

**MARINE POLICY STAFF REPORT - JUNE 19, 2018
and APPENDICES
(Extracted from June 25, 2018 Council Meeting Agenda)**

June 19, 2018 Staff Report:

[Marine Policy Planning](#)
[North Saanich Coastal Mitigation Flooding Bylaw No. 1439 \(2018\)](#)
[North Saanich Official Community Plan Marine Policy Bylaw No. 1442 \(2018\)](#)
[For Information and Decision](#)

With the following attachments:

Appendix A

[Technical Memo April 24, 2018](#)
[OCP Marine Policies and Guidelines Final Draft Tracked Changes](#)
[OCP Marine Policies and Guidelines Final Draft \(April 23 2018\)](#)

Appendix B

[Final Amendment to Section 3.5 and 3.6 – Flood Hazard Area Land Use
Management Guidelines \(January 1, 2018\)](#)

Appendix C

[Technical memo April 3, 2018](#)
[Flood Construction Level Report \(March 27, 2018\) Marine Policy
Updated Tracked](#)
[Flood Construction Level Report \(March 27, 2018\) Marine Policy
Updated Untracked](#)

Appendix D

[Bylaw 1439 Coastal Flooding Mitigation](#)

Appendix E

[Bylaw 1442 Marine Policy](#)

Appendix F

[FAQ Marine Policy June 2018](#)

[June 25, 2018 Presentation to Council](#)



**District of
North Saanich**

STAFF REPORT

To: Rob Buchan
Chief Administrative Officer

Date: June 19, 2018

From: Coralie Breen
Senior Planner

File: 6740-2014

Re: Marine Policy Planning
North Saanich Coastal Mitigation Flooding Bylaw No. 1439 (2018)
North Saanich Official Community Plan Marine Policy Bylaw No. 1442 (2018)
For Information and Decision

RECOMMENDATION:

That Council:

- 1) Give first and second reading to OCP Marine Policy Bylaw 1442 (2018) as attached to this staff report (June 19, 2018) and give consideration to the financial and waste management plans ; and
- 2) Direct staff to proceed to public hearing for Bylaw 1442;
- 3) Give first, second and third readings to Coastal Flood Mitigation Bylaw 1439 (2018) as attached to this staff report (June 19, 2018).

OFFICIAL COMMUNITY PLAN & STRATEGIC PLAN IMPLICATIONS:

This matter relates to the Official Community Plan vision:

Protect and Enhance Rural, Agricultural, Heritage, Marine and Environmental Resources

Official Community Plan (OCP) related policies Sections 4.0 Marine Policies, 14.0 Development Permit Areas, 16.0 Regional Context Statement

This matter relates to the following Strategic Plan Goals:

Preserve and Protect Sensitive & Significant Environmental Areas & Ecosystems
Preserve and Protect Sensitive & Marine Inter-Tidal Habitats
Climate Change Impacts Mitigated

This matter relates the following Strategic Plan Projects:

- #3 Prepare policies to guide marine and shoreline development (including planning for sea level rise).*
- #4 Bring forward to Council the Marine Task Force recommendations and work plan.*
- #5 Review District bylaws and policies that affect waterfront property owners.*

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 OCP Marine Policy Bylaw No. 1442 (2018)

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And consider in this matter the initial review of the Shoal Harbour Migratory Bird Sanctuary to prepare for:

#2 Staff to prepare a report regarding possible roles for the District in the Shoal Harbour Migratory Bird Sanctuary

SCOPE:

There are approximately 731 waterfront lots in the District of North Saanich.

For 0.5 m sea level rise (SLR) scenario 572 lots are directly affected in the shoreline or 15 m setback by wave effects and flooding and 131 lots will be completely inundated or partially inundated by sea level rise.

For the 1.0 m SLR scenario, 550 lots are exposed to flooding and partial flooding or complete inundation on 163 lots (as outlined in the District of North Saanich Flood Construction Levels for 0.5 m and 1.0 m Report, January, 2017 (the FCL Report pg. iii).

PURPOSE OF THE STAFF REPORT:

The purpose of this staff report is to provide Council with:

- 1) draft OCP amendments to the marine policies Bylaw 1442; and
- 2) draft Coastal Flood Mitigation Bylaw 1439

These bylaws are provided subject to Council's direction:

- 272 That Council receive the staff report (April 27, 2018) for information.
- 273 That Council proceed with the coastal floodplain approach as outlined in the staff report (April 27, 2018).
- 274 That Council accept the \$50,000 Transport Canada grant.

DISCUSSION:

This staff report follows a detailed staff report considered by Council on May 7, 2018 whereby Council directed staff to proceed with a Coastal Flood Mitigation Bylaw approach to adaptation to sea level rise. This replaces a previously considered development permit area approach.

Where a local government has detailed information regarding the existence and extent of a flood hazard and it wishes to manage development in a manner that involves least cost and delay to owners seeking to develop their land, a regulatory bylaw under s. 524 offers significant advantages over a development permit area designation, including time and cost savings. Owners who are willing to comply with the regulatory bylaw may simply submit a building permit application supported by drawings that illustrate compliance, rather than first going through a development permit process. An engineer's report addressing the flood hazard on a site-specific basis is only required if the owner seeks an exemption from the bylaw, in respect of flood construction level or building setback.

The enactment of the bylaw provides certainty for owners regarding the standards that will apply when they develop their parcel. With a development permit area designation and standards that are applied as guidelines only, there is some uncertainty as to how strictly the guidelines will be applied when discretion is exercised to issue a development permit. While some owners might prefer a scenario where there is at least a chance that they will be able to obtain a permit

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authorizing development that doesn't comply in every respect with the guidelines, others including the development industry generally prefer the certainty associated with regulations that can be ascertained by consulting a municipal bylaw that is applied without any exercise of discretion. Additionally, a s. 524 bylaw would be more straightforward for District officials to administer, in that the construction standards for each parcel would be ascertainable from the bylaw versus interpretation of an engineer's report referenced in a development permit.

Staff are recommending that the term "Coastal Flood Mitigation Bylaw" be used for a s. 524 bylaw dealing with the coastal flooding hazard because it more accurately describes the nature of the hazard for which the bylaw is being enacted. The term "floodplain" used in the *Local Government Act* is more apt for describing the hazard associated with watercourses such as rivers and estuaries.

Revisions to the outlined recommendations in the Marine Report have considered public consultation feedback and other advice to be consistent with the *Local Government Act*, *Community Charter* and *Building Act* and the new FHALUMG are outlined in the tracked version of the Marine Report which removes the proposed development permit and adds simplified maps versions of the coastal flood mitigation maps attached to the proposed Coastal Flood Mitigation Bylaw. An untracked version of the Marine Report is also attached to this staff report (June 19, 2018).

A Coastal Mitigation Flooding Bylaw 1439 and OCP Marine Policy Bylaw 1442 amendment is attached to this staff report (June 19, 2018). A question and answer is also attached to this staff report (June 19, 2018) which will be posted on the DNS website with the updated DNS OCP Marine Policy and Guidelines Recommendations Report (March, 2018).

LEGAL ASPECTS:

Local Government Act

S. 524 Requirements in relation to flood plain areas

(2) If a local government considers that flooding may occur on land, the local government may, by bylaw, designate the land as a flood plain.

(3) If land is designated as a flood plain under subsection (2), the local government may, by bylaw, specify

(a) the flood level for the flood plain, and

(b) the setback from a watercourse, body of water or dike of any landfill or structural support required to elevate a floor system or pad above the flood level

(4) In making bylaws under this section, a local government must

(a) consider the Provincial guidelines, and

(b) comply with the Provincial regulations and a plan or program the local government has developed under those regulations.

CONSULTATIONS:

Public consultations were held November 16, 2017, October 19, 2017, January 26, 2017, November 17, 2016 and June 7, 2016.

District of North Saanich staff have met with PROW representatives (April 23, 2018) to provide the proposed approach prior to the May 7th Council meeting. PROW is supportive of the approach to remove the proposed development permit and the proposed Coastal Flood Mitigation Bylaw.

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Staff will be providing additional information to PROW (June 19, 2018) prior to Council's deliberations on June 25, 2018. There is no need to consider IAP2 at this time to proceed. Staff acknowledge further consultation with community will be required at the zoning bylaw review and will be included in future strategic planning with Council.

OPTIONS:

Council can:

1. Give first and second readings to the North Saanich OCP Amending Bylaw Marine Policy Bylaw 1442 for first and second reading; and
2. Proceed to public hearing for Bylaw 1442.
3. Give first, second and third readings to the North Saanich Coastal Mitigation Flooding Bylaw 1439 for first, second and third readings.

Bylaw 1439 does not require a public hearing.
4. Other.

NEXT STEPS:

1. Public hearing for the OCP Bylaw 1442
2. Study and Recommendations for Tsehum Harbour and the Shoal Harbor Migratory Bird Sanctuary (Spring – Winter, 2018)
3. Marine Policy Planning – Zoning Bylaw Draft Changes (Winter 2018)

Timeline subject to change.

INTERDEPARTMENTAL INVOLVEMENT/IMPLICATIONS:

The staff report has been circulated to the District of North Saanich Directors for review.

RECOMMENDATIONS:

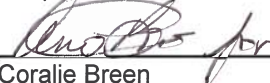
Staff recommends Council proceed with readings for:

1. "North Saanich OCP Marine Policy Bylaw 1442 (2018)"
Updates OCP marine policies to be consistent with the proposed Bylaw 1439; AND
2. "North Saanich Coastal Mitigation Flooding Bylaw No. 1439 (2018)"
AND
3. Direct staff to proceed with the public hearing for Bylaw 1442.

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Respectfully submitted,


 Coralie Breen
 Senior Planner

Concurrence


 Rob Buchan
 Chief Administrative Officer

Concurrence:


 Anne Berry, Director of Planning and Community
 Services

Eymond Toupin, Director of Infrastructure
 Services


 Stephanie Munro, Director of Financial Services

Curt Kingsley, Director of Corporate Services

John Telford, Director of Emergency Services

Appendix A OCP Guidelines and Marine Policy Recommendations Report (April 23, 2018)
 See <https://www.northsaanich.ca/MarinePolicy> updated tracked and untracked versions and technical memo

Appendix B Flood Hazard Area Land Use Management Guidelines (effective January 1, 2018) see
<https://www.northsaanich.ca/MarinePolicy>

Appendix C Flood Construction Level Report (March 27, 2018) See <https://www.northsaanich.ca/MarinePolicy>
 updated tracked and untracked versions and technical memo

Appendix D "North Saanich Coastal Mitigation Flooding Bylaw No. 1439 (2018)".

Appendix E "North Saanich OCP Marine Policy Bylaw No. 1442 (2018)".

Appendix F "FAQ Marine Policy Question and Answer" (June, 2018)

Appendix A



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TECHNICAL MEMO

TO:	To File / For Discussion	DATE:	April 24, 2018
C.C.:	John Readshaw, Sherry Lim	FROM:	Jessica Wilson
PROJECT:	634533 - DNS – FCL Study	MEMO NO:	0009
SUBJECT:	Legend for Highlights to Mark Changes to OCP Marine Policy and Guidelines Recommendations Report	DOCUMENT NO:	634533-0000-4PEN-0009

1. INTRODUCTION

Project: 634533 - DNS – Flood Construction Levels (FCL) Study
Purpose: Legend for highlights to mark changes to the OCP Marine Policy and Guidelines Recommendations Report

References:

Superseded Report: OCP Marine Policy and Guidelines Recommendations – For Sea Level Rise Planning and Adaptation, Dated 13 October 2017, Document No.: 634533-3000-41ER-0002 Rev. No.: **PH**

Revised Report: OCP Marine Policy and Guidelines Recommendations – For Sea Level Rise Planning and Adaptation, Dated 23 April 2018, Document No.: 634533-3000-41ER-0002 Rev. No.: **01**

2. LEGEND

Text or Text – Revisions based on outcome of public consultation or new information/analysis

Text or Text – Edits for wording, grammar, and clarity

Prepared by:	Jessica Wilson, EIT	
Reviewed by:	Sherry Lim, P.Eng	
Approved by:	John Readshaw, P.Eng	
	Name	Signature 20/6/18



District of North Saanich

OCP Marine Policy and Guidelines Recommendations

For Sea Level Rise Planning and Adaptation

Prepared By: SNC-Lavalin Inc. 23 April, 2018

Document No.: 634533-3000-41ER-0002

Revision: 01



District of North Saanich

OCP Marine Policy and Guidelines Recommendations



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EXECUTIVE SUMMARY

Ongoing climate change is expected to lead to many changes including increased temperatures and as a result, increased ice melting and rising sea levels. Although the pace of these effects is still uncertain, this report is the start of a process initiated by the District of North Saanich (DNS) to assess, evaluate and plan for the expected effects of rising sea levels and the likely consequences around the shoreline of the district.

The purpose of this document is to provide recommendations to update the marine policies of the District of North Saanich Official Community Plan (OCP) known as “Official Community Plan Bylaw No. 1130”.

A review and assessment of the results and findings of the Flood Construction Level Study [14] found the following overall consequences:

- Nearly the entire shoreline of the DNS is exposed to a growing flood hazard related to the expected effects of climate change related sea level rise.
- The flood hazard occurs primarily to private properties and differs considerably in character around the shoreline.
- The most exposed areas of the shoreline are located in the Tsehum Harbour area and along Lochside Drive near the McTavish interchange.
- In many locations the future flood hazard is concentrated at the toe of steep cliffs and bluffs and in locations where the cliffs or bluffs are grounded on outcropping bedrock. In these latter situations it will be sometime before a flooding related hazard materializes.
- In many other locations, the future hazard is concentrated at the toe of existing seawalls and the consequences will be manifested either at or adjacent to the seawall base, on publically owned foreshore, or at the top of the seawall where overtopping wave action will create a increasing problem either from the flooding by the overtopping volume of water during storms, from erosion and unravelling of the seawall or from erosion of the land immediately behind the seawall. If structures are located close to the seawall there may be a threat to the safety and security of personnel or to the structure during a coastal storm.
- The scale of the flooding hazard, in all cases, is dependent on individual situations; exposure, resources, relevant time frames and immediate needs and concerns, and is best evaluated and addressed on a site by site and individual by individual basis.

For this reason, three distinct measures are recommended:

1. Existing portions of the OCP should be amended to allow for future adaptation measures by individual parcel owners. These measures are addressed in Section 3.2.1 of this document.
2. The Tsehum Harbour and Lochside Drive areas of the DNS should be added to the OCP as Special Development Areas. These measures are addressed in Section 3.2.2 of this document.
3. A new Coastal Flood Mitigation Bylaw should be adopted by Council to address the growing flood hazard related to sea level rise. Adopting a new bylaw instead of creating a new DPA will address many of the concerns raised during the public consultations. The proposed new bylaw is addressed in Section 3.2.3, 3.3, and Section 4 of this document.

End of Executive Summary

District of North Saanich

OCP Marine Policy and Guidelines Recommendations



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1 INTRODUCTION

1.1 Background

Ongoing climate change is expected to lead to many changes including increased temperatures and as a result, increased ice melting and rising sea levels. Although the pace of these expected effects is still uncertain, this report is intended as the start of a process initiated by the DNS to assess, evaluate and plan for the expected effects of rising sea levels and the likely consequences around the shoreline of the district.

The Province of British Columbia began the process of preparing the province for the upcoming effects of climate change with the publication of an adaptation strategy [1], which identified three key strategies to achieve a prepared and resilient community, as follows:

Stage 1: Build a strong foundation of knowledge

This strategy is aimed at providing decision-makers (e.g. provincial ministries, local governments, private industry, etc.) the appropriate support needed to interpret and understand complex climate projections so that appropriate future adaptation decisions are made.

Stage 2: Assess risks and implement priority adaptation actions in sectors

The risk of areas known to be sensitive to climate change must be assessed and adaptation implementation must be prioritized and staged.

Stage 3: Make adaptation part of Government's business

In order to take action, the planning and implementation of climate change adaptation will be incorporated into government policies, legislations, and regulations.

As part of this initiative, in 2011, the Province released three key Guideline documents ([2][3][4]) that provide guidelines focused on climate change adaptation including, specifically, the identification and management of coastal flood hazard land use [3]. These provincial Guideline documents stress the need to establish management parameters, such as a flood construction level (FCL), to limit risks and damage associated with sea level rise (SLR) and coastal flooding events.

In conjunction with the climate change adaptation Guideline documents, the Province has finalized its amendment to the current standing provincial Flood Hazard Management Guideline document [5], which covers all aspects of flood hazard management, including river and stream related flooding and tsunami hazards. The amendment has been posted to the Flood Safety website and came into force on 1 January 2018 [6]. The work and recommendations described in this report are consistent with the Guideline amendment and the overall key provincial strategy.

As part of the initiative of the District of North Saanich to understand, assess and plan for adaptation to expected climate change and related sea level rise effects, SNC-Lavalin Inc. (SLI) was retained to define the Flood Construction Levels for the DNS, considering shoreline specific conditions including exposure to storm related winds, waves, storm surge and shoreline type and a 0.5 m and a 1.0 m SLR scenario. The findings of the Flood Construction Level definition work are provided in [14], which is referred to in this document as the FCL Study.

1.2 Purpose and Scope

The purpose of this document is to provide sea level rise adaption related recommendations to the ongoing process of assessing, discussing and planning revisions for updating of the District of North Saanich (DNS), Official Community Plan (OCP) known as "Official Community Plan Bylaw No. 1130. These recommendations reflect the results and assessment of the findings of the Flood Study on the consequences to the shorelines of the DNS.

The recommendations in this document have been developed bearing in mind the various strategies, objectives and recommendations outlined in existing planning documents; also relevant to the OCP; including the DNS Marine Task Force review [10], the NSCCAP report [15] and the CRD Regional Growth Strategy [8], where they are specifically related to or are affected by the results of FCL Study.

The recommended OCP policy amendments presented in this document relate to planning horizons that accommodate a 0.5m and 1.0m rise in sea levels. The Provincial updated guidelines recommend also planning for a 2 m rise in sea level, which in 2011 was estimated to occur in 2200. Recent science and assessments suggest a 2 m sea level rise will likely occur sooner than 2200; however, consideration and evaluation of recommendations for this more severe scenario has been deferred until the uncertainty related to the future rate of rise in sea level can be objectively reduced.

1.3 Consultation

Public consultations on the recommendations outlined in this report were held June 7, 2016, November 17, 2016, January 26, 2017 and October 19, 2017 on marine policy planning, sea level rise and flood mapping.

Draft changes to the Official Community Plan, including a proposed new development permit area were presented in January 26, 2017 and October 19, 2017 in public consultation forums with survey and feedback opportunities at both. Seven (7) surveys were completed at the January 26, 2017 forum (100 attendees). Twenty-one (21) feedback forms were received after the October 19, 2017 public consultation (60 attendees).

The current version of this document reflects the comments made during public consultations occurring prior to the date of the current version of the document.

2 RELATIONSHIP OF EXISTING PLANNING TO THE FCL STUDY

2.1 Introduction

The principal existing framework of planning documents that relate to the findings and issues raised by the FCL Study, in chronological order, are:

1. OCP Bylaw 1130, approved in 2007 and in the process of being updated.
2. The DNS Marine Task Force Report, prepared in 2008
3. The DNS Climate Change Action Plan, prepared in 2010
4. The CRD Regional Growth Strategy (DRAFT version 1.5) issued in March 2016.

It should be noted that of these documents, only the Regional Growth Strategy was prepared after the initial release of the three Provincial guideline documents [2][3][4], related to climate change, sea level rise and the resulting implications to British Columbia shoreline. Nevertheless, all four documents contain policy recommendations or conclusions that have meaning or overlap within the context of the findings of the FCL Study. These areas of overlap are briefly summarized in the remainder of Section 2.

2.2 Relationship of Existing Official Community Plan Bylaw No. 1130 to the FCL Study

A detailed review of the implications of the FCL Study to the current OCP Bylaw showed that many areas of the Bylaw need to be updated or revised to reflect the findings and results of the FCL Study. The current OCP also needs to be updated to reflect the outcome of the ongoing Regional Growth Strategy process. The affected areas are briefly summarized below and a more detailed clause by clause examination is provided in Section 3 of this report.

The existing OCP, dated 2007, has eight (8) main areas within the Bylaw document that are affected by the findings and results of the FCL Study:

1. OCP Section 3 relating to Environmentally Sensitive Areas
2. OCP Section 4, relating to Marine Areas
3. OCP Section 6, relating to Residential Areas
4. OCP Section 7, relating to Commercial Development
5. OCP Section 11, relating to Roads and Servicing
6. OCP Section 12, relating to General Development Policies
7. OCP Section 13, relating to Special Development Areas
8. OCP Section 14, relating to Development Permit Areas

It should be noted that a brief review of the District of North Saanich Zoning Bylaw (1255) was conducted as part of this assignment and some zones may contain elements that are influenced by the findings and results of the FCL Study. A review and development of potential changes is deferred until implementation of the recommendations of this document because the final form of amendments to the OCP could influence some zones.

2.3 Relationship of the FCL Study to the Marine Task Force Report

The Marine Task Force Report (MTFR) was prepared in 2008, after the current OCP was adopted by Council, and following an extensive four (4) year program of consultation with the DNS community of interest. The main focus of the process was the protection and enhancement of the economic and environmental marine assets of the DNS. The specific objectives of the Marine Task Force (MTF) were:

1. Review and possibly recommend changes to permitted use and restrictions of the current [2008] seven (7) marine zones around the North Saanich Peninsula.
2. Develop and recommend a method to inventory sensitive shoreline areas.
3. Review and assess effectiveness of existing [DNS] bylaws, policies and procedures with respect to marine foreshore developments.
4. Recommend new policies, as required, to protect marine environments and regulate new marine development, within the context of the OCP and federal and provincial regulations.

The Marine Task Force undertook extensive consultation with the community and addressed in detail key areas of the marine related aspects of the DNS including:

- Current marine and foreshore uses
- Existing boating and (marine) transportation facilities
- The existing (2007) Official Community Plan (OCP) and marine related components
- Zoning Bylaw No. 750, 1993 (repealed)
- Foreshore Lease Policies
- The existing (2008) North Saanich Permitting Process
- The current and expected future economic impact and outlook for the Marine Industry [in DNS]
- North Saanich Policy [marine] options
- Marine/Foreshore usage and zoning
- The existing Shoreline Inventory
- Review of relevant legislation, policies and procedures that address, protect and/or enhance Marine and Foreshore habitats

Details of the key findings and recommendations of the MTF are provided in the MTFR [10] and in a Staff Report to Council, dated 23 September 2008.

The Task Force work was undertaken prior to the release of the Provincial Government climate change related SLR reports issued in 2011 ([2][3][4]), and climate change effects or expected SLR were not explicitly considered by the MTF. There are some implications from the FCL Study findings and results that apply to the MTFR recommendations in varying degrees. A summary of the recommendations and how the FCL Study influences or affects a recommendation, is provided in Table 2-1.

Table 2-1 is ordered according to the degree to which the findings and results of the FCL Study affect the MTFR recommendations. Four (4) MTFR recommendations are directly affected by the FCL Study results. Ten (10) MTFR recommendations will be influenced to some degree by the FCL Study results and in most cases the FCL Study results will inform aspects of the issues or actions that are implied by the recommendations. As an example, the FCL Study results will likely be a consideration in the creation of plans or options for marina expansions or in the site selection and design process for a boat ramp on the west side of the Peninsula. The remaining six (6) MTFR recommendations, which largely relate to coordination or liaison actions to be undertaken, are not affected by the FCL Study.

Table 2-1: Summary of FCL Study Effects on MTFR Recommendations

MTFR Recommendation	General Recommendation	Influence of the FCL Study
1	Better recognize marine heritage, economic contributions and boating interests of many of its residents.	The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) is consistent with this MTFR recommendation.
13	Develop a pro-active report to dealing with and remediating water pollution issues.	The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will help to minimize the entry of pollutants into the waters around the Peninsula as a consequence of flooding or coastal storm damage.
14	Develop guidelines for waste management, pump-outs and design standards.	The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) are an element of the design standards that the MTF recommended be adapted and integrated into District practices.
18	Review policies pertaining to seawalls.	The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will inform adaptation strategies for waterfront land parcels and the design of any shoreline protection.
2	Support up to a 10% expansion in the current capacity of marinas.	No direct influence. Any marina expansion will need to consider the effects of SLR.
3	Discuss expansion options, land use and zoning changes with existing marinas.	No direct influence. Any marina expansion planning or design will need to consider the effects of SLR
4	Suggestions for Reconfiguration of Deep Cove Marina.	No direct influence. Reconfiguration concepts or design will need to consider the effects of SLR
6	Provide flexibility in dealing with rezoning requests for dry land storage.	No direct influence. The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will inform site selection and storage yard design.
7	Develop new guidelines for private docks.	No direct influence. Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will inform design details of any shore connections for any docks.
8	Have District representation on the Tsehum Harbour Commission.	No direct influence. Tsehum Harbour Commission planning and developments will need to conform to the OCP.

MTFR [*] Recommendation	General Recommendation	Influence of the FCL Study
10	Development of a public boat ramp on the west side of the Peninsula.	No direct influence. The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will inform site selection and boat ramp design.
11	Develop a consultation process to review the issues surrounding beach access.	No direct influence. The FCL Study will inform aspects of assessment or design issues of the beach access and maintenance elements of this recommendation.
17	Develop policy to address the replacement of legal non-conforming docks.	No direct influence. The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will inform the replacement design.
19	Review the existing marine zones to simplify them and integrate the other MTFR recommendations.	No direct influence. The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will inform related zoning issues, which are outside of the scope of this study.
5	Keep boat shed regulations the same.	No effect.
9	Ask Parks Canada to consider designating parts of the Saanich Inlet as a Marine Park.	No effect.
12	Support for a Shoreline Inventory.	No effect. This inventory was completed in 2009 and the resulting SILAS Atlas [12] will inform all projects around the DNS shoreline.
15	Ensure the Zoning Bylaw is consistent with federal Private Buoy Regulations	No effect.
16	Liaise with the Integrated Land Management Bureau on Foreshore Leases.	No effect.
20	Consider a successor marine advisory group	No effect.
* Recommendations are numbered as in the Staff Report to Council dated 23 September 2008 regarding implementation of the MTFR.		

2.4 Relationship of the North Saanich Climate Change Action Plan to the FCL Study

The DNS Climate Change Action Plan (NSCCAP) was developed in 2010 to address Provincial government mandated requirements to reduce community GHG emissions. The NSCCAP focused on six (6) main areas of focus, of which, only two have any direct or indirect reference or relationship to the issues raised by the FCL Study. These areas were:

- Focus Area 1 – Green Building Program
- Focus Area 6 – Recommendations for appropriate action.

The recommendations in Focus Area 1 clearly speak to the interests in developing sustainable building programs in the District of North Saanich. Although the programs considered in the NSCCAP do not specifically apply to many of the issues relating to expected sea level rise and the consequences, the focus is relevant to the intentions of the DNS and need to adapt or at least inform developments in DNS of potential adaptation options.

