0.54	**3.31**	2.36	1.37
Parapara	0.11	**2.61**	2.36	0.41	**3.13**	2.36	1.07
Pakawau	0.07	**2.51**	2.36	0.20	**2.83**	2.36	0.60
Puponga	0.12	**2.62**	2.36	0.36	**3.09**	2.36	0.91

(Source: NIWA coastal calculator outputs for Tasman District Council and Nelson City Council.)

Notes:
1. The 'response-variable module' of the coastal calculator was used to calculate Table 2 data. The calculator assumes a number of parameters, including that the beaches are sandy in nature. The above data excludes those parts of shorelines partially or completely affected by rock revetment or other structural interventions, such as at The Haven, Riwaka, Ruby Bay south, Motueka south, mid-Kina Peninsual, mid-Pakawau and much of the Puponga coast.

2. Data is relative to NZVD2016 including -0.17m offset for baseline MSL (2008-2017) projection, being 0.15m above NVD55 0m. NVD55-NZVD2016 differential is assumed as being 0.32m in the coastal calculator.

3. The beach gradients are the average of a number of measurements taken between the 2.0m and 2.5m LiDAR contours (NZVD2016). The data is very sensitive to the beach slope used and for specific design, the upper beach gradient measurement should be checked.

4. The Coastal Calculator uses the Stockdon et al (2006) wave setup and wave runup formula, developed for sandy beaches only. The formula employs a constant beach slope and thus for composite slopes as generally occurs, an upper beach slope is recommended and has been used, as this will conservatively return a higher wave setup and wave runup value. The calculator also assumes that the beach slope used remains constant for whatever sea level rise scenario selected – this may not be the case in reality due to the effect of a number factors such as shoreline erosion, changes to nearshore sediment composition and the like.

2.7 Freeboard

With all hydraulic assessments, whether derived from historical mapped data or computer modelling assessment, there is a degree of uncertainty in the flood level results obtained. In order to account for these uncertainties, as well as for certainties such as maintaining building weather tightness during rainfall, it is usual that a "freeboard" allowance (Table 3) is applied to building platforms and floor levels above the calculated flood level (as illustrated in Figure 5).

Table 3: Minimum Freeboard Requirements

Type of Structure	Freeboard height above design inundation level
Non-habitable residential buildings and detached garages*	0.20m
Commercial and industrial buildings*	0.30m
Habitable dwellings (including attached garages)*	0.50m
Major community facilities related to supply of electricity, telecommunications, water supply or wastewater disposal	0.60m
Bridges and buildings over watercourses (freeboard to the underside of structure)^	0.60m

** Levels as per NZS4404: 2010 Land Development and Subdivision Infrastructure*
^ Levels as per NZTA Bridge Manual, SP/M/022, 3rd edition, May 2016

The minimum freeboard shall be measured from the prescribed water level (e.g. a 1% or 2% AEP event) to either the building platform level, the underside of the floor joists, or underside of the floor slab. Structures need to comply with freeboard requirements of the NZ Building Code and those may be separate from and in addition to the freeboard requirements above. Council can advise on when this may apply.

2.8 Freshwater Inundation Process

The freshwater inundation process uses a methodology broadly similar to the seawater inundation calculation, although the data sources for determination of inundation water levels are variable and include flood records and computer model simulations. Figure 4 summarises the 6 step process to determine minimum ground and/or floor levels in locations subject to freshwater inundation. An explanation of each of the factors included in the calculation is provided in Sections 3-7 and should be read in conjunction with this summary.

Figure 4: Freshwater Inundation Process

Step1: Inundation Information

Is there flooding, secondary flow path or ponding information available for your site to determine water levels? Acceptable information includes Council flood modelling and mapping, or a site specific assessment approved by Council. This information should account for any local adjustment factors such as:

- exposure to freshwater flooding hazard in combination with tidal influence
- topographical effects or changes which could reduce or increase the hazard risk (dune, hill or low point)
- if the site is located within a secondary flow path

Check with Council on what acceptable information is available.

No →

Step 2: Site Specific Assessment

A site specific assessment for flooding, overland flow and ponding may be required where there is a lack of information on water levels or if local adjustment factors apply. Council can advise on when it is appropriate to undertake such an assessment.

Yes →

Step 3: Identify Inundation Levels on Your Site

Based on a minimum of:

- 1% AEP inundation event for subdivision and new buildings (2120 climate) under the RMA 1991 (taking into account climate change effects such as rainfall intensification)
- 2% AEP inundation event for new buildings and alterations (current climate) under the BA 2004

Step 4: Add Freeboard

Refer to Table 3 for a development specific minimum requirement (based on NZS4404).

Step 5: Consider Building Act 2004 Requirements

S71-74 of the Building Act applies if you are proposing to build on land is likely to be or is presently subject to natural hazard(s). The land intimately associated with the building or major alteration must be flood free in a 1% AEP event to avoid a s73 hazard notice. Council can advise on when s71-74 may apply and steps that can be taken (e.g. minimum ground level) to avoid a notice.

Step 6: Minimum Ground and/or Floor Level

The elevation that is determined from the above process is the minimum ground and/or floor level required, relative to RL 0m (NZVD2016).

Note: There may be additional freeboard requirements for new buildings and alterations based on E1 or E2 of the Building Code. Council can advise when this may apply.

2.9 Combined seawater and freshwater inundation

Some sites in the districts may be subject to both seawater and freshwater inundation. In these locations both the seawater calculation, the freshwater process and a combination of the two should be applied to determine which of the three inundation scenarios poses the greatest hazard to land and buildings. The highest value of the three levels calculated will determine the minimum ground and/or floor level. Refer to Table 1 for design event criteria.

2.10 Determining the minimum ground and/or floor level

Once all the steps in the seawater inundation calculation or freshwater inundation process are completed, an elevation will be determined which is relative to RL 0m (NZVD2016). The additional height of the minimum ground and/or floor level required for hazard mitigation at the site will be the difference between the calculated level and the existing ground level.

This can be demonstrated using the scenario illustrated in Figure 5 for a 1% AEP freshwater inundation event. The existing ground level is RL 33.4m. The calculated minimum ground level required for a non-pile foundation design is RL 34.6m. This is a combination of the inundation level (RL 34.1m) and a freeboard (0.5m).

The floor level of House A will be a minimum of 1.425m above existing ground level (RL 34.825m). This allows for the additional minimum 0.225m floor level clearance above infill ground level as required under the Building Code. However, for the building pile substructure foundation examples, the floor level of Houses B and C will be up to 1.2m above the existing ground level to provide appropriate mitigation against inundation hazard (RL 34.6m).

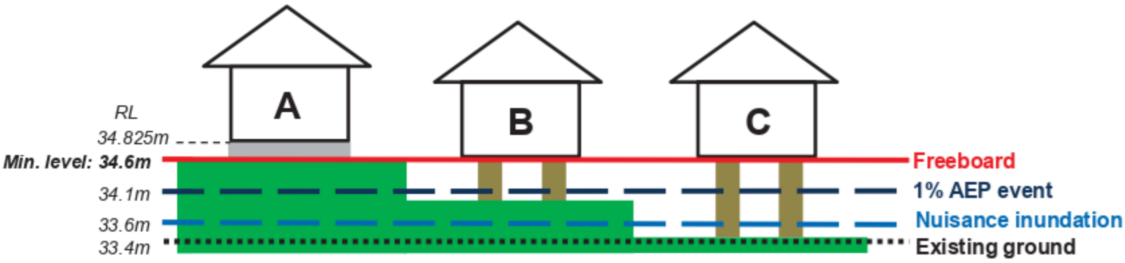
2.11 Options for raising ground and/or floor levels

The options available for raising the ground and/or floor level will be vary between sites and should be discussed with Council. Both Councils' resource management plans set out the policy framework to assess development considerations on land subject to inundation hazards. These include matters such as design, neighbourhood amenity, access and servicing. Refer to the Councils' resource management plans for further guidance on what wider planning considerations will need to be addressed.

In locations where there is an inundation hazard, any new property titles created through subdivision must provide functional land where a building platform can be established that is free from inundation. To achieve this, the ground level will need to be raised above the 1% AEP inundation level over the lifetime of the building (as shown in Figure 5, Option A). The new ground level will also include a freeboard allowance (refer to Table 3). In raising the ground level, it will need to be demonstrated that there are no adverse effects that occur on adjacent property in response to the inundation design event, including raised flood levels, diversion of flood flows and/or secondary flood routes.

For new buildings or major alterations on existing property titles (where subdivision is not undertaken), all three options in Figure 5 may be viable and will also include a freeboard allowance. However, viability will depend on the location of the property (e.g. rural or urban) and the onsite or offsite effects of each option, in addition to other resource management plan considerations.

Figure 5: Options for raising ground and/or floor levels



Options	
A	Subdivision and buildings on river floodplains, freshwater ponding areas and in seawater inundation locations, where infill for a building platform can (or must be for functionality reasons) be undertaken, as there are less than minor adverse effects off-site.
B	Buildings on river floodplains, freshwater ponding areas and in seawater inundation locations, where infill for a building platform can be undertaken to a small degree to reduce nuisance inundation (for example a 20% AEP event), but where full infill has more than minor adverse effects off-site.
C	Buildings on river floodplains, freshwater ponding areas and in seawater inundation locations, where infill for a building platform has more than minor adverse effects off-site.

3 Supporting Information for Calculating Levels

3.1 Introduction

This section provides supporting information and explanation on the different factors of the seawater inundation calculation and freshwater inundation process, as outlined in Section 2. Some subsections and information is relevant to both types of inundation hazard, while others may only be relevant to either seawater or freshwater inundation.

3.2 Seawater and freshwater inundation design events

In this practice note, reference is made to rainfall and sea level/storm-tide events. Both have probabilities associated with them that reflect event severity. The lower the probability of an event occurring, the more severe that event.

It is usual that when the effects of severe rainfall are determined through modelling, a nested rainfall pattern is often used which distributes rainfall in time in such a way as to cause the most adverse performance from the system analysed for the given frequency. In simpler terms, when a 1% AEP rainfall event is used for analysis particularly in small catchments, this rainfall intensity will be assumed to be occurring everywhere in the catchment. In reality rainfall distribution does not always occur in this way and appropriate rainfall distributions are likely to be modelled in larger catchments. When a 1% AEP rainfall event occurs at one location, it is seldom occurring at the same intensity everywhere else in the catchment at the same time, although that depends on the size of the catchment under consideration.

When a sea level is applied in any assessment, this level is made up of several factors which include both tidal and weather related influences. The "predicted tide" is independent of prevailing weather, and is based solely on a standard atmospheric pressure condition and factors including the relative positions of the sun and moon. However, factors relating to a weather event includes low barometric pressure, wind speed and duration, fetch (distance over which the wind blows over water) and shoreline conditions, i.e. factors typically associated with storm conditions and local geography and topography.

The MHWS-6 tide is adopted for the tidal baseline condition from which the hydraulic grade line is calculated, for discharges from open channels and pipelines terminating at the coast. This is to ensure that the effect of a 1% AEP rainfall/runoff event on the drainage network is appropriately simulated or designed for the development being considered, without imposing an improbable tidal boundary condition (such as highest astronomical tide) that would unduly influence rainfall runoff at the coast.

Conversely, an extreme storm-tide event is invariably accompanied by some rainfall. A 5% AEP rainfall event has been allowed for as a reasonable but not improbable combination. Lastly, coinciding extreme (e.g. 1% AEP) storm-tides and rainfall can occur at the same time. However such events have a very low joint probability that is certainly less than 1%. In this practice note, it is considered that reasonable joint probability limits have been set to provide a practical and affordable basis for design. These scenarios are summarised in Table 1 (Section 2).

3.3 Identifying locations subject to seawater and/or freshwater inundation hazards based on reduced level thresholds

In coastal locations both the seawater inundation calculation and the freshwater inundation process relies on RL thresholds as a starting point to determine locations that may be subject to these hazards, as shown in Figure 2 (Section 2). Appendix 1 lists previous vertical datums used.

Historically, 0.0m NZVD55 was the same as 0.0m MSL. In NZVD2016, the datum used for the Top of the South Maps and NCC/TDC LiDAR contour maps, RL 0.0m is no longer the same as MSL 0.0m. The NVD55 0.0m (MSL1939-1942) is 0.337m lower than NZVD2016 0.0m. Due to 0.15m sea level rise since 1939-1942 MSL assessment, MSL (2008-2017) is 0.187m NZVD2016 and becomes 0.047m NZVD2016 (MSL 2020 projection). Once sea levels have risen 0.337m from NVD55 0.0m, NZVD2016 0.0m will then also become mean sea level. This is projected to occur in the early 2020s.

The land elevation and coastal setback thresholds (the ‘RLs’) have been selected on the basis that they are conservative values that capture land potentially affected by a seawater inundation event occurring over a minimum of the next 100 years. The 30m distance threshold from MHWS-6 also coincides, for the moment, with the minimum permitted activity setback distance for buildings from MHWS-6 in the Tasman Resource Management Plan and other national practices such as the coastal marine area setback in the NES for Plantation Forestry (2018).

3.4 Supporting information to inform the Seawater Inundation Calculation

This section details supporting information and explanation specific to the application of the seawater inundation calculation. Refer to Section 2 for the flow diagram summary (Figure 3) to calculate ground and/or floor levels in locations subject to seawater inundation.

3.4.1 Storm Tide Adjustment Factor

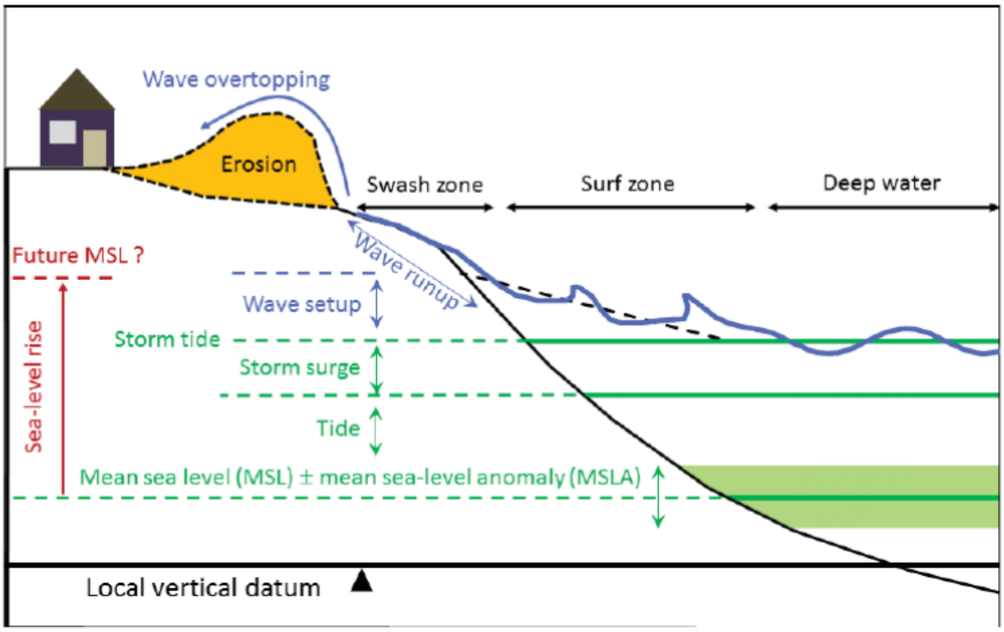
The storm tide adjustment factor considers storm surge and wave set up for all properties, and wave runup for those properties within 30m of the coast as discussed further below.

3.4.1.1 Extreme sea-level elevations from storm-tides and waves

The primary factors affecting seawater inundation hazard are storm surge, wave setup, wave run up and sea level rise. These effects are illustrated in Figure 6 below.

Figure 6: Processes that contribute to seawater inundation and erosion

(Source: MfE (2017))



3.4.1.2 Tasman and Golden Bay coastlines

Extreme tide (storm tide) analysis indicates that Tasman and Golden Bays are tide (as opposed to wave) dominated. Storm-tides having 1% AEP have an elevation varying within a 0.14m range (without wave effects). These elevations change once the effects of waves on a shoreline of a particular gradient and material composition are taken into account.

A NIWA study commissioned by TDC (NIWA 2014(1)) considered 14 representative "open coastline" locations exposed to extreme sea levels within Tasman district and included consideration of combined tide, storm surge (inverse barometric and wind-induced effects), wave setup and wave runup. The Coastal Calculator has been revised (May 2018). This tool can be used at each of these locations to determine a range of outputs for selected inputs, as previously described.

The study shows that wave setup makes a small contribution to total elevation of the sea at the coastline relative to storm tides, owing to the relatively large tidal range and sheltered wave environment within the bays. However, wave runup makes a significantly larger contribution, being almost four times as large as wave setup. Wave runup is very sensitive to beach slope and is calculated at the MHWS-6 level of the beach profile (NIWA, 2014(1)).

The NIWA assessment does not take into account the effects of potential future erosion when considering the risk of inundation and does not provide maps or assessment on the extent, depth or volume of inundation inland of the shoreline.

An additional wave overtopping module to the NIWA coastal calculator enables assessment of the volume of wave overtopping for a range of sea wall structure configurations.

3.4.1.3 Nelson City coastline

NIWA has undertaken a number of coastal assessment studies for NCC over recent years, most recently in November 2015 (NIWA 2015 (2)).
Like the Tasman District, the Nelson City coastal environment is variable, and requires region-specific assessment in terms of design storm tides.

The Wood is effectively protected from wave runup by the Boulder Bank and Nelson Haven. The Wood is located close to the sea-level gauge from which storm-tide elevation probabilities were derived, providing a good degree of confidence in assessed storm-tide elevations for that area.

Stoke is located inside the Waimea Inlet and is protected from direct ocean wave effects. The storm-tide elevations were derived on the coast outside the tidal inlet. Tidal and storm-surge waves can amplify (or decay) inside tidal inlets. While NIWA do not have information on tidal shoaling inside Waimea Inlet, they have allowed for an 8cm amplification in storm surges affecting Stoke, based on NIWA studies from Auckland's Waitemata Harbour. Monaco is also located within the Waimea inlet, but less so than Stoke. Depending on the aspect of the shoreline under consideration and the wind and wave direction, Monaco is likely to be subject to wave runup and wave setup effects somewhere between those experienced at Tahunanui Beach and Stoke.

Glenduan and Tahunanui Beach are both directly exposed to waves from Tasman Bay, thus they require local adjustment factors in the form of wave setup and runup elevations. NIWA's approach to assessing storm tide and wave set up/run up is outlined in their November 2015 report.

3.4.1.4 Coastal inlets

Natural tidal inlets and estuaries in Tasman and Golden Bays and the Nelson Haven have sufficient tidal flow in and out of their entrances such that they effectively reach equilibrium with the open coast sea level across the high tide cycle. That is, at high tide the sea level within the estuary and on the open coast is effectively the same. However, there will be a difference in elevation mid tide when sea water is flowing either in or out of the estuary.

Because estuaries are relatively sheltered environments and have reduced fetch compared to the open coast, wind-generated waves are smaller and their shorelines are subject to reduced wave runup, wave setup and erosion effects. However, sea level elevation resulting from storm surge and wave set up occurs over a sufficiently long duration for open coast shoreline and estuary water levels to be very similar if not the same. For calculating ground and/or floor levels adjacent to estuary margins, only the storm tide and wave setup factor need be used, Wave runup need not be considered unless the site is exposed to some degree of open-coast wave generation or surge effects, with possibly a small allowance made if the fetch across the estuary becomes significant.

Where a tidal inlet or estuary has been modified (such as the construction of a causeway with a culvert or tide gate that restricts the tidal flow) the sea water level within the truncated estuary embayment will often be lower than for the wider estuary and the open coast. However, such locations are also likely to be influenced by stormwater or stream inflows. Both of these effects should be assessed and taken into account with an additional 'local adjustment factor'.

3.4.1.5 Storm tide adjustment factor

Values shown for the storm tide adjustment factor (Table 2, Section 2) are calculated for a present-day 1% AEP joint probability storm-tide event, assuming a sandy shoreline and for the prescribed MHWS-6 beach slope. All structurally modified (e.g. rock revetment) and other shoreline types, including rocky shoreline locations, will require site specific assessment. The data in this table is derived from the NIWA coastal calculator for each of the sites in the Nelson and Tasman districts.

3.4.2 Climate change effects factor: sea level rise

Within the seawater inundation calculation, the climate change effects (CCE) factor accounts for projected sea level rise. The CCE factor applies the transitional sea level rise values shown in Figure 3. The CCE factor does not consider increased rainfall or increased frequency of storm events.

Since the early 2000s, MfE has provided local government with guidance on how to adapt to coastal hazards arising from climate change, particularly hazards associated with sea level rise. This guidance has been used by councils to inform land use and infrastructure asset planning in coastal areas. MfE publications in 2008 and 2009 (MfE 2008(1) and MfE 2009) provided baseline sea level rise recommendations for different future timeframes[5], in metres relative to the 1980-1999 average. To date, both Councils have applied these sea level rise recommendations to their flood modelling scenarios and assumptions and the setting of minimum ground and/or floor levels.

MfE's publication 'Coastal Hazards and Climate Change: Guidance for Local Government' (December 2017) has provided a major revision to the previous guidance and includes the findings of the latest Fifth Assessment Report produced by the Intergovernmental Panel on Climate Change (IPCC). The guidance provides an iterative 10 step framework to enable local government to undertake 'long-term adaptive planning' for climate change in coastal communities, recognising that because of the uncertainty about future climate change it is necessary to examine a range of sea level rise scenarios. The guidance advises councils to consider and apply four sea level rise scenarios when developing and testing adaptation plans and policy, and for the design and adaptive development of assets and infrastructure at the coast. Table 4 provides a bracketed sequence of years in the future when specific sea level rise increments could be reached in New Zealand.

While councils across New Zealand work towards the recommended long term adaptive planning pathways approach as detailed in the guidance, MfE has provided minimum transitional sea level allowances to be used in planning processes as shown in Table 5. Sea level rise allowances are provided for four categories of activities or types of development (A – D) and are expressed as either scenarios or a minimum value. These categories are referred to as the 'development setting' within the seawater inundation calculation.

[5] The previous guidance (MfE July 2008(1)) adopted a risk-based approach, advising local government to start assessments of a range of higher sea levels at a base level of 0.5 metres and at least consider 0.8 metres by the 2090s, with an extension beyond 2100 applying a rate of 10 mm/yr.

Table 4: Range of timeframes when specific sea level rise increments would be reached

(source MfE, 2017)

Table 11: Approximate years, from possible earliest to latest, when specific sea-level rise increments (metres above 1986–2005 baseline) could be reached for various projection scenarios of sea-level rise for the wider New Zealand region

SLR (metres)	Year achieved for RCP8.5 H+ (83%ile)	Year achieved for RCP8.5 (median)	Year achieved for RCP4.5 (median)	Year achieved for RCP2.6 (median)
0.3	2045	2050	2060	2070
0.4	2055	2065	2075	2090
0.5	2060	2075	2090	2110
0.6	2070	2085	2110	2130
0.7	2075	2090	2125	2155
0.8	2085	2100	2140	2175
0.9	2090	2110	2155	2200
1.0	2100	2115	2170	>2200
1.2	2110	2130	2200	>2200
1.5	2130	2160	>2200	>2200
1.8	2145	2180	>2200	>2200
1.9	2150	2195	>2200	>2200

The earliest year listed is based on the RCP8.5 (83rd percentile) or H+ projection and the next three columns are based on the New Zealand median scenarios in figure 27, with the latest possible year assumed to be from a scenario following RCP2.6 (median). Note: the year for achieving the sea-level rise is listed to the nearest five-year value.

Table 5: Minimum transitional New Zealand-wide sea level rise allowances to be applied as the climate change effects factor

(source MfE 2017)

Table 12: Minimum transitional New Zealand-wide SLR allowances and scenarios for use in planning instruments where a single value is required at local/district scale while in transition towards adaptive pathways planning using the New Zealand-wide SLR scenarios

Category	Description	Transitional response
A	Coastal subdivision, greenfield developments and major new infrastructure	Avoid hazard risk by using sea-level rise over more than 100 years and the H+ scenario
B	Changes in land use and redevelopment (intensification)	Adapt to hazards by conducting a risk assessment using the range of scenarios and using the pathways approach
C	Land-use planning controls for existing coastal development and assets planning. Use of single values at local/district scale transitional until dynamic adaptive pathways planning is undertaken	1.0 m SLR
D	Non-habitable short-lived assets with a functional need to be at the coast, and either low-consequences or readily adaptable (including services)	0.65 m SLR

For category 'A' the guidance advises the use of the H+ scenario which identifies a sea level rise of 1.5m for the year 2130 and increases to 1.9m out to the year 2150 (as shown in Table 4). This is a significant change to the previous nominal 1m sea level rise which was applied. The use of the H+ scenario future-proofs the anticipated longer life of new developments and gives cognisance to the NZCPS requirement to avoid future hazard risk over planning timeframes *beyond* 100 years.

For informing where intensification of existing development is inadvisable (category 'B'), the guidance does not provide for a transitional value and instead the full MfE adaptive pathways planning approach should be applied. MfE's guidance outlines the process for the adaptive pathways approach. In such situations it is recommended to discuss early on the suitability of your proposal with Council.

Transitional sea level rise values for categories 'C' (existing development) and 'D' (short-lived non-habitable assets) within Table 5 correspond to the equivalent values recommended for sea level rise from the previous MfE guidance (MfE, 2008a).

Until such time that each Council has progressed the adaptive planning pathways approach as detailed in the MfE guidance, the transitional sea level rise values for each of the development settings (as shown in Table 5) will be applied in planning processes.

3.5 Supporting information to inform the Freshwater Inundation Process

This section details information that informs the application of the freshwater inundation process. Refer to Section 2 for the flow diagram summary (Figure 4) of how to calculate ground and/or floor levels in locations subject to freshwater inundation.

3.5.1 Piped networks, waterways and secondary flowpaths

As described in Section 1, both Councils have inundation modelling work programmes in place and this includes modelling of piped stormwater networks, waterways, and secondary flowpaths that may impact on urban areas. Check with each Council on what modelling information is available or being developed.

Modelled results provide an overview of the flood extent and flood depths. This information can be used to determine the base water level for ground and/or floor level calculations.