The recommendations in Focus Area 6 **are concerned** with densification of existing communities to create mixed-use villages and providing opportunities for shared transit options that will reduce vehicle emissions. These recommendations identify potential village sites or transit centres in Deep Cove, Ardmore and one unspecified area adjacent to Bazan Bay and the McTavish Interchange. The District is not presently proceeding with the mixed use village concept.

The results of the FCL Study indicate these areas may be affected by sea level rise and associated consequences.

2.5 Relationship of the CRD Regional Growth Strategy to the FCL Study

The CRD's Regional Growth Strategy (RGS) [8], issued in 2016 under the auspices of the *Local Government Act*, aims to develop a vision for the Capital Region District for 2038 that recognizes fourteen (14) provincial goals in the *Local Government Act*, which include:

- Protect environmentally sensitive areas
- Encourage economic development that supports the unique character of communities
- Minimize the risks to settlement associated with natural hazards.

To this end the RGS specifically undertakes to:

"...promote human settlement that is socially, economically, and environmentally healthy and that makes efficient use of public facilities and services, land and other resources".

The RGS outlines a vision that includes concentration of the future population in existing urban areas, a belt of protected green space from Saanich Inlet to Juan de Fuca around the perimeter of the metropolitan area and an increase in the use of public transit over single occupancy automobile use. The accomplishment of this vision at the local municipal level is achieved, by agreement, through the incorporation of the RGS objectives and policies into local municipality Official Community Plans (OCP).

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Within the DNS, the RGS identifies, among other aspects:

- New growth opportunities in the vicinity of Tsehum Harbour and the Lochside Drive/McTavish interchange
- Preservation of Green and Blue Space in the Tsehum Harbour water area
- Preservation of Green and Blue Space around the northwest and west shorelines of the Saanich peninsula
- Reduction of development pressures on rural communities in the Saanich peninsula, while still allowing subdivision and some densification.

These areas are all affected to varying degrees by the findings of the FCL Study. Some of the relevant RGS policies that are affected by the findings and results of the FCL Study include:

- Protection of the Green/Blue belt running from Saanich Inlet and around the District shorelines
- Protection of the ecological integrity of the marine areas in the Green/Blue belt, through collaboration and public and private land stewardship programs
- Concentration of most new growth in areas that can be effectively concentrated by express bus transit (ie: the McTavish Interchange area)
- Protection of areas prone to flooding, or the incorporation of appropriate engineering and planning measures to mitigate risk.

The measures outlined in the remainder of this report are intended to assist in conforming to the RGS policies outlined above.

3 RECOMMENDATIONS FOR MARINE POLICIES TO ACCOMMODATE EXPECTED SEA LEVEL RISE

The implementation of marine policies that reflect or anticipate expected sea level rise depends on a number of factors that are inter-related as described below. One of the most important factors is determining what SLR scenario to plan for and specifically, what scenario is relevant to the issues addressed by the proposed marine policies.

A number of ongoing studies relevant to the future expected pace of SLR are being actively conducted by the global science community. Ongoing updates of the findings of these studies are showing that the rate of SLR is increasing faster than initially estimated. It is very possible that 0.5m and 1.0m of SLR may be seen as early as 2030 and 2070, respectively. Further measurement of air, surface and ocean temperatures, melting rates of global ice sheets and the rise of sea level over the coming years will lead to a more clear understanding of the likely pace of sea level rise. In the meantime, it is necessary to begin implementing new marine policies in order to minimize risks and damage associated with SLR and coastal flooding events.

The recommended amendments for the upcoming amendments to the current OCP relate to a planning horizon that accommodates a 0.5m and 1.0m rise in sea levels. Implementation of these policies should reflect these scenarios by applying, as a starting point, the FCLs from the recent FCL Study [14].

3.1 Available Tools

Literature on climate change frequently refers to a quartet of adaptation strategies which can be summarized as follows:

- **Protect** –building protective structures specifically for protecting private and public assets. Protection approaches and designs may be “hard” (e.g. by armouring the coastline with sea dikes, seawalls or riprap revetments) or “soft” (e.g. by constructing or augmenting storm berms, dunes, beaches and marshes).
- **Accommodate** –adapting land-based structures and activities to tolerate flooding and inundation.
- **Retreat** – a strategic decision to withdraw, relocate or abandon public or private assets that are at risk of being impacted by coastal hazards.
- **Avoid** – not developing in areas considered at moderate to high risk to a hazard.

A more in-depth definition of each strategy is available in [2].

In reality, the appropriate strategies can only be chosen after the exposure to sea level rise related flooding hazards is understood, the specific vulnerabilities of exposed areas are defined, and the consequences are understood. The appropriate strategy will depend on individual situations, exposure, resources, relevant time frames and immediate needs and concerns, and are best evaluated and chosen on a site by site and individual by individual basis. The results and findings of the FCL Study are a starting point for this evaluation process. The following parts of Section 3 provide a summary of changes to the existing OCP that are recommended to respond to and anticipate the implications of the FCL Study.

3.2 Recommended Changes to the OCP

This section reviews specific parts of the current OCP Bylaw No. 1130 (OCP), which are affected by SLR and the findings and results of the FCL Study. For each of these parts, the following are identified:

- Current OCP Policy Number that is affected by the FCL Study.
- Existing text of the affected current OCP Policy.
- Evaluation of the current policy, and explanation why there is a need to amend the policy.
- Recommended text to allow for SLR planning. Changes to the current text are highlighted in yellow.

3.2.1 OCP Sections 3 through 12

3.2.1.1 OCP Section 3 – Environmentally Sensitive Areas

The intent of the policies listed in this section is to provide guidance:

“...to ensure that future land and waterfront development is compatible with the physical nature, resources and limitations of the land base, and growth is planned to ensure a high level of protection for the environment” [9].

The FCL Study findings and results have no direct effect on the intent of the current policies presented in Section 3 of the current OCP. However, it is increasingly being recognized worldwide that environmentally sensitive areas, such as tidal marshes or beach areas can provide valuable service in reducing wave related effects to the adjacent shorelines. Enhancement of environmentally sensitive areas, in appropriate manner, can be of value when Protect or Accommodate options are selected by a community. In particular enhancement of the wave energy absorbing features of a shoreline can assist in building resilience for existing shoreline treatments. The recommended changes to this section of the OCP are summarized below in Table 3-1.

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Table 3-1: "Recommendations to Policies - 3.1"

3.0 Environmentally Sensitive Areas	
Policy 3.1	
Current Policy	Evaluation and Explanation of Need for Change
Recognize ecologically sensitive areas by identifying and conserving special wildlife, plant and marine shore environments (such as pocket beaches) in their natural state. These are outlined on Schedule G and identified through the various development permit requirements.	<p>It is generally recognized that ecologically sensitive areas, such as pocket beaches and inter-tidal marshes and related marine vegetation can be beneficially used to build resilience capabilities along the shoreline to absorb and modify storm related wave energy.</p> <p>This suggested change to this section of Bylaw 1130 is intended to allow this the use of these areas in such a fashion where it can be justified.</p>
Recommended Policy	
Recognize ecologically sensitive areas by identifying and conserving special wildlife, plant and marine shore environments (such as pocket beaches or the Shoal Harbour Migratory Bird Sanctuary) in their natural state. Environmentally Sensitive Areas are outlined on Schedule G and identified through the various development permit requirements. Modifications to Environmentally Sensitive Areas that assist in building resilience to the effects of sea level rise will be permitted.	

3.2.1.2 OCP Section 4 – Marine Areas

Section 4 of the OCP provides guidance for the allocation of uses in the foreshore. The purpose of the policies in this section of the OCP is intended to allow for the protection of marine resources and reconcile the demands for the use and conservation of marine areas. Marine Areas are defined as all "areas of the District foreshore extending 300m from the shore" [9].

The implications of the FCL Study to Section 4 are summarized below.

OCP Section 4.1 – General Marine Policies

This section of the OCP provides general policies applicable to the marine areas as a whole.

The FCL Study has no implications to the current policies presented in Section 4.1. As a result, there are no recommended amendments to these general policies.

OCP Section 4.2 – Shoreline Components

This section of the OCP groups the DNS shoreline into four main types of shores and various objectives and policies are prescribed for each of the four shoreline type. The implications of the FCL Study and recommended amendments or changes are summarized below in Table 3-2.

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Table 3-2: Recommendations to “Shoreline Components – Rocky Shores” in OCP Bylaw No. 1130

Rocky Shores	
Policy 4.2.1	
Current Policy	Evaluation and Explanation of Need for Change
<p>To preserve the natural appearance of the rocky shoreline, no buildings or structures, or soil removal or deposit should be permitted within a minimum of 15 metres of the high water mark, except where it can be demonstrated to the District's satisfaction that a lesser distance is acceptable.</p>	<p>Rocky shores exist around the shoreline of the DNS in areas where coastal flooding is expected due to SLR. In some cases low lying bedrock outcrops at the toe of steep coastal bluffs, which will eventually become exposed to sea level rise or wave effects. The risk or magnitude of flooding, erosion and consequential land sliding can be effectively reduced by proper design and construction of coastal structures at the shoreline, including seaward of the existing or legal shoreline boundary. The existing policy does not allow this adaptation approach.</p> <p>The recommended policy change shown below is intended to allow for appropriate works within the 15 m setback along rocky shorelines, if they have the specific purpose of limiting or reducing the risk associated with coastal flooding.</p>
Recommended Policy	
<p>To preserve the natural appearance of the rocky shoreline, no buildings or structures, or soil removal or deposit should be permitted within a minimum of 15 metres of the future estimated high water mark, except where it can be demonstrated to the District's satisfaction that a lesser distance is acceptable, or where works are intended and designed to both preserve the shoreline character and limit coastal flood-related effects.</p>	

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Table 3-3: Recommendations to “Shoreline Components – Beach Shores – Drift Sector Beaches” in OCP Bylaw No. 1130

Beach Shores – Drift Sector Beaches	
Policy 4.2.2	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 4.2.3	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 4.2.4	
Current Policy	Evaluation and Explanation of Need for Change
Due to active erosion of Class 2 and 3 beaches, building prohibitions and soil deposit and removal restrictions shall be placed over lands within a 15 metre horizontal distance of the natural boundary adjoining beach shores, except where it can be demonstrated to the District's satisfaction that a lesser distance is acceptable.	<p>Drift sector beaches exist around the shoreline of the DNS in areas where coastal flooding is expected due to SLR. The risk or magnitude of flooding can be effectively reduced by proper design and construction or maintenance of beaches at the shoreline, including seaward of the existing or legal shoreline boundary. The existing policy does not allow this adaptation approach.</p> <p>The recommended policy change shown below is intended to allow for appropriate works within the 15 m setback along shorelines of drift sector beaches if they have the specific purpose of limiting or reducing the risk associated with coastal flooding.</p>
Recommended Policy	
Due to active erosion of Class 2 and 3 beaches, building prohibitions and soil deposit and removal restrictions shall be placed over lands within a 15 metre horizontal distance of the future estimated natural boundary adjoining beach shores, except where it can be demonstrated to the District's satisfaction that a lesser distance is acceptable, or where works are intended and designed to preserve the shoreline character and limit coastal flood-related effects.	
Policy 4.2.5	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	

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Table 3-4: Recommendations to “Shoreline Components – Beach Shores – Pocket Beaches” in OCP Bylaw No. 1130

Beach Shores – Pocket Beaches	
Policy 4.2.6	
Current Policy	Evaluation and Explanation of Need for Change
Building prohibitions and soil removal and fill restrictions shall be placed on lands within 15 metres horizontal distance landward of the high water mark adjacent to Class 2 or Pocket Beaches except where it can be demonstrated to the District's satisfaction that a lesser distance is satisfactory.	<p>Pocket beaches exist around the shoreline of the DNS in areas where coastal flooding is expected due to SLR. The risk or magnitude of flooding can be effectively reduced by proper design and construction or maintenance of beaches at the shoreline, including seaward of the existing or legal shoreline boundary. The existing policy does not allow this adaptation approach.</p> <p>The recommended policy change shown below is intended to allow for appropriate works within the 15 m setback along shorelines of pocket beaches if they have the specific purpose of limiting or reducing the risk associated with coastal flooding.</p>
Recommended Policy	
Building prohibitions and soil removal and fill restrictions shall be placed on lands within 15 metres horizontal distance landward of the high future estimated water mark adjacent to Class 2 or Pocket Beaches except where it can be demonstrated to the District's satisfaction that a lesser distance is satisfactory, or where works are intended and designed to preserve the shoreline character and limit coastal flood-related effects.	
Policy 4.2.7	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	

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Table 3-5: Recommendations to “Shoreline Components – Mudflats, Marsh and Delta Shores” in OCP Bylaw No. 1130

Mudflats, Marsh and Delta Shores	
Policy 4.2.8	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 4.2.9	
Current Policy	Evaluation and Explanation of Need for Change
Development immediately adjacent to a mudflat, marsh or delta area is discouraged.	<p>Shorelines composed of mudflats, marshes, or deltas have high ecological value and provide valuable wave energy absorption services. Some properties adjacent to these shorelines are expected to experience coastal flooding due to SLR. Specific measures within these properties can be taken to reduce the potential negative effects of flooding. The existing policy discourages development of these properties, which may hinder the properties' opportunity to apply adaptation measures.</p> <p>As of 2016, DNS has no plans to rezone areas adjacent to a mudflat, marsh, or delta. The recommended policy change is intended to provide opportunities related to development of these properties for the specific purpose of reducing the negative impacts of flooding.</p>
Recommended Policy	
Development immediately adjacent to a mudflat, marsh or delta area is discouraged. Consideration will be given to developments that enhance ecological values or include measures to limit or reduce coastal flood-related effects while preserving the shoreline character.	

3.2.1.3 OCP Section 6 – Residential

By law, the OCP is required to plan for and meet the anticipated housing needs for the DNS for at least five years. The aim of the policies provided in Section 6 of the OCP is to maintain and generate a range of parcel sizes to “support low and medium density residential development, in addition to supporting hobby farm and other rural activities adjacent to agricultural areas” [9].

Section 6 refers to the land use designations on Schedule B of the OCP, which forms a general guide to future land use and density. The FCL Study has identified areas along the DNS shoreline that are directly and indirectly affected by 0.5 and 1m of SLR. Of specific concern are two areas currently zoned as multi-family residential that fall within the SLR affected areas:

Area East of McDonald Campground in the Tsehum Harbour area

Area by McTavish Road & Lochside Drive

To address the potential risks associated with coastal flooding, it is recommended that DNS:

Create Special Development Areas for these two sites so that future developments better suit the neighbourhood and particular properties.

Future development within these two new Special Development Areas can be informed by the provisions of the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document).

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Other implications from the FCL Study, which relate to Special Development Area policies, are presented in Section 3.2.2. The following amendments, specifically, for OCP Section 6 are outlined in Table 3-6 below.

Table 3-6: Recommendations to “Residential” in OCP Bylaw No. 1130

Residential	
Policy 6.1	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 6.2	
Current Policy	Evaluation and Explanation of Need for Change
To ensure that residential developments are compatible with the physical site conditions of slope, soil types and drainage patterns, and that natural features such as views, tree cover and variety in terrain are retained and enhanced, the siting of buildings, roads and utilities shall be accomplished in a manner which maintains any sensitive natural areas of the site and preserves the natural landscape.	<p>There are low-lying areas within the DNS where the FCL is greater than the parcel elevation. In some properties, physical site conditions and natural drainage patterns may encourage run-off from coastal wave effects to either converge around a habitable structure, or migrate to a lower lying neighbouring property.</p> <p>The FCL Study has identified areas that are susceptible to coastal flooding. The sentence appended to the end of the current policy is intended to allow for works requiring landscape alteration for the purpose of reducing the effects of coastal flooding. Landscape alteration should be designed such that ground surfaces slope away from structures, and should also be designed discourage the migration of water onto neighbouring properties. The purpose of this amendment is to allow for a parcel owner to alter his/her landscape as an adaptation option.</p> <p>The phrase "...does not negatively impact..." is included to make the policy more consistent with its original intent.</p>
Recommended Policy	
To ensure that residential developments are compatible with the physical site conditions of slope, soil types and drainage patterns, and that natural features such as views, tree cover and variety in terrain are retained and enhanced, the siting of buildings, roads and utilities shall be accomplished in a manner which does not negatively affect sensitive natural areas of the site and, preserves the natural landscape. An exception for slope alteration will be allowed if it is designed to help reduce effects of coastal flooding.	
Policy 6.3 through Policy 6.6	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 6.7	
Current Policy	Evaluation and Explanation of Need for Change
To encourage innovative housing and subdivision designs such as detached clustered residential developments, particularly for sloped upland areas, the District will provide flexibility in regulatory bylaws. Amenity bonusing, in compliance with Section 904 of the Local Government Act, will be supported in certain areas if site conditions warrant, in order to, amongst other things, preserve open space, natural tree cover and environmentally sensitive areas, leaving slopes unaltered.	This amendment reflects an update of reference from Local Government Act (LGA) Section 904 to LGA Section 482. This update is necessary as LGA Section 482 supersedes LGA Section 904.
Recommended Policy	
To encourage innovative housing and subdivision designs such as detached clustered residential developments, particularly for sloped upland areas, the District will provide flexibility in regulatory bylaws. Amenity bonusing, in compliance with Section 482 of the Local Government Act, will be supported in certain areas if site conditions warrant, in order to, amongst other things, preserve open space, natural tree cover and environmentally sensitive areas, leaving slopes unaltered	
Policy 6.8 through Policy 6.12	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	

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Some further recommended amendments to the OCP, independent of the implications from the FCL Study, include amending OCP Schedule B Map and/or Zoning Bylaw No. 1255 Schedule A Map to resolve inconsistencies between the two documents.

The purpose of this amendment is to provide clarification to the overlap between OCP land designation for residential areas, and Zoning Bylaws for family residential and multi-family residential zones.

3.2.1.4 OCP Section 7 – Commercial Development

Commercial Development is a relatively minor aspect of the DNS land use pattern. DNS does not intend to create heavy commercial development, as these are already available in neighbouring municipalities, and is not consistent with the RGS (Section 2.2).

Areas designated as *commercial* and *marine commercial* as identified in Schedule B Map of the OCP, are generally waterfront properties, and consists mainly of marinas, BC Ferries' Swartz Bay Terminal, and the Institute of Ocean Sciences. Results of the FCL Study have no implications to the policy statements provided for either land-based or marine-based commercial uses. However, most of these commercial areas will be affected by expected future sea levels and therefore the proposed the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will apply, or inform future development in these areas.

Existing elements of commercial and marine commercial developments will tend to rise as sea levels rise, or as land based elements are modified to accommodate sea level rise. This may create changes to existing access or views from adjacent areas. Recommended changes to this section of the OCP are summarized below in Table 3-7.

Table 3-7: Recommendations to "7.0 COMMERCIAL DEVELOPMENT"

7.0 Commercial Development	
Land Based Commercial and Marine-Based Commercial Use – Policy 7.9 and Policy 7.15	
Current Policy	Evaluation and Explanation of Need for Change
Buildings used for commercial use must be buffered from adjacent rural and residential uses.	<p>As sea levels rise and a need to protect upland development from the implications of sea level rise emerges, water based commercial uses will likely adapt development to allow activities close to the water while protecting non essential water based activities (for instance offices or parking) behind protection options – floodwalls or sea dikes. Access to or views of related water bodies may be affected.</p> <p>Design options of this type are recognized and permitted in the Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC, Appendix G24.</p>
Recommended Policy	
Buildings or structures used for commercial use must be buffered from adjacent rural and residential uses and should preserve access and views from adjacent rural and adjacent uses.	

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3.2.1.5 OCP Section 8 – Light Industry

The municipality accommodates some light industry which may be located on or adjacent to the District shorelines.

Existing elements of light industry developments will tend to rise as sea levels rise, or as land based elements are modified to accommodate sea level rise. This may create changes to existing access or views from adjacent areas. Recommended changes to this section of the OCP are summarized below in Table 3-8.

Table 3-8: Recommendations to "8.0 LIGHT INDUSTRY"

8.0 Light Industry Development	
Policy 8.5	
Current Policy	Evaluation and Explanation of Need for Change
Buildings used for industrial use must be buffered from adjacent rural and residential uses.	<p><i>As sea levels rise and a need to protect upland development from the implications of sea level rise emerges, water based industrial uses will likely adapt development to allow activities close to the water while protecting non essential water based activities (for instance offices or parking) behind protection options – floodwalls or sea dikes. Access to or views of related water bodies may be affected.</i></p> <p><i>Design options of this type are recognized and permitted in the Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC, Appendix G24.</i></p>
Recommended Policy	
Buildings or structures used for industrial use must be buffered from adjacent rural and residential uses and should preserve access and views from adjacent rural and adjacent uses.	

3.2.1.6 OCP Section 11 – Roads and Servicing

The FCL Study has shown that two portions along the existing main arterial transportation routes in the DNS; along the Patricia Bay Highway at Tsehum Harbour and the intersection with McTavish Drive and the southern portion of Lochside Drive may be affected by coastal storm wave-related effects.

Portions of West Saanich Road, where it is currently protected by a public walkway (Scoter Trail), are also indirectly threatened. This area was identified as an area of concern in the MTFR.

The implications of the FCL Study and recommended amendments specific to OCP Section 11 are summarized in Table 3-9 below.

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Table 3-9: Recommendations to "Roads and Servicing" in OCP Bylaw No. 1130

Roads and Servicing	
Policy 11.1	
Current Policy	Evaluation and Explanation of Need for Change
At the date of adoption of this plan, no new major roads are planned for the District with the exception of those shown on Schedule D. No phasing of any major roads is planned.	<p>The FCL Study has identified areas that may either be directly or indirectly affected by coastal storm wave-related effects. To reduce the potential negative impact on roads, developments should consider the implications of the measures outlined in the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document)</p> <p>The recommended change to the existing policy mandates owner/developer to consider the effects of sea level rise as informed by the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document).</p>
Recommended Policy	
At the date of adoption of this plan, no new major roads are planned for the District with the exception of those shown on Schedule D. No phasing of any major roads is planned. Developments shall take into consideration expected sea level rise for the placement and construction of roads.	
Policy 11.2	
Current Policy	Evaluation and Explanation of Need for Change
The proposed network of bicycle paths is shown on Schedule D.	The recommended change to the existing policy requires owner/developer to consider the effects of sea level rise through adherence of the draft DPA 9.
Recommended Policy	
The proposed network of bicycle paths is shown on Schedule D. Developments shall take into consideration expected sea level rise for the placement and construction of bicycle paths.	
Policy 11.3	
Current Policy	Evaluation and Explanation of Need for Change
The areas that have received servicing are identified on Schedule E. No major expansions of municipal services are planned. There will be no expansion of services outside the North Saanich Servicing Area except for health, fire safety, or agricultural support reasons.	<p>To reduce the potential negative impact on services, it may be necessary to allow for works related to sea level rise adaptation.</p> <p>The recommended amendment to the policy allows for expansion and/or works related to sea level rise adaptation.</p>
Recommended Policy	
The areas that have received servicing are identified on Schedule E. No major expansions of municipal services are planned. There will be no expansion of services outside the North Saanich Servicing Area except for health, fire safety, or agricultural support, or sea level rise adaptation reasons.	

3.2.1.7 OCP Section 12 – General Development Policies

The policies presented in Section 12 of the OCP are applicable to all land use designations. Table 3-10 summarizes the amendments that are recommended to this part of the current OCP so that it becomes consistent with the findings and results of the FCL Study.

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Table 3-10: Recommendations to "General Development Policies" in OCP Bylaw No. 1130

General Development Policies	
Policy 12.1	
Current Text	Evaluation and Explanation of Need for Change
Development must be consistent with the goals and objectives of the Plan.	The purpose of this amendment is to provide recognition of the coastal flood-affected areas, and to enable the parcel owner to act on reducing the risks associated with coastal flood-affected areas.
Recommended Text	
Development must be consistent with the goals and objectives of the Plan. Development shall consider expected coastal flooding, incorporate appropriate adaptation measures and conform with the proposed Coastal Flood Mitigation Bylaw.	
Policy 12.2	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 12.3	
Current Text	Evaluation and Explanation of Need for Change
Development should be consistent with the retention of the visual landscape of natural areas, especially on or near the waterfront, hilltops and ridges.	Some properties within the DNS are located in areas where coastal flooding is expected due to SLR. The risk or magnitude of the effects of SLR can be reduced by adopting site-specific adaptation measures. The recommended policy change is intended to allow for appropriate works with the specific purpose of limiting or reducing the risk and damage associated with coastal flooding.
Recommended Text	
Development should be consistent with the retention of the visual landscape of natural areas, especially on or near the waterfront, hilltops and ridges. Flexibility will be given to development that incorporates adaptation measures that reduce the risk or damage associated with the effects of coastal flooding.	
Policy 12.4 and 12.5	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 12.6	
Current Policy	Evaluation and Explanation of Need for Change
No development or site alteration shall be permitted on a wetland, a riparian area or within the buffer zone specified in this bylaw for wetlands and riparian areas, except as permitted by law.	These areas, where exposed to the threat of future coastal flooding related to sea level rise, will likely become inundated resulting in coastal squeeze and loss of important wetland or riparian habitat. A sea level rise setback should be placed around these areas to maintain the objectives of the RGS to "...maintain and conserve Regional Green/Blue spaces on public and private lands...".
Recommended Text	
No development or site alteration shall be permitted on a wetland, a riparian area or within the buffer zone or related to a floodplain setback , specified in this bylaw for wetlands and riparian areas, except as permitted by law and if they are a necessary sea level rise adaptation measure.	
Policy 12.7 through 12.13	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	

3.2.2 OCP Section 13 - Special Development Areas

The current OCP identifies 6 areas within the DNS as Special Development Areas with the intention of recognizing these areas should be developed in an innovative manner that provides greater flexibility and enables development in a manner that best suits the area and the properties within the area. These six (6) areas are:

- Site 1 – Canoe Cove Marina
- Site 2 – East Saanich/Cresswell (Adjacent to Dean Park Estates)
- Site 3 – Baldwin Property
- Site 4 – Deep Cove Chalet
- Site 5 – Queen Mary Bay
- Site 6 – 9344 Ardmore Drive site

Four of these area; Sites 1, 4, 5, and 6, are located on the waterfront and will be affected by SLR. Sites 2 and 3 are located inland and not affected by sea level rise.

The **four (4)** SLR affected areas require some modifications to the current sections of the OCP as documented further below.

The results of the FCL Study have also shown that two other specific areas of the DNS will be significantly affected by sea level rise. In general terms these are:

- The Tsehum Harbour area
- The shoreline and adjacent areas Lochside Drive and the McTavish Interchange.