The Councils have also mapped or are in the process of mapping some secondary flowpaths for some urban areas. In these circumstances, the location and peak volume of the flowpath has been determined by Council and can be used to determine the appropriate siting of development under both building (Building Act s71-74) and resource consent (RMA s106) processes.

In areas that have not yet had flowpaths mapped, the appropriate location, level and freeboard of ground and/or floor levels for new development will need to be determined from first principles and will be considered as a 'local adjustment factor' when setting the minimum level.

3.5.2 Climate change effects factor: increase in rainfall intensity

Within the freshwater inundation process, the CCE factor accounts for a projected increase in rainfall intensity. It is anticipated that incidences of extreme weather (rainfall events) and associated freshwater inundation will increase in the future, both in magnitude and frequency. Annual rainfall is predicted to rise over the summer, autumn and winter seasons across the Nelson and Tasman districts with high intensity rainfall occurring more often. The CCE factor for the increase in rainfall intensity (approximately 15% greater than present by

2120) should be applied in determining the 1% AEP inundation event for the year 2120, when considering inundation levels for subdivision and new buildings under RMA 1991 processes.

3.6 Supporting information relevant to both the Seawater Inundation Calculation and the Freshwater Inundation Process

3.6.1 Sloping sites

Ground level at the point of interest (which should be taken as an individual building footprint and some curtilage, even if it is within a subdivision development) may be on a slope. In scenarios where ponding (as opposed to overland flow) is the primary consideration, the ground level is to be taken as the lowest ground level subject to ponding as determined either by topographical survey, LiDAR or other relevant method. In the case where overland flow (e.g. river flood plains) is the primary consideration, the ground level at the upstream edge of the proposed development is the ground level that applies. Where multiple buildings are proposed to be formed, the ground levels at each of these should be considered individually.

3.6.2 Freeboard: allowances for flood level uncertainties

With all hydraulic assessments, whether derived from historical mapped data or computer models, there is a degree of uncertainty in the flood level results obtained. There are several reasons for this including a change in topography or watercourse morphology since a flood event map was drawn or modelling undertaken, changing shoreline conditions altering wave runup or inland flow capability, or model parameters that cannot be defined with precision due to lack of climate data. In order to account for these uncertainties, as well as for certainties such as maintaining building weather tightness during rainfall, it is usual that a "freeboard" allowance is also applied to building platforms and floor levels above the calculated flood level. A freeboard factor also allows for water levels that may occur in an unlikely but possible event such as infrastructure blockage or failure, capacity exceedance, floodwater diversion and waves generated by vehicles.

The freeboard allowance when applied to land is intended to ensure that any new subdivision meets the tests of s106 of the RMA 1991 or, in relation to new buildings and major alterations, to avoid the need for a BA 2004 s73 hazard notice. This circumstance applies where land that a building is intimately connected with is likely to be subject to inundation hazard. Section 71-74 of the BA 2004 applies at the building consent stage, irrespective of what other conditions apply in a previous or accompanying resource consent. Applicants can contact the relevant Council for the latest information prior to making any major decisions, as hazard knowledge and management directives evolve over time (refer to Section 6 for more information on s73 hazard notices).

The freeboard allowances specified in Table 3 (Section 2) are to be added to the assessed flood level, to result in a minimum ground and/or floor level. There may be local adjustment factors that affect the nominal freeboard required. This may be due to the effect of unusual topography, new flood mitigation structures or shoreline changes affecting seawater inundation potential. Such circumstances may result in the freeboard being higher or lower than the initial minimum value. Council can advise in those circumstances.

The freeboard allowances listed in Table 3 are taken from the Subdivision and Development Standard NZS4404:2010 in relation to habitable dwellings, non-habitable residential buildings and detached garages, and commercial and industrial buildings. Buildings will also need to comply with freeboard requirements of the Building Code and those may be separate from and in addition to the freeboard requirements listed. Council can advise when this will apply.

The Building Code's Acceptable Solutions and Verification Methods for Clause E1 Surface Water (AS and VM for NZ Building Code) requires a minimum freeboard *to the floor level* of 0.15m above the highest adjacent ground level (which could be inferred to be the ponding level). However, the conditions where 0.15m can be applied are restrictive (see below) and unlikely to be applicable in most inundation scenarios:
A catchment area of no more than 0.25 hectares, and which is:

- *free from a history of flooding;*
- *not adjacent to a watercourse;*
- *not located in low lying area; and*
- *not located in a secondary flow path.*

Conditions are also restrictive where Verification Method E1/VM1 of the AS and VM for NZ Building Code requires a freeboard of 0.50m. This applies where ponded water (2% AEP event assumed) exceeds 100mm in depth and extends from the building directly to a road or carpark and therefore likely to be subject to waves generated by vehicles. Such waves will not be sustained unless there is at least 100 mm depth of water and an unobstructed path from the point where the wave is generated to the building. In calculating this 0.50m freeboard, 0.15m is attributed to flood level estimation uncertainty and the remaining 0.35m to wave effects including 0.20m wave height and 0.15m wave runup (Determination 1999/005). This provides a sound base reference for inundation mitigation calculations in some circumstances. Verification Method E1/VM1 shall be used where the Council does not have more accurate data available from sophisticated hydrological modelling as part of its flood management plans[6]. For all other cases, E1/VM1 requires a freeboard of 0.15m.

The required freeboard for development and subdivision in coastal and near-coastal locations takes into account inundation elevations determined from seawater inundation modelling incorporating allowances for sea level rise, or in the absence of modelling, other assessments that provide reasonably reliable flood levels in a projected climate change/sea level rise future.

3.6.3 Local adjustment factors

The local adjustment (LA) factor enables the minimum acceptable land or floor level at any particular site to be adjusted up or down. The LA factor takes account of local, site or project specific matters that would be inappropriate to apply generally.

In some cases, such as greenfield subdivision, and where Council does not hold sufficient information, the applicant may be required to provide a more detailed site specific assessment of natural hazards to determine an appropriate LA factor. Site specific LA factors should be discussed with Council to ensure all factors are addressed and appropriate minimum ground and/or floor levels are determined.

This practice note does not define the potential LA factors in great detail. The matters listed below are not exhaustive, and there may be further aspects that should be considered when determining the LA factor (including those listed in Section 4). A specialist engineering assessment may be required to determine relevant details for a particular site.

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[6] Acceptable Solutions and Verification Methods are produced by MBIE as a means of compliance with the Building Code. E1/VM1 provides a method for verifying that a proposed building will meet the requirements of Building Code E1.3.1 and E1.3.2 in the following circumstances: (a) the catchment area does not exceed 100ha; and (b) the surface water results only from rainfall on the catchment and does not include water from other sources such an inundation from rivers, lakes or the sea.

- **Existing hazard mitigation works or infrastructure**

Land and/or floor levels may be increased or reduced where, for example, there are existing inundation (or erosion) hazard mitigation works or infrastructure present that will function effectively for a time into the future, but beyond that time mitigation function cannot be relied on or becomes no longer available. In the case of hazard mitigation works, this may be due to expiry of consents or a change of policy with respect to the presence of those works (e.g. tide banks, revetments). In the infrastructure case, the elevation of road corridors or causeways can act to exclude the tide to some degree, but over time may no longer have sufficient elevation to continue to do so.

- **Freshwater/seawater inundation hazard associated with increasing tidal influence**

Ground and/or floor level increases may also be necessary in an area where stormwater/ freshwater or groundwater inundation hazard to inland areas increases as a result of increasing (or elevated) sea states. This would include, for example, areas reliant on natural drainage to the coast, or areas where stormwater detention is provided. As sea levels rise, more frequent and/or longer periods of stormwater detention may be required before drainage can occur. With increasing sea levels, drainage infrastructure may require modification with flap gate or tide exclusion gates, to prevent backflow into low lying areas. Some areas may require pumping systems to discharge stormwater to the coast or be used to lower groundwater levels, without which flood hazard risk to existing or proposed greenfield or infill development becomes a concern.

In soft shoreline areas, particularly where erosion mitigation structures are not already present or are relatively minimalist in scale, increasing sea levels will very likely exacerbate coastal erosion hazard. Further coastal erosion may reduce or remove the depth and/or height of elevated back-beach barrier systems such as dunes, exposing any lower lying hinterland behind to increased frequency and/or severity of inundation.

- **Groundwater**

There may be sites where groundwater may affect potential inundation levels. These are likely to be very low lying areas adjacent to the coast below RL 2.5m (NZVD2016). As the level of the sea rises, the water table will rise in these areas, which may lead to surface ponding in some places and more extensive inundation after heavy rain. It is not known the potential extent of groundwater inundation in low lying coastal areas and therefore this should be considered as a local adjustment factor where it may apply.

- **Topographical effects**

Topographical effects including exposure to wave runup at open sea beach locations during storm surge events require specific assessment. Reference should be made to the extreme sea level elevations from the relevant NIWA reports and any detailed hazard maps that may be available at the time of development when an appropriate LA factor is determined.

Other topographical features or effects can alter storm-tide shoreline water levels or affect wave runup potential in both a present day and future projected sea level rise climate. These include dynamic coastal features such as sand spits and bar deposits that form and disperse over time, and sea level rise exacerbating or initiating erosion of coastal barrier systems, overtopping of natural and/or constructed barriers to seawater inundation, or exacerbating the frequency and/or magnitude of stormwater impounding.

- **Design life of buildings**

The Building Regulations have a requirement that primary structural building elements, including floors, function for the life of the building (for an indefinite period but not less than 50 years, unless specified). Building determination 95/006 clarified that a building that is *"...not stated to have a limited intended life in terms of section 39,* [...] *its intended life is to be* *taken as indefinite but not less than 50 years".*

However, other than for buildings having a specified short term life, the effects of sea level rise beyond the 50 year timeframe applies, dependant on the nature and duration of building use, as per central government guidance, the NZCPS and decisions from the Environment Court.

Where short-lived buildings or assets are proposed, the minimum floor level required may be reduced below that needed to mitigate long-term, extreme hazard exposure, dependent on the use of the building or asset. For more information refer to Section 5 Building Use and Risk.

4 Building Servicing

The following section outlines servicing matters that will need to be considered as part of any new development proposed and may influence minimum ground and/or floor levels as a local adjustment factor.

4.1 Dwellings and onsite effluent and stormwater disposal

For ground level assessments, the level will need to be sufficient to provide effective functioning of wastewater and stormwater systems, treatment or disposal that takes into account rising ground water and sea levels. Development at a number of coastal communities where wastewater reticulation is unavailable hinges upon the feasibility and ongoing function of onsite effluent and stormwater disposal systems. Council may require site specific assessments where new dwellings cannot be connected to reticulated wastewater or stormwater systems. The viability of residential development will depend on being able to achieve wastewater and stormwater standards.

4.2 Reticulated stormwater servicing

Where subdivided lot(s) are being connected to a reticulated stormwater system the ground level assessment will need to take into account making an effective connection to any proposed network. The key considerations will include pipe size, cover and outlet level. This is to ensure the outlet of the stormwater system will not be subject to tailwater effects during the design rainfall or inundation event that the proposed network has adequate cover over the pipes and there is enough fall in the pipe network to effectively connect and function with the network pipe sizes. Also, the secondary flow from uphill areas, roads etc must not impact the new development.

4.3 Backwater

In some locations, the minimum floor level will need to take into account water level affected, for example, by the tide constraining rainfall runoff from rivers and streams, open channels and pipe networks discharging to the coast. In these circumstances, the tide causes a "backwater effect" that can increase water levels in low lying coastal locations.

Typical locations are where land drainage pathways (either built channels, pipe outfalls or streams and rivers) exit to the coast, estuaries, areas inland of causeways or low lying areas adjacent to the coast. Development areas that rely on stormwater detention areas adjacent to the coast are also potentially prone to backwater effects, as these areas may also have drainage outflows constrained by the level of the tide.

For ground and/or floor level assessments at these locations, the inundation level should be determined either with the assistance of historical data and/or by hydraulic calculations taking into account the local catchment characteristics.

4.4 Settlement due to liquefaction

Tasman District
The generally gravely nature of the underlying geology over much of the near coast land in Tasman and Golden Bay is such that widespread seismic liquefaction (as experienced in Christchurch) is considered unlikely to occur. Whilst “pockets” of liquefaction may occur during a strong seismic event in places that are low lying adjacent to the coast, particularly adjacent to existing or former estuary areas, it is generally considered unnecessary at this time to specifically allow for the effects of liquefaction when setting floor levels and building site ground levels in coastal locations.

There are specific sites where liquefaction may affect ground and potential inundation levels. These include tidally-affected and partially enclosed flood zones such as the estuary between Wharf Road and Old Wharf Road in Motueka. While no investigation as to liquefaction risk and response in strong earthquake conditions have been undertaken in these locations, this should be considered for a local adjustment factor.

Nelson City
NCC has undertaken a preliminary liquefaction assessment across the district and identified Tahunanui may be subject to liquefaction during an extreme seismic event. Further assessments have identified an area in Tahunanui where the risk of liquefaction hazard should be managed and mitigated at the time of new subdivision and development. More information on Nelson’s liquefaction hazard can be found on the Council’s website. Liquefaction susceptibility should be considered through a local adjustment factor.

5 Building Use and Hazard Tolerance

The following section outlines building use and inundation hazard considerations which may influence minimum ground and/or floor levels as a local adjustment factor.

5.1 Building use and risk

The nature and use of a building, affects the tolerance to inundation hazard. Clause E1.3.2 of the Building Code requires that water from the 2% AEP flood event shall not enter residential and communal buildings. Council can exercise discretion under the Building Code and accept a lower floor level, or may grant a waiver of any minimum floor level requirement, where the risk of damage is low. A range of factors should be considered by Council and developers/owners when considering appropriate floor levels. Considerations include (but are not limited to):

- building functionality
- vehicle access
- disabled access
- building materials
- community significance of use eg ‘lifeline’ facilities, such as communications equipment, hospitals and other essential services
- risk to life from inundation
- value at risk vs cost to protect
- building owner-insurer relationships or requirements
- amenity and historical value

5.2 Further considerations for owners and designers

The Building Code refers to categories of buildings by importance level based on structural failure considerations. The table of categories is comprehensive and in practice is too complex to assist any process for determining building importance relative to inundation risk exposure for the purpose of this practice note. Therefore a simple classification based on the use of the building can be applied[7] as follows:

- **'Occupied' buildings**

Structures in which people live, sleep or work (i.e. habitable and productive buildings) or have important post disaster functions. 'Habitable or productive buildings' are of high social and economic importance. For example, habitable/productive buildings include residential housing and attached garages, sleepouts, shops, offices, and factories, hospitals and care facilities, buildings containing communication equipment.

- **'Non-Productive' buildings**

Flood hazard exposure to non-productive, non-habitable buildings may generally have only a low economic impact, low structural significance or minor effect. As a consequence, they generally do not need serious consideration when making building decisions on hazard-prone land. They may occupy productive hazard prone land, but contribute only in an ancillary way to its productivity and the consequence of flooding hazard to these buildings is generally not significant. Such buildings may include public toilets, garden sheds, car ports, detached garages, domestic sheds and rural sheds.

There may be situations where a new residential house ('occupied building') is built with a raised floor level while a detached garage or ancillary shed does not require the same raised level as it is a 'non-productive building'. However, a risk to occupants arises when homeowners want to convert these detached garages or sheds to habitable buildings (e.g. creation of an additional room, sleepout, airbnb). In these circumstances, the garage or shed becomes an occupied building and the floor level should be raised to ensure people are not at risk from inundation.

Where there are multiple uses proposed for a new building (e.g. garage with a sleepout), Council will consider the function of the building and require floor levels to be raised to ensure the most vulnerable use (where it is an occupied building) is protected from inundation.

6 Imposing Hazard Notices on Property Titles

Under Section 71 of the BA 2004, a property may be deemed to be subject to a natural hazard and some assessment is required to determine if hazard occurrence is considered "likely" during the lifetime of the building. Section 71(3)(d) identifies inundation as a hazard, including flooding, overland flow, tidal effects, and ponding.

The threshold adopted for this is whether the land that the building is intimately connected to is likely to be subject to inundation during a 1% AEP event (as supported by Determination 2008/82). Thus, it may be possible to meet the requirements of the Building Code by having a minimum floor level set above the 2% AEP flood level, but still be subject to a hazard notice on the title because the land on which the building is intimately connected to is subject to inundation.

Under Section 71 a building consent authority must refuse to grant a building consent for construction of a building, or major alterations to a building if (a) the land on which the building work is to be carried out is subject or is likely to be subject to one or more natural

[7] The two proposed building classifications only relate to implementation of this practice note and does not override requirements under the Building Code or compliance with the BA 2004.

hazards; or (b) the building work is likely to accelerate, worsen, or result in a natural hazard on that land or any other property'.

However, where the building consent authority is satisfied that adequate provision has been or will be made to –

a) protect the land, building work, or other property from the natural hazard or hazards; or
b) restore any damage to the land or other property as a result of the building work,then the building consent must be granted under Section 72 of the BA 2004.

Where a building consent has been granted under Section 72, Section 73 requires that a notice advising of the hazard is placed onto the title of the property.

In order to avoid any consent notices under Sections 72 and 73 of the BA 2004, a property owner will generally need to ensure that both the floor level and land intimately associated with the building is above the 1% AEP flood level. Specific discussion with Council is recommended for landowners seeking this outcome.

7 Options for Reducing Inundation Hazard

Various options exist to reduce inundation hazard exposure to land and buildings. In the first instance, Council will seek to avoid the inundation of buildings by promoting development in areas with no or low flood hazard exposure in their resource management plans. Council will then seek to reduce the likelihood and magnitude of inundation hazard to land and buildings, where such activities do not increase the inundation hazard to other properties.

This means that Council will seek to avoid development in flood hazard areas wherever possible, or mitigate to the hazard exposure of the development to the greatest extent practicable. The purpose of this is to reduce the hazard risk to people and property and preserve expected or required levels of functionality, while allowing for uncertainties associated with increased rainfall, sea level rise and modelling. Mitigating inundation hazard effects through building design is an option available to applicants through the BA 2004 and RMA 1991.

A range of options for mitigating inundation hazard are presented below but there may be others that are also applicable. The feasibility of any option will need to be assessed on a case by case basis and should include an assessment of the potential adverse effects on other parties and whether resource consent will also be required (e.g. for earthworks, alteration of secondary flow paths, exceeding building height standards etc). Where public funding is involved, the life cycle costs of maintaining any option over the lifespan of the development or building also needs consideration.

Any particular option will need to comply with relevant legislation and the policies and rules of the respective Councils' resource management plans, or obtain resource consent or other permits as necessary.

Options for reducing inundation hazards to land where it can be demonstrated that this action will not create an increased hazard or nuisance for any other property include:

- raise ground level
- onsite structural intervention to prevent flood water entry, contain location of, or divert flood waters away from the site including:
  - diversion bunds or walls; and

  - protected preferential drainage flow paths
- offsite structural intervention to reduce site flood hazard exposure by provision of additional works or infrastructure elsewhere including:
  - diversion bunds or walls;
  - protected preferential drainage flow paths; and
  - floodwater detention.

Options for reducing inundation hazards to buildings (in addition to the above):
- alternative building site within a property;
- raising floor height;
- foundation and building design (to allow for future building relocation or raising of the floor height); and
- maintaining required freeboard between ground and/or flooding level and floor levels by avoiding landscaping works or other site developments that may compromise the function of secondary flow paths, flood storage and building freeboard.

Technologies that support these options include:
- Adjustable screw piled houses
- Floating houses as used in New Orleans and Holland
- Flexible, waterproof service connections
- Manual or automatic flood barriers
- Pressure sewer systems with elevated control systems.
- Overhead or off grid power supply

8 Further Information and Guidance

For further information or guidance on how to determine minimum ground and/or floor levels for subdivision, new buildings, and major alterations, please contact the relevant Council as detailed below.

Nelson City Council
Civic House
110 Trafalgar Street
Nelson

Phone: 03 546 0200
Email: enquiry@ncc.govt.nz

Tasman District Council
Richmond Office
189 Queen Street
Richmond

Phone: 03 543 8400
Email: info@tasman.govt.nz

9 Appendices

Appendix 1: **Previous vertical datum**
Appendix 2: **References**

Appendix 1: Superseded vertical datums

NCC Datum	Nelson City Council Datum (12.07 m below NVD-55)
NVD-55	Nelson Vertical Datum 1955 **Conversions:** NVD-55 = +2.24m CD (source: NIWA, 2015 and LINZ, 2016) NVD-55 = -0.337m NZVD2016 at Nelson Port Sea Level gauge (source: LINZ, 2016) NZVD2016 = +2.577m CD (source: LINZ, 2016)

Appendix 2: References

LINZ, 2016	New Zealand Vertical Datum 2016, Land Information New Zealand, July 2016
MfE July 2008(1)	Coastal Hazard and Climate Change: A Guidance Manual for Local Government in New Zealand, Ministry for the Environment, July 2008:
MfE July 2008(2)	Preparing for Climate Change; A guide for Local Government in New Zealand, Ministry for the Environment, July 2008.
MfE March 2009	Preparing for Coastal Change - A guide for Local Government in New Zealand, Ministry for the Environment, March 2009.
MfE, 2017	Coastal Hazards and Climate Change, Guidance for Local Government, Ministry for the Environment, December 2017
NIWA 2009	Review of Nelson City minimum ground level requirements in relation to coastal inundation and sea-level rise, NIWA, August 2009
NIWA 2012	Combined wave and storm tide hazard for southern Tasman Bay, NIWA, July 2012
NIWA 2013	MHWS-6 Report for Tasman District Council, NIWA 2013
NIWA 2013 (2)	MHWS levels including sea-level rise scenarios, Envirolink Small Advice Grant (1437-NLCC80), NIWA, November 2013.
NIWA 2014(1)	Extreme Sea Level Elevations from Storm Tides and Waves Tasman and Golden Bay Coastlines, NIWA, 2014
NIWA 2014 (2)	Synthesis of information from several NIWA studies on high-tide, storm-tide and wave setup and run up along the Nelson City Coastline, Letter report for NCC dated 21 July 2014
NIWA 2015	Climate Variability and Change – Tasman District, August 2015, Chappel et al.
NIWA 2015 (2)	Nelson extreme storm tide plus wave setup and runup, NIWA, November 2015

A2013449

Bioretention Practice Note for Nelson and Tasman Councils

1. Introduction

Purpose

This practice note is intended to support the design and delivery of (public) bioretention devices. It also supports the process to obtain consents and engineering approvals. The applicant needs to ensure that requirements in the local Resource Management Plan and Engineering Standards are also complied with.

Table 1: abbreviations used

LDM	Land Development Manual (jointly owned by Tasman and Nelson councils)
ESCP	Erosion and Sediment Control Plan.
ARI	Annual Return Interval
LID	Low Impact Design
TRMP	Tasman Resource Management Plan
NRMP	Nelson Resource Management Plan

To the reader

This practice note is one of several practice notes developed specifically for stormwater management with an emphasis on environmental protection and the mitigation of development related impacts on flooding and surface waterways, including reducing peak flows, reducing spills and reducing water pollution.

The practice notes will be updated as technology and research progresses.

Currently Tasman District Council and Nelson City Council are preparing changes in the RMA plans and are developing a new joined "Land Development Manual" (LDM) replacing the existing engineering standards. It is the intention that these practice notes will be updated to show how to comply with these new requirements once they are operative,

The digital version of the practice note has hyperlinks to enable easy navigation and access more information.

2. Description

Bioretention devices (also called rain gardens) are engineered vegetated systems designed to treat stormwater using the natural physical, chemical and biological processes shown in Fig. 1. Bioretention devices can be designed to: reduce peak flows for a range of storm sizes (through temporary storage); reduce stormwater volumes discharged (through storage, exfiltration and evapotranspiration); and, reduce pollutants (though filtration, sedimentation, absorption and microbial processing). Bioretention is an efficient and highly effective stormwater management practice when key design steps are adhered to.

Bioretention devices are typically designed to capture stormwater from small storms and the initial (first flush) runoff from larger storms. Excess runoff during these larger storms should bypass the bioretention devices and discharge directly to detention basins and/or surface waters via either the piped (reticulated) network or overland flow. Stormwater that enters a bioretention device will either infiltrate into the surrounding soils (where appropriate) or flow via underdrains and outlet works to the piped network and/or devices such as detention basins or wetlands.

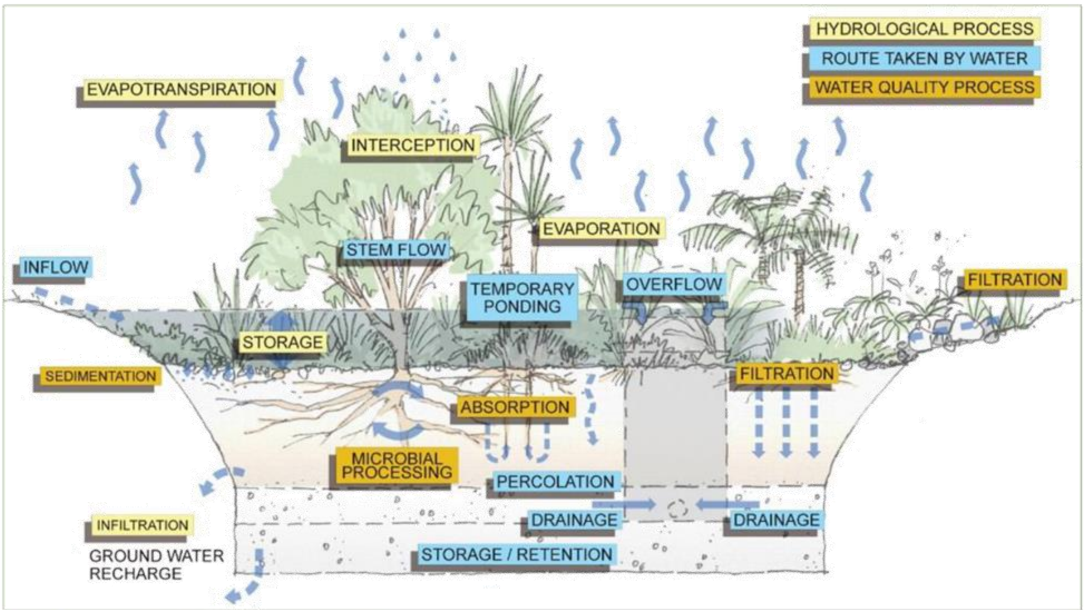

Figure 1: processes in a typical bioretention device

Disclaimer: Although it is the intent for this practice note to comply with the local stormwater LID requirements you always need to ensure that you have met all the requirements in the local Resource Management Plan as well as the LDM.