These areas should be added to the designation of Special Development Areas as the implications of sea level rise and the related effects will likely be the most important and consequential within the DNS boundaries. **The general location of these two new areas is indicated on the attached DRAFT revised Schedule B map for the existing OCP Bylaw 1130, as shown below in Figure 3-1.**

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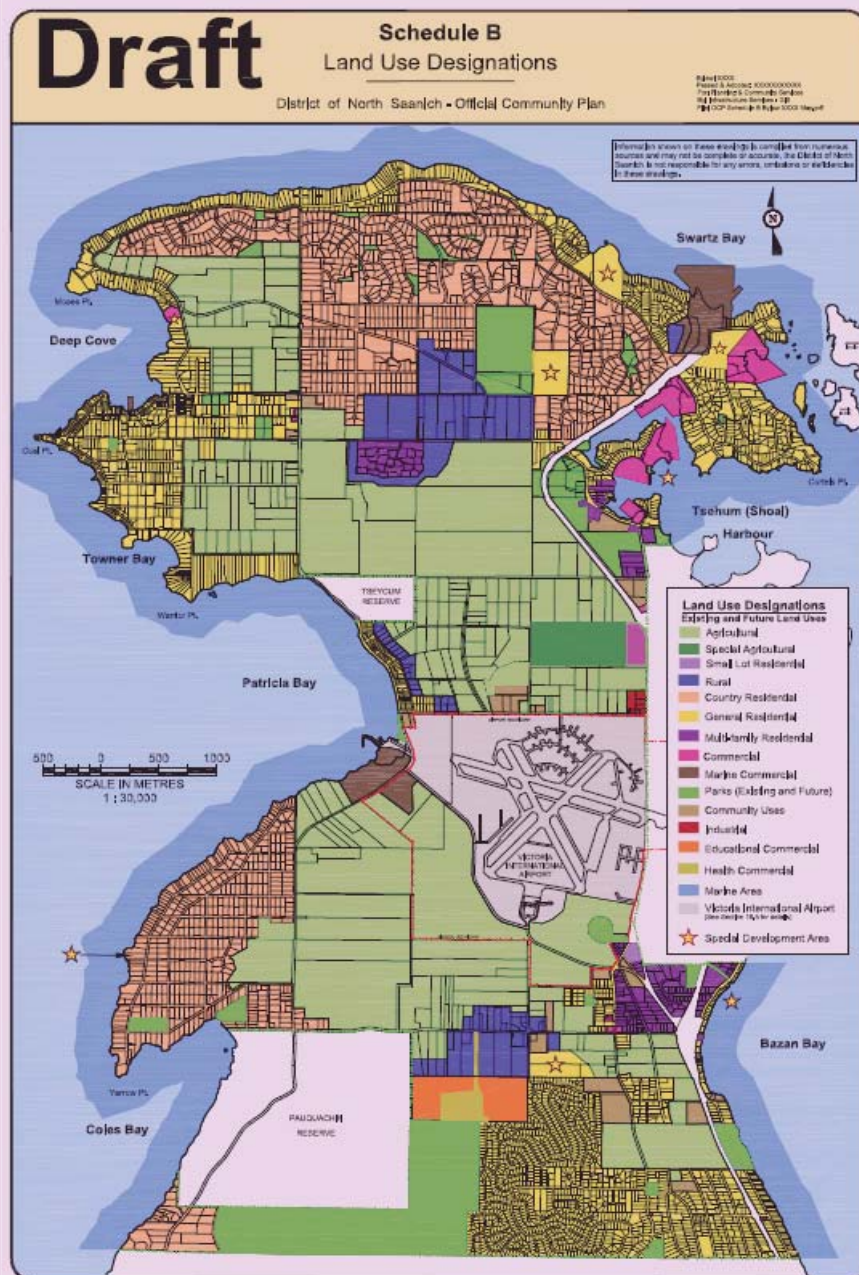


Figure 3-1: Draft (example) of revised OCP Bylaw 1130 Schedule B showing Special Development Areas at Tsehum Harbour and Lochside-Mctavish

(Note: final boundaries for these two Special Development Areas to be defined in SDA process)

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The existing 2 Special Development Area sites and the results and findings of the FCL Study are discussed below.

3.2.2.1 OCP Section 13.1 – Special Development Area Site 1 – Canoe Cove Marina

The results of the FCL Study have no implications to the Justification or Policy Statement for this special development area (SDA). However, the FCL Study shows that this SDA is significantly affected by expected future sea levels. The proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will apply in this SDA.

3.2.2.2 OCP Section 13.4 – Special Development Area Site 4 – Deep Cove Chalet

The results of the FCL Study have no implications to the Justification or Policy Statement for this SDA. However, the FCL Study shows that this SDA is partially affected by expected future sea levels and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will apply here.

3.2.2.3 OCP Section 13.5 – Special Development Area Site 5 – Queen Mary Bay

Designating the two parcels of land at Queen Mary Bay as an SDA was justified for two reasons:

- Site's sensitive and important environmental assets,
- An intent to increase density in the area by creating detached housing clusters.

The FCL Study shows that this SDA is affected by expected future sea levels, and implies that if the densification is undertaken, development should be sited inland, away from the coastal wave-affected area. Schedule B of the OCP should also be revised.

Because a portion of the site is affected by expected SLR, the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will apply here.

If the District allows for a mix of attached and detached housing, Schedule B of the OCP must be revised to reflect multi-family residential land use.

3.2.2.4 OCP Section 13.6 – Special Development Area Site 6 – 9344 Ardmore Drive

The results of the FCL Study have no implications to the Justification or Policy Statement for this SDA. However, the FCL Study shows that this SDA is partially affected by expected future sea levels and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will apply here.

3.2.2.5 OCP Section 13.7 – NEW - Special Development Area Site 7 – Tsehum Harbour

This area is significantly affected by the findings and results of the FCL Study. It is clear this area should be added to the list of Special Development Areas to conform to the Provincial Government updated guideline documents to identify Sea Level Rise Planning Areas where there is a threat of flooding due to expected SLR as a result of ongoing climate change.

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Recommended changes to this section of the OCP are summarized below in Table 3-11.

Table 3-11: Recommendations "13 SPECIAL DEVELOPMENT AREAS"

NEW – 13.7 Tsehum Harbour	
Current Text	Evaluation and Explanation of Need for Change
This SDA currently does not exist in OCP Bylaw 1130.	<i>This area is significantly affected by the findings and results of the FCL Study. It is clear this area should be added to the list of Special Development Areas to conform to the Provincial Government updated guideline documents to identify Sea Level Rise Planning Areas where there is a threat of flooding due to expected SLR as a result of ongoing climate change</i>
Recommended Text	
<p>Justification:</p> <p>The Tsehum Harbour area affected by future sea level rise, as delineated in the proposed Bylaw 1439 – Coastal Flooding Mitigation Bylaw maps is designated as a special development area, as mandated by the Provincial Guideline Memorandum Amendment – Section 3.5 and 3.6 – Flood Hazard Area Land Use Management Guidelines (FHALUMG) effective: 1 January 2018, for the following reasons:</p> <ul style="list-style-type: none"> a) The subject area contains significant residential, commercial, light industrial and parklands. b) The subject area contains significant environmental values to be accommodated in a sensitive manner and which could be protected through innovative design. c) The affected lands fall within the recommended provisions related to Sea Level Rise Planning Areas as defined in the FHALUMG. d) The area includes District infrastructure including utilities, sewer, roads and paths and water supply that are important to the District. e) The area forms the boundaries of the Shoal Harbour Migratory Bird Sanctuary, established in 1931. <p>Policy Statement:</p> <p>In designating these parcels of land as a special development area, the following planning principles shall be reflected for future development:</p> <ul style="list-style-type: none"> a) Existing land uses shall continue to be allowed. b) Bylaw 1439 – Coastal Flood Mitigation Bylaw shall apply. c) Development on existing lots shall conform with FHALUMG. d) The District shall engage in the development of a Long Term Flood Protection Strategy as outlined in Appendix 1 of FHALUMG. e) The Long Term Flood Protection Strategy shall consider the implications of policies applicable to the adjacent parcels in Sidney, BC. <p>The Province of BC's Long Term Flood Projection Strategy shall consider the benefits that might be realized from active stewardship of the Shoal Harbour Migratory Bird Sanctuary that are consistent with the standing policies of the <i>Canada Wildlife Act and Migratory Birds Convention Act, 1994</i>.</p>	

OCP Section 13.8 – NEW - Special Development Area Site 8 – Lochside – McTavish Interchange

This area is significantly affected by the findings and results of the FCL Study. It is clear this area should be added to the list of Special Development Areas to conform to the Provincial Government updated

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guideline documents to identify Sea Level Rise Planning Areas where there is a threat of flooding due to expected SLR as a result of ongoing climate change.

Recommended changes to this section of the OCP are summarized below in Table 3-12.

Table 3-12: Recommendations to "13 SPECIAL DEVELOPMENT AREAS"

NEW – 13.8 Lochside – McTavish Interchange	
Current Text	Evaluation and Explanation of Need for Change
This SDA currently does not exist in OCP Bylaw 1130.	<i>This area is significantly affected by the findings and results of the FCL Study. It is clear this area should be added to the list of Special Development Areas to conform to the Provincial Government updated guideline documents to identify Sea Level Rise Planning Areas where there is a threat of flooding due to expected SLR as a result of ongoing climate change</i>
Recommended Text	
<p>Justification: The Lochside McTavish Interchange Area affected by future sea level rise, as delineated in the Bylaw 1439 – Coastal Flooding Mitigation Bylaw maps is designated as a special development area, as mandated by the Provincial Guideline Memorandum Amendment – Section 3.5 and 3.6 – Flood Hazard Area Land Use Management Guidelines (FHALUMG) effective: 1 January 2018, for the following reasons:</p> <ul style="list-style-type: none"> a) The subject area contains significant residential, commercial, light industrial, parklands and multi-jurisdictional transportation infrastructure. b) The affected lands fall within the recommended provisions related to Sea Level Rise Planning Areas as defined in the FHALUMG. c) The area includes District infrastructure including utilities, sewer, roads and paths and water supply that are important to the District. <p>Policy Statement: In designating these parcels of land as a special development area, the following planning principles shall be reflected for future development:</p> <ul style="list-style-type: none"> a) Existing land uses shall continue to be allowed. b) Bylaw 1439 – Coastal Flooding Mitigation Bylaw shall apply. c) Development on existing lots shall conform with FHALUMG. d) The District shall engage in the development of a Long Term Flood Protection Strategy as outlined in Appendix 1 of FHALUMG. <p>The Long Term Flood Protection Strategy shall consider the implications of policies applicable to the adjacent parcels in Sidney, BC.</p>	

3.2.3 OCP Section 14 - Development Permit Areas

Development Permit Areas (DPA) are contained in the current OCP to cover 7 issues identified in the version of the *LGA* (RSBC 1996) that existed at the time of drafting of the OCP in 2007.

These DPAs are specifically:

- DPA 1: Marine Lands and Foreshore
- DPA 2: Creeks, Wetlands Riparian Areas and Significant Water Resources
- DPA 3: Sensitive Ecosystems
- DPA 4: Steep Slopes
- DPA 5: Commercial and Industrial
- DPA 6: Multi-Family Dwellings
- DPA 8¹: Intensive Residential Development

Since 2007, the *LGA* has been revised and updated. Under section 488 of the latest version of the *LGA* ², the number of purposes for which Development Permit Areas can be designated is summarized below in Table 3-13.

The release of the Provincial guidelines for climate change adaptation [2][3][4] have clearly recognized that SLR and the related coastal storm effects (and related river flow where appropriate) will increase existing and create new flooding hazards. This evolving flooding hazard is consistent with item *b: Protection of development from hazardous conditions* in Table 3-13.

¹ DPA 7 was re-numbered to DPA 6 in the current OCP.

² *Local Government Act (LGA)*, RSBC 2015, was made current on October 26, 2016 and contains additional issues for which a DPA can be created.

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*Table 3-13
(from Section 488 of LGA, RSBC 2015)*

- “ a. *Protection of the natural environment, its ecosystems and biological diversity;*
- b. *Protection of development from hazardous conditions;*
- c. *Protection of farming;*
- d. *Revitalization of an area in which a commercial use is permitted;*
- e. *Establishment of objectives for the form and character of intensive residential development;*
- f. *Establishment of objectives for the form and character of commercial, industrial or multi-family residential development;*
- g. *In relation to an area in a resort region, establishment of objectives for the form and character of development in the resort region;*
- h. *Establishment of objectives to promote energy conservation;*
- i. *Establishment of objectives to promote water conservation;*
- j. *Establishment of objectives to promote the reduction of greenhouse gas emissions.*

While our review of the current OCP has identified some areas of the existing DPAs where amendment is warranted to be consistent with the findings and results of the FCL Study, we originally recommended that the relevant aspects of the FCL Study implications should be concentrated in a separate and new DPA, primarily to allow specific details of the new DPA to be reviewed periodically or refined independently of the existing DPAs. For instance, as the marine environment and ecology evolve as a result of climate change, these changes could be addressed within the existing DPA 1 without affecting any specific issues related to the coastal flooding hazard.

Specific changes recommended to the existing portions of Section 14 of the current OCP, to make it consistent with the findings and results of the FCL Study are summarized below, for the remainder of Section 3 of this document³.

3.2.3.1 OCP Section 14.1 – General Development Permit Guidelines

No changes to the guidelines provided in Section 14.1 of the current OCP are recommended.

³ It should be noted that in the current OCP, the designation reference for the current DPAs refer to Section 919.1(1)(a) of the LGA (RSBC 1996). These references should all be amended to reference Section 488(1)(a) of the updated LGA (RSBC 2015).

3.2.3.2 *OCP Section 14.2 – General Exemptions from Requirement for a Development Permit*

Section 14.2 (General Exemptions from Requirement for a Development Permit) contains 17 clauses, of which several are affected by the results and findings of the FCL Study. These are itemized in separate tables below for clarity.

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Table 3-14: Recommendations to “General Exemptions from Requirement for a Development Permit”

Sections 14.2.1 a) through 14.2.1 c)

OCP Bylaw No. 1130

General Exemptions from Requirement for a Development Permit	
Policy 14.2.1 a) and b)	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 14.2.1 c)	
Current Text	Evaluation and Explanation of Need for Change
<p>...in Development Permit Areas, No. 5 and No. 6, for the construction of fencing and structures less than or equal to 40 m² (430.6 ft²) which are accessory to an existing principal structure. Such accessory structures may include the following:</p> <ul style="list-style-type: none"> - Additions to commercial and industrial buildings - Gazebos - Garden sheds - Tool sheds - Decks 	<p>DPA 5 and 6 pertain to commercial/industrial and multi-family areas, respectively. A number of areas designated under these DPAs are in areas where coastal flooding is expected due to SLR.</p> <p>The existing policy exempts the requirement for a DP for accessory structures less than or equal to 40m² (430.6 ft²), including; additions to commercial and industrial buildings, garden sheds and tool sheds. Additions to commercial and industrial buildings tend to become permanent fixtures to an existing permanent structure. Providing exemption to these additions while knowing that the parcel will eventually experience flooding may be a potential liability issue.</p> <p>Additions to commercial and industrial buildings, garden sheds and tool sheds also tend to contain hazardous or toxic substances (ie: chemicals, fertilizer and fuel) or goods sensitive to flooding. If flooded, these types of substances and materials pose an environmental risk to the marine and shoreline environment.</p> <p>The recommended policy change removes these exemptions and eliminates a liability that may arise.</p>
Recommended Text	
<p>...in Development Permit Areas, No. 5 and No. 6, for the construction of fencing and accessory structures less than or equal to 40 m² (430.6 ft²) which are accessory to an existing principal structure. Such accessory structures may include the following:</p> <ul style="list-style-type: none"> - Additions to commercial and industrial buildings - Gazebos - Garden sheds - Tool sheds - Decks 	

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Table 3-15: Recommendations to “General Exemptions from Requirement for a Development Permit”

Sections 14.2.1 d) through 14.2.1 e)

OCP Bylaw No. 1130

General Exemptions from Requirements for a Development Permit	
Policy 14.2.1 d)	
Current Text	Evaluation and Explanation of Need for Change
...in Development Permit Areas No. 1, 2, 3 and 4, for changes to the height of an existing building, including the addition of another storey, providing there is no increase in the building footprint;	<p>Portions of a land parcel within DPA 1, 2, 3 and 4 may be located in areas where coastal flooding due to SLR is expected.</p> <p>Changing the height of an existing building is a development that involves substantial works. This type of development implies an increase of the structure's overall service life, which could extend to a time when 0.5m SLR or 1.0m SLR is present. It is in the interest for parcel owners to consider the minimum required FCLs to reduce the potential risk and damage associated with coastal flooding.</p> <p>The recommended policy change maintains the flexibility of a parcel owner to add an additional storey but encourages parcel owners to consider the implications of FCLs.</p>
Recommended Text	
...in Development Permit Areas No. 1, 2, 3 and 4, for changes to the height of an existing building, including the addition of another storey, except as defined in the proposed Coastal Flood Mitigation Bylaw.	
Policy 14.2.1 e)	
Current Policy	Evaluation and Explanation of Need for Change
...in Development Permit Areas No. 1, 2, 3 and 4, for structures which are 10 m ² (107 ft ²) or less in size providing they are sited more than 15 metres from a natural marine shoreline;	<p>Some areas within the designated DPA 1, 2, 3 and 4 are located in areas where coastal flooding due to SLR is expected.</p> <p>Structures such as a garden/tool sheds, gazebos, etc. are examples of typical structures with a footprint of roughly 10m² or less. These buildings may or may not be temporary, and may be affected by the 0.5m and 1.0m SLR.</p> <p>The current policy exempts a development permit only if the structure is sited inland of the setback identified in DPA 1 (i.e. 15m). With the introduction of the new Coastal Flooding Mitigation Bylaw, the recommended policy change requires the structure to be sited inland of the setbacks related to the future estimated natural boundary in order to limit the potential risk and damages associated with coastal flooding.</p>
Recommended Policy	
...in Development Permit Areas No. 1, 2, 3 and 4, for structures which are 10 m ² (107 ft ²) or less in size providing they are sited inland of future estimated natural boundary.	

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Table 3-16: Recommendations to "General Exemptions from Requirement for a Development Permit"

Sections 14.2.1 f) through 14.2.1 q)

OCP Bylaw No. 1130

General Exemptions from Requirements for a Development Permit	
Policy 14.2.1 f)	
Current Text	Evaluation and Explanation of Need for Change
...emergency works including tree cutting necessary to remove an immediate danger or hazard;	<p>Section 14.11 defines "development" to include "flood protection works".</p> <p>The current policy considers tree cutting for the purpose of removing immediate danger or hazard as a type of "emergency works". Along the same lines, if an exemption to flood protection works for the purpose of removing immediate danger or hazard is not provided, it will not be possible to prevent or reduce damage from effects of SLR.</p> <p>The recommended policy change provides the parcel owner the flexibility to, take measures (for example, sandbag his/her property before an expected high tide storm event in order) to reduce potential damage that could result from coastal floods.</p>
Recommended Text	
...emergency works including tree cutting or temporary coastal flood-related mitigation measures necessary to remove an immediate danger or hazard;	
Policy 14.2.1 g) through p)	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 14.2.1 q)	
Current Text	Evaluation and Explanation of Need for Change
...in Development Permit Area 8, for the construction or alteration of a single family residential dwelling, except that this exemption does not apply to any parcel having an area equal to or less than five hundred square metres and created by a plan of subdivision registered in the Land Title Office after September 8, 2014.	<p>The land areas covered by DPA 8 include the proposed Special Development Area Site 7 (Tsehum Harbour) and draft Special Development Area Site 8 (Lochside-McTavish). These areas will be significantly affected by the effects of SLR.</p> <p>The recommended change in this policy is intended to ensure that any development, regardless of size is subject to the proposed Coastal Flood Mitigation Bylaw.</p>
Recommended Text	
in Development Permit Area 8, for the construction or alteration of a single family residential dwelling, this exemption does not apply to any parcel having an area equal to or less than five hundred square meters and created by a plan of subdivision registered in the Land Title office after September 8, 2014, however the proposed Coastal Flood Mitigation Bylaw does apply ;	

Recommended changes to specific existing Development Permit Areas in the OCP are discussed below.

3.2.3.3 OCP Section 14.3 – DPA#1 – Development Permit Area No. 1 – Marine Uplands and Foreshore

This DPA is intended to regulate development along the shoreline, foreshore and uplands to provide long-term protection for the ecological values of those areas. The applicable area includes the area extending 15 m inland from the high water mark, around the entire shoreline of the District.

As sea levels rises, the reference datum “the high water mark”, will move inland. The actual meaning of “high water mark” is not defined in the current OCP; however, it shares a conceptual basis with the “natural boundary”⁴ as referenced in the *Land Act*. The reference datum “the high water mark” is also indirectly counter referenced in Section 14.2.1 e) of the current OCP as “a natural marine shoreline”, which is also consistent with the “natural boundary”. All three terms are difficult to interpret in the field when shoreline protection, which eliminates both a “natural boundary” and “a natural marine shoreline” has been constructed and are impossible to identify or define looking into the future when sea level occurs and the shoreline adjusts in response to the rising sea level and the corresponding action of the water.

For clarity and consistency, it is recommended that the terms “high water mark” and “natural marine shoreline” are replaced by the term “estimated future natural boundary as defined in the Provincial Guideline document [3]”. This amendment will make DPA 1 consistent with the amendments to Provincial Guideline documents [2] through [6], which are discussed in more detail below.

3.2.3.4 OCP Section 14.4 – DPA#2 – Development Permit Area No. 2 – Creeks, Wetlands, Riparian Areas and Significant Water Resources

The FCL Study findings and results have no significant direct effect on the areas or objectives considered in this DPA.

3.2.3.5 OCP Section 14.5 – DPA#3 – Development Permit Area No. 3 – Sensitive Ecosystems

The FCL Study findings and results have no significant direct effect on the areas or objectives considered in this DPA.

⁴ The “Natural Boundary” is defined in the *Land Act* as: “...the visible high watermark of any lake, river, stream or other body of water where the presence and action of the water are so common and usual and so long continued in all ordinary years as to mark upon the soil of the bed of the lake, river, stream or other body of water a character distinct from that of the banks thereof, in respect to vegetation, as well as in respect to the nature of the soil itself....for coastal areas, the natural boundary shall include the natural limit of permanent terrestrial vegetation.”.

3.2.3.6 OCP Section 14.6 – DPA#4 – Development Permit Area No. 4 – Steep Slopes

The FCL Study findings and results have no significant direct effect on the areas or objective considered in this DPA, because, specifically, the DPA already requires a Qualified Professional to provide a Slope Stability Plan showing how a proposed development is to be designed and constructed in order to prevent any destabilization or erosion of the slope. As sea levels rise, the toe of many slopes around the shoreline of the DNS will become exposed to wave effects, mainly in areas where the existing slope is perched on an exposed bedrock outcrop, which, in time, will become inundated by rising sea levels. The risk is mainly on a site by site basis and the existing DPA should be sufficient to deal with this risk.

As the pace of sea level rise becomes more certain with time, the existing provision in DPA 4 can and should be revisited.

3.2.3.7 OCP Section 14.7 – DPA#5 – Development Permit Area No. 5 – Commercial and Industrial

All references to Section 919.1(1)(f) should be amended to reference Section 488(1)(f) to maintain consistency with the updated LGA.

Note: commercial lands (land, marine, and educational) identified in Schedule B does not completely agree with commercial lands identified in Map for DPA#5. It is recommended that DNS review and revise the maps so that the content of both maps are in agreement.

3.2.3.8 OCP Section 14.8 – DPA#6 – Development Permit Area No. 6 – Multi-Family Dwellings

All references to Section 919.1(1)(f) should be amended to reference Section 488(1)(f) to maintain consistency with the updated LGA.

3.2.3.9 OCP Section 14.10 – DPA#8 – Development Permit Area No. 8 – Intensive Residential Development

All references to Section 919.1(1)(e) should be amended to reference Section 488(1)(e) to maintain consistency with the updated LGA.

3.3 Recommended Additions to OCP Bylaw No. 1130 (Section 14)

A principal outcome of the review of existing marine policies in the DNS was that specific measures should be incorporated in the existing OCP Bylaw No. 1130 to anticipate the emerging coastal flood hazard, as defined in the FCL Study Report. The first suggested measure was a new DPA which could be tailored specifically to address the hazard posed by expected sea level rise. It is clear from the public consultation process that this approach was considered to be too complex and too expensive in many circumstances.

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The recommendation to add a new DPA to address the Sea Level Rise related Coastal Flooding Hazard is withdrawn.

The risks associated with the growing coastal flooding hazard can be addressed with a proposed Coastal Flood Mitigation Bylaw. This proposed Bylaw is discussed further in Chapter 4.

4 BASIS FOR A COASTAL FLOOD MITIGATION BYLAW

As described in Section 1.3 of this document, public consultations were held on recommended changes to the OCP bylaw described in this report on January 26, 2017 and October 19, 2017. The overall tone of the comments provided by the public was:

- The proposed new DPA (DPA 9 – Sea Level Rise Coastal Flood Hazard Areas) was:
 - Too complex.
 - Too expensive.
 - It should be consistent with measures taken by other local governments – especially Sidney.
- It should be made clear that any proposed change applied only to new developments.
- It was premature to consider a measure as complex as a Development Permit Area and the proposed DPA might have unintended consequences on existing property values due to the uncertainty introduced regarding redevelopment options.

At the same time as the comments from the public were being reviewed and considered, the Province brought into effect, on 1 January 2018, amendments to Sections 3.5 and 3.6 of the Flood Hazard Land Use Management Guidelines [7], which are the reference guidelines of Section 542 of the *Local Government Act*.

Under Section 3.5.4 of the Section 3.5 and 3.6 Amendment [6], the areas of the DNS shown to be exposed to the risk of coastal flooding in the FCL Study may be designated as floodplains and local governments may, by bylaw, specify flood levels and setbacks to address the risk of coastal flooding due to sea level rise. On review, this approach provides a much simpler approach and clearly only applies to new developments.

It is recommended that a Coastal Flood Mitigation Bylaw, based on the results of the FCL Study should be adopted.

The proposed *Bylaw 1439 - Coastal Flooding Mitigation Bylaw* is in DRAFT form, subject to approval by the Council of the District of North Saanich.

4.1 Coastal Flood Mitigation Bylaw Area of Application

The proposed *Bylaw 1439 - Coastal Flood Mitigation Bylaw* is only applicable in the areas where the FCL Study [14] has shown that the existing ground surface in the District of North Saanich is a floodplain, as defined by the methodology outlined in the Provincial Guidelines amendment [6].

The defined floodplains are shown in Figure 4-1, which is the key map for larger scale maps included in Appendix A of this document. The large scale maps in Appendix A show more specific floodplain mapping for sea level rise of 0.5 m and for 1.0 m. More detailed versions of these floodplain maps, that provide reach by reach definition of the associated Flood Construction Levels, are provided in the proposed draft *Bylaw 1439 - Coastal Flood Mitigation Bylaw*. Bylaw 1439 will be considered separately from the OCP review by District of North Saanich Council.

The Key Map (Figure 4-1) and the larger scale maps in Appendix A, will also be included in the OCP amendment Bylaw 1442.