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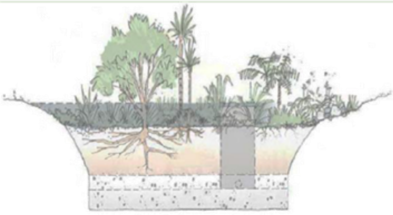
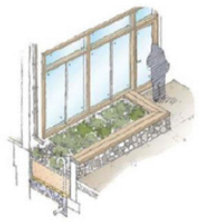
Bioretention Practice Note for Nelson and Tasman Councils

There are a range of applications which are commonly referred to as bioretention devices which are suited to use in the public realm. The most common ones are shown below.

A *raingarden* is a planted filter in which water ponds during rainfall before percolating through the filter media. Raingardens have a specific filter media, storage volume, hydraulic controls (inlets and underdrainage), and specially selected plants to support stormwater treatment. Raingardens must have shapes and inlets that avoid scour and ensure even stormwater loading.	A *bioretention swale* is a linear system, typically used along roads that moves stormwater. Swales have specific filter media in the base and must meet stringent hydraulic controls and plant cover types to avoid scour from high velocity flows. Swales help reduce peak flows by slowing water, but provide limited volume reduction and contaminant removal, however they are effective at reducing impacts of 'spills' and car washing.	*Stormwater planters* are an alternative to a raingarden that is a wholly or partly above ground; almost a 'living water tank'. Planters are large container/confined areas that receive and detain stormwater direct from downpipes. They are suited to treatment of roof runoff in areas where exfiltration is not wanted, such as near buildings. The raised edges can provide separation, security and seating.
		

3. Benefits

Bioretention is one of the preferred methods for stormwater management because they:

- Remove particulate and dissolved contaminants (including sediments, metals, nutrients and hydrocarbons). Bioretention swales are often used alongside roads because of their function and shape, replacing traditional kerb-and-channel design and because runoff from roads is a major contributor to pollution.
- Mitigate the increase in runoff of frequent (small) rainfall events from increased imperviousness. Depending on the design, bioretention can allow runoff to mimic the pre-developed hydrology through detention, infiltration and/or evapotranspiration, therefore reducing scour and erosion in streams and reducing stream animal stress. Bioretention is very effective at intercepting small spills (and detergent/car wash) that can otherwise kill stream life and discolour streams
- Suit inclusion of additional attenuation storage to reduce peak flow rates from larger infrequent events to reduce the risk of downstream flooding and/or to respond to downstream capacity limitations within the primary system.
- Are readily maintainable, so contaminants can be removed, rather than washed into the environment.
- Reduce the temperature of stormwater runoff prior to discharge; this is important for roads and carparks near streams.
- Provide amenity and increased plant cover that contributes to ecological, social, cultural and health benefits.
- Often use the same space as standard landscaping, berms or verges, but are self-watering and self-fertilising (from stormwater), so supports more resilient plant growth.

4. Rules and requirements

In addition to this Practice Note the user/applicant needs to also ensure that any requirements in the operative Resource Management Plans and Engineering requirements are met.

5. Design requirements

The following is intended to guide a design that reflects best practice, will work and is cost-effective to maintain.

This does not include meeting any other requirements; final discretion is with the Council consenting department.

Bioretention devices have a number of key parts as described below; design should be done or peer reviewed by an experienced practitioner.

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Bioretention Practice Note for Nelson and Tasman Councils

a. Bioretention operating layers

The design of bioretention systems requires the design to incorporate specific layers which are fundamental to its performance. These are shown in Fig 2.and discussed in the following sections.

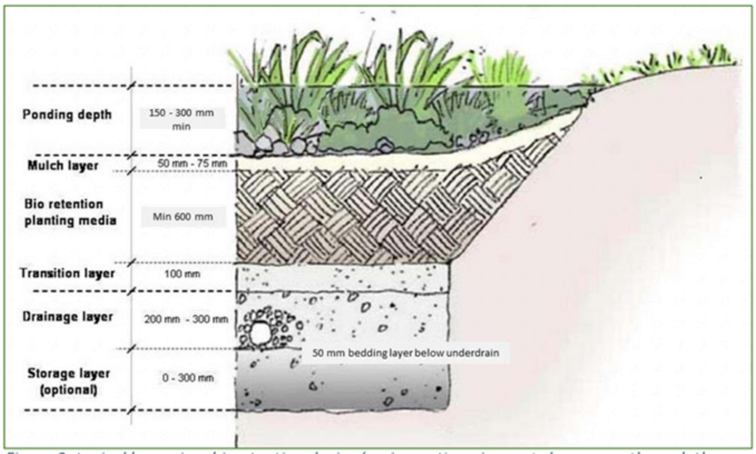


Figure 2: typical layers in a bioretention device (an inspection pipe, not show, goes through the layers and connects into the underdrain)

b. Shape

Whilst the shape of bioretention systems is flexible, it is important to consider the effect on performance. The shape and inlet location shall ensure the full surface of the filter media is covered with stormwater at the design ponding depth and to ensure that inlet velocities and flow routes into the system do not cause surface scour. The shape should protect plants from traffic damage (i.e. minimum 1.5 m width adjacent to parking areas), reduce maintenance (have more 'core' relative to edge), maximise other benefits such as amenity, and provide for cost effective maintenance.

c. Location

Water runs downhill. The device should be located so stormwater from the contributing catchments can enter under gravity. The location should avoid underground and above-ground services where practicable. Where this is unavoidable, the design should reduce the risk of damage to the device during maintenance of the other services (signage, use of conduits, etc.). Avoid putting lighting (especially uplighting), signs and rubbish bins in these devices. Raingardens on street corners add to road safety by preventing parking, creating a physical buffer for pedestrians and narrowing road crossings while also capturing the most contaminated runoff (generated at places where cars turn and brake).

Devices should be least 3 meters from building foundations unless an impermeable layer is used to protect the building, or a stormwater planter is used. Devices must be set back from existing retaining walls a distance equal to 1.5 x the height of the wall unless specific geotechnical design certification is provided. Devices which are adjacent to roads and/or public pathways must consider safety in design, account for surcharge loading from the roadway, and manage the step down to the filter surface through appropriate edge treatments. Access for maintenance is required, in particular the inlet and outlet structures, so setting them at least 1 m back from the edge of active traffic lanes improves safety and can dramatically decrease maintenance costs. Plants require adequate natural light. Raingarden function is enhanced if roots of adjacent evergreen trees can access the devices; large-leafed deciduous trees have potential to block inlets and smother groundcovers at leaf-fall.

d. Road runoff

The grade of the road will affect the design solutions that can be used.

- Bio-retention, is suitable treatment options for shallow grades (<5%) parallel to the roadway. Sometimes it is cost efficient to use swales (horizontal flow only) to convey stormwater to a bioretention device. Swales (and filter strips) only provide for some water quality treatment and cannot be used to reduce volume or flows. Raingardens can be combined seamlessly with swales on shallow grades by varying excavation depth.
- For grades between 5% and 8% check dams and other flow control measures will be needed. Catchment data should be used for site-specific design.
- For grades greater than 8% it is recommended that treatment is offline. This should involve diverting 'first flush' and low flows for treatment using solutions such as stepped rain gardens. Options require detailed site-specific design.
- Minimising impervious areas. Pervious materials may be suitable for drives and light-vehicle parking areas and can reduce the size and cost of a bioretention device.
- Roads are often used as overland flow paths. Some of these might only be used in large storms that exceed the design capacity of the primary system. Location of flow paths should be avoid scouring of bioretention device(s).

e. Size

The size of bioretention systems needs to be proportional to the contributing catchment. This can range from 2 m^2 up to 1,000 m^2 where inflows are from the piped network, appropriate inlet design ensures even distribution across the device. Locally specific analysis to define the preferred sizing method shall also be consistent with the local requirements. Where bioretention systems are provided for water quality only, a minimum filter media footprint equal to 2% of the contributing catchment shall be adopted. Bioretention need to be a minimum width to minimise plant stress and edge maintenance (depending on plant size). Minimum bioretention volume is needed to support trees; large trees may require 10 to 30 m^3, so consider how soils outside the devices can also support tree growth.

Bioretention systems complement detention storage designed to mitigate flooding, downstream erosion or address network capacity constraints. Any such temporary detention storage must be above the top of the normal operating water level (top of operating detention storage) and must only be engaged in events greater than the post developed 2 year ARI event. If this is applied then the hydraulic design needs to show that flood flows do not compromise the working of the bioretention devices. Required volumes for such attenuation must be calculated in accordance with the local requirements.

f. Inlet design

Effective inlet design is essential for a bioretention device to function and be maintainable. Flows can be either concentrated surface flow (i.e. direct from a minimum of two kerb openings/cuts), distributed surface flow (i.e. multiple kerb inlets or sheet flow) or via the pipe network (with inlet diversion structure for large catchments). Bubble ups are not acceptable as they have a high risk of blockage. Up The inlet must be designed to facilitate the managed deposition of coarse sediment and the cleanout of the sediment. This is typically achieved by ensuring a minimum 200 mm wide (a standard shovel width) with 100 mm step down at the inlet to the bioretention surface and a defined sediment deposition zone such as a concrete apron, or (for large systems) a forebay. Bioretention systems shall not be subject to continuous baseflows from catchments with constant flows from contributing streams or groundwater ingress. If possible, high flows should bypass the device. The levels should allow for increasing soil level over time (due to deposition). As inlet design is a common problem, a number of good/bad practice examples are included in section 9.2.

g. Operating detention depth

The operating detention depth is used to increase the efficiency of the bioretention system (through attenuating flows from the first flush and treating through the media) and enable the flows to engage the full filter surface area. The operating detention depth shall be 300mm (excluding mulch) unless there are identified public safety risks or functional constraints which cannot be designed for. In these instances a minimum of 150 mm must be achieved. Note that edges may be battered / sloped to reduce risks of vertical drops. The maximum ponding shall be 350 mm depth. The operating detention depth is controlled by the hydraulic structures (either the crest of overflow manhole or kerb invert to support bypass of peak flows).

h. Mulch layer

Mulches are a 50 to 75 mm deep layer of non-floating organic placed over the surface before or after planting. Inorganic mulches must be washed, i.e. contain no silt or clay. An adequate depth of suitable mulch helps plant establishment by supressing weeds and reducing drought stress. Suitable organic mulches will reduce risk of crusting/sealing and erosion, reduce compaction during planting and reduce surface temperature. The depth of mulch shall be allowed for when setting the overflow level. Mulch must enable new shoots to establish through it. Bark nuggets float and are not suitable. Do not use weed mat or filter fabric under the much layer as they have a high risk of blocking with sediment.

i. Bioretention filter media

Filter medium and drainage specification is fundamental to the performance of bioretention. Filter media must support plant growth (i.e. provide initial nutrients, plant-available water and air) whilst also meeting a prescribed hydraulic conductivity to support the filtration of particulates. This is typically achieved with a sandy loam soil mix. Filter media must be <u>from an approved commercial source</u> and meet the following criteria:

- Hydraulic conductivity of 100-300 mm/hr.
- Sandy loam with clay content of 3–5%
- Organic content of 2-5% (by weight) if no organic mulch or surface amendment used, 1-3% if organic mulch or 50 to 75 mm depth of weed-free compost amendment to the upper 200 to 250 mm of media is used
- pH 5.5 to 7.5, Total Copper <80 mg/kg, total Zn <200 mg/kg
- No added inorganic fertilisers, free of plant pests and diseases, free of building materials.

Media should not generate contaminants and not structurally collapse. The optimal media depth is 600mm. When trees are planted, the depth this should be either increased to 1m or minimum 5m^3 volume provided, or trees specifically enabled to exploit favourable adjacent soils outside the bioretention area (for example, plant trees on the edge of swales, never in the centre). The media surface shall be approximately level (+/-30 mm) to avoid localised blinding, excluding batters. For bioretention swales the surface should be gently sloping with a maximum grade of 2%. Filter media shall be lightly compacted only (single pass of hand roller or saturation and drawdown) with any natural differential settling requiring top up during establishment. Install media in 300mm layers and ensure that the finished surface is completely level prior to planting.

j. Transition layer / bridging layer

A transition layer is required between the filter media and the drainage layer to prevent migration of fines into the drainage layer. A geofabric must **not be used** under any circumstance. The filter zone should consist of 100mm of washed coarse sand (i.e. 5mm washed sand).

k. Drainage layer and under drain

A minimum 200 mm thick layer of clean, washed fine gravel (i.e. washed driveway chip) shall be installed beneath the transition layer to surround the perforated underdrain pipes and provide additional storage zone where included. A minimum 50mm bedding layer beneath the pipe shall be provided. The size of the drainage gravel should be determined by the size of the perforations of the under drain pipe, i.e. d_{85} > 1 x size of the perforation.

Underdrains shall be provided in all bioretention systems even when ground infiltration is used. The under drain should be a slotted PVC pipe with a minimum diameter of 100mm and should have a minimum slope of 0.5%. For filter areas up to 10m^2 a single 100mm diameter pipe will suffice, for areas between 10m^2 and 20m^2 a single 150mm or two 100mm diameter pipes will suffice. For areas larger than 20m^2 a site specific design is required. Under drains should be evenly spaced (1.5 m spacing) along the length of the device and connect to the outlet pipe via a solid pvc collector pipe. The invert level of the outlet pipes will determine the standing water level between events and can be designed to support a storage reservoir within the drainage layer. The standing water level must not extend above the base of the transition layer. Such reservoirs are particularly valuable to reduce drought stress and maximise evapotranspiration for deep rooted plants such as trees.

Where ground exfiltration is desired, ensure the base of the device is roughened with a toothed bucket prior to installation of drainage layer. This helps remove compaction and smearing that otherwise limits exfiltration.

l. Liner

An impervious liner is required when bio-retention is used in geotechnical unstable or steep sites greater than 1V:5H. Systems may also be lined to support a permanent saturated storage zone at the base of the bioretention to enhance nutrient removal (through anoxic conditions) and provide a water source during prolonged dry spells. Liners can be compacted clay (either imported or in-situ), synthetic clay liners (GCL) or polyethylene (HDPE or heavy duty PE sheets).

A permeable geotextile liner must be included where bioretentions are constructed on dispersive clay soils to prevent migration into the drainage layer.

m. Root barrier

Where trees are included in bioretention systems, consider species tolerance of significant root disruption during replacement of filter media. A root barrier should be used to identify extent of media removal but should not surround the tree (i.e., allow root movement to adjacent suitable soils). The use of a perimeter root barrier can be used to protect sewers, or foundations which are likely to be at risk from root penetration. The root barrier should only be placed adjacent to the services which require protection and not around the whole device. A better approach is to place services in conduits at the time of construction.

n. Plants

Bioretention devices rely on very high plant cover between 200 to 600 mm height to protect the surface (maintain infiltration rates), support bio-chemical treatment of contaminants, prevent weed growth and keep people/traffic out of the device. Plants must be able to tolerate short periods of inundation with silty water and saturated soils along with longer dry periods. Bioretention plants should be perennial, evergreen and live at least ten years, although up to 10% other species is permissible (for colour and seasonal interest). Most suburban raingardens have low contaminant loading and are likely to last at least 50 years before renewal, so consider landscape succession. Using a variety plant species in a device increases resilience and probably enhances performance. The majority of groundcover plants should have deep, fibrous root systems and spreading or creeping growth form with many anchoring points, rather than clumped growth forms. Sightlines, operations and maintenance consequences should be considered, particularly for plants along road or footpath edges. Native plants are preferred but not essential. A high density of planting with small to medium grades of groundcover (e.g. 5 to 9 root trainers/m^2, or 3 to 5, 1 litre pots/m^2) will be most resilient to drought and weeds. Large grades of plants are vulnerable to poor weather during establishment.

A separate comprehensive planting list is attached which has species, key attributes, operation and maintenance implications, etc. If plants are chosen from this list then approval from council can be assumed although alternatives can be proposed (discretion of council). Case studies from Nelson Tasman should be visited to assess plant aesthetics and maintenance; see http://nelson.govt.nz/assets/Environment/Downloads/Water/freshwater-working-groups/Applying-Low-Impact-Designs-in-Nelson-Tasman-Landcare-Report-August-2016.pdf

o. Flushing/inspection riser

A solid drainage pipe extends to the surface with an inspection opening which also allows flushing of sediment from the under-drain. Inspection risers in mown grass areas need to be physically protected from mowers and weed whackers (e.g. with rocks/concrete nib), or placed flush with ground surface with a curb-marker (stamp) identifying its location.

p. Infiltration and geotech

The infiltration of treated stormwater into the surrounding soils is supported where the underlying soils are suited to infiltration to support stream base flows and will not adversely impact on adjacent properties or land. An impermeable liner is required to avoid infiltration in locations where slopes are greater than 1:5 (20%) or geotechnical unstable layers exist. In situations where nitrogen loads are expected to adversely impact on the receiving environment the use of an impermeable liner beneath the bioretention will support anoxic conditions and improved treatment performance through enhanced denitrification. This is referred to as a saturated zone bioretention. In such cases a wood chip amendment to substrate also enhances performance

q. Overflow

Even where a bioretention is configured to be off line, overflow must be allowed for (to address long duration and very intense events). Ideally high flows should be by-passed to a discharge point located outside the bioretention device (such as standard sump downstream of the inlet). Overflows located within the bioretention can comprise a raised manhole which connects into the underdrains or an overflow weir which connects back to the surface network at the downstream end of the system. As outlet design is a common problem, a number of good/bad practice examples are included in in section 9.2.

r. Maintenance Access

Suitable, safe access needs to be provided for routine maintenance appropriate to the size. Consider safety in design, including parking, pedestrian and vehicle sight lines and CPTED. Maintenance is more efficient if inlets and overflows are readily visible from a distance and at least 1 m from active road edges on corner bioretention. Inlets should be have a flat base at least a shovel width across 200 mm).

s. Protection

The design (shape) and planting plan must prevent vehicles driving through or parking on the bioretention devices and/or pedestrians walking through to avoid compaction and damage to plants and soil. Create raised crossings along pedestrian 'desire lines', for example adjacent to shop entrances or adjacent gates.

6. Construction

Although bioretention devices should not be fully built until the rest of the site has been constructed and the site stabilised (about 80% build-out), this rarely happens in large subdivisions. During the bulk earthworks and initial building phase the footprint should be excavated and can be configured as sediment control/capture devices as part of the Erosion and Sediment Control Plan (ESCP). The ESCP must consider the sensitivity of the receiving environment and ensure that protection is provided during the building and establishment phase. If the bioretention device is constructed before the rest of the site is stabilised then cover the substrate with a geotextile and rolled turf. Trees can be planted at this stage if they are physically protected. Once buildout is achieved the turf and geotextile is removed and planting completed. Filter socks are to be used across all inlets during these construction activities.

7. Handover

Plant establishment is critical for a bioretention device to perform. Plants shall be maintained by the developer/contractor for 24 months from the time of practical completion (establishment phase). This shall include weed control, replacement of unhealthy plants and rectification of any construction flaws. At the time that bioretention device is vested to Council all plants must have been growing for at least 3 months and be in good condition as per the design intent and/or a defect liability and bond details where applicable.

Checking is required at several stages during the construction to ensure the bioretention devices is constructed to specifications. At the hand-over stage particular attention is required to ensure the establishment phase is managed (e.g. by taking a bond) and that plant health is satisfactory.

8. Responsibility and maintenance

This practice note only covers publically vested bioretention devices or bioretention devices jointly owned and managed through a body corporate or institution that can be expected to be able to operate and maintain the device (council discretion).

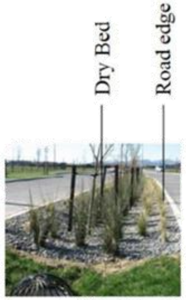
One of the important considerations with bio-retention devices is long-term maintenance. A bio-retention device is a garden and not just a drainage system – they are generally low maintenance, not NO maintenance. They need water when it doesn't rain until the plants are established. During dry periods the under drain in the bio-retention devices may cause the planting soil to dry out. Watering the vegetation on an as needed basis helps ensure a healthy condition and appearance. Maintenance will include:

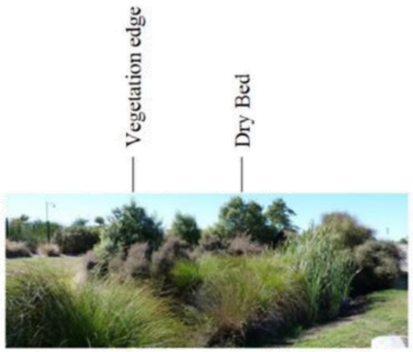
- ~ Weed regularly (particularly during establishment) to maintain amenity, prevent weeds flowering or seeding (build-up of a seed bank), and to ensure rapid establishment of dense cover of desirable plants. Weeds tend to establish at inlets due to seed loads in sediment in bright light (not shaded by desirable plants).
- ~ Ensure that inlets are clear of accumulated sediment and/or plant growth or leaves (especially in autumn)
- ~ Ensure the outlet is not blocked. If underdrains become blocked, use the inspection pipe to clean with water jets or rodding.
- ~ If water ponds on the surface for more than 24 hours, check for a crust formed by fine sediments or concrete wash accumulating on the surface; these can be raked (to break any crust) or scraped off where deeper.

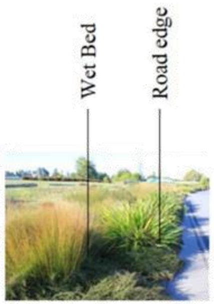
- ~ Don't park or drive on the device as this causes compaction and leaves ruts. If the device is mown, compaction is likely under wet conditions – ensure the grass is at least 80 mm height and dense (do not spray broadleaf weeds – hand weed)
- ~ Plant health is an indicator of system effectiveness. Plants along edges are likely to require trimming; trees are likely to require removal of staking, pruning (particularly crown lifting to maintain sightlines) or thinning from time to time.
- ~ Do not fertilise or add pesticides such as slug bait.
- ~ Strong water flows may cause erosion, particularly at inlets. Erosion will need to be repaired and measures put in place to prevent recurrence (for example, removing inlet constraints, creating wider inlet or adding rip rap).
- ~ Remove rubbish, litter and debris, however, dead plant leaves can be retained, tucked out of sight where they contribute to stormwater attenuation.

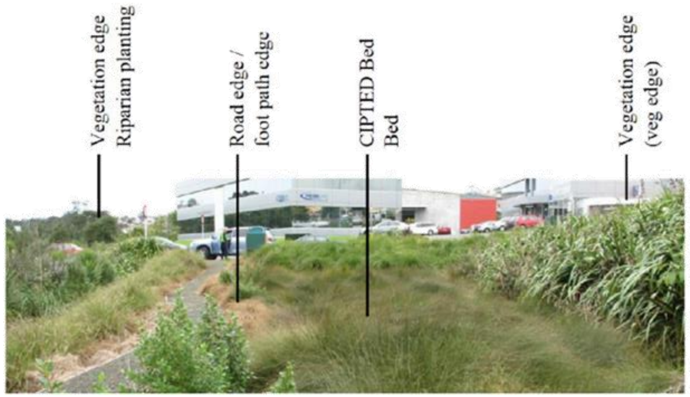
9. Attachments

9.1. Plants for Nelson/Tasman stormwater bioretention









NOTES:

Match plant size to location within the bioretention device as shown above. The width and height of plants along edges with roads or foot paths has a huge impact on maintenance costs. Upright and shorter plants require less trimming. The photos above show key plant selection zones: road 'edge', wet or dry swale 'base' or bed through which water flows (requiring dense ground covers that filter water and avoid deflecting or concentrating water flows), a 'CIPTED' bed that allows open views across the devices (and can include trees or shrubs that are narrow or have trunks with clear 2 to 2.5 m trunks to maintain views and light levels to ground cover plants) and 'vegetation edge' that abuts taller landscaping elements (allowing plants that 'flop', or are bulkier).

Match plant species to site conditions. The species below have been selected based on performance in silt loam and sandy soils in Nelson/Tasman, however the level of drought stress varies across devices with changes in soil depth, organic content and temperature. Salt wind and frosts are also site specific.

Most groundcover plants listed below are at least 400 mm tall, but less than 1 to 1.3 m at maturity, and form dense cover that is able to supress weeds that require light to grow. Smaller groundcovers can be used where a higher level of maintenance is agreed: these include smaller sedges such as *Carex comans, C. buchananii* , *C. flagellifera* and *C. petriei* , rasp fern, and many creeping herbs: *Acaena species (bidibid), Dichondra repens, Centella uniflora, Cotulas, Leptinellas, Lobelia angulate, Mazus radicans, Muehlenbeckia axillaris, Sellieria radicans* In sandy coastal carparks in Nelson, *Euphorbia glauca* has been used as an attractive component with the tree *ngaio (Myporum laetum)*. Grasses that may be mistaken for weeds, such as *Poa imbecilla, Hierochloe redolens, Lachnogrostis, Microlaena stipoides* and *Rytidosperma*, have not been included.

Links for further information, including sourcing, planting timing and methods are given below. However, note that planting in all bioretention devices should be staggered, in clusters to specifically **avoiding lines** as these may concentrate water flow and lead to erosion. High plant density at inlets helps reduce erosion risk. Where pukekos are present larger plant sizes and specific planting methods may need to be used to prevent plant removal.