The Key Map (Figure 4-1) and the larger scale maps in Appendix A, were prepared in accordance with the results of the FCL Study [14] and the Provincial Guidelines [6].

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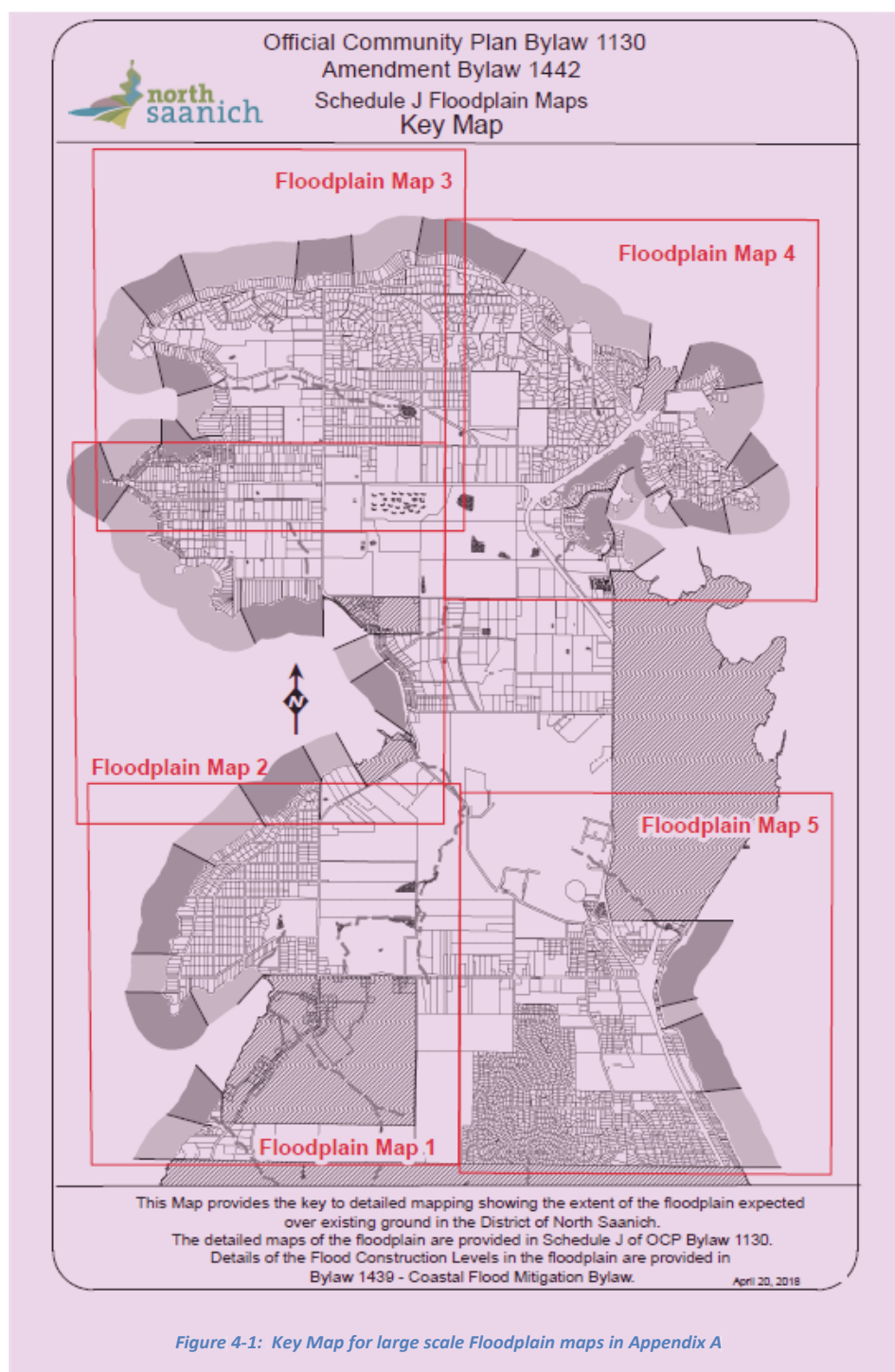


Figure 4-1: Key Map for large scale Floodplain maps in Appendix A

5 GLOSSARY

Abbreviations, acronyms and definitions of terms used in this report are listed below.

5.1 Abbreviations and Acronyms

AEP	Annual Exceedance Probability	The probability (or % chance) of a specific event occurring or being exceeded in any given year.
CD	Chart Datum	In the DNS area, CD is 2.2m (± 0.1 m) below Geodetic Datum (CGVD28).
CGVD28	Canadian Geodetic Vertical Datum (1928)	<p>In most places in Canada, this is the current reference datum for terrestrial vertical elevations and is generally the same as mean sea level, based on astronomical tides alone. A detailed description is available online at:</p> <p>http://www.nrcan.gc.ca/earth-sciences/geomatics/geodetic-reference-systems/9054# Canadian Geodetic Vertical 1.</p> <p>CGVD28 is being replaced with a newer datum plane based on a North American common geoid. The new datum is notionally equivalent to the local coastal mean sea level. Details are available online at:</p> <p>http://www.nrcan.gc.ca/earth-sciences/geomatics/geodetic-reference-systems/9054# Benchmarks Information</p>
CRD	Capital Regional District	
DFL	Designated Flood Level	A water surface elevation which includes appropriate allowances for future SLR, land crustal movement, tide, and storm surge during the Designated storm.
DPA	Development Permit Area	Refers to Development Permits as per Division 7 of the LGA or Section 14 of the OCP.
DS	Designated Storm	A storm which includes concurrent time series of winds, storm surge and waves, with a specific AEP.
FCL	Flood Construction Level	Defined as the underside elevation of a wooden floor system or the top elevation of a concrete slab, for habitable buildings [1].
FCL Study		SNC Lavalin Inc's report "Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise", SLI Document: 634533-3000-41ER-0001 [14].
	Floodplain Bylaw	Bylaw designated under Section 524 of the <i>Local Government Act</i> .

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HHWLT	Higher High Water Large Tide	The average of the annual highest tide over an 18.6 year complete tidal cycle. In the DNS area, HHWLT is 1.5 m above Geodetic Datum (CGVD28) and 3.7 m above Chart Datum (± 0.2 m).
LGA	Local Government Act	Refers to the updated <i>Local Government Act</i> (RSBC 2015), which was made current as of October 26, 2016.[11]
NCCAP	North Saanich Climate Action Plan	Refers to Reference [15].
MTF	Marine Task Force	Refers to the individuals responsible for the MTFR.
MTFR	Marine Task Force Report	Refers to Reference [10].
OCP	Official Community Plan	Depending on context refers to Official Community Plan Bylaw No. 1130, dated 23 May 2007 or its update [9].
RGS	Regional Growth Strategy	Refers to Reference [8].
RSBC	Revised Statutes of British Columbia	
SDA	Special Development Area	Refers to Special Development Area as per Section 13 of the OCP.
SLI	SNC Lavalin Inc	
SLR	Sea Level Rise	The rise in sea level including: global sea level rise driven by global warming and local sea level rise driven by regional tectonic or isostatic (glacial) subsidence or uplift.
SWAN	Simulating WAVes Nearshore	Wave modelling software, which can simulate wave generation, propagation, dissipation and transformation to the shoreline.
°T	Degrees, True North	Direction in degrees, with respect to True North.

5.2 Definitions

2011 Provincial Guidelines	Guidelines posted by BCMOE, BCMOE (2011a,b,c), and available online at: http://www.env.gov.bc.ca/wsd/public_safety/flood/fhm-2012/draw_report.html#3
Estimated Future Natural Boundary	The estimated location of the future Natural Boundary after sea level has risen, usually by a defined amount. Defined in the 2011 Provincial Guidelines .
Fetch	The horizontal distance over open water (in the direction of the wind) over which wind generates waves.

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Foreshore	That part of the shoreline extending between the upper limit of wave interaction with the shoreline and the low tide elevation. Typically the inland limit of the foreshore would be landward of the Natural Boundary .
Freeboard	A vertical allowance added to the DFL and the Wave Effect allowance to establish the FCL. This allowance is generally included to cover any uncertainties in defining the FCL.
Geodetic Datum	The reference plane for terrestrial vertical elevations in Canada and in general approximately equal to mean sea level.
Natural Boundary	The present Natural Boundary as defined in the British Columbia <i>Land Act, Section 1</i> .
Nearshore	An indefinite zone extending seawards from the shoreline to deepwater, typically well seaward of the breaker zone and in water depths in the order of 20 m.
Overtopping	The passage of water over the crest of a shoreline or shoreline structure as a result of wave run-up.
Residual Water Level	The component of the measured water level that is not attributed to tidal effects. The residual water level is generally assumed to be approximately equal to the storm surge. Calculated as the measured total water level minus the predicted tides at a given location.
Run-Up	The vertical distance travelled by the action of individual waves that break and travel up the shoreline or slope of a shoreline structure.
Storm Surge	The non-tidal rise/fall in a body of water due to atmospheric effects.

6 REFERENCES

6.1 Reference Documents

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- [7]
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- [13] SLI 2016. "Flood Construction Level Study". Document No. 634533-1000-41ER-0001. Rev. 00. 2 May 2016.
- [14] SLI 2018. "Flood Construction Levels for 0.5 m and 1.0 m Sea Level Rise". Document No. 634533-3000-41ER-0001. Rev. 00, March 27, 2018.
- [15] SSGWWC 2007. "North Saanich Climate Action Plan". Sustainability Solutions Group Workers Cooperative 2007. Available online at: <https://sites.google.com/a/sustainabilitysolutions.ca/north-saanich-project-pages/home>

NOTICE TO READERS

This document contains the expression of the professional opinion of SNC-Lavalin Inc. ("SLI") as to the matters set out herein, using its professional judgment and reasonable care. It is to be read in the context of the Agreement, and the methodology, procedures and techniques used, SLI's assumptions, and the circumstances and constraints under which its mandate was performed. This document is written solely for the purpose stated in the Agreement, and for the sole and exclusive benefit of the Client, whose remedies are limited to those set out in the Agreement. This document is meant to be read as a whole, and sections or parts thereof should thus not be read or relied upon out of context.

SLI has, in preparing any cost estimates, followed methodology and procedures, and exercised due care consistent with the intended level of accuracy, using its professional judgment and reasonable care, and is thus of the opinion that there is a high probability that actual costs will fall within the specified error margin. However, no warranty should be implied as to the accuracy of any estimates contained herein. Unless expressly stated otherwise, assumptions, data and information supplied by, or gathered from other sources (including the Client, other consultants, testing laboratories and equipment suppliers, etc.) upon which SLI's opinion as set out herein is based has not been verified by SLI; SLI makes no representation as to its accuracy and disclaims all liability with respect thereto.

SLI disclaims any liability to the Client and to third parties in respect of the publication, reference, quoting, or distribution of this report or any of its contents to and reliance thereon by any third party.

District of North Saanich

OCP Marine Policy and Guidelines Recommendations



REVISION INDEX AND SIGNATURES

Issue Code	Rev. No	Date (yyyy-mm-dd)	Description of Changes	Initials
RR	PA	2016-11-03	Released for Internal Review	SL
RR	PB	2016-12-12	Released Client Information and Comment	JSR
RR	PC	2016-12-20	DPA 9 complete. Awaiting legal comments	JSR
RR	PD	2016-12-22	Legal comments incorporated	JSR
RR	PE	2017-01-04	DNS comments incorporated	JSR
RR	PF	2017-01-05	Additional DNS comments incorporated	SL
RR	PG	2017-01-24	COW comments incorporated	JSR
RR	PH	2017-10-13	Comments from Consultation incorporated	JSR
RR	PI	2018-03-07	Comments from Consultation incorporated	JSR
RI	0	2018-03-27	Released for Information and Client Use	JSR
RI	01	2018-04-23	Schedule B and Floodplain maps added	JSR

Issue Codes:

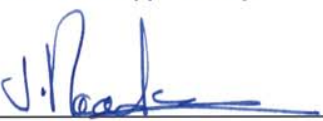
RC	Released for Construction
RD	Released for Design
RF	Released for Fabrication
RI	Released for Information
RP	Released for Purchase
RQ	Released for Quotation
RR	Released for Review and Comments

Prepared by:


 Sherry Lim, P.Eng.
 Project Engineer



Reviewed and Approved By:


 John Readshaw, P.Eng.
 Manager, Coastal Engineering and Dredging



End of Document except for Appendices.

District of North Saanich

OCP Marine Policy and Guideline Recommendations - APPENDIX A



APPENDIX A – Floodplain Maps for 0.5 and 1.0 m sea level rise

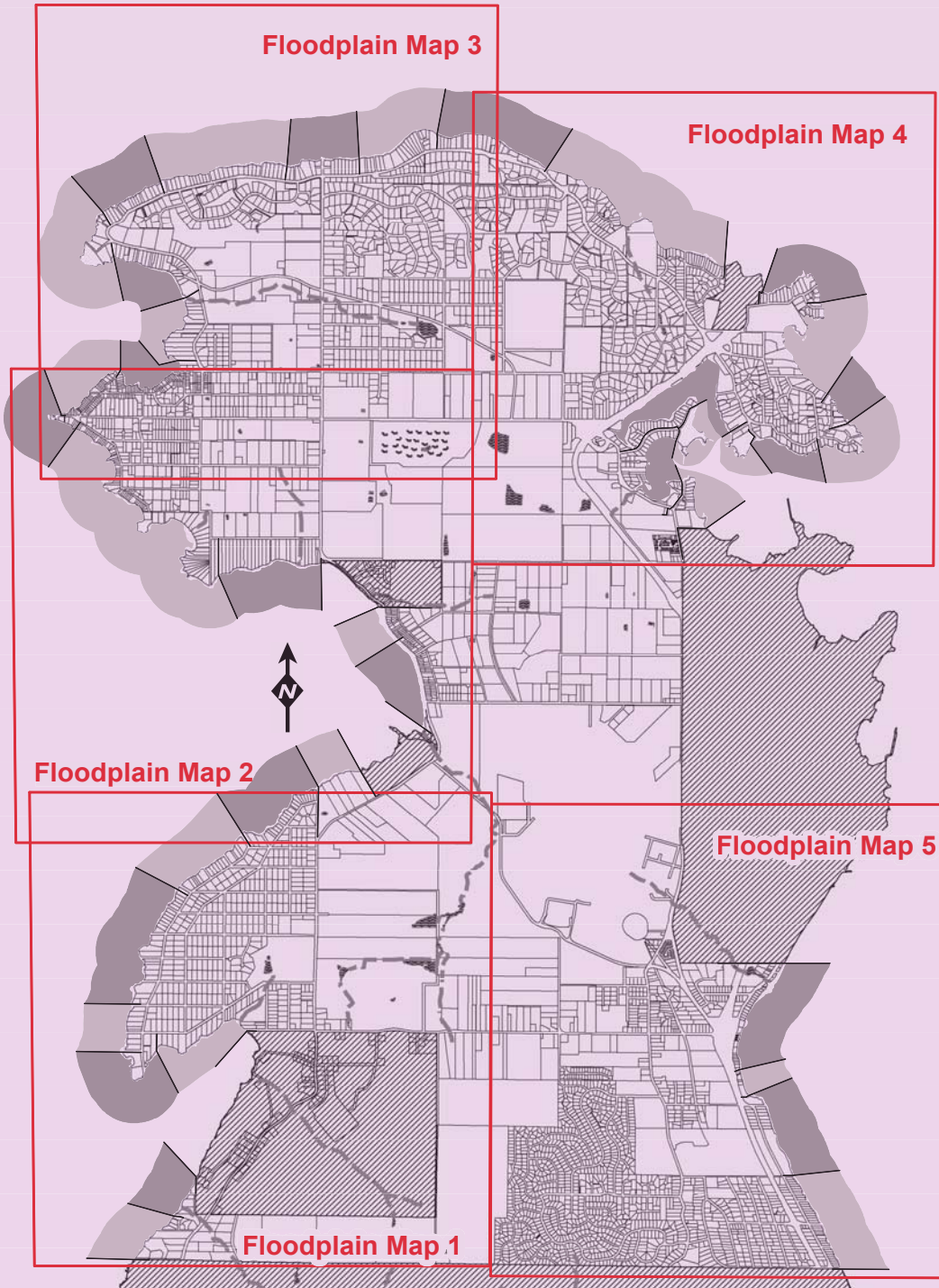
Key Map – 1 map

Floodplain Maps for 0.5 m SLR – 5 maps

Floodplain Maps for 1.0 m SLR – 5 maps



Official Community Plan Bylaw 1130
Amendment Bylaw 1442
Schedule J Floodplain Maps
Key Map



This Map provides the key to detailed mapping showing the extent of the floodplain expected over existing ground in the District of North Saanich.
The detailed maps of the floodplain are provided in Schedule J of OCP Bylaw 1130.
Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

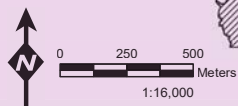
April 20, 2018



Floodplain Map 1
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
0.5 m Sea Level Rise

Floodplain Map 2

Floodplain Map 1



- Extent of the Floodplain ground subject to Flood Construction Level (FCL) elevation
- Not Defined
- Ponds
- Creeks

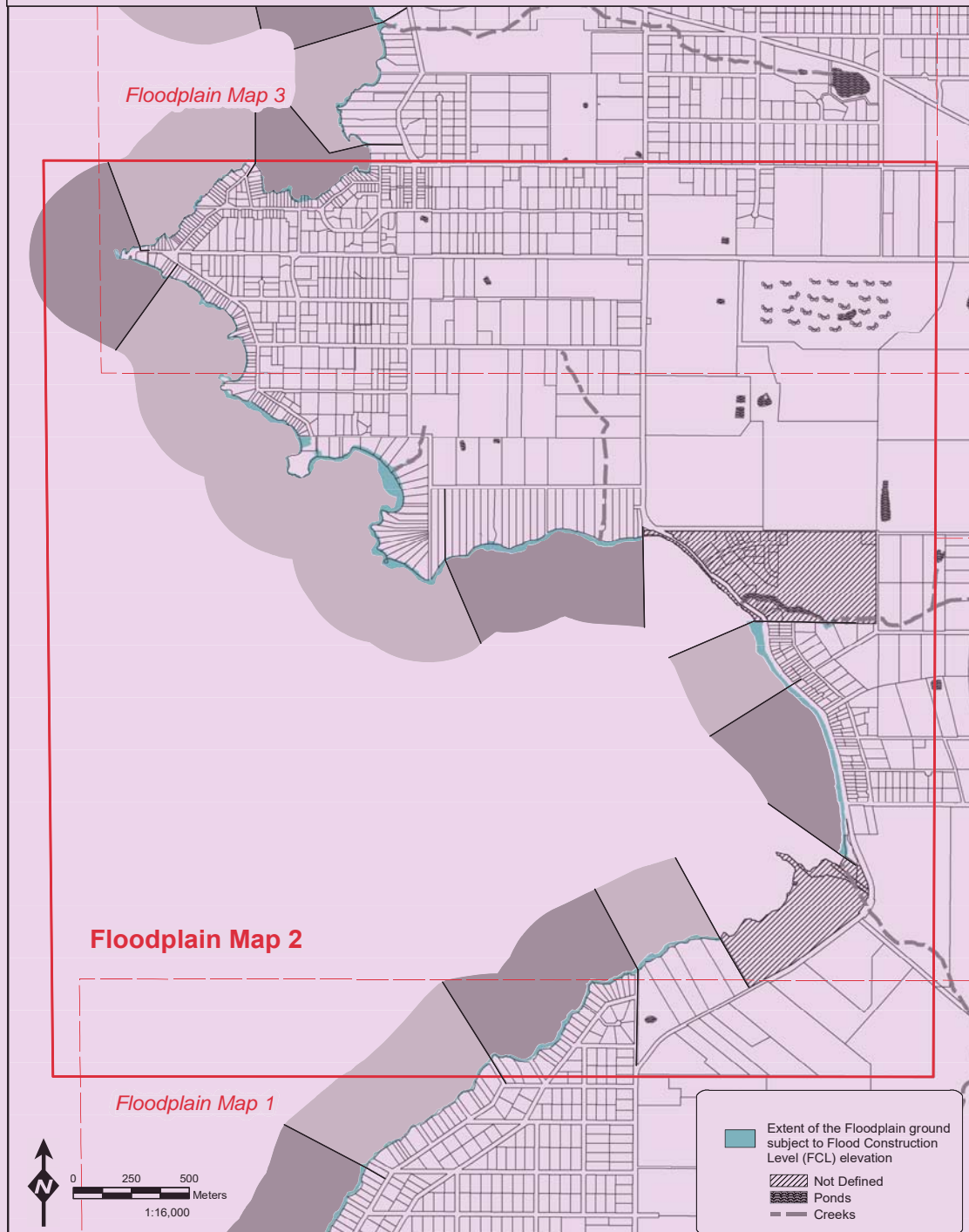
This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
 Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 2
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
0.5 m Sea Level Rise



This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

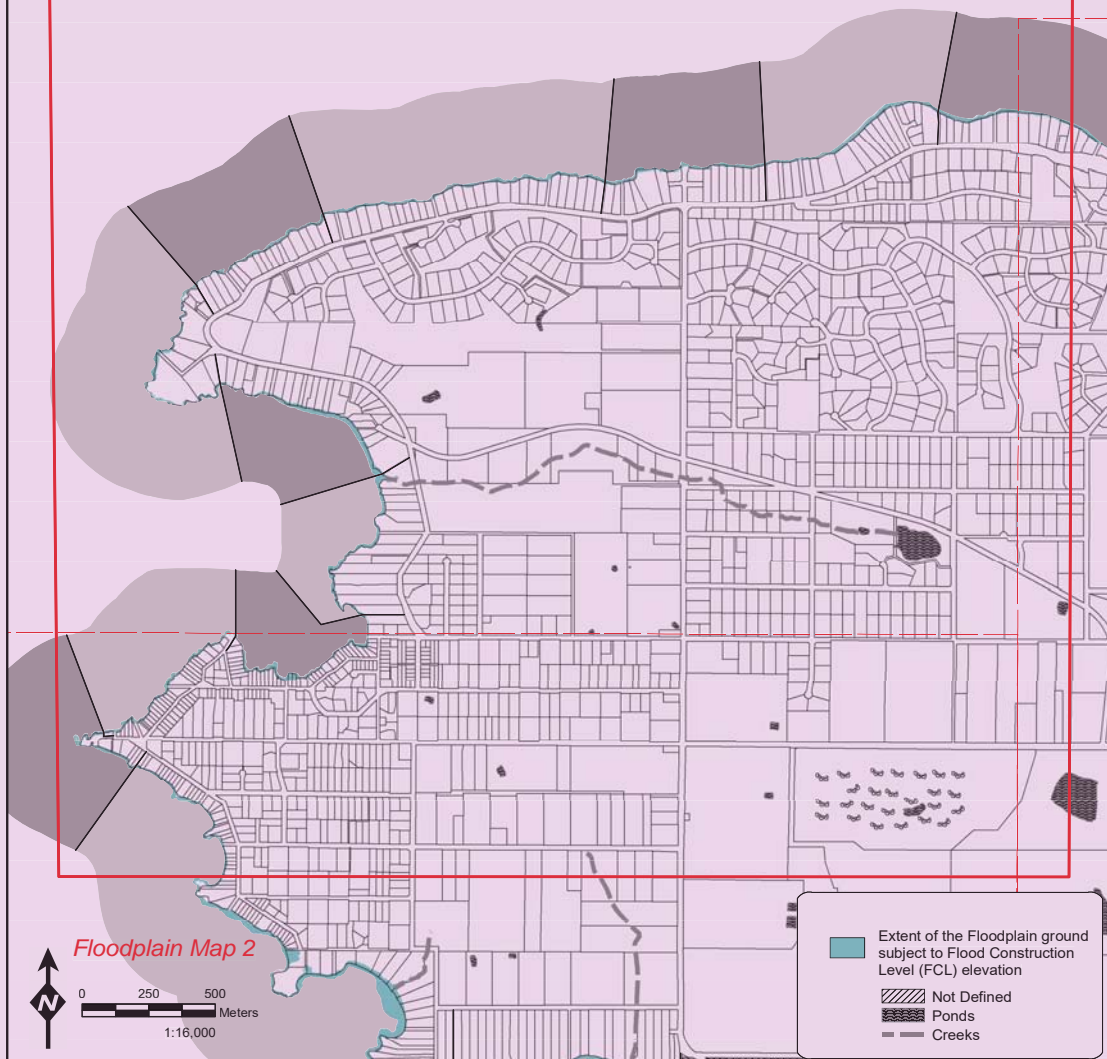
Details of the Flood Construction Levels in the floodplain are provided in
 Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 3
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
0.5 m Sea Level Rise

Floodplain Map 3



This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

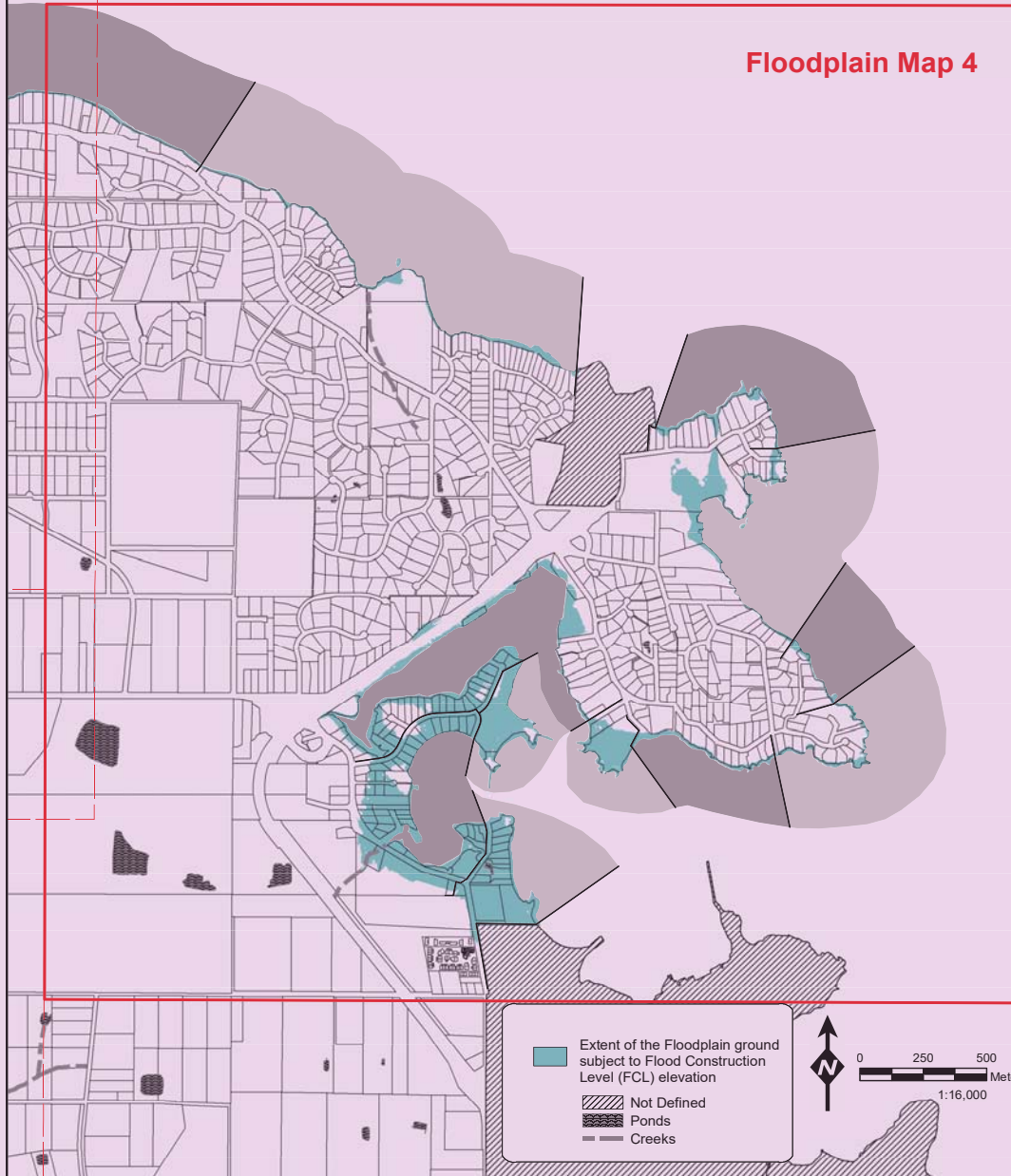
Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 4
 Schedule J - Official Community Plan
 Bylaw 1130 Amendment Bylaw 1442
 0.5 m Sea Level Rise