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Bioretention Practice Note for Nelson and Tasman Councils

~ Nelson Living Heritage plant guide: http://nelson.govhttp://nelson.govt.nz/assets/Environment/Downloads/living-heritage-nelson-native-plants.pdf
~ Back yard biodiversity in Canterbury http://www.lincolnenvirotown.org.nz/assets/Uploads/docs/BackyardBiodiversityBookletWEBMarch2011.pdf
~ Landscape and ecology values within stormwater management http://www.aucklandcity.govt.nz/council/documents/technicalpublications/TR2009083.pdf
~ How to put nature into our neighbourhoods http://www.mwpress.co.nz/__data/assets/pdf_file/0015/70503/LRSS_35_nature_neighbourhoods.pdf
~ Nga Tipu Aotearoa – New Zealand Plants http://www.landcareresearch.co.nz/resources/data/nzplants

Table 2: Planting list for stormwater bioretention. ***Bold plants indicate suggested use as dominant components****, (N) indicates plant recommended in Nelson's Living Heritage Guide.*

Groundcover plants	*Anemanthele lessoniania*	bamboo grass (N)	0.9 m with taller flower spikes best planted in raingardens with better soils and fertility (less stressful)
	Apodasmia similis	jointed rush (N)	0.5 to 1.3 m rush, very weed resistant once established and tolerant of a wide range of conditions but naturally found in saline environments; select upright and shorter forms available in Nelson. Will smother other plants in tough sites.
	Astelia fragrans	astelia, kahaka (N)	1.5 m spreading 1.5 m lilly, highly aesthetic, berries, use as minor component in moist sites (not very sandy media), establishes slowly; *Astelia grandis* is suitable for very moist sites
	Austroderia richardii	South Island toetoe (N)	2 m spreading 2 m tussock was *Cortaderia.* very sensitive to glyphosate, too large for bioretention less than 3 m width or adjacent to road sight lines. Use as scattered plants within shrubs.
	Austrostipa stipoides	Estuary needle grass (N)	0.7 M, grass with very sharp tips, hard to weed but useful to exclude people
	Blechnum novae zelandiae	kiokio (N)	1.5 m fern, new foliage is attractive red, use as minor component in larger, moist or shaded raingardens as tends to establish slowly
	Carex geminata	cutty grass, rautahi	0.8 m tussock with sharp edges helps keep people out of swales
	Carex lessoniana	rautahi	1.0 m green tussock-sedge
	Carex secta	purei, makura (N)	2m green tussock-sedge when mature, not suitable for swales as forms a trunk, too large for bioretention cells less than 2.5 m width; check sight lines
	Carex testaceae	speckled sedge	0.5 to 0.7 m, moderate drought and waterlogging tolerance so for sites with richer soils, edge plant where no glyphosate is used
	Carex virgata	purei, makura (N)	1m sharp-edged sedge, often used in swales, grows fast and will smother other plants in high fertility conditions
	Coprosma acerosa	sand coprosma	0.2 to 1.2 m depending on cultivar – a wide variety of leaf colours available as with other ground-cover coprosmas, and nearly all have performed well in Nelson / Tasman (see photos)

Bioretention Practice Note for Nelson and Tasman Councils

	Coprosma repens	taupata (N)	Prostrate forms have been successful in Nelson coastal raingardens where there is no frost, but are not local, otherwise use *C. acerosa*
	Chinochloa rubra	red tussock	1.2 m tussock suits frosty sites with moderate to high moisture (not droughts or salt). Highly attractive, long lived tussock.
	Cyperus ustulatus	umbrella sedge, upoko tangata (N)	0.8 to 1.5 m, very sharp-edged sedge, deciduous so can look messy, minor and tough to weed amongst
	Dianella nigra	**turutu, NZ blueberry**	0.5 to 0.8 m lily with blue berries, a useful and widely used edge plant
	Eleocharis acuta	spike sedge	0.5 m suits base of wet, narrow swales as has low drought tolerance
	Ficinia nodosa	**knobby clubrush (N)**	0.6 to 1 m green-orange sedge (edge) with high drought and salt wind tolerance, unsuitable for base of wet swales
	Hebe species	koromiko	Variety of heights to 3 m depending on species and cultivar that require well-drained raingardens, not suitable for swales
	Juncus australis	rush (N)	0.6 to 1.2 m hardy rush for swales may be seen as weed by farmers, will invade swales near pasture with seed sources
	Juncus edgariae	wiwi, common rush (N)	1.5 m spreading 1 m for swales
	Lepidosperma australe	four square sedge	0.6 m upright sedge with high drought tolerance for swales
	Libertia peregrinans *L.grandiflora/L. ixioides (N)*	NZ iris	0.5 to 0.7 m tussocks with white flowers and attractive short seed heads; an edge plant that spreads by seeds and rhizomes. Plant with scrambling 'gap fillers'; not suitable with deciduous trees as hard to remove weeds/rubbish without pulling out clumps
	Phormium cookianum	whārariki, coastal flax (N)	1 to 1.5 m but size varies with cultivar; consider length of flower spikes where adjacent to paths or roads (1.5 to 2 m); remove larger plants at 12 months
Shrubs and Trees for larger bioretention areas, particularly along edges and adjacent areas where roots can enter bioretention to enhance recovery	*Coprosma propinqua*	Mingimingi (N)	6 m narrow, small-leafed shrub with berries and high tolerance of drought, moisture, salt and wind. Space out to maintain sight lines
	Carpodetus serratus	putaputaweta (N)	Small tree to 10 m can be covered in small white flowers attractive to insects, mainly better draining but moist soils
	Coprosma tenuicaulis	Swamp coprosma, hukihuki	3 m tangled but upright shrub with black berries for wetter swales provides interest and diversity in wetter swales
	Cordyline australis	ti kouka, cabbage tree (N)	Narrow, architectural tree to 12 m tolerant of wind, provides fragrant flowers and fruit for birds and insects but little shade. Plant at least 3 m from any mown areas as leaves damage mowers

of stormwater detention volumes	*Dacrycarpus dacrydioides*	kahikatea, white pine (N)	Noble, slow-growing, tall tree (20-30m), plant where weeds can be maintained for at least 3 years
	Hebe stricta var, atkinsonii	n/a (N)	Fast-growing shrub with large 'bottle brushes' of white flowers; other hebes are also used in Nelson; select cultivars with heights that will maintain required sight lines or confirm maintenance allows trimming (e.g. hedge)
	Hoheria angustifolia	houhere, narrow-leafed lacebark (N)	Small tree to 10 m with tangled juvenile form
	Kunzea ericoides	kanuka (N)	Small tree to 10 m for drier raingardens with abundant, small white flowers
	Leptosopermum scoparium	manuka, teatree (N)	Small tree to 8 m with abundant white flowers (or pink to red if cultivars are used) produced over a long period, tolerant of compaction and full sun
	Phormium tenax	harakeke, flax (N)	2 to 2.5 m monocot clump; plant at least 3 m from paths or roads, do not use in swales, too large for bioretention less than 4 m width or adjacent to road sight lines
	Plagianthus regius	manatu, lowland ribbonwood (N)	Small tree to 15 m
	Sophora microphylla	Kowhai (N)	Small tree to 10 m, attractive to tui, bellbird (nectar) and keruru (leaves) but needs reasonably free drainage, not ponded water

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Bio retention checklist

9.2. Good and bad practise examples

	Good example Large bioretention retrofitted into heritage landscape feature. Bioretention utilises existing formed edges to create ponding with dense plant cover
	Bad example Raingarden undersized for its catchment and landuse (high traffic road with increased loads). Lack of surface vegetation and maintenance results in reduced infiltration rates and surface ponding. Poor landscape outcomes
	Bad example Levels of raingarden not able to receive inflows from kerb resulting in excessively dry media and poor plant health. Contaminants (and flow) bypass system.
	Bad example Use of gabion at inlet results in blockage which is difficult to rectify. Ultimately inlet is restricting inflows into system. Worsened by significant deciduous trees in immediate catchment and lack of sediment control in development building phase

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	Bad example Sloped raingarden surface prevents engagement of full filter media area and reduces the detention storage volume. Raingarden effectively overflows from lower corner with uncontrolled flow across footpath.
	Bad example Stormwater catch pit located immediately upstream of raingarden. Flows unable to enter raingarden resulting in negligible treatment and poor plant growth.
	Bad example Small raingarden inlets prone to rapid blockage and difficult to maintain. Ultimately prevents flow entering system and therefore prevents treatment.
	Bad example Small raingarden inlets prone to rapid blockage and difficult to maintain. Ultimately prevents flow entering system and therefore prevents treatment.
	Bad example Lack of detention depth and step down from road surface results in plants blocking inflows

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Bio retention checklist

	✗	Bad example Small raingarden inlets prone to rapid blockage and difficult to maintain. Ultimately prevents flow entering system and therefore prevents treatment. Worsened by position on busy arterial road preventing easy maintenance.

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Bio retention checklist

The most common bioretention devices: raingardens, bioretention swales and stormwater planters.

Wooden stormwater planter showing key features from left to right: Outlet of underdrain (to rock-mulched surface swale); a PVC pipe with perforations spreads stormwater evenly, avoids erosion, and is detachable for cleaning; the overflow and black plastic-lining that is waterproof with swale in the background; the wooden box integrated into decking with white inlet downpipe. The plants are oioi (*Apodasmia similis, left*), *Sellieria radicans* (centre), and a perennial, non-native lilly (right).

Stormwater planters and planter-possibilities: left – downpipe scuppers discharge onto rock-rip rap which removes energy from stormwater before it flows into planted bed; metal lining creates a hard-wearing edge against the building. Centre – This Nelson pool has planter boxes that could be easily re-purposed as planter boxes to capture runoff from the white downpipe. Right – Runoff from this Nelson carpark could be treated in the planter given suitable inlets and sub-drainage.

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Bio retention checklist

Bioretention swale about six months after planting and after about three years; plants on the well-drained edges are prostrate Coprosmas, prostrate manuka, mountain flax and scrambling pohuehue, with oioi in the wet base of the swale.

Raingarden treating parking lot runoff shortly after planting, showing the overflow, and after about three years; a diverse range of native groundcovers is used including coprosmas, shrubby pohuehue, sedges and Astelia, with lancewood providing interest.

Bioretention can be located to provide multiple benefits: these three locations protect pedestrians from traffic, maintain clear views of intersections by preventing parking, and also receive the dirtiest runoff (corners are where brakes and tyres are worn, and spills are most likely to occur). Left – bump out in Nelson city could be converted to a raingarden; centre – bump out raingarden protects a bus stop and pedestrian crossing (Portland, Oregon, before planting); right – turn around raingarden with edges protected by boulders (North Harbour residential development).

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Bio retention checklist

Effective placement of bioretention. Left – bioretention in a public through fare separates cycle parking from pedestrians ; Centre and right – bioretention set back from the road edge allows people to get out of cars and reduces need for traffic controls when trimming vegetation / removing litter (Portland, Oregon and New Lynn Auckland)

Edge details are important. Left – raised edges with colour differentiation from the pavement reduce risk of pram and pedestrian entry in this public space (Adelaide Zoo); centre – tall concrete edge creates car and cyclist hazard, and high-maintenance grass strip between footpath and device (Auckland); right – sharp drop, colour contrast and bollards along edge of large raingarden that receives runoff from downpipe (with boulders to dissipate energy)

Narrow bioretention and small cell on corners with no protective edges are highly vulnerable to traffic damage

Disclaimer: Although it is the intent for this practice note to comply with the local stormwater LID requirements you always need to ensure that you have met all the requirements in the local Resource Management Plan as well as the LDM.

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Bio retention checklist

TREE PLACEMENT

Left – placing trees between raingardens helps anchor trees and reduces damage to trees if raingardens are rejuvenated; the sloping sides at this site allow concrete retaining to be reduced. Right – bioretention swale showing underdrain and clean gravel drainage layer during construction. Deeper areas (foreground) support trees with 1000 mm media; between the trees the depth is 600 mm (photo by Chris Stumbles). Right – existing trees are incorporated into raingardens with a temporary cover of coir matting preventing weed establishment until planting.

INLETS

Inlets must be large to avoid being blocked by litter (fast food outlet in left photo) or leaves, especially if deciduous trees are nearby. Plane trees have large leaves and meant the inlets in the centre photo needed at least weekly maintenance. Inlets can be created by having gaps between bricks, but in this case the gap is too narrow (right)

These inlets are too narrow. Centre – an innovative cap allows for stencilling stormwater information but increases risk of blockage. Right – placement of stones reduces potential scour at the bioretention side of the inlet.

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Bio retention checklist

A 50 to 100 mm drop over concrete allows sheet flow into these swales planted with scrambling pohuehue and pohutukawa trees (left, Auckland), low sedges and taller rushes with kōwhai and ribbonwood trees (centre, Lincoln, Canterbury) and mountain flax and pohutukawa (right, Waitakere).

In the absence of a vertical 50 to 100 mm drop into a swale, physical barriers are usually important to exclude vehicles. Left – boulders used (Nelson); centre – bollards used (Melbourne); right – a clever use of curbs around trees (Nelson)

Physical protection and effective drop into a grass swale planted with totara (Manukau), trees should be planted on the sides of a swale as shown in Saxton Fields (centre). Trees should not be planted in the centre of swales as 1) the surface rises with tree age 2) bare sprayed areas around tree bases should not be in the main flow path (right, Stoke).

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Bio retention checklist

Non-floating mulches include shell (left, Nelson port) and composted, stringy bark (centre, Stoke). Bark nuggets (right) should never be used where water will float or pond as they are prone to floating.

Common faults. Inadequate planting density in swale base and rock mulch that is too big to allow rushes to spread (Left), planting in rows that leave the vital central area bare (centre) and using plants that flop over areas that require clear passage (right). These plants need cutting 2 to 4 times a year so are expensive to maintain.

NELSON PHOTOS

Left – Nelson has a range of upright, smaller stature oioi that create a weed-resistant cover with reduced trimming requirement (left, Mitre 10 Nelson). Centre – placement of seating over the garden edge protects the garden from damage and creates a sense of enclosure (Stoke, not bioretention, but could easily be). Right – small sedges (*Carex testaceae*) form a shorter, low maintenance edge to a pathway. The sedges are protected from invasion from adjacent oioi by a concrete nib (Stoke).

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Bio retention checklist

Attractive plantings in dry detention basins / overland flow paths, Stoke using mainly flax and sedges with cabbage trees. The drier 'riparian' areas include colourful flowering hebes and manuka with kowhai and ribbonwood trees.

Nelson/Tasman Bioswale plantings. Left – stakes are used to allow fast identification for efficient weed control during establishment of this swale. Centre – a low-maintenance edge of gravel-mulched, short turutu (Dianella nigra) and taller oioi and knobby clubrush (Ficnia nodosa) in the centre. Right – *Cyperus ustulatus* in the centre of this raingarden is considered 'messy' by some people and may require removal of seed-heads to achieve suitable aesthetic outcomes in some localities.

Plant species used in drier bioswales and raingardens include shrubby pohehue (*Meuhlenbeckia astonii*) and Libertia species (here at Tahuna), although Libertia can be difficult to weed (left), small sedges and oioi (centre, Stoke). Right – some Hebe species and cultivars can be used to form short, fast-growing hedges with abundant flowers

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Bio retention checklist

Prostrate, dense Coprosma species and cultivars are useful plants for bioretention: left – Coprosma acerosa, centre – Coprosma acerosa 'Hawera', right - Coprosma repens 'Poor Knights' has glossy, bright-green leaves (Nelson Port), a taller olive-brown Coprosma lies behing.

Avoid planting lowland flax within 2.5 to 3 m of paths (Stoke cycleway

9.3. Acknowledgements and source references

The Practice notes were developed by Morphum Environmental with input from Robyn Simcock from Landcare related to planting specifications and overall peer review.

These practice notes including graphic are largely based on information from the North Shore City Council Bioretention guidelines (2008), the Long Bay Practice Notes developed for North Shore city Council by D & B Kettle Consulting Ltd (2011) and the Bioretention Practices Notes for Hamilton City Council (2016).

9.4. Version, version control and change comments

The Practice notes were developed by Morphum Environmental with input from Robyn Simcock from Landcare related to planting specifications and overall peer review.

Summary of changes

Version	Date	comments
0.1	24 January 2017	First draft for comment from the Industry
0.2	12 June 2017	Second draft including planting requirements
1.0	16 June 2017	Immediate Release version, showing good practice, independent of local requirements

9.5. Want to know more?

There is a lot of information available related to Low Impact Design (LID, or Water Sensitive Urban Design (wsud). Underneath are few references. It should be noted that all info in these documents is not necessarily agreed, up to date and/or applicable in the Nelson/Tasman area and that the application of LID is evolving over time.

Landcare / Morphum Ltd: "Applying Low Impact (Water Sensitive) Design in Nelson Tasman", June 2016. A review of LID practices in Tasman and Nelson and issues experienced by council and the industry. Includes description of many different LID devices and recommendations for improvement.

All Hamilton practice notes can be found on the Hamilton Council website

Auckland council "Water Sensitive Design Guide GD04". An online resource, including background and wider design approach.

CRC for Water Sensitive Cities: "Adoption guidelines for stormwater biofiltration systems – Summary report"

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Wetland Practice Note for Nelson and Tasman Councils

1. Introduction

Table 1: abbreviations used

LDM	Land Development Manual (jointly owned by Tasman and Nelson councils)
ESCP	Erosion and Sediment Control Plan.
ARI	Annual Return Interval
LID	Low Impact Design
TRMP	Tasman Resource Management Plan
NRMP	Nelson Resource Management Plan

Purpose

This practice note is intended to primarily support the design and delivery of constructed wetlands for stormwater treatment for water quality improvements. The applicant needs to ensure that requirements in the local Resource Management Plan and Engineering Standards are also complied with.

Where appropriate wetlands are also very well suited to be co-located with additional detention storage as part of flood mitigation, network capacity constraints or to reduce scour in downstream waterways. The design of such detention must be undertaken with due consideration to the critical wetland design elements which support water quality treatment as a priority. Whilst the design of detention storage is discussed at a high level in this document the specific design requirements and sizing are addressed in the LDM and the detention practice note.

To the reader

This practice note is one of a number of practice notes developed for stormwater management.

Please ensure this is the latest available version of the practice note. The practice note will be updated as technology and research progresses.

Currently Tasman District Council and Nelson City Council are preparing changes in the RMA plans and are developing a new joined “Land Development Manual” (LDM) replacing the existing engineering standards. It is the intension that these practice notes will be updated to show how to comply with these new requirements once these are operative.

The digital version of the practice note will include hyperlinks to enable easy navigation and to find more information elsewhere.

2. Description

Wetlands are devices with variable depths of permanent water and high cover of aquatic plants that use a combination of physical, chemical and biological processes to remove contaminants from inflowing and impounded waters. As a stormwater best management practice, the use of wetlands world-wide, and within New Zealand, is increasing due to their water storage, purification and contaminant removal characteristics (their primary purpose and function), and also their secondary benefits, including provision of wildlife habitat, ecosystem goods and services and amenity value. When designed and constructed appropriately, stormwater wetlands are visually appealing stormwater treatment options, improving public amenity and ecological values of urban environments.

Wetlands covered in this practice note are for the treatment of urban runoff and are not intended for treating tradewaste discharges, wastewater, agricultural/horticultural runoff or high sediment loads from construction sites. Wetlands can be configured to provide some or all of a catchments additional infrequent flood detention requirements and can replace more traditional detention basins with appropriate design considerations. The feasibility and suitability of this depends significantly on site specific considerations such as topography, drainage inverts, public safety and integration with whole of catchment planning. Any instances where the wetland footprint is to be inundated during flood events must ensure that protection of the wetland is a priority. This is achieved through ensuring that the wetlands remain offline and that flood engagement is through backwatering within the high-flow bypass channel or downstream network rather than uncontrolled discharge into the forebay.

3. Benefits

Wetlands are one of the preferred methods for stormwater management at a larger scale and are suited to treating flows from large development areas or large piped networks. The benefits of constructed wetlands include;

- **Quality**. The inherent physical, biological and chemical treatment mechanisms and symbiotic processes in a vegetated wetland support the removal of a wide range of typical urban contaminants. The principal physical, chemical and biological removal mechanisms include sedimentation, adsorption, precipitation and dissolution, filtration, bacterial and biochemical interactions, volatilisation, and infiltration. The hydraulic retention time (the time stormwater remains in the wetland) is important to achieve a good treatment outcome. The hydraulic retention time can be expressed as the ratio of the mean wetland volume to mean outflow (or inflow) rate. Similarly, the hydraulic efficiency within a wetland is based on maximising the contact time of untreated water with the wetland vegetation and the removal mechanisms which it supports. This is achieved through ensuring that short-circuiting is avoided and that flows are dispersed across the full width of the wetland to maximise plant contact. Dense cover of emergent vegetation and planting of suitable riparian shade trees reduces the temperature of treated outflows.
- **Quantity**. Stormwater wetlands provide some inherent downstream scour protection by slowing down and attenuating flows during rainfall events. Designed extended detention volume helps lower peak flow discharges and can attempt to mimic ‘natural’ discharges during frequent rainfall events. Wetlands can be designed as part of a larger ‘flood control basin’ or to

reduce flows and volumes to protect downstream environment from erosion. Flow velocities through the wetland must be managed to reduce the risk of scour of plants and biofilm or the suspension of entrained sediments.

- **Ecosystem Services**. Along with supporting a relatively high diversity of flora, fauna and fish, wetlands are recognised for having important roles in 'ecosystem goods and services'
- **Amenity**. Well designed and maintained, functional wetlands integrate well into existing landscapes. Design can range from very natural looking wetlands to contemporary landscape features used in urban centres. Landscape amenity is key to the overall success (and acceptance) of wetlands and should be considered throughout the design process.
- **Operation and maintenance**. Wetlands (where designed, constructed and operated properly) require less maintenance and are less expensive to maintain than other traditional treatment systems. Keys are fast establishment of plant cover and early maintenance to minimise weeds.


Examples of detention basins with healthy wetland plants in Tasman (left) and wetland in Nelson (right), 2017

4. Rules and requirements

In addition to this Practice Note the user/applicant needs to also ensure that any requirements in the operative Resource Management Plans and Engineering requirements are met.

5. Design requirements

The following is intended to guide a design reflect best practice, that work and are cost-effective to maintain.

This does not include meeting any other requirements; final discretion is with the Council consenting department.

Wetlands are complex and design shall be undertaken or peer reviewed by an experienced and qualified practitioner. Fundamental design considerations on key components are provided below.

1. Location considerations

Table 2: location considerations

Item	Consideration
Drainage	Ensure the target catchment is able to drain (by gravity) to the wetland preferably through a single inlet with an invert which enables the footprint to be achieved with efficient earthworks. Ensure the proposed outlet level (i.e. invert of receiving drains and/or watercourse) will enable drawdown of the wetland to at least the normal water level (NWL) during normal operating conditions, and allow control of water level during establishment so that extended detention is NOT used until plants are established/12 months old.
Discharge	Ensure that the discharge is suitable for the receiving environment. Consider appropriate mitigation standards for water quality, including temperature, and any additional detention requirements.
Maintenance access	Consider how machinery will access the wetland for construction and maintenance, including clean out of the sediment forebay and potential drying/storage of excavated materials (See also page 12)
Pre-treatment	Ensure a forebay is incorporated into the design unless approved catchment pre-treatment is provided. Pre-treatment may include swales and raingardens (See also page 8)

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Item	Consideration
Offline and bypass	Vegetated wetlands shall be placed offline to the main channel/reticulated pipes for peak flows. Allowance must be made for appropriate bypass or high flow diversion upstream of the wetland (see also page 11). If the Wetland is to be integrated with any detention storage, this must be provided entirely above the top water level for water quality purposes and must ensure that the wetland is protected from high velocity flows in accordance with this practice note.
Draw down	Wetlands must be free draining by gravity to at least the NWL. Allowance shall be made for draining the wetland for maintenance and to periodically support plant succession following seeding. The forebay should be able to be drawn down (either by gravity or pumping) independently from the remainder of the wetland through the inclusion of an impermeable earth bund or similar.
Lining	Wetlands must be lined to at least the NWL with an appropriate impermeable liner to prevent water losses. Lining can be either compacted clay (*in situ* or imported) or synthetic products such as geo-synthetic clay liners (GCL) or HDPE in accordance with manufacturer's specifications. (see also page 13)
Water table	Where wetlands shall be constructed above shallow water tables, attention must be given to constructability and issues with lining. Construction timing (when groundwater recedes) or synthetic liners may be required.
Underground services	Contact utilities (power, water, gas) and check with the council for locations of underground services in your area. If underground services are near or in the proposed wetland location, consider relocating the wetland away from these services. If relocating is not an option due to site constraints, agreement on solutions will need to be arranged with asset owners/managers. Risks of compromising the device when maintenance of the other service is required can be reduced by using signs, conduits, using walkways or overflows as access points/protection etc).
Setback	Wetland areas shall be located at least 1.5 m from property boundaries. Wetlands shall not be located within a 1V:1.5H plane taken from the toe of any retaining wall without geotechnical certification confirming long term stability.
Overhead setback	Trees located to the north and west of the wetland and around any open water areas provide valuable shading, reducing water temperatures. Provide overhead setbacks to ensure mature trees do not interfere with utilities such as power lines. Relevant utility managers must be consulted for up to date guidance on setbacks etc.
Contaminated land	Contaminated soils cannot be used for wetlands. Excavations required for wetlands may therefore pose a financial risk as such material must be disposed of. Potential land contamination must be considered at the concept design phase based on information from site-specific investigations and will require specific risk management to prevent issues such as leaching to contaminated soils.
Slope stability	To minimise the risk of slope failure, wetlands should be placed greater than 15 m away from non-engineered slopes 15% or greater and consideration must be given to the risks of slope instability from saturating the toe of slopes. Where required, impermeable lining may be required to extend above the NWL to the top of operational water levels. Geotechnical advice shall be sought where appropriate.
Expansive soils	Wetlands placed within 5 m of a structure should be lined entirely to the top of operational water level. Structures include buildings (residential and commercial), retaining walls (>1m height), trafficable roads/rail, utility infrastructure (i.e. cell towers, transmission pylons and masts), playgrounds, private boundary fences and swimming pools.

2. Bathymetry

Wetland bathymetry (contours and water depths) must be configured to manage flow paths, water depths and velocities to achieve the required level of treatment while ensuring resilience to the anticipated frequency and duration of inundation. The intention is to prevent high velocity flows forming and ensuring robust plant communities can develop by preventing drying out of permanent water areas, and controls on the days of extended inundation.

Banded bathymetry comprises alternating shallow and deep sections interspersed with occasional open water ponded areas. The cross-section perpendicular to the flow direction is uniform to ensure even velocities across the full width of the wetland. This maximises water exposure to treatment processes associated with wetland vegetation and prevents the formation of preferential flow paths within the wetland footprint. The cross-section at the shallowest point of the wetland is the critical cross-section since this governs the flow rate necessary to achieve the design velocity. Hydraulic efficiency is optimised by maximising the wetland's length to width ratio and ensuring that flows engage the full width of the wetland.

3. Wetland design requirements

Table 3 Wetland Design requirements

Item	Description
Water Quality Volume (WQV)	Required where the wetland is providing a water quality function.
Live Storage Volume)	The live storage volume allows for greater residence time within the wetland which enhances several of the treatment processes including sedimentation, filtration and microbial action.

Flood mitigation can be provided within the wetland footprint as long as the entire attenuation volume is above the live water level (including EDV). Attenuation requirements for flood protection or network constraints are to be derived from the LDM and the Detention practice note. The design of the wetland hydraulics must protect the wetland from potential scour through the use of appropriately sized flood attenuation outlet controls which support backwater inundation of the wetland and prevent the risk of high velocities through the wetland causing re-suspension of sediments and scour of biofilms. Hydraulic controls to engage the flood attenuation should be positioned within the high flow bypass channel where possible to ensure that the wetland is fully protected from high velocity flows and remains offline under usual operating conditions. The design of these flood control aspects must be undertaken by a suitably qualified engineer and designed in accordance with the local requirements.

Wetlands shall be sized in accordance with the methods provided in the local requirements to calculate the water quality volume and flowrate.

4. Wetland components to be considered during concept design

The functional components to consider during the wetland layout development are outlined in Table 4. Treatment performance is based on the controlled passage of water through the vegetated elements of the wetland and the complex treatment processes these support. Attention to internal batters and longitudinal grade is required to ensure that flows are not concentrated into preferential flow paths which can result in short-circuiting and impaired performance.

Table 4 Wetland components to be considered during layout development

Item	Description
Main body	The main wetland body is the bulk of the area of the wetland and provides water quality treatment. The body is sized to provide the WWQV and the EDV (where included) in conjunction with the forebay. The main body can also provide storage for flood mitigation above the top of any extended detention volume level (EDV).
Forebay	The wetland forebay provides coarse sediment removal prior to runoff entering the main wetland body. The forebay should be 10% of the main body area. The volume of the forebay counts towards the WWQV.
High flow bypass	A high flow bypass shall be included that becomes active when storm events exceed the storage provided by the extended detention zone or inflows exceed the calculated peak water quality flowrate. The high flow bypass should be located before entry to the wetland and must have a minimum capacity of flows of up to network capacity or the 100-year event where the wetland is within an overland flow path. In instances where flood attenuation is required, this should be primarily supported through hydraulic control within the bypass channel which causes backwatering within the channel and engagement of the wetland flood storage. Where this is not possible and flood flows discharge into the wetland, it must be demonstrated that these flows will not cause excessive scour.
Maintenance access	A trafficable maintenance access track must be provided to the sediment forebay as a minimum to allow access for maintenance. This shall be a minimum 3.0 m wide and suitable for truck access with a maximum grade of 1V:8H. Vehicle access must also be provided to the outlet structure and foot access provided around the full perimeter for maintenance personnel.

5. Wetland shape, sizing and design parameters

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Wetlands can have many shapes which typically respond to the site characteristics and topography. It is suggested to use a shape that can blend into the finished landscape and that will maximise other benefits such as amenity and provide for cost effective maintenance. Typical shape types are linear and kidney shape with the potential to increase the overall flow length through the use of internal baffles or bunds. Because wetlands should be offline from a natural stream, the inlet and outlet location often influence the shape along with topography.

Typical shapes are shown in Figure 1 which show the diversion into the forebay, bypass channels and outlets back into the downstream extent of the bypass. Further detail is provided in section 8.

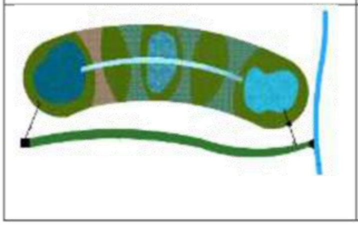
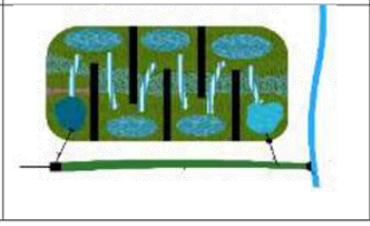
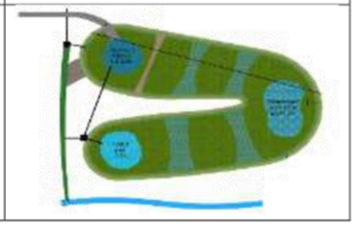
Linear	Extended flow path	Kidney Shape
		

Figure 1: various shapes of Wetlands for stormwater treatment

The sizing of wetlands provides sufficient capacity and conditions to support water quality treatment processes. This is achieved by sizing the wetland based on the calculated water quality volume and then designing the internal bathymetry to provide a mix of shallow and deep marsh zones to sustain robust emergent vegetation.

Figure 2 provides a schematic representation of an offline linear wetland configuration with key functional zones with a typical long section.

Terms used to describe the various wetland zones are given in Table 5.

Design parameters for the permanent storage zone (with and without EDV) are given in Table 5. Note that these do not include the forebay area which equates to an additional 10% of the total footprint area.

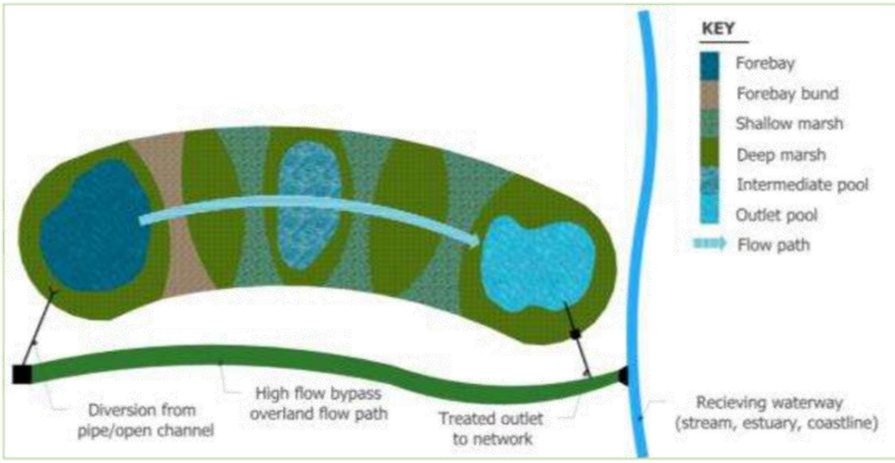


Figure 2: Schematic of typical zones in offline linear constructed wetland

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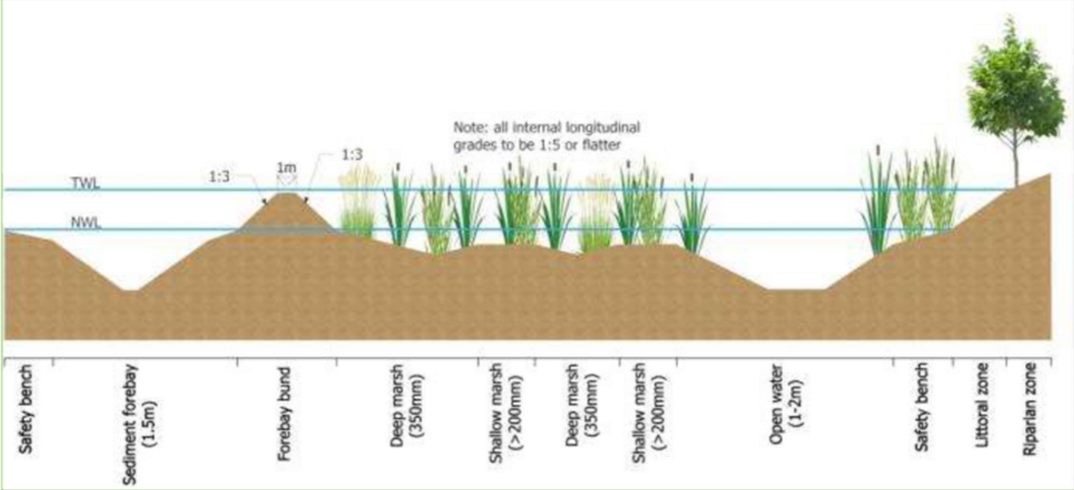

Table 5: Terms used for wetland sizing

Item	Description
Zone – Permanent storage zone (PSZ)	The PSZ is the base zone of the wetland main body excluding the forebay area. The water in this zone does not drain out between events (but can evapo-transpire). The PSZ is required within all wetlands to retain water and support the biological processes within the wetland.
Zone – Live storage zone (LSZ)	The LSZ is the storage zone above the permanent storage zone that provides the live portion of the WWQV. The live storage zone cannot be counted for flood storage during large events.
Zone – Flood storage zone (FSZ)	The FSZ is the storage zone above the live storage zone that provides flood storage only. The FSZ is only required if the wetland is providing flood mitigation or attenuating flows due to downstream network constraints, potential flooding or excessive downstream scour.
Depth – Normal water level (NWL)	The NWL is the top of the permanent storage zone. This water level is relatively constant between storm events and can only be reduced by evapotranspiration or controlled drawdown. The NWL is the top of the PSZ.
Depth – Live water level (LWL)	The LWL is the maximum height reached by the extended detention volume and is the top of the LSZ.
Depth – Flood water level (FWL)	The FWL is the maximum height reached during 100 year event (or other specified flood detention magnitude).

Table 6: permanent storage design parameters for wetland design

Wetland with no EDVDV included	Description
PSZ volume* x 0.80 = WQV	More than half the WQV needs to be permanent pool to allow pollutant removal between storm events. If there is no extended detention, the permanent pool should contain the entire WQV.
40% (±5%) PSZ area between 0.00 and 0.35 m deep at NWL	**Shallow marsh** water depths to support emergent macrophyte species provided in Table 14
40% (±5%) PSZ area between 0.35 and 0.50 deep at NWL	**Deep marsh** water depths to support emergent macrophyte species provided in Table 14.

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Wetland with no EDVDV included	Description
10% (±2%) PSZ area between 0.50 and 1.20 m deep at NWL	**Intermediate deep pools** within main wetland body provide habitat diversity in the wetland. These should comprise no more than 10% of the main wetland body area.
10% (±2%) PSZ area between 0.50 and 1.50 m at NWL	**Outlet deep pool** provides a stilling area before discharge out of the wetland. This should comprise no more than 10% of the main wetland body area.
The length of the PSZ must be at least 5 times the width of the PSZ	Elongated wetlands prevent the risk of short circuiting.
Batters > 0.25 m below NWL maximum 1V:3H	Batters below safety bench extending to variable base
Extending from NWL a 2m wide safety bench must be provided at a maximum slope of 1V:8H	Planted Safety bench must extend around entire perimeter (including forebay) immediately below NWL.
Batters above NWL must be a maximum of 1V:3H	Planted batters above NWL to transition to existing ground.
Emergent Macrophyte vegetation to cover a minimum of 80% of main wetland area at NWL	Dense and diverse plant community critical to support treatment processes. The 80% coverage is supported by the distinct shallow and deep marsh zones
*PSZ volume is adjusted by 0.75 and 0.8 respectively to account for the plant mass volume in this zone.	

Figure 3 provides a schematic of a typical wetland edge with safety batter and planting to align with depth and inundation.

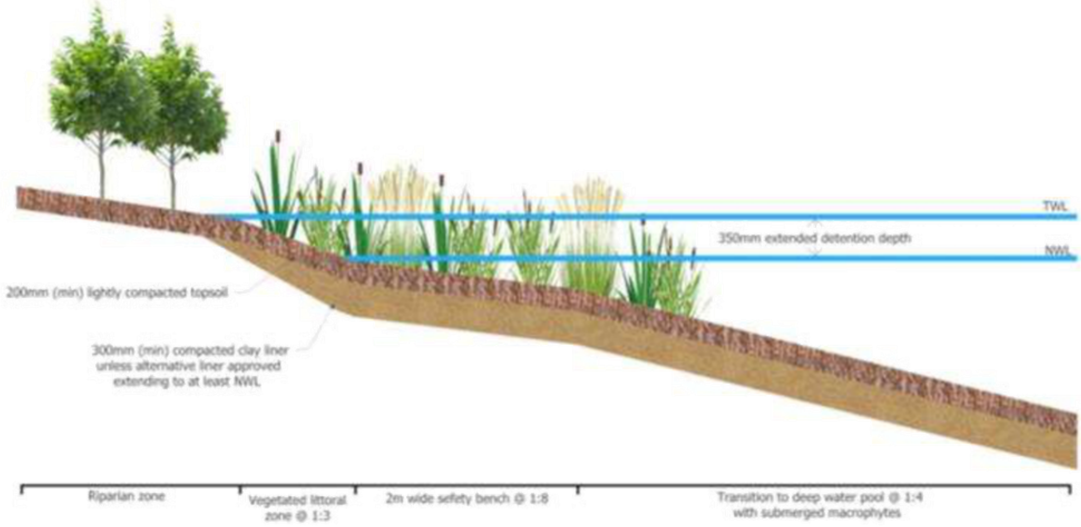

Figure 3: Typical wetland edge detail

6. Live storage zone design parameters

The live storage zone provides frequent, temporary storage of runoff during and immediately after storm events. Design parameters for the live storage zone are given in Table 6.

Table 7: Live storage zone design parameters

Wetland with EDV included	Description
Volume of LSZ = Extended Detention Volume	The extended detention volume needs to be entirely provided in the LSZ.
Volume of LSZ > WQV – PSZ volume	The water quality volume is provided in the LSZ and PSZ.
LSZ batters are a maximum of 1V:3H	Batters above normal water level are a maximum of 1V:3H.
LWL < 0.35 m above NWL	The depth of the LSZ should be no deeper than 0.35 m to support healthy plants.
Velocity of flow with depth at: NWL + (LWL – NWL) / 3 during peak flow of WQV event should be less than 0.05 m s^{-1}	Peak flow assuming a water level 1/3 of the way between NWL and LWL should be less than 0.05 m s^{-1} in the WQV event to avoid sediment resuspension and stripping of biofilms.

7. Sediment forebay design parameters

The sediment forebay comprises a deep, low-velocity pool to provide pre-treatment by retaining coarse-to-medium-sized suspended solids. This enables managed cleanout of these sediments and prevents smothering of the wetland treatment area, thereby increasing wetland longevity. A high-flow bypass is necessary to prevent re-suspension of accumulated sediment by inflows associated with storm events. Design parameters for the sediment forebay are given in Table 8.

Maintenance access to the forebay is necessary to allow periodic sediment removal. The forebay base is to be lined with compacted crushed rock or concrete so that excavator operators can distinguish between accumulated sediment and the forebay base.

The forebay is to be separated from the wetland body with an impermeable bund of compacted earth (with 200 mm topsoil in areas to be planted). The bund should have a 1 m wide crest that is level, set to the elevation of the NWL, and is well vegetated or includes a concrete level spreader beam.

Table 8: Sediment Forebay design parameters

Requirement	Description
Area of Sediment forebay = 0.1 x PSZ area (±5%)	The area of the forebay(s) needs to be in proportion to the PSZ area to provide sufficient storage for coarse sediments. If there are multiple forebays, the total forebay area should comply with this requirement.
Volume of Sediment forebay = 0.15 x PSZ volume (±10%)	The volume of the forebay(s) needs to be in proportion to the PSZ volume to provide sufficient storage for coarse sediments. If there are multiple forebays, the total forebay volume should comply with this requirement.
Forebay arrangement	The forebay shall have a surface length to width ratio between 2:1 and 3:1.
Maximum depth of Sediment forebay = 2 m	The forebay needs to be maintainable. Maximum depth is 2m as depths over 2 m can result in special equipment being required for maintenance.
Maintenance bench within 12 m of any part of forebay area	Unless maintenance access is provided into the base of the forebay, all parts of the forebay must be within 12 m of a maintenance bench (hardstand) to ensure the forebay can be dug out without the use of special equipment. The hardstand must be designed to support loading of suitable excavator.
Safety bench should be a minimum of 2 m wide and maximum of (1V:8H slope) extending from NWL.	Heavily vegetated safety bench to comprise 2 m wide bench extending from NWL

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Requirement	Description
Batters below NWL maximum 1V:3H	Geotechnical advice on saturated slope stability required
Batters above NWL maximum 1V:3H	Batters above the NWL shall have a maximum slope of 1:3 where planted and 1:5 where mowing is required. Note, all wetlands which include EDZ will require planted littoral zones above the NWL.
Forebay Bund	The forebay shall be separated from the main wetland body with an impermeable bund with a crest at (or up to 100 mm below) NWL to support independent drawdown of the forebay water level. The bund shall be compacted earth with a formed level crest width of 1 m.

Figure 4 shows the typical layout of a forebay and Figure 5 shows a cross section through a typical bund separating the forebay from the main wetland body.

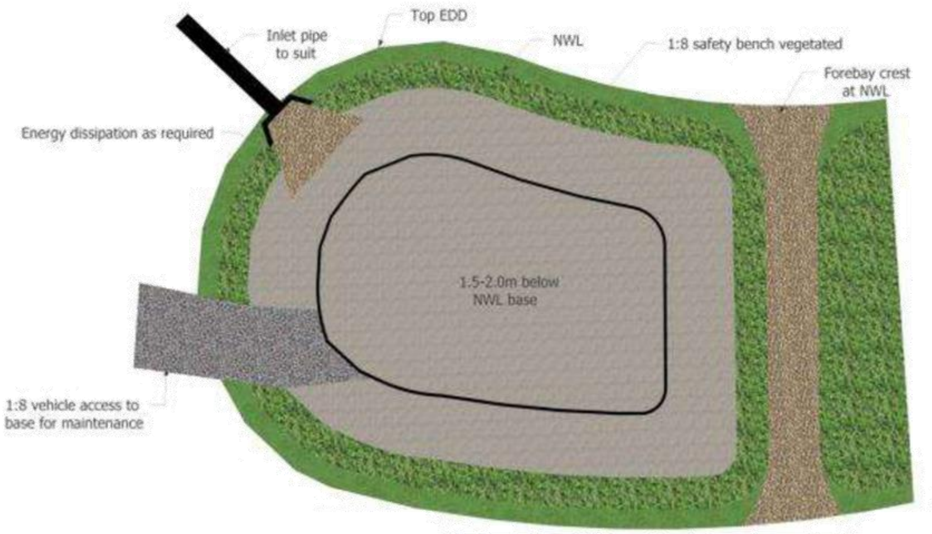

Figure 4: Typical forebay layout

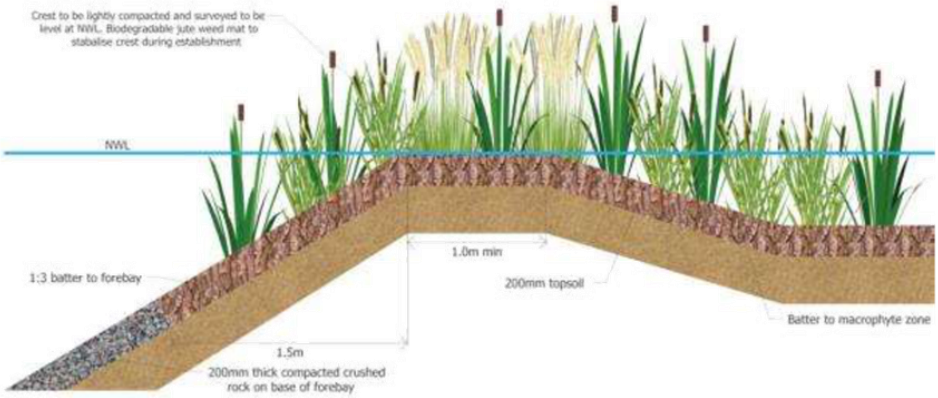

Figure 5: Typical wetland forebay bund cross section

8. Wetland inlet design requirements

To protect the wetland from the damaging effects of uncontrolled inflows, inlet design should include energy dissipation to reduce water velocity, prevent erosion around the inlet and provide an even distribution of flow into the wetland. Inlets must discharge to the forebay to ensure pre-treatment. Inlet design requirements are given in Table 9.

Table 9: Inlet Design Requirements

Parameter	Requirement	Verification method
Inlet pipe/channel	Any inlet elements must meet relevant Council design standards and be appropriately sized for design flows.	Approval at time of construction drawings sign off. All pipe sizes/channel dimensions to be marked clearly on as-built drawing set. Note this document does not cover design of upstream reticulated networks.
Diversion configurations	Any diversion works (including chambers, weirs, orifices and energy dissipaters) must be appropriately designed for the target inflows with consideration for operating hydraulics and head. Tolerances for critical structures must be stated in construction specifications.	As-built verification survey of all critical levels required to ensure diversion will function as intended.
Erosion protection	Design of inlets must consider potential for erosion from all design inflows. Energy dissipaters associated with inlets should aim to reduce water velocity, prevent erosion of areas surrounding the inlet, and provide an even distribution of flow into the wetland. Gross pollutant traps and debris screens can be included as part of the inlet design. Consideration should be given to storage capacity, potential clogging, and hydraulic implications when sizing gross pollutant traps, based on overall catchment characteristics.	Approval at time of construction drawings sign off supported by appropriate calculations.
Construction tolerances	Construction tolerance for the inlet is 5 mm.	As-built survey.

9. Wetland outlet design requirements

The outlet structure controls the water volume and hydraulic regime within the wetland, thereby performing both water quality and quantity functions.

Outlet structure design is determined by site characteristics, desired treatment functions, ecosystem connectivity, and maintenance considerations. Design requirements for outlets are given in Table 9.

Hydraulic control should be provided by a removable weir plate installed within a manhole located adjacent to the wetland outlet. Weirs should be sized the support the intended engagement of the extended detention volume and drawdown over 24 hours. A submerged pipe outlet draws off cooler deep water from the outlet pool, thereby reducing temperature-related effects on the receiving environment.

Outlet structures should enable periodic drawdown of the wetland volume for management and maintenance purposes as well as control normal water level in the wetland. Depth control is especially important during plant establishment so that plants are not drowned.

Table 10: Outlet design requirements

Parameter	Requirement	Verification method
Outlet hydraulics	Control outflows to either pass design flows in wetlands without extended detention or support drawdown of extended detention over average of 24-hr period.	Stage storage and stage outflow calculations to demonstrate hydraulic function
Outlet pool	Include a deep pool (1.5 m deep) at the downstream end of the wetland. Treated flows to be drawn from at least 500 mm below the surface via a pipe connection to the outlet control structure.	Earthworks model based on finished surface. As-built survey to verify finished levels.
Outlet structure	Hydraulic control to be contained within a suitable manhole or open chamber located on the batter adjacent to the wetland with flow control to define NWL and drawdown of event flows.	Design plans and As-built survey showing all critical levels within tight (5mm) tolerance level)
Outlet location	Outlet control structures must be accessible for inspection and maintenance (i.e. within manhole on batters). Submerged connection to outlet pool is to be included to avoid blockage and draw cooler water.	Design plans and as constructed drawings showing all critical levels within tight (5mm) tolerance level)
Fish passage	Fish passage shall only be required where viable upstream habitat exists for indigenous species. Where wetlands are located with fish passage required the design must include provision for passage in a range of typical operating events. Fish passage will not be achievable across the full range of operating conditions while also achieving operational requirements to support primary function of water quality improvements. The inclusion of any habitat provisions within the wetland itself (such as eel hides) must consider management of these species during future operations and maintenance.	Design plans and as constructed drawings
Discharge to receiving environment	All outfalls must comply with relevant Council standards to avoid scour and instability.	Design plans and as constructed drawings
Construction tolerances	Construction tolerance for the outlet is 5 mm.	As-built survey.

10. Bypass/spillway design requirements

A high-flow bypass is necessary to divert flows away from the wetland that are greater than the design maximum water quality flow rate. This is to ensure the biological treatment elements, such as macrophytes and biofilms, are not scoured by high-velocity flows and that accumulated sediments are not re-mobilised. The bypass must be placed upstream of the sediment forebay. Spillway design requirements are given in Table 11.

Table 11: bypass / spillway design requirements

Parameter	Requirement	Verification method
High flow bypass	Wetlands shall be constructed off line to flows in exceedance of the target treatment flowrate (lesser of calculated WQ flowrate or flowrate based on velocity calculations). This should be supported with an upstream diversion where possible such as modified manhole to side cast target flows into wetland inlet.	Design drawings and hydraulic calculations for all diversion structures and weirs.
Overflow outfalls	Design should include provision for an overflow spillway to be engaged at top of extended detention (or maximum standing water head where extended detention not included). The spillway should be located as close to inlet as possible and be sized to pass maximum flows without excessive head. Must be designed to withstand scour forces.	Design drawings and hydraulic calculations for all diversion structures and weirs.
Flood flow protection	Where wetlands are located online to large flood flows (including those engaged as part of flood attenuation) the design must consider potential risks in these infrequent events. Must demonstrate that have considered all flows up to 100-year event and included suitable spillways or throttled outlets with attenuation storage as part of design.	Design drawings and hydraulic calculations for all diversion structures and weirs.
Construction tolerances	Construction tolerance for the high flow bypass weir is 5 mm.	As-built survey.

Figure 6 shows the schematic arrangement of highflow bypass and potential re-engagement of the wetland footprint for infrequent flood detention. [to be improved in later version]

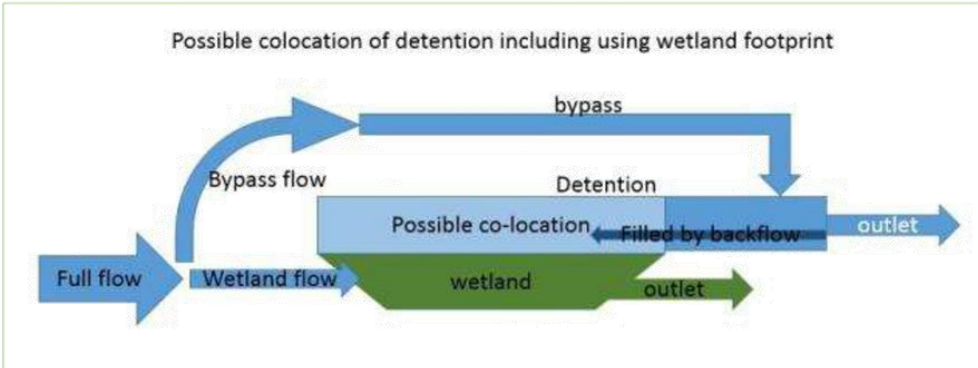

Figure 6: Schematic of functional arrangement to support flood detention above water quality treatment wetland

11. Maintenance access design requirements

Vehicle access to the sediment forebay is necessary to permit periodic cleaning out of accumulated sediment. Where it is not possible to clean the forebay from the perimeter hardstand, this must include trafficable access into the base of the forebay itself. Light vehicle access to other parts of the wetland must also be available for maintenance purposes. Pedestrian access to the entire perimeter is required for weed control and maintenance of vegetated areas.