Floodplain Map 4



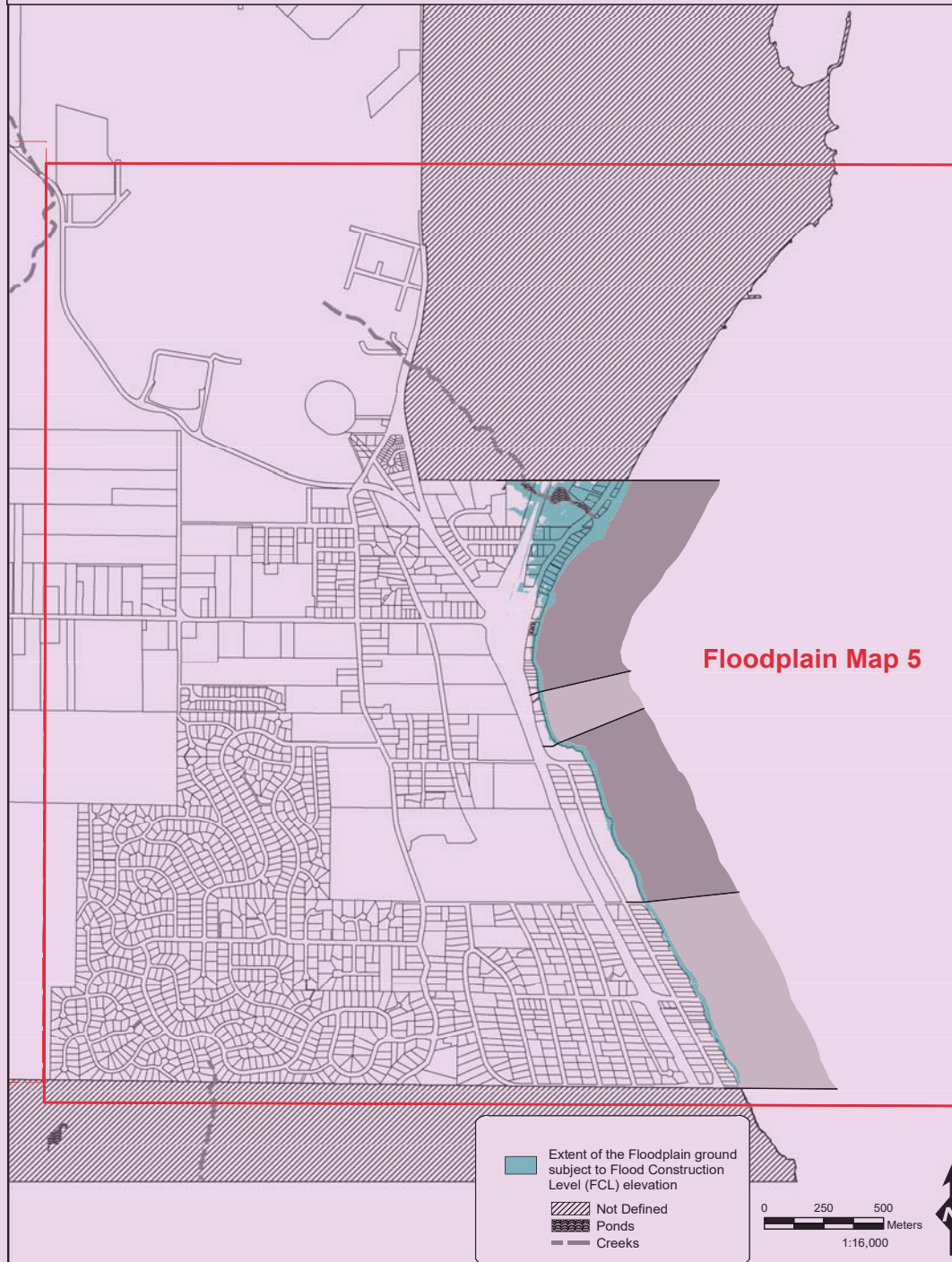
This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
 Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 5
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
0.5 m Sea Level Rise



This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

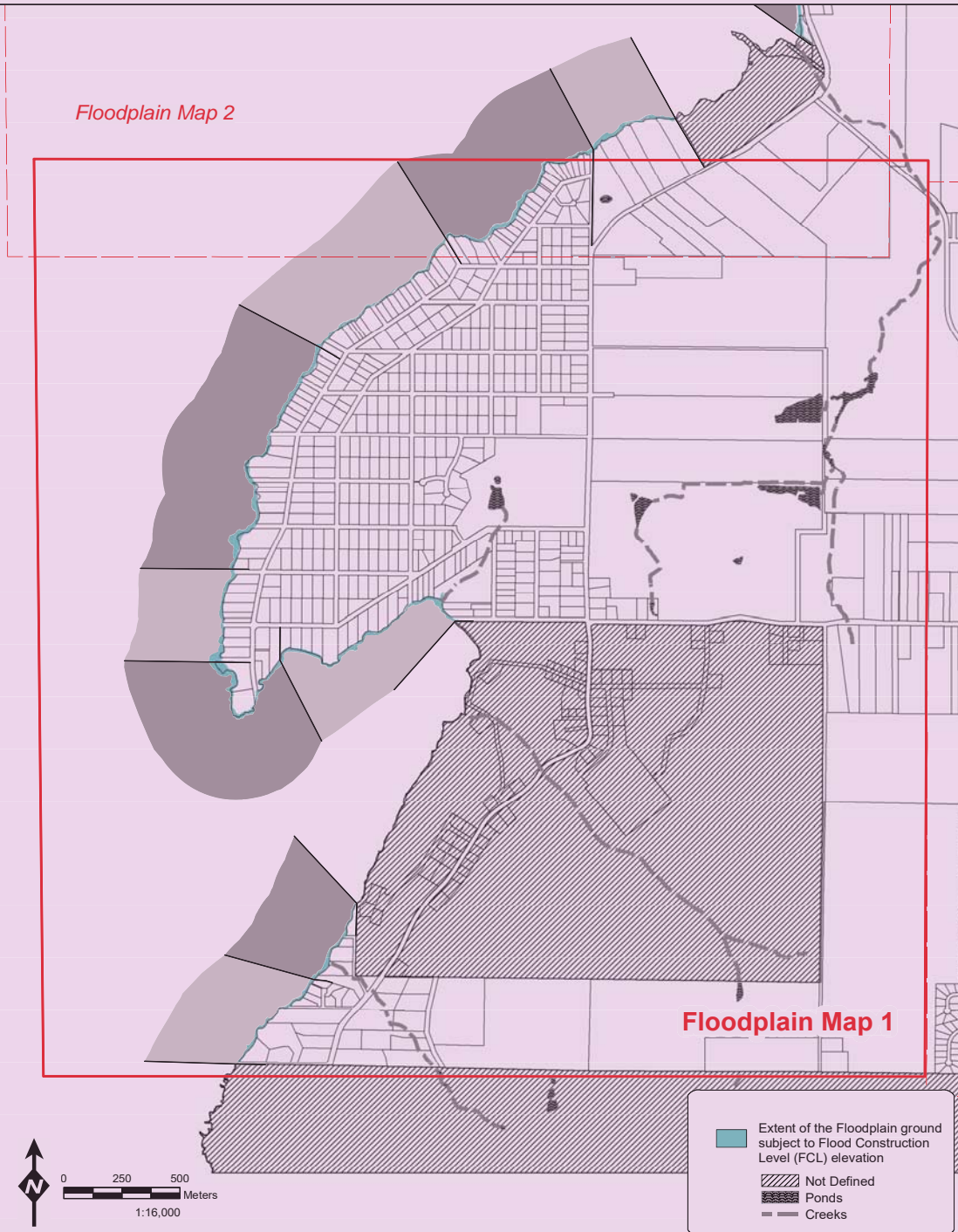
Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 1
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
1 m Sea Level Rise

Floodplain Map 2



Floodplain Map 1

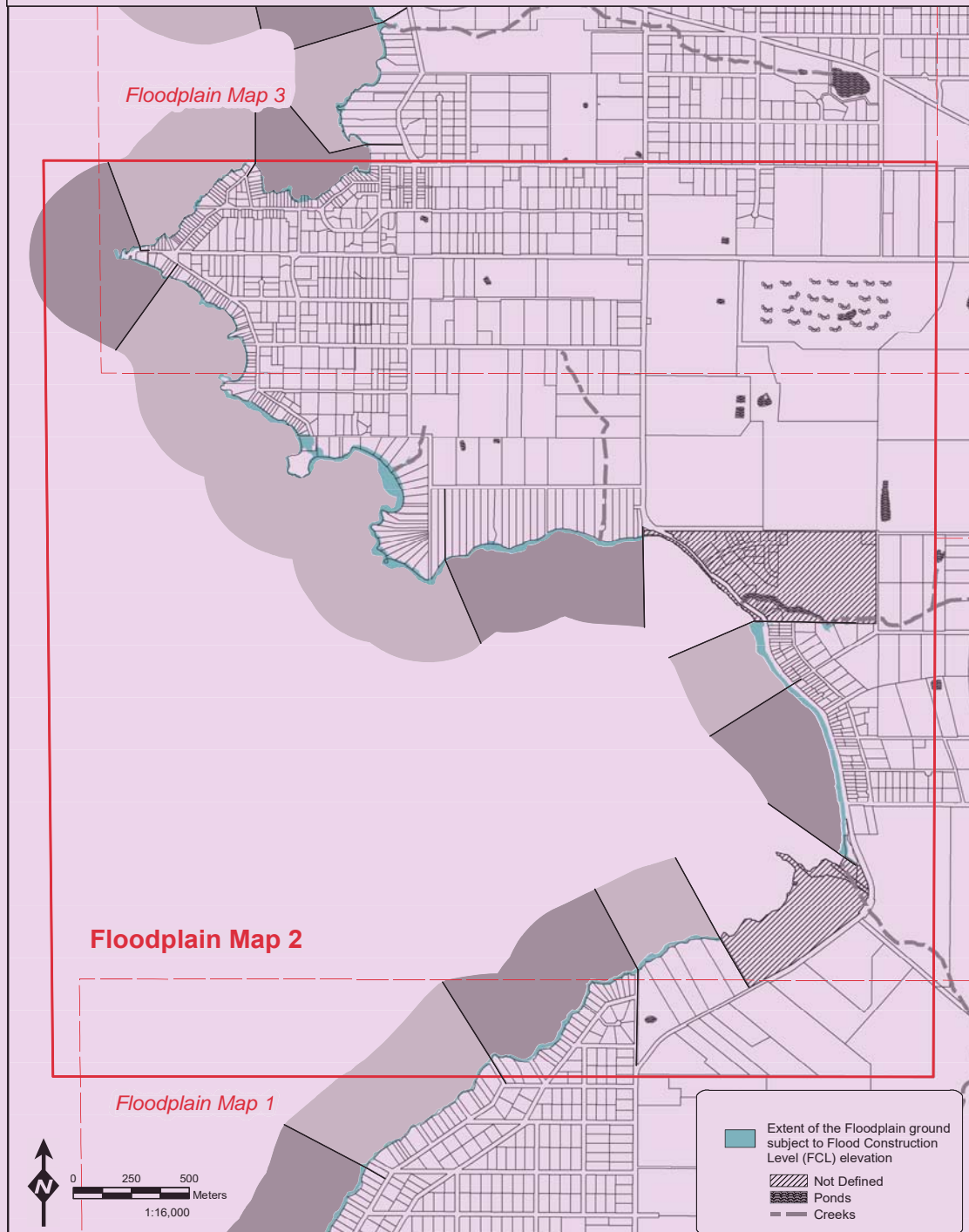
This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
 Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 2
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
1 m Sea Level Rise



This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

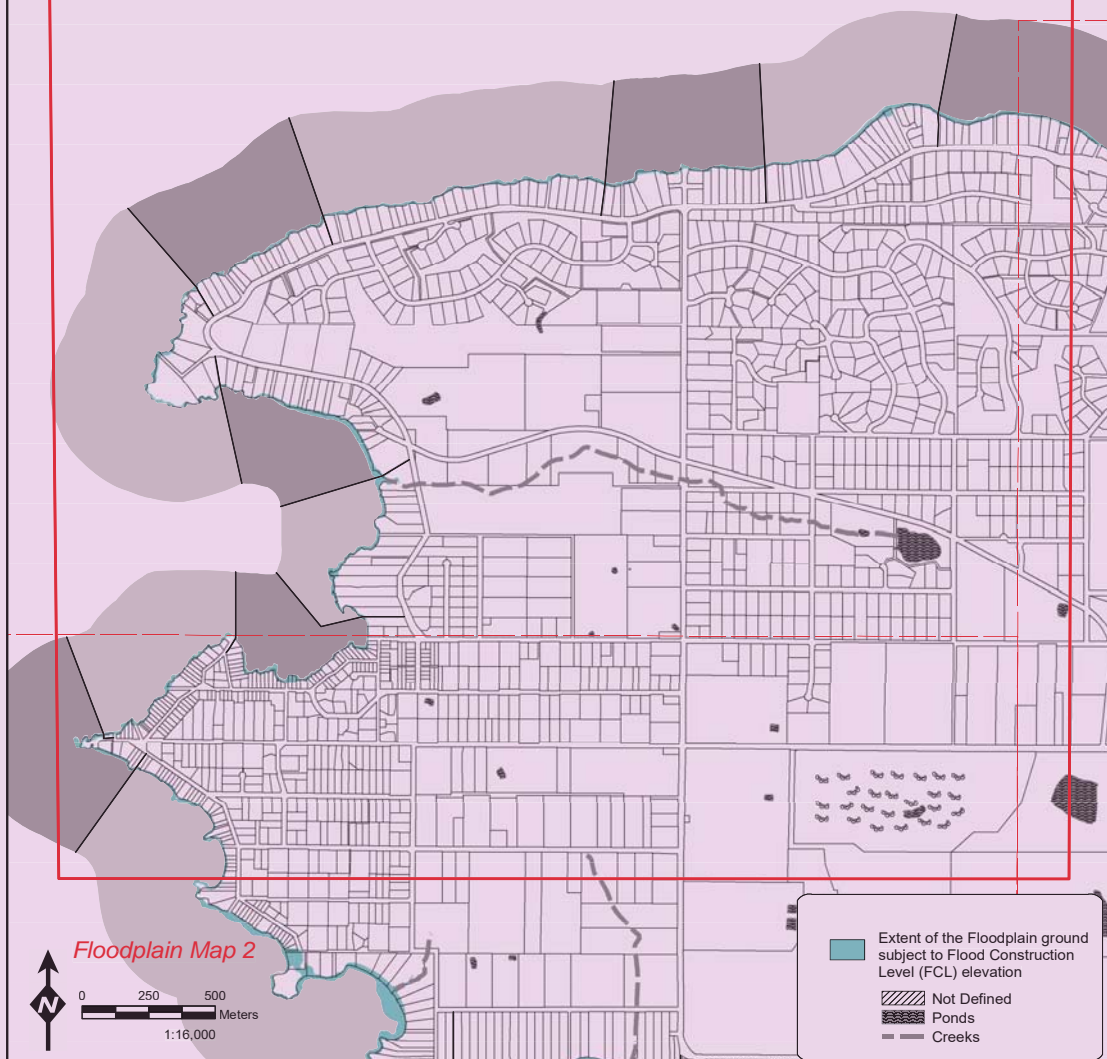
Details of the Flood Construction Levels in the floodplain are provided in
 Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 3
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
1 m Sea Level Rise

Floodplain Map 3



This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

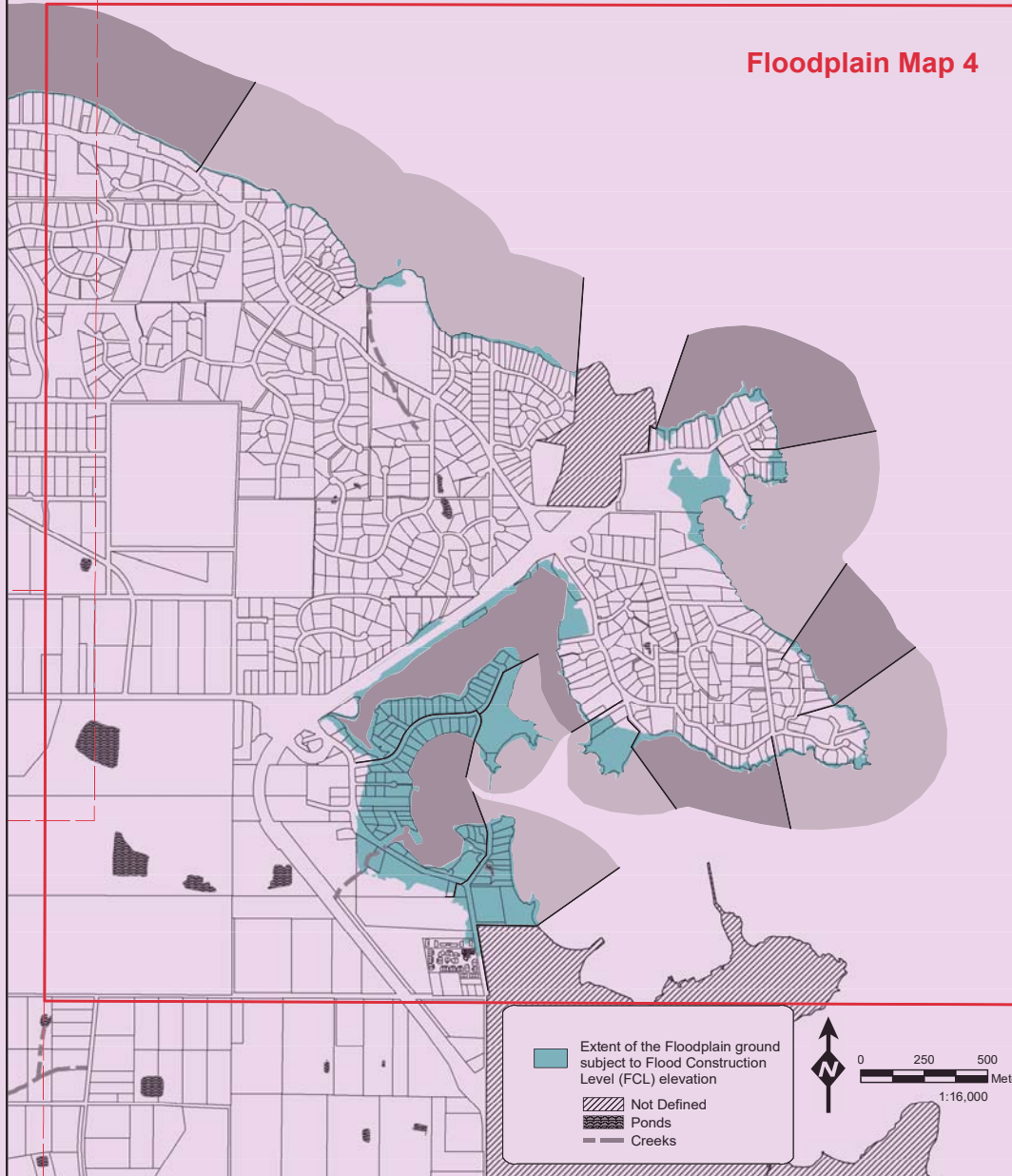
Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 4
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
1 m Sea Level Rise

Floodplain Map 4



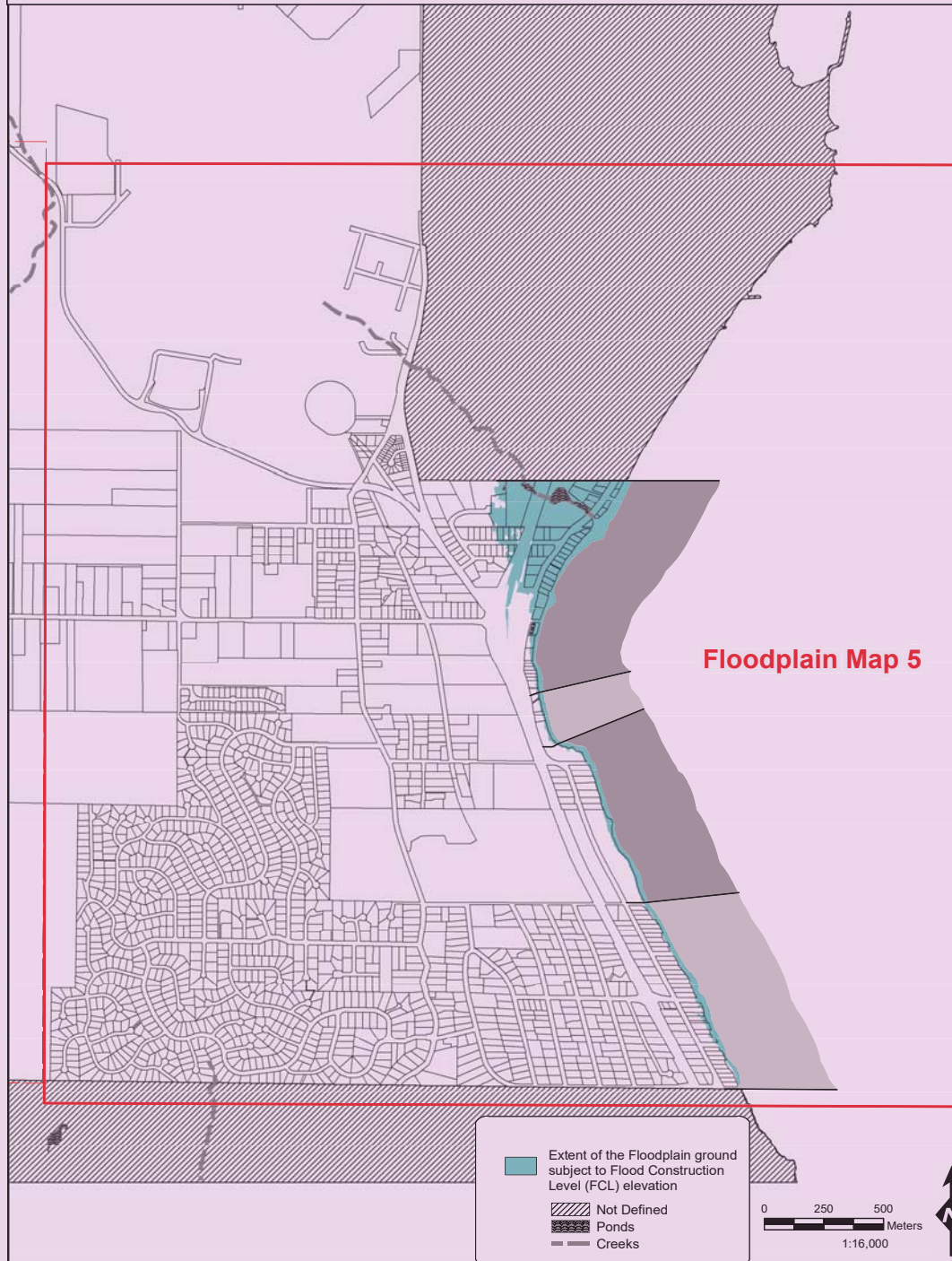
This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 5
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
1 m Sea Level Rise



This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018

District of North Saanich

OCP Marine Policy and Guideline Recommendations



End of Document





District of North Saanich

OCP Marine Policy and Guidelines Recommendations

For Sea Level Rise Planning and Adaptation

Prepared By: SNC-Lavalin Inc. 23 April, 2018

Document No.: 634533-3000-41ER-0002

Revision: 01



District of North Saanich

OCP Marine Policy and Guidelines Recommendations



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EXECUTIVE SUMMARY

Ongoing climate change is expected to lead to many changes including increased temperatures and as a result, increased ice melting and rising sea levels. Although the pace of these effects is still uncertain, this report is the start of a process initiated by the District of North Saanich (DNS) to assess, evaluate and plan for the expected effects of rising sea levels and the likely consequences around the shoreline of the district.

The purpose of this document is to provide recommendations to update the marine policies of the District of North Saanich Official Community Plan (OCP) known as “Official Community Plan Bylaw No. 1130”.

A review and assessment of the results and findings of the Flood Construction Level Study [14] found the following overall consequences:

- Nearly the entire shoreline of the DNS is exposed to a growing flood hazard related to the expected effects of climate change related sea level rise.
- The flood hazard occurs primarily to private properties and differs considerably in character around the shoreline.
- The most exposed areas of the shoreline are located in the Tsehum Harbour area and along Lochside Drive near the McTavish interchange.
- In many locations the future flood hazard is concentrated at the toe of steep cliffs and bluffs and in locations where the cliffs or bluffs are grounded on outcropping bedrock. In these latter situations it will be sometime before a flooding related hazard materializes.
- In many other locations, the future hazard is concentrated at the toe of existing seawalls and the consequences will be manifested either at or adjacent to the seawall base, on publically owned foreshore, or at the top of the seawall where overtopping wave action will create a increasing problem either from the flooding by the overtopping volume of water during storms, from erosion and unravelling of the seawall or from erosion of the land immediately behind the seawall. If structures are located close to the seawall there may be a threat to the safety and security of personnel or to the structure during a coastal storm.
- The scale of the flooding hazard, in all cases, is dependent on individual situations; exposure, resources, relevant time frames and immediate needs and concerns, and is best evaluated and addressed on a site by site and individual by individual basis.