Table 12: Maintenance access requirements

Parameter	Requirement	Verification method
Forebay access	Full 3m wide (minimum) trafficable access (crushed gravel or similar) must be provided to a suitable hardstand for small systems (where standard long reach excavator can access all areas of forebay from hardstand) or 4 m wide access track to base of forebay for larger wetlands. Access tracks into the forebay to be no steeper than 1V:12H and be constructed with a robust unsealed surface such as 150 mm cement treated crushed rock suitable for heavy vehicles.	Sign off as part of maintenance plan prior to construction approval

Wetland vehicular access	Vehicle access (ute) should be provided to at least 50% of the wetland perimeter (including to all hydraulic structures) along the top of extended detention depth or minor setback for landscape planting. Design of access track must consider other site users and public safety.	Sign off as part of maintenance plan prior to construction approval
Wetland pedestrian access	Pedestrian access must be provided around the entire perimeter including any bunds, structures or hydraulic controls. Preferred access routes should be marked on maintenance plans and maintained free of excessive vegetation growth above 1 m height. All pedestrian paths must comply with Council guidelines	Sign off as part of maintenance plan prior to construction approval

12. Wetland liner design requirements

Impermeable lining of all wetlands is critical to ensure that the water level is sustained during prolonged dry spells and that the emergent aquatic vegetation is supported. In situ soils may be suitable for use but will require verification testing and reworking to form a homogenous liner across entire wetland. Where in-situ soils are not suitably impermeable, an imported impermeable liner, either natural or synthetic, must be used. Liner design requirements are given in Table 13.

Table 13: Liner design requirements

Parameter	Requirement	Verification method
Permeability	Entire wetland (to top of normal water level) must demonstrate a permeability of $1x10^{-9}$ m s^{-1} or lower.	Geotech testing at time of construction or approval of synthetic liner prior to installation
Imported Natural Clay liner option	Minimum 300 mm of well compacted clay required across entire wetland including batters. Material must be uniform in composition and constructed to achieve consistent compaction across full area.	Imported and *In situ* clay material must be tested and approved prior to procurement to demonstrate permeability of 1 x 10^{-9} m/s at 95% standard maximum dry density. Post construction testing must confirm 95% standard maximum dry density to at least 300 mm depth. Minimum testing requirements of 1 test/150 m^2 compacted clay material (based on 300 mm uniform liner depth) to be tested by independent geotechnical engineers in accordance with NZ standards for clay liners.
In-situ Clay liner option	Minimum 300 mm of well compacted clay required across entire wetland. Approval must be sought for use of in-situ clay material versus imported clay. Where in-situ material is approved for use, all batters shall be completely re-constructed with clay liner to ensure no heterogeneity.	
Synthetic liners	Geo-synthetic Clay Liners (GCL) or HDPE (min 1.5 mm) may be suitable in absence of suitable clay source. Approval for material to be provided prior to specification including manufacturers testing and independently verified performance data. Consideration must be given to slope stability on batters to prevent sloughing.	Material to be pre-approved. Installation must be undertaken by approved installer with comprehensive QA procedures to verify integrity of all joins, welds, protrusions and anchoring. Protection of liner post installation critical during subsequent works. All membranes must be covered by at least 300 mm soil/rock to support plant growth and provide consolidating pressure for GCL.
Topsoil	Entire wetland (including batters and terrestrial areas) must include 200 – 300 mm depth of lightly compacted topsoil. Topsoil can be site sourced or imported but must be free of weeds, woody matter or contaminated soils. The topsoil must be suitable for horticultural purposes with suitable organic content and structure. Where possible, soils below the NWL should have lower organic content to reduce the incidence of	Material to be used as topsoil to be pre-approved by designer or suitably qualified horticulturalist/landscape contractor.

	nuisance filamentous algal blooms in the initial growing season.	

13. Planting and plant selection

Selection of suitable plants for wetlands is critical to ensure sustained performance under a range of conditions. To achieve this, the bulk of species used should be adaptable to the broadest ranges of depth, frequency and duration of inundation and a diverse range of species should be used, avoiding planting large blocks of single-species.

The following specifications are required:

- Avoid mown grass adjacent to water as this attracts ducks and geese. Maintaining a dense edge of taller plants helps prevent common ducks and geese fouling the wetland.
- Perennial, evergreen species should be planted in preference to non-perennial and/or deciduous species. Raupo is not recommended due to die-back in winter and tendency to over dominate other species.
- A diverse assemblage of plants is preferable. Native local species (with seed eco sourced by nurseries) complement local vegetative communities and help ensure plants are well adapted to local climate, even though soil conditions are likely to be more compacted
- Do not plant trees over liners unless there is adequate rooting depth (>600 mm) to minimise risk of liner being damaged by roots or being exposed if trees are uprooted
- Plants must be supplied as individual plants (i.e. tubestock or pots) and shall not be substituted for manually separated reclaimed clumps or propagation trays cut into units. Plants must be healthy and robust with vegetation extending above the planted water depth,
- Plants should be planted with a minimum density of 4 plants/m^2 to form full coverage of the shallow and deep marsh areas to achieve a minimum of 80% coverage within 2 growing seasons. Extended detention shall not be used during establishment, i.e. water levels should not overtop planted vegetation during the developmental growth phase during establishment. Species should be well mixed within their growing conditions to form a natural assemblage where possible. Up to 10% of plants can be 'diversity' planting (i.e. not purely selected for treatment characteristics) to increase overall biodiversity, particularly around the perimeter of the wetland.
- Dense, rigid and tall marsh species should be selected as far as practical within deep marsh zones. Tall marsh species with spreading leaves should be selected adjacent to open water areas.
- Vegetation that provides a high level of shading (including trees, shrubs and reeds / tall sedges) should be planted around and within the wetted margin of the wetland. Swamp forest is one of the most threatened are rare natural ecosystems in the Nelson Tasman district. Concentrate tall, spreading plants on the northern aspect of a wetland to help reducing water temperatures. Care must be taken where synthetic liners are used in areas with permeable in-situ soils. In these instances the use of large tree species should be avoided due to potential instability and risks of damage to synthetic liners.
- Avoid planting in straight rows; plant in clusters so that area looks more natural and plants can shelter each other; where pasture or weed growth is anticipated, stake terrestrial plants as soon as they are planted so they are easy to find during maintenance
- Be careful with organic mulches – these should not be used in areas where water will flow as this will wash them into surface waters; organic mulches at 70 to 100 mm depth on upper batters can increase establishment by reducing weed competition, keeping the soil cool and increase water available for plants. However, mulching wet, 'heavy' compacted soils will exacerbate wetness and anaerobic conditions – in such cases create rough surfaces during planting (+/- 100 mm) as this helps plants to access a variety of conditions.

Plant species tables are provided in Table 14 please refer to these tables for guidance on plant species suitable for use in wetlands Bold plants are the most resilient and fastest-growing. N= referenced in Living heritage guide http://nelson.govt.nz/environment/biodiversity-2/nelson-nature/resources/living-heritage-plant-guide, 'Freshwater wetlands and waterways' page 27-29 with 'wet' plant preference

Table 14: planting list for wetlands

Littoral Edge (extended detention depth above normal water level)	?		
	Austroderia richardii	N very sensitive to glyphosate	
	Blechnum minus/ novae zelandiae	N Swamp kiokio and kiokio	
	Coprosma propinqua	N mingimingi	
	Coprosma robusta	N karamu	
	Gahnia xanthocarpa	N mapere, giant cutty sedge	2m sedge
	Hierochloe redolens	N karetu, holy grass	
	Juncus australis	N rush (can be confused with weeds)	
	Carex dissita	N purei, makura	1m sedge
	Carex secta	N purei, makura	1m sedge
	Carex virgata	N purei, makura	1m sedge
	Cyperus ustulatus	N toetoe, upoko tangata (mainly coastal, < 10%, deciduous)	0.8m sedge
	Phormium tenax	N harakeke, flax	2m monocot clump former
	Phormuim cookianum	Mountain flax useful next to paths, not wet or compacted	
	Cordyline australis	N ti kouka, cabbage tree	
	Melicytus micranthus	N Manakura, swamp mahoe	
Shallow marsh; 0 – 250 mm depth	Carex geminata	N rautahi	1m sedge
	Carex secta	N	
	Coprosma tenuicaulis	?check	
	Carex virgata	N	
	Eleocharis acuta	sharp spike sedge	0.9m sedge
	Isolepsis prolifera	clubrush	0.5m rush
	Machaerina articulata	N jointed twig rush	1.8m sedge
	Apodasmia similis	**oioi**	
Deep marsh; 250 mm to 500 mm depth	4.Bulboshoenus caldwelii	N (prefers brackish water)	
	1.**Eleocharis sphacelata**	bamboo spike sedge	1m sedge
	2.**Shoenoplectus tabernaemontani**	kāpūngāwhā, lake clubrush	1-2m sedge
	3. Machaerina rubiginosa	N Baumea (M. articulata not in region)	0.9m sedge
'Trees' Where>0.6 m rooting depth (islands, edges), >5 m from areas that will be excavated (e.g., forebays), not over liners	Dacrocarpus dacrydiodes	N Kahikatea	
	Hebe stricta var atkinsonii	N Koromiko (not for wet, compacted areas)	
	Laurelia novae-zelandiae	N Pukatea	
	Leptospermum scoparium	N manuka	
	Syzygium maire	N Swamp maire	

Weeds to watch for and remove (see Hornwort (*ceratophyllum demersum*), *Egeria densa*, Senegal tea (*Gymnocoronis spilanthides), Lagarosiphon* major, and Parrots feather (*Myriophyllum aquaticum*) and fringed waterlilly (*Nymphoides peltata*)

These can rapidly invade waterways, crowd out native species and block channels. https://www.marlborough.govt.nz/repository/libraries/id:1w1mps0ir17q9sgxanf9/hierarchy/Documents/Environment/Biosecurity/PlantMeInstead.pdf)

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6. Construction

The construction of wetlands must be undertaken by experienced operators who understand the requirements outlined in this practice note and the criticality of liners, hydraulic structures and plants. In particular the importance of the wetland liner and the considerations to achieve a continuous impermeable liner when working near or below the groundwater level.

Inspections and approvals through the construction process must be closely adhered to in accordance with the verification methods provided in this practice note.

Timing of planting and the management of water levels need to be considered. Planting of wetland plants shall be undertaken between September to May and terrestrial planting from May to October. The water level in the wetland shall be limited to at least 150 mm below the NWL until plants are growing vigorously and at least 50% of the stem height will remain above the NWL. Timing for this will vary depending on planting but will typically take 6 – 12 months.

Wetland establishment is a critical stage in construction. Wetlands shall be maintained by the developer/contractor for a minimum of 24 months from the time of practical completion. This shall include weed control, replacement of unhealthy plants and rectification of any construction flaws. At the time that wetland assets are vested to Council they must be in optimal condition as per the design intent. This must include a minimum of 80% plant cover at the normal water level, no invasive or noxious weeds and the sediment forebay must be fully cleaned out to ultimate as built levels.

7. Handover

Plant establishment is critical for a wetland to perform. Plants shall be maintained by the developer/contractor for 24 months from the time of practical completion (establishment phase). This shall include weed control, replacement of unhealthy plants and rectification of any construction flaws. At the time that the wetland is vested to Council all plants must have been growing for at least 3 months and be in good condition as per the design intent and/or a defect liability and bond provided where applicable.

Checking is required at several stages during the construction to ensure the wetland is constructed to specifications. At the hand-over stage particular attention is required to ensure the establishment phase is managed (e.g. by taking a bond) and that plant health is satisfactory.

8. Responsibility and maintenance

This practice note only covers publically vested wetland systems. One of the important considerations with wetlands is long-term maintenance. Whilst wetlands are generally low maintenance it is important to understand the maintenance requirements as deficiencies can cause the systems to fail or function poorly without expensive remedial works, not NO maintenance. Some attention point are:

- Landscaped areas above the top operational water level should be mulched with minimum 75 mm hardwood mulch to suppresses weeds and retain moisture.
- Batters and landscaped areas may require regular, knowledgeable weeding for the first 24 months, or until canopy closure. Routinely (every 3 months) inspect all inlet and outlet structures to identify and rectify blockages, scour or structural issues
- Inspect wetland following any extreme weather events (>1 in 10 year storm) to rectify any scour or blockages
- Inspect the wetland annually to assess plant health and ensure that 80% plant cover is sustained. Where plants are in poor health or have died, work out why they have died, mitigate conditions, and replace as required.
- Inspect the wetland six monthly for evidence of invasive species (plants or animals). Where identified these shall be eradicated as soon as practical.

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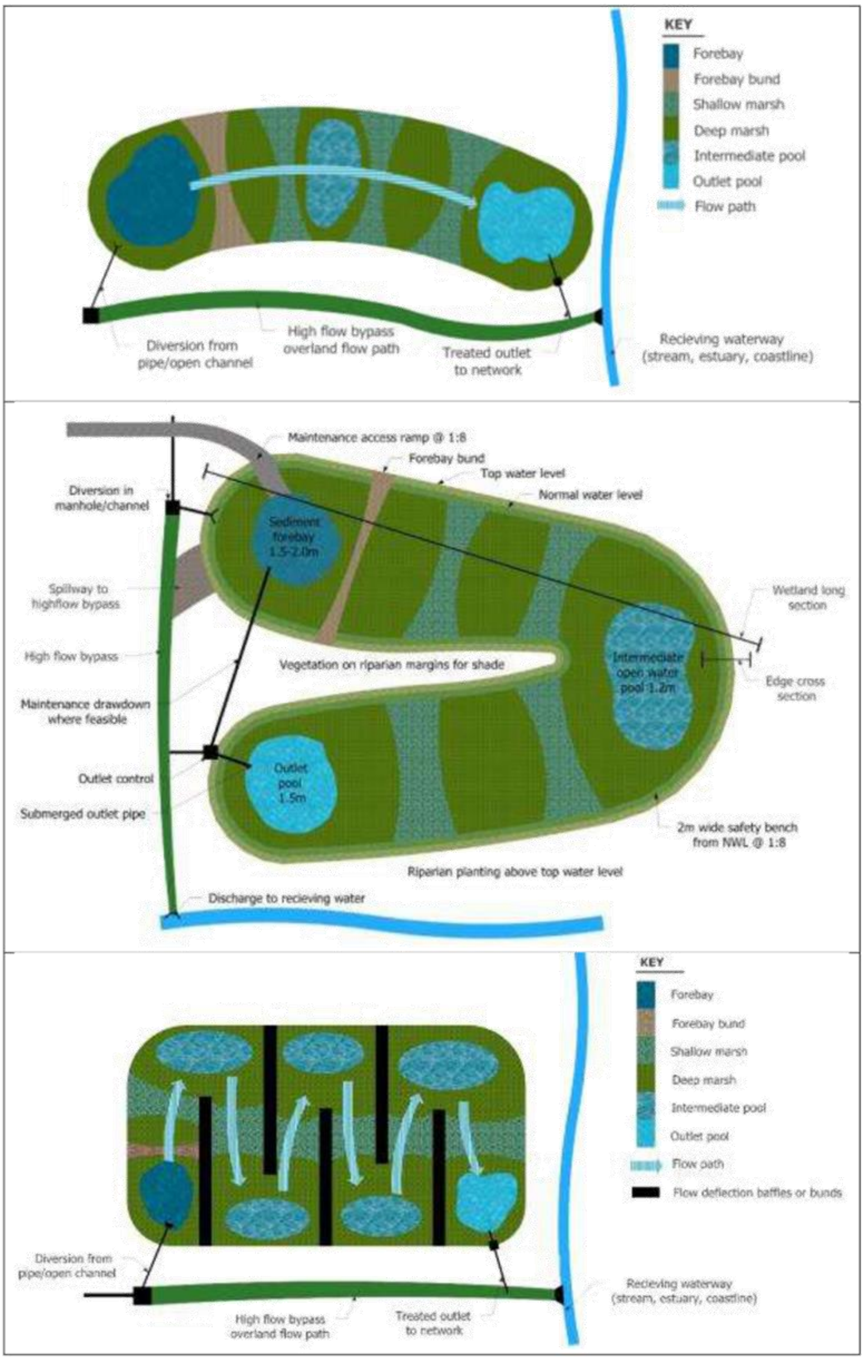
9. Attachments

9.1. Typical shapes and components



9.2. Plants for Nelson/Tasman stormwater treatment wetlands

Plants should be established at the driest part of their range so they can spread into deeper areas once root systems are established; not planted underwater like rice in paddy fields; water tables will therefore be lower during establishment than when operational, i.e. the shallow marsh zone will be dry, only the deep marsh will have water'

Table 15: planting list for wetlands. Bold plants indicate suggested use as dominant components, (N) indicates plant recommended for wetland restoration in Nelson's Living Heritage Guide.

Littoral Edge: Above the normal water level but inundated during rainfall as part of extended detention depth	*Astelia fragrans (Riparian)*	swamp astelia, kahaka	1.5 m spreading 1.5 m lilly, highly aesthetic, berries, minor
	Austroderia richardii (Riparian)	South island toetoe (N)	2 m spreading 2 m tussock was *Cortaderia.* very sensitive to glyphosate, mainly riparian
	Blechnum novae zelandiae (Riparian)	kiokio (N)	1.5 m fern, Minor, new foliage is attractive red
	Carex secta	purei, makura (N)	2m sedge when mature
	Carex virgata	purei, makura (N)	1m sedge
	Coprosma propinqua (Riparian)	mingimingi (N)	3 m divaricating shrub, with blue berries, minor
	Coprosma tenuicaulis(Riparian)	Swamp coprosma, hukihuki	3 m tangled but upright shrub with black berries, minor
	Cyperus ustulatus	umbrella sedge, upoko tangata (N)	0.8 to 1.5 m sedge, deciduous so can look messy, minor
	Juncus australis	rush (N)	0.6 to 1.2 m hardy rush of disturbed, wet pasture
	Jnucus edgariae	wiwi, common rush (N)	1.5 m spreading 1 m
	Juncus pallidus	giant rush (N)	1.7 m spreading 2 m
	Juncus sarophorus	blue rush (N)	1.5 m spreading 1 m
	Phormium tenax	harakeke, flax (N)	2 to 2.5 m monocot clump; plant at least 3 m from paths
Shallow marsh; Up to 200 mm below NWL	*Blechnum minus (Riparian)*	swamp kiokio (N)	1 m fern, once established forms a dense sward
	Carex geminata (need to be very careful to only plant in very shallow water (<100 mm)	rautahi (N)	0.8 to 1m sedge, can be regarded as 'untidy'
	Carex lessoniana*(need to be very careful to only plant in very shallow water (<100 mm)*	rautahi	1.5m sedge, can be regarded as 'untidy'
	Carex secta** and **Carex virgata	purei, makura (N)	1 to 2m sedges complement each other to create dense, weed supressing swards
	Eleocharis acuta	sharp spike sedge	0.5 to 0.9m sedge

	Isolepsis prolifera	clubrush	0.3 to 0.5m spreading 2 m, fast-growing rush useful to include in areas that are periodically weed-eated
	Apodasmia similis	jointed rush (N)	0.5 to 1.3 m rush, primarily for brackish water but is very weed resistant once established and tolerant of a wide range of conditions
Deep marsh; Between 200 mm and 500 mm below NWL	*Bolboshoenus caldwelii*	n/a (N)	1.5 m sedge, prefers brackish water
	Eleocharis sphacelata	Kuta, ngawha, bamboo spike sedge	1-2m sedge grows in water up to 1 m depth, used for fibre
	Shoenoplectus tabernaemontani	kāpūngāwhā, lake clubrush (N)	1-2m sedge also used for fibre and rongoa (maori medicine)
Trees for riparian edge and adjacent areas that have suitable rooting depth and protection of liners	*Carpodetus serratus*	putaputaweta (N)	Small tree to 10 m can be covered in small white flowers attractive to insects, mainly better draining but moist soils
	Coprosma robusta	karamu (N)	Fast growing shrub with berries (for birds) that will spread from seed under suitable conditions
	Cordyline australis	yi kouka, cabbage tree (N)	Valuable narrow, architectural tree to 12 m tolerant of wind, provides fragrant flowers and fruit for birds and insects but little shade. Plant at least 3 m from any mown areas
	Dacrycarpus dacrydioides	kahikatea, white pine (N)	Noble, slow-growing, tall tree (20-30m), plant where weeds can be maintained for at least 3 years
	Hebe stricta var, atkinsonii	n/a (N)	Fast-growing shrub with large 'bottle brushes' of white flowers; other hebes are also used in nelson
	Hoheria angustifolia	houhere, narrow-leafed lacebark	Small tree to 10 m with tangled juvenile form
	Leptosopermum scoparium	manuka, teatree (N)	Small tree to 8 m with abundant white flowers tolerant of compaction and full sun
	Plagianthus regius	manatu, lowland ribbonwood	Small tree to 15 m
	Sophora microphylla	kowhai	Small tree to 10 m, attractive to tui, bellbird (nectar) and keruru (leaves) but needs reasonably free drainage, not ponded water

Footnotes

1. Most trees and shrubs will need to tolerate at least seasonable waterlogging unless they are planted on 'islands' or adjacent areas with deeper, free-draining soils
2. Phormium tenax is not recommended for standing water even though it will grow there due to its bunched, water-deflecting, growth form
3. Raupo has been excluded under the following rationale

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- Has a tendency to overtake other aquatic macrophyte species and initially develops into large clumped areas of vegetation. These are particularly dense both above and importantly below the water level and result in flows being forced around the clumps resulting in preferential flow paths, reduced contact time between plant stems and stormwater and increased velocities causing stripping of biofilms. In the long term Raupo can cause large spreading clumps which can ultimately choke the flow and impact hydraulics
- Raupo's growth habit results in significant vegetation matter with succession and die back over winter (it is deciduous). This increases the organic loadings into the wetland and results in nutrient leaching. The same is true to an extent with Bolboschoenus but I like to include small numbers of that as that add significant aesthetics and food source
- Raupo is less effective at transferring oxygen to the root zone and submerged sediments, this is particularly important for a range of the chemical and biological processes.
- The dense mass of dead plant material above the NWL in winter/spring will retain moisture after drawdown and support mosquito larvae without predation within the main wetland body

4. Taller shrubs and small trees have been put in their own category, as an adequate root zone above a liner is required to reduce risk of liner from roots. Pukatea and maire have not been included but are valuable, long lived trees given overhead shelter and coastal locations for the latter (maire is also locally extinct) and extended weed control and continuously moist conditions for both. Melicytus micranthus (swamp mahoe) is a shrub that also prefers shelter and could be use in low numbers, once cover is present, to provide understorey within kahikatea plantings. Neomyrtus pedunculata could also be planted in low numbers but is probably vulnerable to the new pathogen myrtle rust.

Other comments

- Carex lessoniania removed from littoral and placed in shallow marsh Need to be careful with Carex planted in standing water as tendency for them to rot during establishment. Best to only plant in very shallow edges and ideally draw down water below NWL for establishment
- Gahnia xanthocarpa (N) removed as is usually found in low fertility wetlands and does not form a , also highly abrasive so difficult to maintain, often has high mortality during establishment but highly attractive seed heads
- Hierochloe redolens (N) not included as would tend to be removed/sprayed out as a grass weed unless specialist maintenance crew is engaged
- Carex dissita (N) is removed as it prefers shade – a forest groundcover under kahikatea, and only about 500 mm tall so not as effective as other species at supressing pasture weeds
- Bolboschoenus fluviatilis and B. medianua removed as not naturally found in the area, although at this latitude
- Carex maorica not included in shallow marsh, as generally difficult to source
- Machaerina/Baumea articulata is not included as it is both a species of low fertility areas and has a very restricted range on islands in Nelson area (so unnaturally expanding its range is not favoured); Machaerina rubinginosa is also a species of low-fertility wetlands so not included Rubiginosa grows well in stormwater wetlands and is suited to both shallow and deep marsh areas

9.3. Good and bad practise examples

Below are some photos of good and no-so-good examples of wetlands

	Well planted establishing wetland (6 months after planting)
	Well planted establishing wetland (6 months after planting)
	Submerged outlet pipe with connection to hydraulic controls within grated manhole

	Diverse shallow marsh species mix (9 months after planting)
	Established wetland (12 months after planting) showing dense vegetation across full width. Outlet pool in foreground
	Shallow and deep marsh areas planted at 4 plants/m^2. Photo 1 month after planting

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	Boardwalk constructed on wetland bund. Open water on left as outlet pool with submerged connection beneath bund. Photo 1 month after planting.
	Reduced amenity through outlet design. Note lack of vegetation within wetland and/or batters
	Poorly designed outlet configuration with accessibility issues and discharge of surface waters with elevated temperatures. Limited vegetation cover in wetland

Online wetland subjected to full flows from catchment with resulting resuspension of sediments etc

Discharge of high flows into online wetland. Elevated suspended sediments from subdivision during build out phase

Poor design outcome with limited planting, lack of littoral edge and degraded water quality reducing amenity

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	Poor bathymetric design with edge planting only and clear preferential flow path through central deep channel
	Wetland vegetation in base of detention basin with permanently wetted base
	Well established wetland vegetation and riparian margins

9.4. Acknowledgements and source references

These practice notes, including many graphic, are largely based on information from the North Shore City Council Bioretention guidelines (2008), the Long Bay Practice Notes developed for North Shore city Council by D & B Kettle Consulting Ltd (2011) and the Bioretention Practices Notes for Hamilton City Council (2016).