For this reason, three distinct measures are recommended:

1. Existing portions of the OCP should be amended to allow for future adaptation measures by individual parcel owners. These measures are addressed in Section 3.2.1 of this document.
2. The Tsehum Harbour and Lochside Drive areas of the DNS should be added to the OCP as Special Development Areas. These measures are addressed in Section 3.2.2 of this document.
3. A new Coastal Flood Mitigation Bylaw should be adopted by Council to address the growing flood hazard related to sea level rise. Adopting a new bylaw instead of creating a new DPA will address many of the concerns raised during the public consultations. The proposed new bylaw is addressed in Section 3.2.3, 3.3, and Section 4 of this document.

End of Executive Summary

District of North Saanich

OCP Marine Policy and Guidelines Recommendations



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1 INTRODUCTION

1.1 Background

Ongoing climate change is expected to lead to many changes including increased temperatures and as a result, increased ice melting and rising sea levels. Although the pace of these expected effects is still uncertain, this report is intended as the start of a process initiated by the DNS to assess, evaluate and plan for the expected effects of rising sea levels and the likely consequences around the shoreline of the district.

The Province of British Columbia began the process of preparing the province for the upcoming effects of climate change with the publication of an adaptation strategy [1], which identified three key strategies to achieve a prepared and resilient community, as follows:

Stage 1: Build a strong foundation of knowledge

This strategy is aimed at providing decision-makers (e.g. provincial ministries, local governments, private industry, etc.) the appropriate support needed to interpret and understand complex climate projections so that appropriate future adaptation decisions are made.

Stage 2: Assess risks and implement priority adaptation actions in sectors

The risk of areas known to be sensitive to climate change must be assessed and adaptation implementation must be prioritized and staged.

Stage 3: Make adaptation part of Government's business

In order to take action, the planning and implementation of climate change adaptation will be incorporated into government policies, legislations, and regulations.

As part of this initiative, in 2011, the Province released three key Guideline documents ([2][3][4]) that provide guidelines focused on climate change adaptation including, specifically, the identification and management of coastal flood hazard land use [3]. These provincial Guideline documents stress the need to establish management parameters, such as a flood construction level (FCL), to limit risks and damage associated with sea level rise (SLR) and coastal flooding events.

In conjunction with the climate change adaptation Guideline documents, the Province has finalized its amendment to the current standing provincial Flood Hazard Management Guideline document [5], which covers all aspects of flood hazard management, including river and stream related flooding and tsunami hazards. The amendment has been posted to the Flood Safety website and came into force on 1 January 2018 [6]. The work and recommendations described in this report are consistent with the Guideline amendment and the overall key provincial strategy.

As part of the initiative of the District of North Saanich to understand, assess and plan for adaptation to expected climate change and related sea level rise effects, SNC-Lavalin Inc. (SLI) was retained to define the Flood Construction Levels for the DNS, considering shoreline specific conditions including exposure to storm related winds, waves, storm surge and shoreline type and a 0.5 m and a 1.0 m SLR scenario. The findings of the Flood Construction Level definition work are provided in [14], which is referred to in this document as the FCL Study.

1.2 Purpose and Scope

The purpose of this document is to provide sea level rise adaption related recommendations to the ongoing process of assessing, discussing and planning revisions for updating of the District of North Saanich (DNS), Official Community Plan (OCP) known as "Official Community Plan Bylaw No. 1130. These recommendations reflect the results and assessment of the findings of the Flood Study on the consequences to the shorelines of the DNS.

The recommendations in this document have been developed bearing in mind the various strategies, objectives and recommendations outlined in existing planning documents; also relevant to the OCP; including the DNS Marine Task Force review [10], the NSCCAP report [15] and the CRD Regional Growth Strategy [8], where they are specifically related to or are affected by the results of FCL Study.

The recommended OCP policy amendments presented in this document relate to planning horizons that accommodate a 0.5m and 1.0m rise in sea levels. The Provincial updated guidelines recommend also planning for a 2 m rise in sea level, which in 2011 was estimated to occur in 2200. Recent science and assessments suggest a 2 m sea level rise will likely occur sooner than 2200; however, consideration and evaluation of recommendations for this more severe scenario has been deferred until the uncertainty related to the future rate of rise in sea level can be objectively reduced.

1.3 Consultation

Public consultations on the recommendations outlined in this report were held June 7, 2016, November 17, 2016, January 26, 2017 and October 19, 2017 on marine policy planning, sea level rise and flood mapping.

Draft changes to the Official Community Plan, including a proposed new development permit area were presented in January 26, 2017 and October 19, 2017 in public consultation forums with survey and feedback opportunities at both. Seven (7) surveys were completed at the January 26, 2017 forum (100 attendees). Twenty-one (21) feedback forms were received after the October 19, 2017 public consultation (60 attendees).

The current version of this document reflects the comments made during public consultations occurring prior to the date of the current version of the document.

2 RELATIONSHIP OF EXISTING PLANNING TO THE FCL STUDY

2.1 Introduction

The principal existing framework of planning documents that relate to the findings and issues raised by the FCL Study, in chronological order, are:

1. OCP Bylaw 1130, approved in 2007 and in the process of being updated.
2. The DNS Marine Task Force Report, prepared in 2008
3. The DNS Climate Change Action Plan, prepared in 2010
4. The CRD Regional Growth Strategy (DRAFT version 1.5) issued in March 2016.

It should be noted that of these documents, only the Regional Growth Strategy was prepared after the initial release of the three Provincial guideline documents [2][3][4], related to climate change, sea level rise and the resulting implications to British Columbia shoreline. Nevertheless, all four documents contain policy recommendations or conclusions that have meaning or overlap within the context of the findings of the FCL Study. These areas of overlap are briefly summarized in the remainder of Section 2.

2.2 Relationship of Existing Official Community Plan Bylaw No. 1130 to the FCL Study

A detailed review of the implications of the FCL Study to the current OCP Bylaw showed that many areas of the Bylaw need to be updated or revised to reflect the findings and results of the FCL Study. The current OCP also needs to be updated to reflect the outcome of the ongoing Regional Growth Strategy process. The affected areas are briefly summarized below and a more detailed clause by clause examination is provided in Section 3 of this report.

The existing OCP, dated 2007, has eight (8) main areas within the Bylaw document that are affected by the findings and results of the FCL Study:

1. OCP Section 3 relating to Environmentally Sensitive Areas
2. OCP Section 4, relating to Marine Areas
3. OCP Section 6, relating to Residential Areas
4. OCP Section 7, relating to Commercial Development
5. OCP Section 11, relating to Roads and Servicing
6. OCP Section 12, relating to General Development Policies
7. OCP Section 13, relating to Special Development Areas
8. OCP Section 14, relating to Development Permit Areas

It should be noted that a brief review of the District of North Saanich Zoning Bylaw (1255) was conducted as part of this assignment and some zones may contain elements that are influenced by the findings and results of the FCL Study. A review and development of potential changes is deferred until implementation of the recommendations of this document because the final form of amendments to the OCP could influence some zones.

2.3 Relationship of the FCL Study to the Marine Task Force Report

The Marine Task Force Report (MTFR) was prepared in 2008, after the current OCP was adopted by Council, and following an extensive four (4) year program of consultation with the DNS community of interest. The main focus of the process was the protection and enhancement of the economic and environmental marine assets of the DNS. The specific objectives of the Marine Task Force (MTF) were:

1. Review and possibly recommend changes to permitted use and restrictions of the current [2008] seven (7) marine zones around the North Saanich Peninsula.
2. Develop and recommend a method to inventory sensitive shoreline areas.
3. Review and assess effectiveness of existing [DNS] bylaws, policies and procedures with respect to marine foreshore developments.
4. Recommend new policies, as required, to protect marine environments and regulate new marine development, within the context of the OCP and federal and provincial regulations.

The Marine Task Force undertook extensive consultation with the community and addressed in detail key areas of the marine related aspects of the DNS including:

- Current marine and foreshore uses
- Existing boating and (marine) transportation facilities
- The existing (2007) Official Community Plan (OCP) and marine related components
- Zoning Bylaw No. 750, 1993 (repealed)
- Foreshore Lease Policies
- The existing (2008) North Saanich Permitting Process
- The current and expected future economic impact and outlook for the Marine Industry [in DNS]
- North Saanich Policy [marine] options
- Marine/Foreshore usage and zoning
- The existing Shoreline Inventory
- Review of relevant legislation, policies and procedures that address, protect and/or enhance Marine and Foreshore habitats

Details of the key findings and recommendations of the MTF are provided in the MTFR [10] and in a Staff Report to Council, dated 23 September 2008.

The Task Force work was undertaken prior to the release of the Provincial Government climate change related SLR reports issued in 2011 ([2][3][4]), and climate change effects or expected SLR were not explicitly considered by the MTF. There are some implications from the FCL Study findings and results that apply to the MTFR recommendations in varying degrees. A summary of the recommendations and how the FCL Study influences or affects a recommendation, is provided in Table 2-1.

Table 2-1 is ordered according to the degree to which the findings and results of the FCL Study affect the MTFR recommendations. Four (4) MTFR recommendations are directly affected by the FCL Study results. Ten (10) MTFR recommendations will be influenced to some degree by the FCL Study results and in most cases the FCL Study results will inform aspects of the issues or actions that are implied by the recommendations. As an example, the FCL Study results will likely be a consideration in the creation of plans or options for marina expansions or in the site selection and design process for a boat ramp on the west side of the Peninsula. The remaining six (6) MTFR recommendations, which largely relate to coordination or liaison actions to be undertaken, are not affected by the FCL Study.

Table 2-1: Summary of FCL Study Effects on MTFR Recommendations

MTFR * Recommendation	General Recommendation	Influence of the FCL Study
1	Better recognize marine heritage, economic contributions and boating interests of many of its residents.	The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) is consistent with this MTFR recommendation.
13	Develop a pro-active report to dealing with and remediating water pollution issues.	The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will help to minimize the entry of pollutants into the waters around the Peninsula as a consequence of flooding or coastal storm damage.
14	Develop guidelines for waste management, pump-outs and design standards.	The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) are an element of the design standards that the MTF recommended be adapted and integrated into District practices.
18	Review policies pertaining to seawalls.	The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will inform adaptation strategies for waterfront land parcels and the design of any shoreline protection.
2	Support up to a 10% expansion in the current capacity of marinas.	No direct influence. Any marina expansion will need to consider the effects of SLR.
3	Discuss expansion options, land use and zoning changes with existing marinas.	No direct influence. Any marina expansion planning or design will need to consider the effects of SLR
4	Suggestions for Reconfiguration of Deep Cove Marina.	No direct influence. Reconfiguration concepts or design will need to consider the effects of SLR
6	Provide flexibility in dealing with rezoning requests for dry land storage.	No direct influence. The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will inform site selection and storage yard design.
7	Develop new guidelines for private docks.	No direct influence. Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will inform design details of any shore connections for any docks.
8	Have District representation on the Tsehum Harbour Commission.	No direct influence. Tsehum Harbour Commission planning and developments will need to conform to the OCP.

MTFR Recommendation	General Recommendation	Influence of the FCL Study
10	Development of a public boat ramp on the west side of the Peninsula.	No direct influence. The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will inform site selection and boat ramp design.
11	Develop a consultation process to review the issues surrounding beach access.	No direct influence. The FCL Study will inform aspects of assessment or design issues of the beach access and maintenance elements of this recommendation.
17	Develop policy to address the replacement of legal non-conforming docks.	No direct influence. The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will inform the replacement design.
19	Review the existing marine zones to simplify them and integrate the other MTFR recommendations.	No direct influence. The FCL Study and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will inform related zoning issues, which are outside of the scope of this study.
5	Keep boat shed regulations the same.	No effect.
9	Ask Parks Canada to consider designating parts of the Saanich Inlet as a Marine Park.	No effect.
12	Support for a Shoreline Inventory.	No effect. This inventory was completed in 2009 and the resulting SILAS Atlas [12] will inform all projects around the DNS shoreline.
15	Ensure the Zoning Bylaw is consistent with federal Private Buoy Regulations	No effect.
16	Liaise with the Integrated Land Management Bureau on Foreshore Leases.	No effect.
20	Consider a successor marine advisory group	No effect.
* Recommendations are numbered as in the Staff Report to Council dated 23 September 2008 regarding implementation of the MTFR.		

2.4 Relationship of the North Saanich Climate Change Action Plan to the FCL Study

The DNS Climate Change Action Plan (NSCCAP) was developed in 2010 to address Provincial government mandated requirements to reduce community GHG emissions. The NSCCAP focused on six (6) main areas of focus, of which, only two have any direct or indirect reference or relationship to the issues raised by the FCL Study. These areas were:

- Focus Area 1 – Green Building Program
- Focus Area 6 – Recommendations for appropriate action.

The recommendations in Focus Area 1 clearly speak to the interests in developing sustainable building programs in the District of North Saanich. Although the programs considered in the NSCCAP do not specifically apply to many of the issues relating to expected sea level rise and the consequences, the focus is relevant to the intentions of the DNS and need to adapt or at least inform developments in DNS of potential adaptation options.

The recommendations in Focus Area 6 are concerned with densification of existing communities to create mixed-use villages and providing opportunities for shared transit options that will reduce vehicle emissions. These recommendations identify potential village sites or transit centres in Deep Cove, Ardmere and one unspecified area adjacent to Bazan Bay and the McTavish Interchange. The District is not presently proceeding with the mixed use village concept.

The results of the FCL Study indicate these areas may be affected by sea level rise and associated consequences.

2.5 Relationship of the CRD Regional Growth Strategy to the FCL Study

The CRD's Regional Growth Strategy (RGS) [8], issued in 2016 under the auspices of the *Local Government Act*, aims to develop a vision for the Capital Region District for 2038 that recognizes fourteen (14) provincial goals in the *Local Government Act*, which include:

- Protect environmentally sensitive areas
- Encourage economic development that supports the unique character of communities
- Minimize the risks to settlement associated with natural hazards.

To this end the RGS specifically undertakes to:

"...promote human settlement that is socially, economically, and environmentally healthy and that makes efficient use of public facilities and services, land and other resources".

The RGS outlines a vision that includes concentration of the future population in existing urban areas, a belt of protected green space from Saanich Inlet to Juan de Fuca around the perimeter of the metropolitan area and an increase in the use of public transit over single occupancy automobile use. The accomplishment of this vision at the local municipal level is achieved, by agreement, through the incorporation of the RGS objectives and policies into local municipality Official Community Plans (OCP).

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Within the DNS, the RGS identifies, among other aspects:

- New growth opportunities in the vicinity of Tsehum Harbour and the Lochside Drive/McTavish interchange
- Preservation of Green and Blue Space in the Tsehum Harbour water area
- Preservation of Green and Blue Space around the northwest and west shorelines of the Saanich peninsula
- Reduction of development pressures on rural communities in the Saanich peninsula, while still allowing subdivision and some densification.

These areas are all affected to varying degrees by the findings of the FCL Study. Some of the relevant RGS policies that are affected by the findings and results of the FCL Study include:

- Protection of the Green/Blue belt running from Saanich Inlet and around the District shorelines
- Protection of the ecological integrity of the marine areas in the Green/Blue belt, through collaboration and public and private land stewardship programs
- Concentration of most new growth in areas that can be effectively concentrated by express bus transit (ie: the McTavish Interchange area)
- Protection of areas prone to flooding, or the incorporation of appropriate engineering and planning measures to mitigate risk.

The measures outlined in the remainder of this report are intended to assist in conforming to the RGS policies outlined above.

3 RECOMMENDATIONS FOR MARINE POLICIES TO ACCOMMODATE EXPECTED SEA LEVEL RISE

The implementation of marine policies that reflect or anticipate expected sea level rise depends on a number of factors that are inter-related as described below. One of the most important factors is determining what SLR scenario to plan for and specifically, what scenario is relevant to the issues addressed by the proposed marine policies.

A number of ongoing studies relevant to the future expected pace of SLR are being actively conducted by the global science community. Ongoing updates of the findings of these studies are showing that the rate of SLR is increasing faster than initially estimated. It is very possible that 0.5m and 1.0m of SLR may be seen as early as 2030 and 2070, respectively. Further measurement of air, surface and ocean temperatures, melting rates of global ice sheets and the rise of sea level over the coming years will lead to a more clear understanding of the likely pace of sea level rise. In the meantime, it is necessary to begin implementing new marine policies in order to minimize risks and damage associated with SLR and coastal flooding events.

The recommended amendments for the upcoming amendments to the current OCP relate to a planning horizon that accommodates a 0.5m and 1.0m rise in sea levels. Implementation of these policies should reflect these scenarios by applying, as a starting point, the FCLs from the recent FCL Study [14].

3.1 Available Tools

Literature on climate change frequently refers to a quartet of adaptation strategies which can be summarized as follows:

- **Protect** – *building protective structures specifically for protecting private and public assets. Protection approaches and designs may be “hard” (e.g. by armouring the coastline with sea dikes, seawalls or riprap revetments) or “soft” (e.g. by constructing or augmenting storm berms, dunes, beaches and marshes).*
- **Accommodate** – *adapting land-based structures and activities to tolerate flooding and inundation.*
- **Retreat** – *a strategic decision to withdraw, relocate or abandon public or private assets that are at risk of being impacted by coastal hazards.*
- **Avoid** – *not developing in areas considered at moderate to high risk to a hazard.*

A more in-depth definition of each strategy is available in [2].

In reality, the appropriate strategies can only be chosen after the exposure to sea level rise related flooding hazards is understood, the specific vulnerabilities of exposed areas are defined, and the consequences are understood. The appropriate strategy will depend on individual situations, exposure, resources, relevant time frames and immediate needs and concerns, and are best evaluated and chosen on a site by site and individual by individual basis. The results and findings of the FCL Study are a starting point for this evaluation process. The following parts of Section 3 provide a summary of changes to the existing OCP that are recommended to respond to and anticipate the implications of the FCL Study.

3.2 Recommended Changes to the OCP

This section reviews specific parts of the current OCP Bylaw No. 1130 (OCP), which are affected by SLR and the findings and results of the FCL Study. For each of these parts, the following are identified:

- Current OCP Policy Number that is affected by the FCL Study.
- Existing text of the affected current OCP Policy.
- Evaluation of the current policy, and explanation why there is a need to amend the policy.
- Recommended text to allow for SLR planning. Changes to the current text are highlighted in yellow.

3.2.1 OCP Sections 3 through 12

3.2.1.1 OCP Section 3 – Environmentally Sensitive Areas

The intent of the policies listed in this section is to provide guidance:

“...to ensure that future land and waterfront development is compatible with the physical nature, resources and limitations of the land base, and growth is planned to ensure a high level of protection for the environment” [9].

The FCL Study findings and results have no direct effect on the intent of the current policies presented in Section 3 of the current OCP. However, it is increasingly being recognized worldwide that environmentally sensitive areas, such as tidal marshes or beach areas can provide valuable service in reducing wave related effects to the adjacent shorelines. Enhancement of environmentally sensitive areas, in appropriate manner, can be of value when Protect or Accommodate options are selected by a community. In particular enhancement of the wave energy absorbing features of a shoreline can assist in building resilience for existing shoreline treatments. The recommended changes to this section of the OCP are summarized below in Table 3-1.

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Table 3-1: "Recommendations to Policies - 3.1"

3.0 Environmentally Sensitive Areas	
Policy 3.1	
Current Policy	Evaluation and Explanation of Need for Change
Recognize ecologically sensitive areas by identifying and conserving special wildlife, plant and marine shore environments (such as pocket beaches) in their natural state. These are outlined on Schedule G and identified through the various development permit requirements.	<p>It is generally recognized that ecologically sensitive areas, such as pocket beaches and inter-tidal marshes and related marine vegetation can be beneficially used to build resilience capabilities along the shoreline to absorb and modify storm related wave energy.</p> <p>This suggested change to this section of Bylaw 1130 is intended to allow this the use of these areas in such a fashion where it can be justified.</p>
Recommended Policy	
Recognize ecologically sensitive areas by identifying and conserving special wildlife, plant and marine shore environments (such as pocket beaches or the Shoal Harbour Migratory Bird Sanctuary) in their natural state. Environmentally Sensitive Areas are outlined on Schedule G and identified through the various development permit requirements. Modifications to Environmentally Sensitive Areas that assist in building resilience to the effects of sea level rise will be permitted.	

3.2.1.2 OCP Section 4 – Marine Areas

Section 4 of the OCP provides guidance for the allocation of uses in the foreshore. The purpose of the policies in this section of the OCP is intended to allow for the protection of marine resources and reconcile the demands for the use and conservation of marine areas. Marine Areas are defined as all "areas of the District foreshore extending 300m from the shore" [9].

The implications of the FCL Study to Section 4 are summarized below.

OCP Section 4.1 – General Marine Policies

This section of the OCP provides general policies applicable to the marine areas as a whole.

The FCL Study has no implications to the current policies presented in Section 4.1. As a result, there are no recommended amendments to these general policies.

OCP Section 4.2 – Shoreline Components

This section of the OCP groups the DNS shoreline into four main types of shores and various objectives and policies are prescribed for each of the four shoreline type. The implications of the FCL Study and recommended amendments or changes are summarized below in Table 3-2.

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Table 3-2: Recommendations to “Shoreline Components – Rocky Shores” in OCP Bylaw No. 1130

Rocky Shores	
Policy 4.2.1	
Current Policy	Evaluation and Explanation of Need for Change
<p>To preserve the natural appearance of the rocky shoreline, no buildings or structures, or soil removal or deposit should be permitted within a minimum of 15 metres of the high water mark, except where it can be demonstrated to the District's satisfaction that a lesser distance is acceptable.</p>	<p>Rocky shores exist around the shoreline of the DNS in areas where coastal flooding is expected due to SLR. In some cases low lying bedrock outcrops at the toe of steep coastal bluffs, which will eventually become exposed to sea level rise or wave effects. The risk or magnitude of flooding, erosion and consequential land sliding can be effectively reduced by proper design and construction of coastal structures at the shoreline, including seaward of the existing or legal shoreline boundary. The existing policy does not allow this adaptation approach.</p> <p>The recommended policy change shown below is intended to allow for appropriate works within the 15 m setback along rocky shorelines, if they have the specific purpose of limiting or reducing the risk associated with coastal flooding.</p>
Recommended Policy	
<p>To preserve the natural appearance of the rocky shoreline, no buildings or structures, or soil removal or deposit should be permitted within a minimum of 15 metres of the future estimated high water mark, except where it can be demonstrated to the District's satisfaction that a lesser distance is acceptable, or where works are intended and designed to both preserve the shoreline character and limit coastal flood-related effects.</p>	

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Table 3-3: Recommendations to “Shoreline Components – Beach Shores – Drift Sector Beaches” in OCP Bylaw No. 1130

Beach Shores – Drift Sector Beaches	
Policy 4.2.2	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 4.2.3	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 4.2.4	
Current Policy	Evaluation and Explanation of Need for Change
Due to active erosion of Class 2 and 3 beaches, building prohibitions and soil deposit and removal restrictions shall be placed over lands within a 15 metre horizontal distance of the natural boundary adjoining beach shores, except where it can be demonstrated to the District’s satisfaction that a lesser distance is acceptable.	<p>Drift sector beaches exist around the shoreline of the DNS in areas where coastal flooding is expected due to SLR. The risk or magnitude of flooding can be effectively reduced by proper design and construction or maintenance of beaches at the shoreline, including seaward of the existing or legal shoreline boundary. The existing policy does not allow this adaptation approach.</p> <p>The recommended policy change shown below is intended to allow for appropriate works within the 15 m setback along shorelines of drift sector beaches if they have the specific purpose of limiting or reducing the risk associated with coastal flooding.</p>
Recommended Policy	
Due to active erosion of Class 2 and 3 beaches, building prohibitions and soil deposit and removal restrictions shall be placed over lands within a 15 metre horizontal distance of the future estimated natural boundary adjoining beach shores, except where it can be demonstrated to the District’s satisfaction that a lesser distance is acceptable, or where works are intended and designed to preserve the shoreline character and limit coastal flood-related effects.	
Policy 4.2.5	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	

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Table 3-4: Recommendations to “Shoreline Components – Beach Shores – Pocket Beaches” in OCP Bylaw No. 1130

Beach Shores – Pocket Beaches	
Policy 4.2.6	
Current Policy	Evaluation and Explanation of Need for Change
Building prohibitions and soil removal and fill restrictions shall be placed on lands within 15 metres horizontal distance landward of the high water mark adjacent to Class 2 or Pocket Beaches except where it can be demonstrated to the District's satisfaction that a lesser distance is satisfactory.	<p>Pocket beaches exist around the shoreline of the DNS in areas where coastal flooding is expected due to SLR. The risk or magnitude of flooding can be effectively reduced by proper design and construction or maintenance of beaches at the shoreline, including seaward of the existing or legal shoreline boundary. The existing policy does not allow this adaptation approach.</p> <p>The recommended policy change shown below is intended to allow for appropriate works within the 15 m setback along shorelines of pocket beaches if they have the specific purpose of limiting or reducing the risk associated with coastal flooding.</p>
Recommended Policy	
Building prohibitions and soil removal and fill restrictions shall be placed on lands within 15 metres horizontal distance landward of the high future estimated water mark adjacent to Class 2 or Pocket Beaches except where it can be demonstrated to the District's satisfaction that a lesser distance is satisfactory, or where works are intended and designed to preserve the shoreline character and limit coastal flood-related effects.	
Policy 4.2.7	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	

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Table 3-5: Recommendations to “Shoreline Components – Mudflats, Marsh and Delta Shores” in OCP Bylaw No. 1130

Mudflats, Marsh and Delta Shores	
Policy 4.2.8	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 4.2.9	
Current Policy	Evaluation and Explanation of Need for Change
Development immediately adjacent to a mudflat, marsh or delta area is discouraged.	<p>Shorelines composed of mudflats, marshes, or deltas have high ecological value and provide valuable wave energy absorption services. Some properties adjacent to these shorelines are expected to experience coastal flooding due to SLR. Specific measures within these properties can be taken to reduce the potential negative effects of flooding. The existing policy discourages development of these properties, which may hinder the properties' opportunity to apply adaptation measures.</p> <p>As of 2016, DNS has no plans to rezone areas adjacent to a mudflat, marsh, or delta. The recommended policy change is intended to provide opportunities related to development of these properties for the specific purpose of reducing the negative impacts of flooding.</p>
Recommended Policy	
Development immediately adjacent to a mudflat, marsh or delta area is discouraged. Consideration will be given to developments that enhance ecological values or include measures to limit or reduce coastal flood-related effects while preserving the shoreline character.	

3.2.1.3 OCP Section 6 – Residential

By law, the OCP is required to plan for and meet the anticipated housing needs for the DNS for at least five years. The aim of the policies provided in Section 6 of the OCP is to maintain and generate a range of parcel sizes to “support low and medium density residential development, in addition to supporting hobby farm and other rural activities adjacent to agricultural areas” [9].

Section 6 refers to the land use designations on Schedule B of the OCP, which forms a general guide to future land use and density. The FCL Study has identified areas along the DNS shoreline that are directly and indirectly affected by 0.5 and 1m of SLR. Of specific concern are two areas currently zoned as multi-family residential that fall within the SLR affected areas:

Area East of McDonald Campground in the Tsehum Harbour area

Area by McTavish Road & Lochside Drive

To address the potential risks associated with coastal flooding, it is recommended that DNS:

Create Special Development Areas for these two sites so that future developments better suit the neighbourhood and particular properties.