9.5. Version, version control and change comments

The Practice notes were developed by Morphum Environmental with input from Robyn Simcock from Landcare related to planting specifications and overall peer review.

Summary of changes

Version	Date	comments
0.1	24 January 2017	First draft for comment from the Industry
0.2	13 July 2017	Second draft including planting requirements
1.0	16 June 2017	Immediate Release version, showing good practice, independent of local requirements

9.6. Want to know more?

There is a lot of information available related to Low Impact Design (LID, or Waster Sensitive Urban Design (wsud). Underneath are few references. It should be noted that all info in these documents is not necessarily agreed, up to date and/or applicable in the Nelson/Tasman area and that the application of LID is evolving over time.

- Landcare / Morphum Ltd: "Applying Low Impact (Water Sensitive) Design in Nelson Tasman", June 2016. A review of LID practices in Tasman and Nelson and issues experienced by council and the industry. Includes description of many different LID devices and recommendations for improvement.
- All Hamilton practice notes can be found on the Hamilton Council website
- Auckland council "Water Sensitive Design Guide GD04". An online resource, including background and wider design approach.
- Morphum Ltd: Draft-"Constructed Wetland Design Guide, April 2015" – for Auckland Council, was not published in the format delivered.

NELSON CITY COUNCIL

Nelson Resource Management Plan

DRAFT Plan Change 27
Land Development Manual References Changes

DRAFT Proposed Plan Amendments

Consultation Date
13 August 2018

Feedback Closes
5pm 28 September 2018

Contents Plan Change 27 Nelson Resource Management Plan Amendments

Introduction

This consultation provides the community with an opportunity to provide feedback on a draft of Plan Change 27 prior to formal notification under the Resource Management Act 1991 (RMA).

This consultation also seeks public comment on the intention to update and incorporate by external reference the Nelson Tasman Land Development Manual 2018 under Part 3 of the First Schedule, RMA into the Nelson Resource Management Plan.

Concurrently with this draft plan change Nelson City Council and Tasman District Council are also seeking public feedback on the content of the draft Nelson Tasman Land Development Manual 2018 as Council's minimum standards for works on Council assets and assets to vest, under the Local Government Act 2002 (LGA).

This document contains the proposed Nelson Resource Management Plan amendments which can be generally summarised as follows:

- Externally reference[1] throughout the Plan the Nelson Tasman Land Development Manual 2018 to replace the Nelson City Council Land Development Manual 2010 as a means of compliance for controlled activity subdivisions, and as an assessment criterion for restricted discretionary and discretionary activity subdivisions.

- Consequential amendments including rewriting of the building over drains rule so that it operates independently of the NTLDM, and removal of access diagrams and requirements in appendix 11 and 12 as these requirements are now contained in the NTLDM.

Note: no changes are proposed to designations or regional rules.

[1] Externally reference means a document referred to as per Part 3, First Schedule, Resource Management Act 1991.

Plan Amendments – Instructions for Submitters

Plan Change 27 uses the following different types of text to indicate to the reader what is included in the plan change and what is proposed to be changed.

'Normal text' applies to current operative provisions that remain unchanged. To aid understanding, full text of provisions to be changed have been included in this document. **The reader should however be aware that the Plan Change relates only to the underlined and strikethrough text, and that the operative text is unable to be submitted upon.**

'Underline' applies to proposed new provisions.

~~'Strikethrough'~~ applies to operative provisions proposed to be deleted or amended as described.

'Italics' applies to instructions for amendments.

^{PC13} or $^{07/01}$ applies to text inserted from other plan changes.

(Draft Proposed Plan Change 27 starts on the following page).

1.0 Plan Wide Amendments

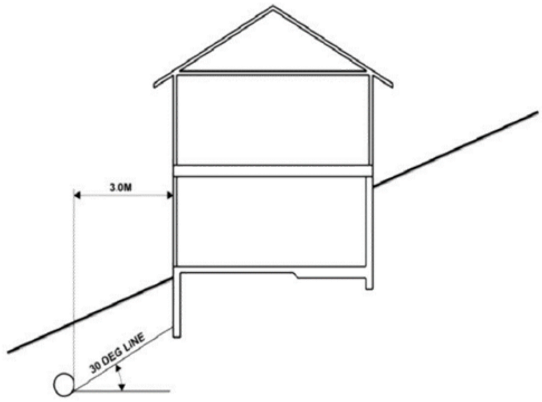
***Amend** all references, except those in regional rules or designations, throughout the plan to Nelson City Council Land Development Manual 2010 to Nelson Tasman land Development Manual 2018, unless otherwise specified in the following sections.*

***Delete** rules REr.34, RUr.31A, ICr.39, SCr.28, INr.32 and OSr.28 Building over or alongside drains and **replace** with the new rule below in each of the Residual, Inner City, Suburban Commercial, Industrial and Open Space Zone. The current rule relies on the NCC Land Development Manual 2010 standards for building over drains which are not included in the Nelson Tasman Land Development manual 2018, the rule has been redrafted to stand alone.*

Proposed REr.34, RUr.31A, ICr.39, SCr.28, INr.32 and OS.28:

Item	Permitted	Controlled	Discretionary/Non-complying
REr.34 RUr.31A ICr.39 SCr.28 INr.32 OSr.28 Building over or alongside drains (piped or open) and water mains	REr.34.1 RUr.31A ICr.39.1 SCr.28.1 INr.32.1 OSr.28.1 Structures 3metres or greater from a drain (piped or open) are a permitted activity. Structures closer than 3metres to a piped drain or watermain are permitted provided that they: For drains or watermains less than or equal to 300mm diameter a) must be located no closer than 1metre measured horizontally from the near side of any public unsleeved water main or common private or public sewer or stormwater drain, or For drains or watermains greater than 300mm b) must be located no closer than 1.5metre measured horizontally from the near side of any public water main, or common private or public sewer or stormwater drain, or For drains 150mm or less c) may be located within 1metre or directly over a common private or public drain if the diameter of the pipe is 150mm or less; providing that: i) The length of pipe or drain built over is no more than 6 meters in length; and ii) There are no changes in direction or junctions in the portion built over; and iii) The length of pipe built over is relaid using a continuous length of pipe without joints, sleeved inside a 225mm diameter class 4 concrete pipe; and	REr.34.2 RUr.31A ICr.39.2 SCr.28.2 INr.32.2 OSr.28.2 Structures: That contravene c) ii) to vi) only are controlled activities The matters of control are; a) Physical accessibility to the pipe, and b) The ground/floor type and design used to provide quick and easy removal to provide the ability to access the pipes for maintenance and repair, and c) The depth of concrete/permanent surface floor over the pipe, and d) Alternative locations for the pipe and methods of emplacement.	REr.34.3 RUr.31A ICr.39.3 SCr.28.3 INr.32.3 OSr.28.3 Discretionary Activity Building within 3m of the top of bank of an open drain is discretionary. All other activities are discretionary.

	iv) There is a minimum 6metre clear length and 3metre clear width and 1.8metre clear height at one end of the sleeve to allow replacement of the pipe; and v) The pipes are not water mains or pressurised pipelines; and in all cases d) may overhang the line of the pipe or drain, provided the structure is cantilevered or is an eave and the height to the underside of the structure above ground level is not less than 1.8metre where the required pipe or drain is greater than 150mm in diameter or width; and e) structures located within 3metre, measured horizontally, from the near side of the pipe or drain must have the base of the foundations deeper than a line drawn at 30degrees from the horizontal from the invert (bottom) of the pipe or drain (or between 30 degrees and 45 degrees if the design has been certified by a suitably qualified engineer)(see diagram).		

Assessment Criteria	Explanation
REr.34.4 ICr.39.4 SCr.28.4 IN.32.4 OS.28.4 a) the nature of the structure and whether access to the pipe or drain can be maintained b) any measures taken to ensure that replacement of the pipe or drain can be undertaken. c) the nature of the pipe or drain, taking into account materials of construction and any bends or joints. d) The accessibility of the pipework or drain and the ease by which it could be extracted.	REr.34.5 ICr.39.5 SCr.28.5 IN.32.5 OS.28.5 This rule applies to piped and open drains. Limiting access to pipes and drains means that repair and maintenance may be very costly and may even result in pipes or drains having to be relocated. This rule seeks to preserve access to all pipes or drains where off-site facilities are likely to be affected. Alternative techniques for ensuring access for maintenance and repair purposes may be considered on a case by case basis through the resource consent process. At the time that application is made for building consent, a request shall be made in writing to waive the rule relating to "Building over or alongside drains, pipes and water mains" where one of these Techniques is proposed to apply. Diagram referred to in REr.34.1a: 

2.0 Chapter 2 Meaning of Words

***Amend existing** definitions as follows:*

MW.iii Definitions

Accessway	includes a footpath, walkway or cycleway and each of these terms and their design requirements are further defined in the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018 (NTLDM).
Classified roads	means roads with a hierarchical classification of Arterial, Principal and Collector. Refer to section 4 'Transport' of the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018 (NTLDM).
Unclassified roads	means roads with a hierarchical classification of Sub-Collector, Local Roads and Residential Lanes. Refer to section 4 'Transport' of the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018 (NTLDM).

3.0 Chapter 3 Administration

AD 10 Relevant documents

Add new information and delete existing from AD10 - Relevant documents as follows:

AD10.2.iii

NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018 (NTLDM).

The NTLDM is a document that combines network asset design and construction requirements for both Nelson and Tasman regions. It is intended to provide consistent minimum standards and guidance for network assets that Council will accept as part of its network, and activities affecting them including maintenance and operations. It also includes formation and construction standards for some private assets that connect to network assets.

The NTLDM replaces former Engineering Standards, the Nelson Land Development Manual 2010, and the Tasman District Engineering Standards.

The relationship of the NTLDM to asset management functions under the Local Government Act (2002) and resource management functions of Council under the Resource Management Act (1991) is important.

All subdivision and development within Nelson and Tasman must be consistent with the requirements of the respective Resource Management Plans (RMPs), being the Tasman RMP and the Nelson RMP. Subdivision and development must be consistent with applicable RMP rules, either by meeting conditions for permitted activities or by applying for and gaining a resource consent.

However, where a new Council network asset is being created, maintained, or replaced through development, such as a new road or water supply pipeline, it is the NTLDM that provides more detailed design and construction standards of what the Councils will accept and take over as a public asset. Additionally, practice notes provide comprehensive design details that can support developers and maintenance and operation contractors in carrying out their activities in a way that will meet Council's expectations for design and construction. The NTLDM and practice notes can also aid the Councils in achieving levels of service that are set out in Long Term Plans and objectives of the RMP's.

Parts of the NTLDM are externally referenced provisions of the Nelson Resource Management Plan or Tasman Resource Management Plan, where specified in those plans. The specified parts will be subject to First Schedule requirements of the Resource Management Act as "externally referenced" standards.

The Council has a Land Development Manual (LDM) which includes both design guidance and minimum standards for subdivision and development. The Manual represents quality urban design and engineering practice and includes design features and standards that are acceptable to the Council. The Manual will be regarded as an acceptable means of compliance with requirements of the Plan and any conditions of consent. It contains minimum design and construction standards as well as design guidance. Minimum standards are differentiated from design guidance for the purpose of assessing compliance with the NRMP rules, as defined in Section 1.1.1 General of the LDM. The Council recognises there may be other acceptable means of compliance, in which case proposals should be accompanied by appropriate supporting detail at the time of resource consent application. The Land Development Manual 2010 is an externally referenced document, and as such has effect as if it is part of the NRMP.

AD 11 Plan construction

Amend reference in AD11 - Plan construction as follows:

AD11.3.3.i e)

e) The area is above the contour for which water can be supplied to meet the requirements of the ~~Council's Land Development Manual~~ Nelson Tasman Land Development Manual 2018 (NTLDM). (The standards are based on the NZS4404: Land Development and Subdivision, and the New Zealand Fire Service Water Supplies Code of Practice).

4.0 Chapter 5 District Wide Objectives and Policies

DO10 Land transport

Amend references and existing wording in DO10 - Land transport as follows:

Methods - DO10.1.2.ix

Chapter 4 of the Nelson Tasman Land Development Manual 2018NCC Land Development Manual 2010 providing a range of road designs to allow the functional and operational objectives of the transport network to be achieved.

Methods - DO10.1.3.vii

NCC Land Development Manual 2010Chapter 4 of the Nelson Tasman Land Development Manual 2018 providing a range of road standards to allow the functional and operational objectives of the transport network to be achieved.

Methods - DO10.1.7.ii

Road and subdivision designs that take into account and promote the needs of pedestrians and cyclists provided through the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018 Transport SectionChapter.

DO13A Urban Design

Amend references and existing wording in DO13A – Urban design as follows:

Methods – DO13A.2.1.iii

Standards and design guidanceMandatory matters and good practice in the Nelson Tasman Land Development Manual 2018NCC Land Development Manual.

Methods – DO13A.2.2.vi

The Nelson Tasman Land Development Manual 2018 NCC Land Development Manual provides opportunities for trade-offs to enable reduced road widths when integrated with public open space or esplanade reserve, where footpaths and/or parking can be accommodated outside of legal road.

Methods – DO13A.2.3.vi

Implement Nelson Tasman Land Development Manual 2018 NCC Land Development Manual Parks and Reserves and Transport sections.

Methods – DO13A.3.1.iii

Standards and guidanceMandatory matters and good practice contained in the Nelson Tasman Land Development Manual 2018NCC Land Development ManualParks andReserves and Landscaping, and Transport sections.

Explanation and Reasons – DO13A.3.2.i

The Council will encourage designs for public spaces that create win win situations, enabling a range of environmental, economic and social/cultural benefits to be acheivedachieved. An example of this approach is the design of an esplanade reserve that has both ecological benefits through its design width and planting, and also provides benefits for the adjoining suburban neighbourhood in terms of amenity, recreation, accessibility and connectivity, and low impact stormwater opportunities. Quality urban design also treats streets and other thoroughfares as positive spaces with multiple functions

Methods – DO13A.3.2.iv

Implement Nelson Tasman Land Development Manual 2018NCC Land Development ManualParks and Reserves, Stormwater and Transport sections.

Methods – DO13A.5.1.v

Mandatory matters and good practice Standards and design guidance in the Nelson Tasman Land Development Manual 2018Land Development Manual 2010.

Methods – DO13A.6.2.iii

Mandatory matters and good practice Standards and design guidance in the Nelson Tasman Land Development Manual 2018NCC Land Development Manual.

DO14 Subdivision and development

Amend references and existing wording in DO14 – Subdivision and development as follows:

Methods – DO14.2.1.viii

Nelson Tasman Land Development Manual 2018Nelson City Council Land Development Manual.

Methods – DO14.3.1.viii

NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018.

Policy – DO14.3.2. i)

i) All wastewater, water and stormwater infrastructure specified in Section 3Chapters 5, 6 and 7 of the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018 to become public shall be vested in Council.

Methods – DO14.3.2.vi

NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018.

Methods – DO14.3.3.vi

NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018.

5.0 Chapter 7 Residential Rules

Rule REr.31 - Fences

Amend references and existing wording in Rule REr.31 – Fences as follows:

Explanation - REr.31.5 - Notes

Refer to rules REr.29 corner sites, REr.40 Access and Chapter 4, section ~~4.3.15.4~~ 4.10 of the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual~~, and REr.92 Heritage Precincts Front fences for other rules relating to fence heights or locations.
Refer to the NCC Residential Street Frontage Guidelines

Rule REr.40 – Access

Amend references and existing wording in Rule REr.40 – Access as follows:

Permitted - REr.40.1

Vehicle access must be provided and maintained for each site (except for small unstaffed network utility buildings) in accordance with the standards set out in Appendix 11 and the mandatory matters in ~~sections 4.3.7d)1) to 7), 4.3.7e) to i), 4.3.7d), 4.3.8.2a) to c), 4.3.8.5a), 4.3.12.7a) to c), 4.3.15d), 4.3.15.1a) to f), 4.3.15.2b) to d), 4.3.15.3b) to c), 4.3.15.3a) and Tables 4-6, 4-7, and 4-164 and Figures 4-M, 4-N, 4-O and 4-P~~Chapter 4, section 4.10 of the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010~~. Where vehicle access is not required under this rule but voluntarily provided, all such access must be provided in accordance with Appendix 11 and ~~minimum standards~~mandatory matters in the Nelson Tasman Land Development Manual 2018 ~~NCC Land Development Manual 2010~~ as listed above.

Rule REr.56 – Network Utility - Roads

Amend references and existing wording in Rule REr.56 – Network Utility - Roads as follows:

Permitted - REr.56.1 b)

b) the ~~minimum~~ mandatory matters ~~standards (as defined Section 1.1.1 General) in Section~~ in Chapter 4 of the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010~~ are complied with.

Assessment Criteria - REr.56.4 a)

a) the matters in ~~section~~ Chapter 4 of the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010~~.

Rule REr.58 – Building on low lying sites

Amend references and existing wording in Rule REr.58 – Building on low lying sites as follows:

Assessment Criteria - REr.58.4 d)

d) ~~section 5.6.5b) and Table 5-6 and 5-7 in section~~Chapter 5, section 5.4.5 of the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010.~~

Rule REr.63 – Service overlay - Building

Amend references and existing wording in Rule REr.63 – Services overlay - Building as follows:

Assessment Criteria - REr.63.4 a)

a) the matters in the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010.~~

Rule REr.107 – Subdivision - General

Amend references and existing wording in Rule REr.107 – Subdivision - General as follows:

Controlled - REr.107.2 b)

it complies with the ~~minimum standards as defined in Section 1.1.1 General~~mandatory matters in the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010~~, and

Controlled - REr.107.2 i) Control is reserved over:

the mandatory matters in the Nelson Tasman Land Development Manual 2018 ~~NCC Land Development Manual 2010~~, and

Discretionary/Non-Complying - REr.107.3 iii)

the matters in the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010~~

Assessment Criteria - REr.107.4 a)

the matters in the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010~~.

Assessment Criteria - REr.107.4 ff)

the extent to which the proposed public reserves achieve the outcomes sought in ~~section 12~~Chapter 10 Parks and Reserves of the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010~~.

Explanation - REr.107.5

A restricted discretionary activity category is provided in recognition that it is difficult to achieve the better urban design outcomes sought by the NRMP and the Nelson Tasman Land Development Manual 2018 ~~NCC Land Development Manual~~ through a prescriptive set of ~~minimum~~ mandatory standards. The restricted discretionary category is therefore provided for applicants who can demonstrate, through compliance with Appendix 14, that the proposed design solution is compatible with the urban design outcomes sought by the Plan and the good practice guidance in the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual~~. This category also includes Comprehensive Housing Developments in the restricted discretionary subdivision category.

In order to achieve high quality urban design outcomes it is considered that the design and construction of local neighbourhood reserves should be undertaken in conjunction with the residential subdivision. The process and design criteria to achieve this are outlined in ~~section 12~~Chapter 10 'Parks and Reserves' of the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010~~.

Rule REr.108 – Subdivision – Services Overlay

Amend references and existing wording in Rule REr.108 – Subdivision – Services Overlay as follows

Discretionary/Non-Complying - REr.108.3 iii)

the matters in the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010~~, and

Assessment Criteria - REr.108.4 b)

the ~~minimum standards and the matters~~mandatory matters and good practice guidance in the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010~~

Rule REr.108 – Subdivision – Landscape Overlay

Amend references and existing wording in Rule REr.109 – Subdivision – Landscape Overlay as follows

Discretionary/Non-Complying - REr.109.3 iii) c)

the matters in the Nelson Tasman Land Development Manual 2018 ~~NCC Land Development Manual 2010~~ with particular regard to the alignment and location of roads, the width of carriageways and planting of berms, and

Schedule U - Marsden Plateau Landscape Area

Amend references and existing wording in Schedule U – Marsden Plateau Landscape as follows

Assessment Criteria U.8.1 viii)

The degree of compliance with Appendices 10, 11, 12 and the matters in ~~section~~ Chapter 4 of the Nelson Tasman Land Development Manual 2018 ~~NCC Land Development Manual 2010~~ except where specific alternatives are provided to address environmental and landscape values of the site and assessment criteria in this schedule, through design.

Assessment Criteria U.8.2 v)

the matters in the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010~~.

Explanation U.9

Consideration of context requires recognition that the ecosystems and habitats of the natural environment are an important resource. In this situation where they play a significant landscape role as the backdrop to the City, they should be incorporated into the design of the subdivision to achieve an integration of natural and built environments. For this reason specific rules, assessment criteria and roading standards have been developed to assist with the integration of development with the landscape, and its ability to acknowledge natural systems and to enhance residential amenity. The roading standards in Table 1 can be used for the Marsden Plateau in lieu of those contained in ~~section~~ Chapter 4 of the Nelson Tasman Land Development Manual 2018 ~~Land Development Manual 2010~~ as they directly relate to the assessment criteria for development within this Schedule. The proposed roading standards are in Table 1 along with definitions detailing the intended use of each road type.

6.0 Chapter 8 Inner City Rules

Rule ICr.32 – Access

Amend references and existing wording in Rule ICr.32 Access as follows:

Permitted ICr.32.1 a)

a) Vehicle access must be provided and maintained on each site (except for Small Unstaffed Network Utility Buildings) in accordance with the standards set out in Appendix 11 (access standards) and the mandatory matters detailed at Chapter 4, section 4.10 of the Nelson Tasman Land Development Manual 2018 ~~s 4.3.7d)1) to 7), 4.3.7e) to i), 4.3.7d), 4.3.8.2a) to c), 4.3.8.5a), 4.3.12.7a) to c), 4.3.15d), 4.3.15.1a) to f), 4.3.15.2b) to d), 4.3.15.3b) to c), 4.3.15.3a) and Tables 4-6, 4-7, and 4-164 and Figures 4-M, 4-N, 4-O and 4-P NCC Land Development Manual 2010~~ except that no vehicle access may be provided across any scheduled frontage shown on Planning Map 1.

Rule ICr.53 – Network utility - roads

Amend references and existing wording in Rule ICr.53 Network utility - roads as follows:

Permitted ICr.53.1 b)

the ~~minimum standards (as defined in Section 1.1.1 General)~~mandatory matters in ~~Section~~ Chapter 4 of the Nelson Tasman Land Development Manual 2018 ~~NCC Land Development Manual~~ 2010 are complied with.

Assessment Criteria ICr.53.4 a)

the ~~minimum standards (as defined in Section 1.1.1 General) in section~~mandatory matters in Chapter 4 of the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010~~.

Rule ICr.54 – Building on low lying sites

Amend references and existing wording in Rule ICr.54 Building on low lying sites as follows:

Assessment Criteria ICr.54.4 d)

~~section 5.6.5b) and Table 5-6 and 5-7 in section~~Chapter 5, section 5.4.5 of the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010~~.

Rule ICr.81 – Subdivision - general

Amend references and existing wording in Rule ICr.81 Subdivision General as follows:

Controlled ICr.81.2 b)

it complies with the ~~minimum standards as defined in Section 1.1.1 General~~mandatory matters in the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010,~~ and

Controlled ICr.81.2 i) Control is reserved over:

the matters contained in the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010~~, and

Discretionary/Non-complying ICr.81.3 a)

every allotment (other than an access lot) complies with ~~the standards as defined in Section 1.1.1 General~~mandatory matters relating to storm water and sewerage in ~~Sections~~ Chapters 5 & 6 of the ~~NCC~~ Nelson Tasman Land Development Manual 201~~0~~8, and

Assessment Criteria ICr.81.4 a)

the matters in the <u>Nelson Tasman Land Development Manual 2018</u>~~NCC Land Development Manual 2010~~, and

7.0 Chapter 9 Suburban Commercial Rules

Rule SCr.32 – Access

Amend references and existing wording in Rule SCr.32 Access as follows:

Permitted SCr.32.1

Vehicle access must be provided and maintained on each site (except for Small Unstaffed Network Utility Buildings) in accordance with the standards set out in Appendix 11 (access standards) and the mandatory matters detailed at Chapter 4, section 4.10 of the Nelson Tasman Land Development Manual 2018 ~~s 4.3.7d)1) to 7), 4.3.7e) to i), 4.3.7d), 4.3.8.2a) to c), 4.3.8.5a), 4.3.12.7a) to c), 4.3.15d), 4.3.15.1a) to f), 4.3.15.2b) to d), 4.3.15.3b) to c), 4.3.15.3a) and Tables 4-6, 4-7, and 4-164 and Figures 4-M, 4-N, 4-O and 4-P of the NCC Land Development Manual 2010~~

Rule SCr.46 – Network utility - roads

Amend references and existing wording in Rule SCr.46 Network utility - roads as follows:

Permitted SCr.46.1 b)

the ~~minimum standards (as defined in section 1.1.1 General) in Section 4 of the NCC Land Development Manual 2010~~ mandatory matters in Chapter 4 of the Nelson Tasman Land Development Manual 2018 are complied with.

Assessment Criteria SCr.46.4 a)

the matters in the Nelson Tasman Land Development Manual 2018~~NCC Land Development Manual 2010.~~

Assessment Criteria SCr.47.4 d)

the matters in ~~Section 4 of the NCC Land Development Manual 2010~~ Chapter 4 of the Nelson Tasman Land Development Manual 2018.

Rule SCr.71 – Subdivision - general

Amend references and existing wording in Rule SCr.71 Subdivision – general as follows:

Controlled SCr.71.2 b)

it complies with ~~minimum standards (as defined in section 1.1.1 General) in Section 4 of the NCC Land Development Manual 2010~~ the mandatory matters in the Nelson Tasman Land Development Manual 2018, and

Controlled SCr.71.2 i) Control is reserved over:

the matters contained in the ~~NCC Land Development Manual 2010.~~ Nelson Tasman Land Development Manual 2018, and

Discretionary/Non-complying SCr.71.3 a)

it complies with ~~minimum standards as defined in Section 1.1.1 General relating to stormwater and sewerage in sections 5 & 6 of the Land Development Manual 2010~~ the mandatory matters relating to stormwater and wastewater in Chapters 5 & 6 of the Nelson Tasman Land Development Manual 2018.

Assessment Criteria SCr.71.4 a)

the matters in the ~~Land Development Manual 2010~~ Nelson Tasman Land Development Manual 2018.