Future development within these two new Special Development Areas can be informed by the provisions of the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document).

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Other implications from the FCL Study, which relate to Special Development Area policies, are presented in Section 3.2.2. The following amendments, specifically, for OCP Section 6 are outlined in Table 3-6 below.

Table 3-6: Recommendations to “Residential” in OCP Bylaw No. 1130

Residential	
Policy 6.1	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 6.2	
Current Policy	Evaluation and Explanation of Need for Change
To ensure that residential developments are compatible with the physical site conditions of slope, soil types and drainage patterns, and that natural features such as views, tree cover and variety in terrain are retained and enhanced, the siting of buildings, roads and utilities shall be accomplished in a manner which maintains any sensitive natural areas of the site and preserves the natural landscape.	<p>There are low-lying areas within the DNS where the FCL is greater than the parcel elevation. In some properties, physical site conditions and natural drainage patterns may encourage run-off from coastal wave effects to either converge around a habitable structure, or migrate to a lower lying neighbouring property.</p> <p>The FCL Study has identified areas that are susceptible to coastal flooding. The sentence appended to the end of the current policy is intended to allow for works requiring landscape alteration for the purpose of reducing the effects of coastal flooding. Landscape alteration should be designed such that ground surfaces slope away from structures, and should also be designed to discourage the migration of water onto neighbouring properties. The purpose of this amendment is to allow for a parcel owner to alter his/her landscape as an adaptation option.</p> <p>The phrase "...does not negatively impact..." is included to make the policy more consistent with its original intent.</p>
Recommended Policy	
To ensure that residential developments are compatible with the physical site conditions of slope, soil types and drainage patterns, and that natural features such as views, tree cover and variety in terrain are retained and enhanced, the siting of buildings, roads and utilities shall be accomplished in a manner which does not negatively affect sensitive natural areas of the site and, preserves the natural landscape. An exception for slope alteration will be allowed if it is designed to help reduce effects of coastal flooding.	
Policy 6.3 through Policy 6.6	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 6.7	
Current Policy	Evaluation and Explanation of Need for Change
To encourage innovative housing and subdivision designs such as detached clustered residential developments, particularly for sloped upland areas, the District will provide flexibility in regulatory bylaws. Amenity bonusing, in compliance with Section 904 of the Local Government Act, will be supported in certain areas if site conditions warrant, in order to, amongst other things, preserve open space, natural tree cover and environmentally sensitive areas, leaving slopes unaltered.	This amendment reflects an update of reference from Local Government Act (LGA) Section 904 to LGA Section 482. This update is necessary as LGA Section 482 supersedes LGA Section 904.
Recommended Policy	
To encourage innovative housing and subdivision designs such as detached clustered residential developments, particularly for sloped upland areas, the District will provide flexibility in regulatory bylaws. Amenity bonusing, in compliance with Section 482 of the Local Government Act, will be supported in certain areas if site conditions warrant, in order to, amongst other things, preserve open space, natural tree cover and environmentally sensitive areas, leaving slopes unaltered	
Policy 6.8 through Policy 6.12	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	

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Some further recommended amendments to the OCP, independent of the implications from the FCL Study, include amending OCP Schedule B Map and/or Zoning Bylaw No. 1255 Schedule A Map to resolve inconsistencies between the two documents.

The purpose of this amendment is to provide clarification to the overlap between OCP land designation for residential areas, and Zoning Bylaws for family residential and multi-family residential zones.

3.2.1.4 OCP Section 7 – Commercial Development

Commercial Development is a relatively minor aspect of the DNS land use pattern. DNS does not intend to create heavy commercial development, as these are already available in neighbouring municipalities, and is not consistent with the RGS (Section 2.2).

Areas designated as *commercial* and *marine commercial* as identified in Schedule B Map of the OCP, are generally waterfront properties, and consists mainly of marinas, BC Ferries' Swartz Bay Terminal, and the Institute of Ocean Sciences. Results of the FCL Study have no implications to the policy statements provided for either land-based or marine-based commercial uses. However, most of these commercial areas will be affected by expected future sea levels and therefore the proposed the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will apply, or inform future development in these areas.

Existing elements of commercial and marine commercial developments will tend to rise as sea levels rise, or as land based elements are modified to accommodate sea level rise. This may create changes to existing access or views from adjacent areas. Recommended changes to this section of the OCP are summarized below in Table 3-7.

Table 3-7: Recommendations to "7.0 COMMERCIAL DEVELOPMENT"

7.0 Commercial Development	
Land Based Commercial and Marine-Based Commercial Use – Policy 7.9 and Policy 7.15	
Current Policy	Evaluation and Explanation of Need for Change
Buildings used for commercial use must be buffered from adjacent rural and residential uses.	<p>As sea levels rise and a need to protect upland development from the implications of sea level rise emerges, water based commercial uses will likely adapt development to allow activities close to the water while protecting non essential water based activities (for instance offices or parking) behind protection options – floodwalls or sea dikes. Access to or views of related water bodies may be affected.</p> <p>Design options of this type are recognized and permitted in the Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC, Appendix G24.</p>
Recommended Policy	
Buildings or structures used for commercial use must be buffered from adjacent rural and residential uses and should preserve access and views from adjacent rural and adjacent uses.	

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3.2.1.5 OCP Section 8 – Light Industry

The municipality accommodates some light industry which may be located on or adjacent to the District shorelines.

Existing elements of light industry developments will tend to rise as sea levels rise, or as land based elements are modified to accommodate sea level rise. This may create changes to existing access or views from adjacent areas. Recommended changes to this section of the OCP are summarized below in Table 3-8.

Table 3-8: Recommendations to "8.0 LIGHT INDUSTRY"

8.0 Light Industry Development	
Policy 8.5	
Current Policy	Evaluation and Explanation of Need for Change
Buildings used for industrial use must be buffered from adjacent rural and residential uses.	<p><i>As sea levels rise and a need to protect upland development from the implications of sea level rise emerges, water based industrial uses will likely adapt development to allow activities close to the water while protecting non essential water based activities (for instance offices or parking) behind protection options – floodwalls or sea dikes. Access to or views of related water bodies may be affected.</i></p> <p><i>Design options of this type are recognized and permitted in the Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC, Appendix G24.</i></p>
Recommended Policy	
Buildings or structures used for industrial use must be buffered from adjacent rural and residential uses and should preserve access and views from adjacent rural and adjacent uses.	

3.2.1.6 OCP Section 11 – Roads and Servicing

The FCL Study has shown that two portions along the existing main arterial transportation routes in the DNS; along the Patricia Bay Highway at Tsehum Harbour and the intersection with McTavish Drive and the southern portion of Lochside Drive may be affected by coastal storm wave-related effects.

Portions of West Saanich Road, where it is currently protected by a public walkway (Scoter Trail), are also indirectly threatened. This area was identified as an area of concern in the MTFR.

The implications of the FCL Study and recommended amendments specific to OCP Section 11 are summarized in Table 3-9 below.

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Table 3-9: Recommendations to "Roads and Servicing" in OCP Bylaw No. 1130

Roads and Servicing	
Policy 11.1	
Current Policy	Evaluation and Explanation of Need for Change
At the date of adoption of this plan, no new major roads are planned for the District with the exception of those shown on Schedule D. No phasing of any major roads is planned.	<p>The FCL Study has identified areas that may either be directly or indirectly affected by coastal storm wave-related effects. To reduce the potential negative impact on roads, developments should consider the implications of the measures outlined in the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document)</p> <p>The recommended change to the existing policy mandates owner/developer to consider the effects of sea level rise as informed by the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document).</p>
Recommended Policy	
At the date of adoption of this plan, no new major roads are planned for the District with the exception of those shown on Schedule D. No phasing of any major roads is planned. Developments shall take into consideration expected sea level rise for the placement and construction of roads.	
Policy 11.2	
Current Policy	Evaluation and Explanation of Need for Change
The proposed network of bicycle paths is shown on Schedule D.	The recommended change to the existing policy requires owner/developer to consider the effects of sea level rise through adherence of the draft DPA 9.
Recommended Policy	
The proposed network of bicycle paths is shown on Schedule D. Developments shall take into consideration expected sea level rise for the placement and construction of bicycle paths.	
Policy 11.3	
Current Policy	Evaluation and Explanation of Need for Change
The areas that have received servicing are identified on Schedule E. No major expansions of municipal services are planned. There will be no expansion of services outside the North Saanich Servicing Area except for health, fire safety, or agricultural support reasons.	<p>To reduce the potential negative impact on services, it may be necessary to allow for works related to sea level rise adaptation.</p> <p>The recommended amendment to the policy allows for expansion and/or works related to sea level rise adaptation.</p>
Recommended Policy	
The areas that have received servicing are identified on Schedule E. No major expansions of municipal services are planned. There will be no expansion of services outside the North Saanich Servicing Area except for health, fire safety, or agricultural support, or sea level rise adaptation reasons.	

3.2.1.7 OCP Section 12 – General Development Policies

The policies presented in Section 12 of the OCP are applicable to all land use designations. Table 3-10 summarizes the amendments that are recommended to this part of the current OCP so that it becomes consistent with the findings and results of the FCL Study.

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Table 3-10: Recommendations to "General Development Policies" in OCP Bylaw No. 1130

General Development Policies	
Policy 12.1	
Current Text	Evaluation and Explanation of Need for Change
Development must be consistent with the goals and objectives of the Plan.	The purpose of this amendment is to provide recognition of the coastal flood-affected areas, and to enable the parcel owner to act on reducing the risks associated with coastal flood-affected areas.
Recommended Text	
Development must be consistent with the goals and objectives of the Plan. Development shall consider expected coastal flooding, incorporate appropriate adaptation measures and conform with the proposed Coastal Flood Mitigation Bylaw.	
Policy 12.2	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 12.3	
Current Text	Evaluation and Explanation of Need for Change
Development should be consistent with the retention of the visual landscape of natural areas, especially on or near the waterfront, hilltops and ridges.	Some properties within the DNS are located in areas where coastal flooding is expected due to SLR. The risk or magnitude of the effects of SLR can be reduced by adopting site-specific adaptation measures. The recommended policy change is intended to allow for appropriate works with the specific purpose of limiting or reducing the risk and damage associated with coastal flooding.
Recommended Text	
Development should be consistent with the retention of the visual landscape of natural areas, especially on or near the waterfront, hilltops and ridges. Flexibility will be given to development that incorporates adaptation measures that reduce the risk or damage associated with the effects of coastal flooding	
Policy 12.4 and 12.5	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 12.6	
Current Policy	Evaluation and Explanation of Need for Change
No development or site alteration shall be permitted on a wetland, a riparian area or within the buffer zone specified in this bylaw for wetlands and riparian areas, except as permitted by law.	These areas, where exposed to the threat of future coastal flooding related to sea level rise, will likely become inundated resulting in coastal squeeze and loss of important wetland or riparian habitat. A sea level rise setback should be placed around these areas to maintain the objectives of the RGS to "...maintain and conserve Regional Green/Blue spaces on public and private lands...".
Recommended Text	
No development or site alteration shall be permitted on a wetland, a riparian area or within the buffer zone or related or a floodplain setback , specified in this bylaw for wetlands and riparian areas, except as permitted by law and if they are a necessary sea level rise adaptation measure.	
Policy 12.7 through 12.13	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	

3.2.2 OCP Section 13 - Special Development Areas

The current OCP identifies 6 areas within the DNS as Special Development Areas with the intention of recognizing these areas should be developed in an innovative manner that provides greater flexibility and enables development in a manner that best suits the area and the properties within the area. These six (6) areas are:

- Site 1 – Canoe Cove Marina
- Site 2 – East Saanich/Cresswell (Adjacent to Dean Park Estates)
- Site 3 – Baldwin Property
- Site 4 – Deep Cove Chalet
- Site 5 – Queen Mary Bay
- Site 6 – 9344 Ardmore Drive site

Four of these area; Sites 1, 4, 5, and 6, are located on the waterfront and will be affected by SLR. Sites 2 and 3 are located inland and not affected by sea level rise.

The four (4) SLR affected areas require some modifications to the current sections of the OCP as documented further below.

The results of the FCL Study have also shown that two other specific areas of the DNS will be significantly affected by sea level rise. In general terms these are:

- The Tsehum Harbour area
- The shoreline and adjacent areas Lochside Drive and the McTavish Interchange.

These areas should be added to the designation of Special Development Areas as the implications of sea level rise and the related effects will likely be the most important and consequential within the DNS boundaries. The general location of these two new areas is indicated on the attached DRAFT revised Schedule B map for the existing OCP Bylaw 1130, as shown below in Figure 3-1.

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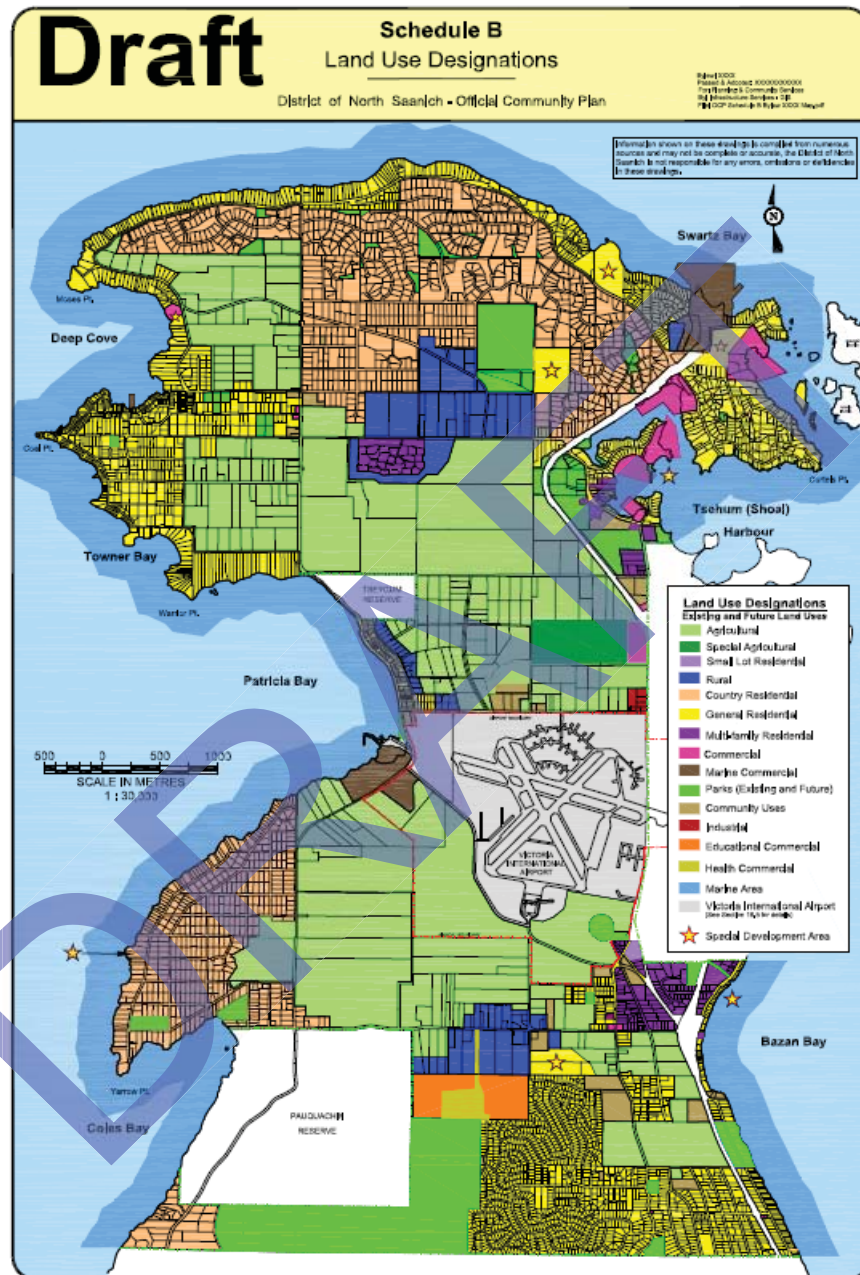


Figure 3-1: Draft (example) of revised OCP Bylaw 1130 Schedule B showing Special Development Areas at Tsehum Harbour and Lochside-Mctavish

(Note: final boundaries for these two Special Development Areas to be defined in SDA process)

The existing 2 Special Development Area sites and the results and findings of the FCL Study are discussed below.

3.2.2.1 OCP Section 13.1 – Special Development Area Site 1 – Canoe Cove Marina

The results of the FCL Study have no implications to the Justification or Policy Statement for this special development area (SDA). However, the FCL Study shows that this SDA is significantly affected by expected future sea levels. The proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will apply in this SDA.

3.2.2.2 OCP Section 13.4 – Special Development Area Site 4 – Deep Cove Chalet

The results of the FCL Study have no implications to the Justification or Policy Statement for this SDA. However, the FCL Study shows that this SDA is partially affected by expected future sea levels and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will apply here.

3.2.2.3 OCP Section 13.5 – Special Development Area Site 5 – Queen Mary Bay

Designating the two parcels of land at Queen Mary Bay as an SDA was justified for two reasons:

- Site's sensitive and important environmental assets,
- An intent to increase density in the area by creating detached housing clusters.

The FCL Study shows that this SDA is affected by expected future sea levels, and implies that if the densification is undertaken, development should be sited inland, away from the coastal wave-affected area. Schedule B of the OCP should also be revised.

Because a portion of the site is affected by expected SLR, the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will apply here.

If the District allows for a mix of attached and detached housing, Schedule B of the OCP must be revised to reflect multi-family residential land use.

3.2.2.4 OCP Section 13.6 – Special Development Area Site 6 – 9344 Ardmere Drive

The results of the FCL Study have no implications to the Justification or Policy Statement for this SDA. However, the FCL Study shows that this SDA is partially affected by expected future sea levels and the proposed Coastal Flooding Mitigation Bylaw (Section 4 of this Document) will apply here.

3.2.2.5 OCP Section 13.7 – NEW - Special Development Area Site 7 – Tsehum Harbour

This area is significantly affected by the findings and results of the FCL Study. It is clear this area should be added to the list of Special Development Areas to conform to the Provincial Government updated guideline documents to identify Sea Level Rise Planning Areas where there is a threat of flooding due to expected SLR as a result of ongoing climate change.

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Recommended changes to this section of the OCP are summarized below in Table 3-11.

Table 3-11: Recommendations "13 SPECIAL DEVELOPMENT AREAS"

NEW – 13.7 Tsehum Harbour	
Current Text	Evaluation and Explanation of Need for Change
This SDA currently does not exist in OCP Bylaw 1130.	<i>This area is significantly affected by the findings and results of the FCL Study. It is clear this area should be added to the list of Special Development Areas to conform to the Provincial Government updated guideline documents to identify Sea Level Rise Planning Areas where there is a threat of flooding due to expected SLR as a result of ongoing climate change</i>
Recommended Text	
<p>Justification: The Tsehum Harbour area affected by future sea level rise, as delineated in the proposed Bylaw 1439 – Coastal Flooding Mitigation Bylaw maps is designated as a special development area, as mandated by the Provincial Guideline Memorandum Amendment – Section 3.5 and 3.6 – Flood Hazard Area Land Use Management Guidelines (FHALUMG) effective: 1 January 2018, for the following reasons:</p> <ul style="list-style-type: none"> a) The subject area contains significant residential, commercial, light industrial and parklands. b) The subject area contains significant environmental values to be accommodated in a sensitive manner and which could be protected through innovative design. c) The affected lands fall within the recommended provisions related to Sea Level Rise Planning Areas as defined in the FHALUMG. d) The area includes District infrastructure including utilities, sewer, roads and paths and water supply that are important to the District. e) The area forms the boundaries of the Shoal Harbour Migratory Bird Sanctuary, established in 1931. <p>Policy Statement: In designating these parcels of land as a special development area, the following planning principles shall be reflected for future development:</p> <ul style="list-style-type: none"> a) Existing land uses shall continue to be allowed. b) Bylaw 1439 – Coastal Flood Mitigation Bylaw shall apply. c) Development on existing lots shall conform with FHALUMG. d) The District shall engage in the development of a Long Term Flood Protection Strategy as outlined in Appendix 1 of FHALUMG. e) The Long Term Flood Protection Strategy shall consider the implications of policies applicable to the adjacent parcels in Sidney, BC. <p>The Province of BC's Long Term Flood Projection Strategy shall consider the benefits that might be realized from active stewardship of the Shoal Harbour Migratory Bird Sanctuary that are consistent with the standing policies of the <i>Canada Wildlife Act and Migratory Birds Convention Act, 1994.</i></p>	

OCP Section 13.8 – NEW - Special Development Area Site 8 – Lochside – McTavish Interchange

This area is significantly affected by the findings and results of the FCL Study. It is clear this area should be added to the list of Special Development Areas to conform to the Provincial Government updated

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guideline documents to identify Sea Level Rise Planning Areas where there is a threat of flooding due to expected SLR as a result of ongoing climate change.

Recommended changes to this section of the OCP are summarized below in Table 3-12.

Table 3-12: Recommendations to "13 SPECIAL DEVELOPMENT AREAS"

NEW – 13.8 Lochside – McTavish Interchange	
Current Text	Evaluation and Explanation of Need for Change
This SDA currently does not exist in OCP Bylaw 1130.	<i>This area is significantly affected by the findings and results of the FCL Study. It is clear this area should be added to the list of Special Development Areas to conform to the Provincial Government updated guideline documents to identify Sea Level Rise Planning Areas where there is a threat of flooding due to expected SLR as a result of ongoing climate change</i>
Recommended Text	
<p>Justification: The Lochside McTavish Interchange Area affected by future sea level rise, as delineated in the Bylaw 1439 – Coastal Flooding Mitigation Bylaw maps is designated as a special development area, as mandated by the Provincial Guideline Memorandum Amendment – Section 3.5 and 3.6 – Flood Hazard Area Land Use Management Guidelines (FHALUMG) effective: 1 January 2018, for the following reasons:</p> <ul style="list-style-type: none"> a) The subject area contains significant residential, commercial, light industrial, parklands and multi-jurisdictional transportation infrastructure. b) The affected lands fall within the recommended provisions related to Sea Level Rise Planning Areas as defined in the FHALUMG. c) The area includes District infrastructure including utilities, sewer, roads and paths and water supply that are important to the District. <p>Policy Statement: In designating these parcels of land as a special development area, the following planning principles shall be reflected for future development:</p> <ul style="list-style-type: none"> a) Existing land uses shall continue to be allowed. b) Bylaw 1439 – Coastal Flooding Mitigation Bylaw shall apply. c) Development on existing lots shall conform with FHALUMG. d) The District shall engage in the development of a Long Term Flood Protection Strategy as outlined in Appendix 1 of FHALUMG. <p>The Long Term Flood Protection Strategy shall consider the implications of policies applicable to the adjacent parcels in Sidney, BC.</p>	

3.2.3 OCP Section 14 - Development Permit Areas

Development Permit Areas (DPA) are contained in the current OCP to cover 7 issues identified in the version of the *LGA* (RSBC 1996) that existed at the time of drafting of the OCP in 2007.

These DPAs are specifically:

- DPA 1: Marine Lands and Foreshore
- DPA 2: Creeks, Wetlands Riparian Areas and Significant Water Resources
- DPA 3: Sensitive Ecosystems
- DPA 4: Steep Slopes
- DPA 5: Commercial and Industrial
- DPA 6: Multi-Family Dwellings
- DPA 8¹: Intensive Residential Development

Since 2007, the *LGA* has been revised and updated. Under section 488 of the latest version of the *LGA* ², the number of purposes for which Development Permit Areas can be designated is summarized below in Table 3-13.

The release of the Provincial guidelines for climate change adaptation [2][3][4] have clearly recognized that SLR and the related coastal storm effects (and related river flow where appropriate) will increase existing and create new flooding hazards. This evolving flooding hazard is consistent with item *b: Protection of development from hazardous conditions* in Table 3-13.

¹ DPA 7 was re-numbered to DPA 6 in the current OCP.

² *Local Government Act (LGA)*, RSBC 2015, was made current on October 26, 2016 and contains additional issues for which a DPA can be created.

Table 3-13
(from Section 488 of LGA, RSBC 2015)

- “ a. *Protection of the natural environment, its ecosystems and biological diversity;*
- b. *Protection of development from hazardous conditions;*
- c. *Protection of farming;*
- d. *Revitalization of an area in which a commercial use is permitted;*
- e. *Establishment of objectives for the form and character of intensive residential development;*
- f. *Establishment of objectives for the form and character of commercial, industrial or multi-family residential development;*
- g. *In relation to an area in a resort region, establishment of objectives for the form and character of development in the resort region;*
- h. *Establishment of objectives to promote energy conservation;*
- i. *Establishment of objectives to promote water conservation;*
- j. *Establishment of objectives to promote the reduction of greenhouse gas emissions.*

While our review of the current OCP has identified some areas of the existing DPAs where amendment is warranted to be consistent with the findings and results of the FCL Study, we originally recommended that the relevant aspects of the FCL Study implications should be concentrated in a separate and new DPA, primarily to allow specific details of the new DPA to be reviewed periodically or refined independently of the existing DPAs. For instance, as the marine environment and ecology evolve as a result of climate change, these changes could be addressed within the existing DPA 1 without affecting any specific issues related to the coastal flooding hazard.

Specific changes recommended to the existing portions of Section 14 of the current OCP, to make it consistent with the findings and results of the FCL Study are summarized below, for the remainder of Section 3 of this document³.

3.2.3.1 OCP Section 14.1 – General Development Permit Guidelines

No changes to the guidelines provided in Section 14.1 of the current OCP are recommended.

³ It should be noted that in the current OCP, the designation reference for the current DPAs refer to Section 919.1(1)(a) of the LGA (RSBC 1996). These references should all be amended to reference Section 488(1)(a) of the updated LGA (RSBC 2015).

3.2.3.2 OCP Section 14.2 – General Exemptions from Requirement for a Development Permit

Section 14.2 (General Exemptions from Requirement for a Development Permit) contains 17 clauses, of which several are affected by the results and findings of the FCL Study. These are itemized in separate tables below for clarity.