8.0 Chapter 10 Industrial Rules

Rule INr.36 – Access

Amend references and existing wording in Rule INr.36 Access as follows:

Permitted INr.36.1

Vehicle access must be provided and maintained for each site (except for small unstaffed network utility buildings) in accordance with the standards set out in Appendix 11 and the mandatory matters at Chapter 4, section 4.10 s 4.3.7d)1) to 7), 4.3.7e) to i), 4.3.7d), 4.3.8.2a) to c), 4.3.8.5a), 4.3.12.7a) to c), 4.3.15d), 4.3.15.1a) to f), 4.3.15.2b) to d), 4.3.15.3b) to c), 4.3.15.3a) and Tables 4-6, 4-7, and 4-164 and Figures 4-M, 4-N, 4-O and 4-P of the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018.

Rule INr.52 – Network utility - roads

Amend references and existing wording in Rule INr.52 Network utility - roads as follows:

Permitted INr.52.1 b)

the minimum standards (as defined in Section 1.1.1 General)mandatory matters in Section Chapter 4 of the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018 are complied with.

Assessment Criteria INr.52.4 a)

the matters in section Chapter 4 of the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018.

Rule INr.53 - Building on low lying sites

Amend references and existing wording in Rule INr.53 Building on low lying sites as follows:

Assessment Criteria INr.53.4 d)

section 5.6.5b) and Table 5-6 and 5-7 in section 5Chapter 5, section 5.3.5 of the Nelson Tasman Land Development Manual 2018NCC Land Development Manual.

Rule INr.55 – Service Overlay Building

Amend references and existing wording in Rule INr.53 Service Overlay Building as follows:

Assessment Criteria INr.55.4 a)

the development standards and design guidelinesmandatory matters and good practice guidance contained in the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018.

Rule INr.73 – Subdivision - general

Amend references and existing wording in Rule INr.73 Subdivision - general as follows:

Controlled INr.73.2 b)

it complies with the minimum standards as defined in Section 1.1.1 Generalmandatory matters in the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018, and

Controlled INr.73.2 i) Control is reserved over:

the matters contained in the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018, and

Discretionary/Non-complying INr.73.3 a)

it complies in all respects with all the ~~minimum standards as defined in Section 1.1.1 General~~mandatory matters relating to stormwater and wastewater ~~sewerage~~ in ~~Sections~~ Chapters 5 & 6 of the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018.

Assessment Criteria INr.73.4 a)

the matters in the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018.

Rule INr.74 – Services Overlay - Subdivision

Amend references and existing wording in Rule INr.74 Services Overlay - Subdivision as follows:

Discretionary/Non-complying INr.74.3 a)

every allotment (other than an access lot) complies with the ~~minimum standards as defined in Section 1.1.1 General~~mandatory matters relating to stormwater and wastewater ~~sewerage~~ in ~~sections~~ Chapters 5 & 6 of the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018, and

9.0 Chapter 11 Open Space and Recreation

Rule OSr.25 – Building on low lying sites

Amend references and existing wording in Rule OSr.25 - Building on low lying sites as follows:

Assessment Criteria OSr.25.4 d)

section 5.6.5b) and Table 5-6 and 5-7Section 5.3.5 in section Chapter 5 of the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018.

Rule OSr.35 – Access

Amend references and existing wording in Rule OSr.35 - Access as follows:

Permitted OSr.35.1

Vehicle access must be provided and maintained for each site in accordance with the standards set out in Appendix 11 and the mandatory matters at Chapter 4, section 4.10 s 4.3.7d)1) to 7), 4.3.7e) to i), 4.3.7d), 4.3.8.2a) to c), 4.3.8.5a), 4.3.12.7a) to c), 4.3.15d), 4.3.15.1a) to f), 4.3.15.2b) to d), 4.3.15.3b) to c), 4.3.15.3a) and Tables 4-6, 4-7, and 4-164 and Figures 4-M, 4-N, 4-O and 4-P of the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018.

Rule OSr.46 – Network utility - roads

Amend references and existing wording in Rule OSr.46 – Network utility - roads as follows:

Permitted OSr.46.1 b)

the minimum standards (as defined in Section 1.1.1 General)mandatory matters in Section Chapter 4 of the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018 are complied with.

Assessment Criteria OSr.46.4 a)

the matters in section Chapter 4 of the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018.

Rule OSr.51 – Services Overlay - Building

Amend references and existing wording in Rule OSr.51 – Services Overlay - Building as follows:

Assessment Criteria OSr.51.4 a)

the mandatory matters and good practice guidance development standards and design guidelines contained in the NCC Land Development Manual 2010Nelson Tasman Land Development Manual 2018.

10.0 Chapter 12 Rural Rules

Rule RUr.28 –Buildings

Amend references and existing wording in Rule RUr.28 –Buildings as follows:

Assessment Criteria RUr.28.4 b)

the matters in the ~~NCC Land Development Manual 2010~~ Nelson Tasman Land Development Manual 2018.

Rule RUr.29 –Building on low lying sites

Amend references and existing wording in Rule RUr.29 –Building on low lying sites as follows:

Assessment Criteria RUr.29.4 d)

section ~~5.6.5b) and Table 5-6 and 5-7 in~~ 5.3.5, ~~section~~ Chapter 5 of the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018.

Rule RUr.36 –Access

Amend references and existing wording in Rule RUr.36 –Access as follows:

Permitted RUr.36.1

Vehicle access must be provided and maintained for each site in accordance with the standards set out in Appendix 11 and the mandatory matters at Chapter 4, section 4.10 ~~s 4.3.7d)1) to 7), 4.3.7e) to i), 4.3.7d), 4.3.8.2a) to c), 4.3.8.5a), 4.3.12.7a) to c), 4.3.15d), 4.3.15.1a) to f), 4.3.15.2b) to d), 4.3.15.3b) to c), 4.3.15.3a) and Tables 4-6, 4-7, and 4-164 and Figures 4-M, 4-N, 4-O and 4-P~~ of the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018.

Rule RUr.46 –Network utility - roads

Amend references and existing wording in Rule RUr.46 –Network utility - roads as follows:

Permitted RUr.46.1 b)

the ~~minimum standards (as defined in Section 1.1.1 General)~~mandatory matters in Section 4 of the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018 are complied with.

Assessment Criteria RUr.46.4 a)

the matters in ~~section~~ Chapter 4 of the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018.

Rule RUr.49A –Services Overlay - Building

Amend references and existing wording in Rule RUr.49A –Services Overlay - Building as follows:

Assessment Criteria RUr.49A.4 a)

the matters in the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018.

Rule RUr.78 –Subdivision - general

Amend references and existing wording in Rule RUr.78 –Subdivision - general as follows:

Controlled RUr.78.2 b)

it complies with the ~~minimum standards as defined in Section 1.1.1 General~~mandatory matters in the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018, and

Controlled RUr.78.2 i)

the matters contained in the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018, and

Discretionary/Non-complying RUr.78.3 a)

it complies in all respects with all the ~~minimum standards~~mandatory matters in ~~Section~~ Chapter 7 Water, ~~Section~~ Chapter 5 Stormwater and ~~Section~~ Chapter 6 Wastewater in the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018, and

Assessment Criteria RUr.78.4 a)

the matters contained in the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018.

Rule RUr.79 –Subdivision within the Coastal Environment Overlay

Amend references and existing wording in Rule RUr.79 –Subdivision within the Coastal Environment Overlay as follows:

Discretionary/Non-complying RUr.79.3 a)

It complies in all respects with the relevant standards in Appendices 10 to 12, and the ~~minimum standards as defined in Section 1.1.1 General~~mandatory matters in the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018, except in the case of allotments created solely for access or for a network utility where the title of the lot records that it was created solely for access or network utility purposes and that the lot may not comply with requirement for other uses; and

Rule RUr.80 –Subdivision within the Landscape Overlay

Amend references and existing wording in Rule RUr.80 –Subdivision within the Landscape Overlay as follows:

Discretionary/Non-complying RUr.80.3 a)

every allotment (other than an access allotment) complies with the ~~minimum standards (as defined in Section 1.1.1 General)~~mandatory matters relating to stormwater and wastewater in ~~sections~~ Chapters 5 & 6 of the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018, and

Rule RUr.85 –Services Overlay

Amend references and existing wording in Rule RUr.85 –Services Overlay as follows:

Assessment Criteria RUr.85.4 b)

the matters in the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018.

11.0 Volume 3 Appendix 7 Guide to subdivision in the landscape overlay

AP7.3 –Performance guidelines – residential zone

Amend references and existing wording in AP7.3 –Performance guidelines – residential zone as follows:

AP7.3.i h)

Carriageway widths may be varied from ~~tables 4-3 & 4-4~~those given in ~~section~~ Chapter 4 of the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018, to allow the creation of open space or planted areas within legal road, provided it can be demonstrated that traffic movements will not be adversely affected. Compensatory parking bays may need to be provided in suitable areas.

12.0 Volume 3 Appendix 10 – Parking & Loading

AP10.2 – Definitions

Amend references and existing wording in AP10.2 – Definitions as follows:

All weather surface

~~means a minimum of a layer of basecourse gravel generally all passing a 40mm sieve and compacted with a mechanical roller to a thickness above the subgrade of 150mm when compacted.~~
means construction of a carriageway with adequate drainage, a sound subgrade and compacted graded aggregates that results in a carriageway that is usable by vehicles in all weather conditions.

Classified Road

means roads with a hierarchical classification of Arterial, Principal, and Collector. Refer to ~~section~~ Chapter 4 'Transport' of the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018.

Permanent Surface

~~means a drained hard and durable surface of bituminous chip seal, asphalt, concrete, interlocking paving blocks, or other such approved solid and durable paving (see figure 10, Appendix 11 – access standards) and includes a timber deck, where above ground level.~~
means construction of a carriageway with adequate drainage, a sound subgrade and compacted graded aggregates that results in a carriageway that is usable by vehicles in all weather conditions.

Unclassified Road

means roads with a hierarchical classification of Sub-Collector, Local Roads and Residential Lanes. Refer to ~~section~~ Chapter 4 'Transport' of the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018.

AP10.8 – surfacing of parking and loading spaces

Amend references and existing wording in AP10.8 .iv–surfacing of parking and loading spaces as follows:

c) compliance with the access standards in Chapter 4, section 4.10 ~~s 4.3.7d)1) to 7), 4.3.7e) to i), 4.3.7d), 4.3.8.2a) to c), 4.3.8.5a), 4.3.12.7a) to c), 4.3.15d), 4.3.15.1a) to f), 4.3.15.2b) to d), 4.3.15.3b) to c), 4.3.15.3a) and Tables 4-6, 4-7, and 4-164 and Figures 4-M, 4-N, 4-O and 4-P~~ of the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018 is required.

13.0 Volume 3 Appendix 11 – Access Standards

AP11 – overview – application of Appendix 11

Amend references and existing wording in AP11 –overview – application of Appendix 11 as follows:

AP11.i e)

Any access or accessway must comply with the relevant ~~design and construction standards~~mandatory matters specified in ~~section~~ Chapter 4 'Transport' of the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018.

AP11.ii

For subdivisions creating sites that are steeper than 1 in 8 for residential and 1 in 16 for non residential, the subdivision consent application plans shall show indicative access to a parking space within each lot and the extent of works (including cut/fill batters and retaining) that would be needed. Any retaining structures must be located on private land and not legal road. Final details of the access construction will be required to be shown on engineering plans submitted in accordance with the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018.

AP11.1 – minimum distance of vehicle crossing from intersections

Amend references and existing wording in AP11.1 –minimum distance of vehicle crossing from intersections as follows:

AP11.1.i

Vehicle crossing spacing from intersections shall be in accordance with Section 4.10 Private Access and Crossings Nelson Tasman Land Development Manual 2018.~~No part of a vehicle crossing shall be closer to a road intersection than the distances permitted in Table 11.1.1 below.~~

~~EXEMPTION~~

~~Where the boundaries of the site do not allow the provision of any vehicle crossing in conformity with the above distances, a single vehicle crossing may be constructed provided it is located adjoining an internal boundary of the site in the position which most nearly complies with the provisions of Table 11.1.1.~~

~~Table 11.1.1 minimum distance of vehicle crossing from intersections~~

	~~Intersecting Road Type (in metres)~~		
~~Frontage Road~~	~~State Highway/ Arterial~~	~~Principal/ Collector~~	~~Sub Collector/ Local~~
~~T1.1 Speed limit-up to 50 km/hr~~			
~~State Highway/ Arterial~~	~~60~~	~~50~~	~~35~~
~~Principal/ Collector~~	~~50~~	~~35~~	~~20~~
~~Sub Collector/ Local~~	~~30~~	~~25~~	~~10~~
~~T1.2 Speed limit-80km/hr~~			
~~State Highway/ Arterial~~	~~110~~	~~90~~	~~60~~
~~Principal/ Collector~~	~~85~~	~~70~~	~~50~~
~~Sub Collector/ Local~~	~~60~~	~~50~~	~~40~~
~~T1.3 Speed limit-greater than or equal to 100 km/hr~~			
~~State Highway/ Arterial~~	~~170~~	~~130~~	~~90~~

Principal/ Collector		125	100	75
Sub Collector/ Local		80	70	60
T1.4 Calculation of Distance Values between Tabled Speeds (see Ap11.1.i Note a))				
Formulae:	[(D2-D1) / (Tabled Speed2 -Tabled Speed1)] x (actual speed limit - Tabled Speed1) + D1			
Where : D2 is the distance in the higher tabled speed limit D1 is the distance in the lower tabled speed limit for the same road type				

AP11.1.ii Notes

AP11.1.ii Notes

a) For roads with gazetted speed limits that fall between speed values shown in Table 11.1.1 above, the distance measurements must be proportioned using the method in Table 11.1.1 T1.4 above.

b) Access ways and vehicle crossings should always be on the road of the lowest order where the intersection is between two streets of different categories.

c) Distances shall be measured along the boundary parallel to the centreline of the road from the kerb or formed edge of the intersecting road.

d) Road types (State Highway, Arterial, Principal, Collector, Sub-Collector, and Local) are identified on Planning Maps A2.1 Urban Road Hierarchy Map and A2.2 District Road Hierarchy Map.

AP11.2 – maximum number and minimum spacing of vehicle crossings

Amend references and existing wording in AP11.2 –maximum number and minimum spacing of vehicle crossings as follows:

The maximum number of vehicle crossings permitted for each site shall be in accordance with Section 4.10 Private Access and crossings of the Nelson Tasman Land Development Manual 2018Table 11.2.1 below.

		Frontage Road Hierarchy		
Zone	**Frontage length (m)**	**Unclassified**	**Collector / Principal**	**State Highway / Arterial**
Residential	-	1	1	1
Other Zones	< 60	2	1	1
	60 - 100	2	2	1
	> 100	3	2	2

AP11.2.i Notes

AP11.2.i Notes

a) For sites with frontage to a Classified Road where the speed limit is 80km/h or higher, the minimum spacing between successive vehicle crossings shall be 200 metres. For all other roads, the minimum distance between vehicle crossings shall be 7.5m. The spacing of accesses applies within both sites and between adjacent sites.

b) The maximum number of crossing must be rounded to the nearest whole number. For example: 2.6 crossings will be rounded up to 3 crossings but 2.4 crossings will be rounded down to 2 crossings.

AP11.3 – design of vehicle access

Amend and delete wording in AP11.3 –design of vehicle access as follows:

AP11.3.1

Any access must comply with the relevant design and construction standards specified in Section Chapter 4, Section 4.10 Private Access and Crossings Transport of the Nelson Tasman Land Development Manual 2018Land Development Manual 2010.

AP11.3.2

AP11.3.2 Access to Rural Zone sites must comply with the layout shown in figures 7, 8 or 9. Figure 2 and its accompanying notes must be used to determine the applicable figure.

Delete Figure 2 – Application of access diagrams within the rural zone

AP11.3.3

AP11.3.3 Application Notes for Figure 2

a) Definitions
   i) Light Vehicle means a motor vehicle up to 3500kg gross laden weight.
   ii) Heavy Vehicle is defined in Chapter 2 Meanings of Words - i.e. 'a motor vehicle exceeding 3500kg gross laden weight (Refer Heavy Motor Vehicle Regulations 1974)'
   iii) Road Hierarchy means the road classification set out on Planning Map A2.1 and A2.2. For the purpose of Figure 2, a 'proposed' classification is deemed to be the same as the main classification. i.e. 'Proposed SH6' has same meaning as 'SH6'.

b) Advisory Note: Consent may be required by the road controlling authority for any work adjacent to or over the legal road or state highway. Persons intending to undertake such works should consult the appropriate road controlling authority prior to commencement of work.

c) Application of Figure 2 to Subdivision:
   i) For the purpose of Figure 2, if the activity to which the subdivision relates is not known then the activity is deemed to be a rural activity.
   ii) In relation to a controlled activity subdivision the standards of access shown in Figures 2, 3 and 4 are the minimum required. Under RUr.78.2 viii control is reserved over the development of the subdivision and sites having regard to appropriate vehicle access.

d) Where any legal road is not shown on the Road Hierarchy it shall be deemed to be classed as local road under the Road Hierarchy.

e) Interpretation Of Movement In Relation To Heavy Vehicles
   i) The same or different heavy vehicles arriving once and departing once, or vice versa, from the access, shall be counted as 2 vehicle movements.

f) One Off Activities In Relation To Heavy Vehicle Movements
   i) There will be no limit on heavy vehicle movements in relation to the clause marked ‡ in Figure 2, in which case figure 2 will apply, if the activity is a one off activity, such as an on-site private building project, and

      a. the prior written consent of the adjoining road controlling authority is obtained for the one off activity, in relation to the effects on the adjoining road; and

      b. any damage which, in the opinion of the road controlling authority, has been done to the road in the course of the activity or work shall be re instated by the user or at their cost, to the satisfaction of that authority.

ii) ~~Any application in which this part of the Plan is to be used, must include the prior written consent required under 'f) i) a)' and also provide a statement signed by the person with financial or controlling authority for the activity or work agreeing to reinstate any such damage in accordance with 'f) i) b)' above.~~

~~AP11.3.4~~

~~In addition to AP11.3.4 vehicular access to any site zoned Open Space and Recreation and which:~~

~~a) Is surrounded by land zoned Rural; or~~
~~b) Any vehicular access for the site adjoins or is directly opposite to a rurally zoned site must comply with the layout shown in figure 2.(Low Intensity Rural Access)~~

~~AP11.3.5~~

~~For sites which adjoin or are capable of gaining vehicle access from publicly owned and operated carpark, no vehicle entrance may be provided to any site from any road, if access is obtainable from publicly owned and operated carparks or from any Right of Way or proposed or existing service lane. If no such access is available the vehicle entrance must be on the road of the lowest order as shown on the Road Hierarchy Maps A2.1 and A2.2.~~

AP11.4 – vehicle oriented commercial activities

Amend and delete references and existing wording in AP11.4 –vehicle oriented commercial activities as follows:

AP11.4.2 b)

Vehicle crossings into vehicle oriented commercial activities must comply with the minimum distance of vehicle crossing from intersections contained in Section 4.9.2 Private Access of the Nelson Tasman Land Development Manual 2018~~Table 11.2.1~~.

Delete Figure 6 – Required sight distances

Delete Figure 7 – Low intensity rural access

Delete Figure 8 – Medium intensity rural access

Delete Figure 9 – High intensity rural access : details of required access taper, access surfacing, and localised widening

14.0 Volume 3 Appendix 12 – Tracking curves

AP12.1 – clearances additional to tracking curves

Amend references and existing wording in AP12.1 – clearances additional to tracking curves as follows:

AP12.1.i

Tracking curves shall be in accordance with Chapter 4, Section 4.10 of the Nelson Tasman Land Development Manual 2018. A clearance factor is to be added onto the 85 percentile tracking curves as an allowance for driver unfamiliarity, vehicle steering variation, manoeuvring past obstacles and variations in approach manoeuvring in accordance with the standards below.

AP12.1.ii

For residential activities a minimum clearance of 300mm must be applied to both sides of the 85 percentile car tracking curve of this design vehicle for any part of the vehicle manoeuvre except:

a) any manoeuvre within a parking space, or

b) any manoeuvre through an opening to a parking space (such as garage doors), or

c) any part of a manoeuvre not involving horizontal turns or changes in direction.

AP12.1.iii

For other than residential activities using the 85 percentile car tracking curve a minimum clearance of 600mm must be applied to both sides of the 85 percentile tracking curve of this design vehicle for any part of the vehicle manoeuvre except:

a) any manoeuvre within a parking space, or

b) any manoeuvre through an opening to an outdoor parking space, or

c) any part of a manoeuvre not involving horizontal turns or changes in direction.

For the avoidance of doubt, the 600mm clearance factor is required for any part of a manoeuvre through an entrance or exit of a building or enclosed area.

AP12.1.iv

For other than residential activities using the tracking curves other than the 85 percentile car tracking curve a minimum clearance of 600mm must be applied to both sides of the 85 percentile tracking curve of the particular design vehicle for any part of the vehicle manoeuvre except:

a) any manoeuvre within a parking space, or

b) any manoeuvre through an opening to an outdoor parking space

For the avoidance of doubt, the 600mm clearance factor is required for any part of a manoeuvre through an entrance or exit of a building or enclosed area.

AP12.1.v

Obstructions to tracking curve clearances:

no structure, object, building or part of a building shall obstruct the minimum clearance from the ground level or finished floor level if within a building, up to a height of:

a) 2.3m in the case of a 85 percentile car tracking manoeuvre, or

b) 4.4m (minimum) in the case of any other vehicle manoeuvre

AP12.2 – 85 percentile car – tracking curves

Delete references, figure 1 and existing wording in AP12.2 – 85 percentile car – tracking curves

AP12.3 – 85 percentile two axle truck – tracking curves

Delete references, figure 2 and existing wording in AP12.3 – 85 percentile two axle truck – tracking curves

AP12.4 – 85 percentile semi-trailer– tracking curves

Delete references, figure 3 and existing wording in AP12.4 – 85 percentile semi-trailer– tracking curves

AP12.5 – 85 percentile tour coach– tracking curve

Delete references, figure 4 and existing wording in AP12.5 – 85 percentile tour coach– tracking curve

15.0 Volume 3 Appendix 14 – Residential subdivision design & information requirements

AP14.1 – General

Amend references and existing wording in AP14.1 – general as follows:

AP14.1.i

Appendix 14 and the restricted discretionary activity subdivision provisions under Rule REr.107 are provided because the Council recognises that in pursuing better urban design it is difficult to achieve such a goal by imposing prescriptive rules and minimum standards. This will be particularly relevant for hillside greenfield subdivision and intensification within the existing residential area.

In recognition of this barrier, the restricted discretionary category provides an avenue for those designs that may not comply in full with the ~~minimum standards~~ mandatory matters set out in the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018. Such developments may in fact still represent quality urban design for the particular site and therefore warrant a restricted discretionary activity status and non-notified consent process.

AP14.2 – Information requirements

Amend references and existing wording in AP14.2 – Information requirements as follows:

AP14.2.i b)

- Preliminary infrastructure plans
  - May be required for works not included in the design and construction requirements of the Land Development Manual 2010. Refer to Chapter 2 ~~3.1~~ of the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018.

AP14.2.2 – Design Description: Subdivision and Development Plan

Amend references and existing wording in AP14.2.2 – Design Description: Subdivision and Development Plan as follows:

AP14.2.2.ii e) ii)

preliminary infrastructure design for areas departing from the ~~minimum standard~~mandatory matters in the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018. Cross sections may be necessary to illustrate site specific design responses.

AP14.3.1 – Movement network

Amend references and existing wording in AP14.3.1 – Movement network as follows:

AP14.3.i

~~Section~~ Chapter 4 of the ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018 provides advice on the road standards relative to function and speed environments, use of and standards for cul de sacs, residential lanes and rights of way. Council's Transport Officers can provide advice regarding existing traffic movements, intended connections and any upgrading plans or requirements.

AP14.3.2 – Open space network

Amend references and existing wording in AP14.3.2 – Open space network as follows:

AP14.3.2.i

The ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018 contains a chapter on parks and reserves ~~and landscaping~~ which details the different types of Council owned reserves and their design requirements. Council staff can provide advice in respect of the need or not of particular reserves in particular locations, and should be consulted prior to proposing the selection of any site for an intended public reserve. Where significant landscapes and ecological and natural features exist on site they should be assessed for their suitability for incorporation into the subdivision design. Subdivision design has the potential to incrementally enhance biodiversity corridors in Nelson and is an important component of quality urban design and the suitability of wildlife.

AP14.3.5 – Stormwater management

Amend references and existing wording in AP14.3.5 – Stormwater management as follows:

AP14.3.5.i

Stormwater management and low impact design should be considered early in the site planning process as these will usually influence the design of the subdivision and roads. The ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018 provides design objectives and standards for reticulated and low impact stormwater management in the stormwater section, and the parks and reserves section provides guidance on when a stormwater device is acceptable within a public reserve, and the level of reserves contribution offset provided. Given Nelson's hilly topography and soils it will be difficult for a design to rely solely on low impact approaches and these will likely need to be combined with a reticulated system.

AP14.3.7 – Reticulated services

Amend references and existing wording in AP14.3.7 – Reticulated services as follows:

AP14.3.7.i

The ~~NCC Land Development Manual 2010~~Nelson Tasman Land Development Manual 2018 provides minimum standards and information requirements necessary to accompany an application, including requirements for street lighting.

16.0 Volume 3 Appendix 22 – Comprehensive housing development

AP22.6 – Access, parking and services

Amend references and existing wording in AP22.6 – Access, parking and services as follows:

AP22.6.iii

Parking, access and services should be in accordance with Appendices 10 (standards and terms for parking and loading) and 11 (access standards), and the ~~minimum standards~~mandatory matters in ~~section~~ Chapter 4 of the ~~NCC~~ Nelson Tasman Land Development Manual 2018~~0~~. The development may make provision for reduced car parking provision where it can be demonstrated that actual parking demand will be less than the parking requirements in Appendix 10 (Standards and Terms for Parking and Loading). For example, this may be because of proximity to local shops or public transport, high numbers of cycle connections and/or reduced vehicle based travel dependence for other reasons. Any assessment for a reduction in car parking numbers will be carried out through the resource consent process.