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Table 3-14: Recommendations to "General Exemptions from Requirement for a Development Permit"

Sections 14.2.1 a) through 14.2.1 c)

OCP Bylaw No. 1130

General Exemptions from Requirement for a Development Permit	
Policy 14.2.1 a) and b)	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 14.2.1 c)	
Current Text	Evaluation and Explanation of Need for Change
<p>...in Development Permit Areas, No. 5 and No. 6, for the construction of fencing and structures less than or equal to 40 m² (430.6 ft²) which are accessory to an existing principal structure. Such accessory structures may include the following:</p> <ul style="list-style-type: none"> - Additions to commercial and industrial buildings - Gazebos - Garden sheds - Tool sheds - Decks 	<p>DPA 5 and 6 pertain to commercial/industrial and multi-family areas, respectively. A number of areas designated under these DPAs are in areas where coastal flooding is expected due to SLR.</p> <p>The existing policy exempts the requirement for a DP for accessory structures less than or equal to 40m² (430.6 ft²), including; additions to commercial and industrial buildings, garden sheds and tool sheds. Additions to commercial and industrial buildings tend to become permanent fixtures to an existing permanent structure. Providing exemption to these additions while knowing that the parcel will eventually experience flooding may be a potential liability issue.</p> <p>Additions to commercial and industrial buildings, garden sheds and tool sheds also tend to contain hazardous or toxic substances (ie: chemicals, fertilizer and fuel) or goods sensitive to flooding. If flooded, these types of substances and materials pose an environmental risk to the marine and shoreline environment.</p> <p>The recommended policy change removes these exemptions and eliminates a liability that may arise.</p>
Recommended Text	
<p>...in Development Permit Areas, No. 5 and No. 6, for the construction of fencing and accessory structures less than or equal to 40 m² (430.6 ft²) which are accessory to an existing principal structure. Such accessory structures may include the following:</p> <ul style="list-style-type: none"> - Additions to commercial and industrial buildings - Gazebos - Garden sheds - Tool sheds - Decks 	

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Table 3-15: Recommendations to “General Exemptions from Requirement for a Development Permit”

Sections 14.2.1 d) through 14.2.1 e)

OCP Bylaw No. 1130

General Exemptions from Requirements for a Development Permit	
Policy 14.2.1 d)	
Current Text	Evaluation and Explanation of Need for Change
...in Development Permit Areas No. 1, 2, 3 and 4, for changes to the height of an existing building, including the addition of another storey, providing there is no increase in the building footprint;	<p>Portions of a land parcel within DPA 1, 2, 3 and 4 may be located in areas where coastal flooding due to SLR is expected.</p> <p>Changing the height of an existing building is a development that involves substantial works. This type of development implies an increase of the structure's overall service life, which could extend to a time when 0.5m SLR or 1.0m SLR is present. It is in the interest for parcel owners to consider the minimum required FCLs to reduce the potential risk and damage associated with coastal flooding.</p> <p>The recommended policy change maintains the flexibility of a parcel owner to add an additional storey but encourages parcel owners to consider the implications of FCLs.</p>
Recommended Text	
...in Development Permit Areas No. 1, 2, 3 and 4, for changes to the height of an existing building, including the addition of another storey, except as defined in the proposed Coastal Flood Mitigation Bylaw.	
Policy 14.2.1 e)	
Current Policy	Evaluation and Explanation of Need for Change
...in Development Permit Areas No. 1, 2, 3 and 4, for structures which are 10 m ² (107 ft ²) or less in size providing they are sited more than 15 metres from a natural marine shoreline;	<p>Some areas within the designated DPA 1, 2, 3 and 4 are located in areas where coastal flooding due to SLR is expected.</p> <p>Structures such as a garden/tool sheds, gazebos, etc. are examples of typical structures with a footprint of roughly 10m² or less. These buildings may or may not be temporary, and may be affected by the 0.5m and 1.0m SLR.</p> <p>The current policy exempts a development permit only if the structure is sited inland of the setback identified in DPA 1 (i.e. 15m). With the introduction of the new Coastal Flooding Mitigation Bylaw, the recommended policy change requires the structure to be sited inland of the setbacks related to the future estimated natural boundary, in order to limit the potential risk and damages associated with coastal flooding.</p>
Recommended Policy	
...in Development Permit Areas No. 1, 2, 3 and 4, for structures which are 10 m ² (107 ft ²) or less in size providing they are sited inland of future estimated natural boundary.	

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Table 3-16: Recommendations to "General Exemptions from Requirement for a Development Permit"

Sections 14.2.1 f) through 14.2.1 q)

OCP Bylaw No. 1130

General Exemptions from Requirements for a Development Permit	
Policy 14.2.1 f)	
Current Text	Evaluation and Explanation of Need for Change
...emergency works including tree cutting necessary to remove an immediate danger or hazard;	<p>Section 14.11 defines "development" to include "flood protection works".</p> <p>The current policy considers tree cutting for the purpose of removing immediate danger or hazard as a type of "emergency works". Along the same lines, if an exemption to flood protection works for the purpose of removing immediate danger or hazard is not provided, it will not be possible to prevent or reduce damage from effects of SLR.</p> <p>The recommended policy change provides the parcel owner the flexibility to take measures (for example, sandbag his/her property before an expected high tide storm event in order) to reduce potential damage that could result from coastal floods.</p>
Recommended Text	
...emergency works including tree cutting or temporary coastal flood-related mitigation measures necessary to remove an immediate danger or hazard;	
Policy 14.2.1 g) through p)	
There are no implications from the FCL Study, therefore no changes to the OCP Policy are recommended.	
Policy 14.2.1 q)	
Current Text	Evaluation and Explanation of Need for Change
...in Development Permit Area 8, for the construction or alteration of a single family residential dwelling, except that this exemption does not apply to any parcel having an area equal to or less than five hundred square metres and created by a plan of subdivision registered in the Land Title Office after September 8, 2014.	<p>The land areas covered by DPA 8 include the proposed Special Development Area Site 7 (Tsehum Harbour) and draft Special Development Area Site 8 (Lochside-McTavish). These areas will be significantly affected by the effects of SLR.</p> <p>The recommended change in this policy is intended to ensure that any development, regardless of size is subject to the proposed Coastal Flood Mitigation Bylaw.</p>
Recommended Text	
in Development Permit Area 8, for the construction or alteration of a single family residential dwelling, this exemption does not apply to any parcel having an area equal to or less than five hundred square meters and created by a plan of subdivision registered in the Land Title office after September 8, 2014, however the proposed Coastal Flood Mitigation Bylaw does apply.	

Recommended changes to specific existing Development Permit Areas in the OCP are discussed below.

3.2.3.3 OCP Section 14.3 – DPA#1 – Development Permit Area No. 1 – Marine Uplands and Foreshore

This DPA is intended to regulate development along the shoreline, foreshore and uplands to provide long-term protection for the ecological values of those areas. The applicable area includes the area extending 15 m inland from the high water mark, around the entire shoreline of the District.

As sea levels rises, the reference datum “the high water mark”, will move inland. The actual meaning of “high water mark” is not defined in the current OCP; however, it shares a conceptual basis with the “natural boundary”⁴ as referenced in the *Land Act*. The reference datum “the high water mark” is also indirectly counter referenced in Section 14.2.1 e) of the current OCP as “a natural marine shoreline”, which is also consistent with the “natural boundary”. All three terms are difficult to interpret in the field when shoreline protection, which eliminates both a “natural boundary” and “a natural marine shoreline” has been constructed and are impossible to identify or define looking into the future when sea level occurs and the shoreline adjusts in response to the rising sea level and the corresponding action of the water.

For clarity and consistency, it is recommended that the terms “high water mark” and “natural marine shoreline” are replaced by the term “estimated future natural boundary as defined in the Provincial Guideline document [3]”. This amendment will make DPA 1 consistent with the amendments to Provincial Guideline documents [2] through [6], which are discussed in more detail below.

3.2.3.4 OCP Section 14.4 – DPA#2 – Development Permit Area No. 2 – Creeks, Wetlands, Riparian Areas and Significant Water Resources

The FCL Study findings and results have no significant direct effect on the areas or objectives considered in this DPA.

3.2.3.5 OCP Section 14.5 – DPA#3 – Development Permit Area No. 3 – Sensitive Ecosystems

The FCL Study findings and results have no significant direct effect on the areas or objectives considered in this DPA.

⁴ The “Natural Boundary” is defined in the *Land Act* as: “...the visible high watermark of any lake, river, stream or other body of water where the presence and action of the water are so common and usual and so long continued in all ordinary years as to mark upon the soil of the bed of the lake, river, stream or other body of water a character distinct from that of the banks thereof, in respect to vegetation, as well as in respect to the nature of the soil itself....for coastal areas, the natural boundary shall include the natural limit of permanent terrestrial vegetation.”.

3.2.3.6 OCP Section 14.6 – DPA#4 – Development Permit Area No. 4 – Steep Slopes

The FCL Study findings and results have no significant direct effect on the areas or objective considered in this DPA, because, specifically, the DPA already requires a Qualified Professional to provide a Slope Stability Plan showing how a proposed development is to be designed and constructed in order to prevent any destabilization or erosion of the slope. As sea levels rise, the toe of many slopes around the shoreline of the DNS will become exposed to wave effects, mainly in areas where the existing slope is perched on an exposed bedrock outcrop, which, in time, will become inundated by rising sea levels. The risk is mainly on a site by site basis and the existing DPA should be sufficient to deal with this risk.

As the pace of sea level rise becomes more certain with time, the existing provision in DPA 4 can and should be revisited.

3.2.3.7 OCP Section 14.7 – DPA#5 – Development Permit Area No. 5 – Commercial and Industrial

All references to Section 919.1(1)(f) should be amended to reference Section 488(1)(f) to maintain consistency with the updated LGA.

Note: commercial lands (land, marine, and educational) identified in Schedule B does not completely agree with commercial lands identified in Map for DPA#5. It is recommended that DNS review and revise the maps so that the content of both maps are in agreement.

3.2.3.8 OCP Section 14.8 – DPA#6 – Development Permit Area No. 6 – Multi-Family Dwellings

All references to Section 919.1(1)(f) should be amended to reference Section 488(1)(f) to maintain consistency with the updated LGA.

3.2.3.9 OCP Section 14.10 – DPA#8 – Development Permit Area No. 8 – Intensive Residential Development

All references to Section 919.1(1)(e) should be amended to reference Section 488(1)(e) to maintain consistency with the updated LGA.

3.3 Recommended Additions to OCP Bylaw No. 1130 (Section 14)

A principal outcome of the review of existing marine policies in the DNS was that specific measures should be incorporated in the existing OCP Bylaw No. 1130 to anticipate the emerging coastal flood hazard, as defined in the FCL Study Report. The first suggested measure was a new DPA which could be tailored specifically to address the hazard posed by expected sea level rise. It is clear from the public consultation process that this approach was considered to be too complex and too expensive in many circumstances.

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The recommendation to add a new DPA to address the Sea Level Rise related Coastal Flooding Hazard is withdrawn.

The risks associated with the growing coastal flooding hazard can be addressed with a proposed Coastal Flood Mitigation Bylaw. This proposed Bylaw is discussed further in Chapter 4.

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4 BASIS FOR A COASTAL FLOOD MITIGATION BYLAW

As described in Section 1.3 of this document, public consultations were held on recommended changes to the OCP bylaw described in this report on January 26, 2017 and October 19, 2017. The overall tone of the comments provided by the public was:

- The proposed new DPA (DPA 9 – Sea Level Rise Coastal Flood Hazard Areas) was:
 - Too complex.
 - Too expensive.
 - It should be consistent with measures taken by other local governments – especially Sidney.
- It should be made clear that any proposed change applied only to new developments.
- It was premature to consider a measure as complex as a Development Permit Area and the proposed DPA might have unintended consequences on existing property values due to the uncertainty introduced regarding redevelopment options.

At the same time as the comments from the public were being reviewed and considered, the Province brought into effect, on 1 January 2018, amendments to Sections 3.5 and 3.6 of the Flood Hazard Land Use Management Guidelines [7], which are the reference guidelines of Section 542 of the *Local Government Act*.

Under Section 3.5.4 of the Section 3.5 and 3.6 Amendment [6], the areas of the DNS shown to be exposed to the risk of coastal flooding in the FCL Study may be designated as floodplains and local governments may, by bylaw, specify flood levels and setbacks to address the risk of coastal flooding due to sea level rise. On review, this approach provides a much simpler approach and clearly only applies to new developments.

It is recommended that a Coastal Flood Mitigation Bylaw, based on the results of the FCL Study should be adopted.

The proposed *Bylaw 1439 - Coastal Flooding Mitigation Bylaw* is in DRAFT form, subject to approval by the Council of the District of North Saanich.

4.1 Coastal Flood Mitigation Bylaw Area of Application

The proposed *Bylaw 1439 - Coastal Flood Mitigation Bylaw* is only applicable in the areas where the FCL Study [14] has shown that the existing ground surface in the District of North Saanich is a floodplain, as defined by the methodology outlined in the Provincial Guidelines amendment [6].

The defined floodplains are shown in Figure 4-1, which is the key map for larger scale maps included in Appendix A of this document. The large scale maps in Appendix A show more specific floodplain mapping for sea level rise of 0.5 m and for 1.0 m. More detailed versions of these floodplain maps, that provide reach by reach definition of the associated Flood Construction Levels, are provided in the proposed draft *Bylaw 1439 - Coastal Flood Mitigation Bylaw*. Bylaw 1439 will be considered separately from the OCP review by District of North Saanich Council.

The Key Map (Figure 4-1) and the larger scale maps in Appendix A, will also be included in the OCP amendment Bylaw 1442.

The Key Map (Figure 4-1) and the larger scale maps in Appendix A, were prepared in accordance with the results of the FCL Study [14] and the Provincial Guidelines [6].

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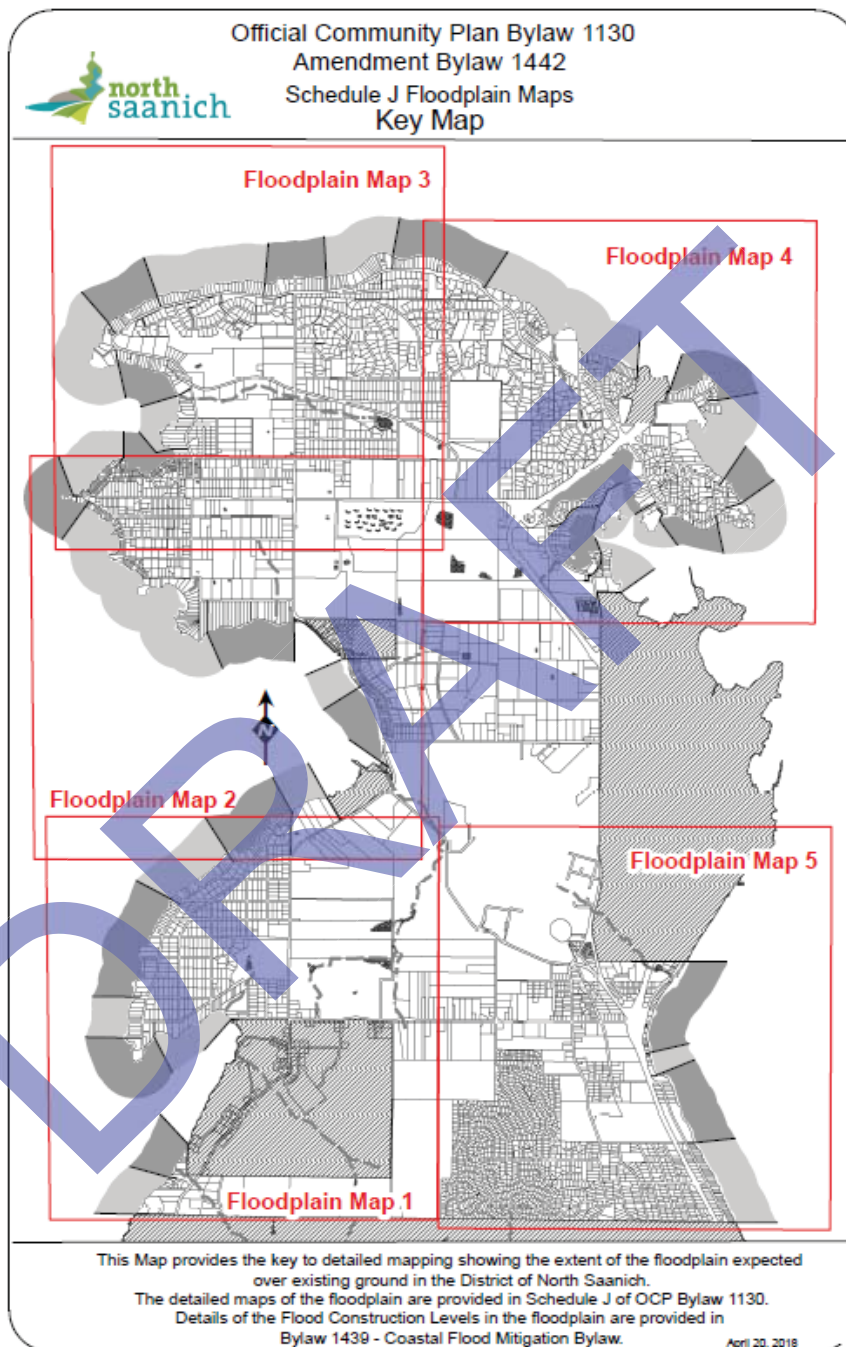


Figure 4-1: Key Map for large scale Floodplain maps in Appendix A

5 GLOSSARY

Abbreviations, acronyms and definitions of terms used in this report are listed below.

5.1 Abbreviations and Acronyms

AEP	Annual Exceedance Probability	The probability (or % chance) of a specific event occurring or being exceeded in any given year.
CD	Chart Datum	In the DNS area, CD is 2.2m (± 0.1 m) below Geodetic Datum (CGVD28).
CGVD28	Canadian Geodetic Vertical Datum (1928)	<p>In most places in Canada, this is the current reference datum for terrestrial vertical elevations and is generally the same as mean sea level, based on astronomical tides alone. A detailed description is available online at:</p> <p>http://www.nrcan.gc.ca/earth-sciences/geomatics/geodetic-reference-systems/9054# Canadian Geodetic Vertical 1.</p> <p>CGVD28 is being replaced with a newer datum plane based on a North American common geoid. The new datum is notionally equivalent to the local coastal mean sea level. Details are available online at:</p> <p>http://www.nrcan.gc.ca/earth-sciences/geomatics/geodetic-reference-systems/9054# Benchmarks Information</p>
CRD	Capital Regional District	
DFL	Designated Flood Level	A water surface elevation which includes appropriate allowances for future SLR, land crustal movement, tide, and storm surge during the Designated storm.
DPA	Development Permit Area	Refers to Development Permits as per Division 7 of the LGA or Section 14 of the OCP.
DS	Designated Storm	A storm which includes concurrent time series of winds, storm surge and waves, with a specific AEP.
FCL	Flood Construction Level	Defined as the underside elevation of a wooden floor system or the top elevation of a concrete slab, for habitable buildings [1].
FCL Study		SNC Lavalin Inc's report "Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise", SLI Document: 634533-3000-41ER-0001 [14].
	Floodplain Bylaw	Bylaw designated under Section 524 of the <i>Local Government Act</i> .

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HHWLT	Higher High Water Large Tide	The average of the annual highest tide over an 18.6 year complete tidal cycle. In the DNS area, HHWLT is 1.5 m above Geodetic Datum (CGVD28) and 3.7 m above Chart Datum (± 0.2 m).
LGA	Local Government Act	Refers to the updated <i>Local Government Act</i> (RSBC 2015), which was made current as of October 26, 2016.[11]
NSCCAP	North Saanich Climate Action Plan	Refers to Reference [15].
MTF	Marine Task Force	Refers to the individuals responsible for the MTFR.
MTFR	Marine Task Force Report	Refers to Reference [10]
OCP	Official Community Plan	Depending on context refers to Official Community Plan Bylaw No. 1130, dated 23 May 2007 or its update [9].
RGS	Regional Growth Strategy	Refers to Reference [8].
RSBC	Revised Statutes of British Columbia	
SDA	Special Development Area	Refers to Special Development Area as per Section 13 of the OCP.
SLI	SNC Lavalin Inc	
SLR	Sea Level Rise	The rise in sea level including: global sea level rise driven by global warming and local sea level rise driven by regional tectonic or isostatic (glacial) subsidence or uplift.
SWAN	Simulating WAVes Nearshore	Wave modelling software, which can simulate wave generation, propagation, dissipation and transformation to the shoreline.
°T	Degrees, True North	Direction in degrees, with respect to True North.

5.2 Definitions

2011 Provincial Guidelines	Guidelines posted by BCMOE, BCMOE (2011a,b,c), and available online at: http://www.env.gov.bc.ca/wsd/public_safety/flood/fhm-2012/draw_report.html#3
Estimated Future Natural Boundary	The estimated location of the future Natural Boundary after sea level has risen, usually by a defined amount. Defined in the 2011 Provincial Guidelines .
Fetch	The horizontal distance over open water (in the direction of the wind) over which wind generates waves.

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Foreshore	That part of the shoreline extending between the upper limit of wave interaction with the shoreline and the low tide elevation. Typically the inland limit of the foreshore would be landward of the Natural Boundary .
Freeboard	A vertical allowance added to the DFL and the Wave Effect allowance to establish the FCL. This allowance is generally included to cover any uncertainties in defining the FCL.
Geodetic Datum	The reference plane for terrestrial vertical elevations in Canada and in general approximately equal to mean sea level.
Natural Boundary	The present Natural Boundary as defined in the <i>British Columbia Land Act, Section 1</i> .
Nearshore	An indefinite zone extending seawards from the shoreline to deepwater, typically well seaward of the breaker zone and in water depths in the order of 20 m.
Overtopping	The passage of water over the crest of a shoreline or shoreline structure as a result of wave run-up.
Residual Water Level	The component of the measured water level that is not attributed to tidal effects. The residual water level is generally assumed to be approximately equal to the storm surge. Calculated as the measured total water level minus the predicted tides at a given location.
Run-Up	The vertical distance travelled by the action of individual waves that break and travel up the shoreline or slope of a shoreline structure.
Storm Surge	The non-tidal rise/fall in a body of water due to atmospheric effects.

6 REFERENCES

6.1 Reference Documents

- [1] BCMoE 2010. "Preparing for Climate Change: British Columbia's Adaptation Strategy". BC Ministry of Environment. February 2010.
- [2] BCMoE (2011a). "Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use: Draft Policy Discussion Paper". BC Ministry of Environment. 27 January 2011.
- [3] BCMoE (2011b). "Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use: Guidelines for Management of Coastal Flood Hazard Land Use". BC Ministry of Environment. 27 January 2011.
- [4] BCMoE (2011c). "Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use: Sea Dike Guidelines". BC Ministry of Environment. 27 January 2011.
- [5] BCMOE (2004). "Flood Hazard Land Use Management Guidelines". Available online at: http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/guidelines-2011.pdf.
- [6] BCMoE (2016). "Amendment Section 3.5 and 3.6 - Flood Hazard Area Land Use Management Guidelines", 2 October 2017. Available online at: http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/integrated-flood-hazard-mgmt/final_amendment_to_s_35_and_36_fhalumg_17-10-01.pdf
- [7]
- [8] CRD 2016. "Capital Regional District: Regional Growth Strategy". Draft (v.1.5). March 2016.
- [9] DNS 2007. "Official Community Plan Bylaw No. 1130. A bylaw to guide and direct decision-making on all aspects of planning and land use management within the District of North Saanich". 23 May 2007.
- [10] DNS 2008. "District of North Saanich: Marine Task Force Final Report". District of North Saanich. July 2008.
- [11] LGA 2015. "Local Government Act [RSBC 2015]". Copyright Queen's Printer, Victoria, BC, Canada. Available on line at: [http://www.bclaws.ca/civix/document/LOC/lc/statreg/--%20L%20--/Local%20Government%20Act%20\[RSBC%202015\]%20c.%201/00_Act/r15001_00.htm](http://www.bclaws.ca/civix/document/LOC/lc/statreg/--%20L%20--/Local%20Government%20Act%20[RSBC%202015]%20c.%201/00_Act/r15001_00.htm)
- [12] SeaChange 2009. "Saanich Inlet and Peninsula Atlas of Shorelines (SIPAS)". Technical Report prepared by SeaChange Marine Conservation Society, Peninsula Streams Society and Saanich Inlet Protection Society. Available online at: <http://seagrassconservation.org/wp-content/uploads/2015/01/SIPAS-Technical-Report.pdf>
- [13] SLI 2016. "Flood Construction Level Study". Document No. 634533-1000-41ER-0001. Rev. 00. 2 May 2016.
- [14] SLI 2018. "Flood Construction Levels for 0.5 m and 1.0 m Sea Level Rise". Document No. 634533-3000-41ER-0001. Rev. 00, March 27, 2018.
- [15] SSGWWC 2007. "North Saanich Climate Action Plan". Sustainability Solutions Group Workers Cooperative 2007. Available online at: <https://sites.google.com/a/sustainabilitysolutions.ca/north-saanich-project-pages/home>

NOTICE TO READERS

This document contains the expression of the professional opinion of SNC-Lavalin Inc. ("SLI") as to the matters set out herein, using its professional judgment and reasonable care. It is to be read in the context of the Agreement, and the methodology, procedures and techniques used, SLI's assumptions, and the circumstances and constraints under which its mandate was performed. This document is written solely for the purpose stated in the Agreement, and for the sole and exclusive benefit of the Client, whose remedies are limited to those set out in the Agreement. This document is meant to be read as a whole, and sections or parts thereof should thus not be read or relied upon out of context.

SLI has, in preparing any cost estimates, followed methodology and procedures, and exercised due care consistent with the intended level of accuracy, using its professional judgment and reasonable care, and is thus of the opinion that there is a high probability that actual costs will fall within the specified error margin. However, no warranty should be implied as to the accuracy of any estimates contained herein. Unless expressly stated otherwise, assumptions, data and information supplied by, or gathered from other sources (including the Client, other consultants, testing laboratories and equipment suppliers, etc.) upon which SLI's opinion as set out herein is based has not been verified by SLI; SLI makes no representation as to its accuracy and disclaims all liability with respect thereto.

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REVISION INDEX AND SIGNATURES

Issue Code	Rev. No	Date (yyyy-mm-dd)	Description of Changes	Initials
RR	PA	2016-11-03	Released for Internal Review	SL
RR	PB	2016-12-12	Released Client Information and Comment	JSR
RR	PC	2016-12-20	DPA 9 complete. Awaiting legal comments	JSR
RR	PD	2016-12-22	Legal comments incorporated	JSR
RR	PE	2017-01-04	DNS comments incorporated	JSR
RR	PF	2017-01-05	Additional DNS comments incorporated	SL
RR	PG	2017-01-24	COW comments incorporated	JSR
RR	PH	2017-10-13	Comments from Consultation incorporated	JSR
RR	PI	2018-03-07	Comments from Consultation incorporated	JSR
RI	0	2018-03-27	Released for Information and Client Use	JSR
RI	01	2018-04-23	Schedule B and Floodplain maps added	JSR

Issue Codes:


RC Released for Construction
RD Released for Design
RF Released for Fabrication
RI Released for Information
RP Released for Purchase
RQ Released for Quotation
RR Released for Review and Comments

Prepared by:


 Sherry Lim, P. Eng.
 Project Engineer



Reviewed and Approved By:


 John Readshaw, P. Eng.
 Manager, Coastal Engineering and Dredging



End of Document except for Appendices.

District of North Saanich

OCP Marine Policy and Guideline Recommendations - APPENDIX A



APPENDIX A – Floodplain Maps for 0.5 and 1.0 m sea level rise

Key Map – 1 map

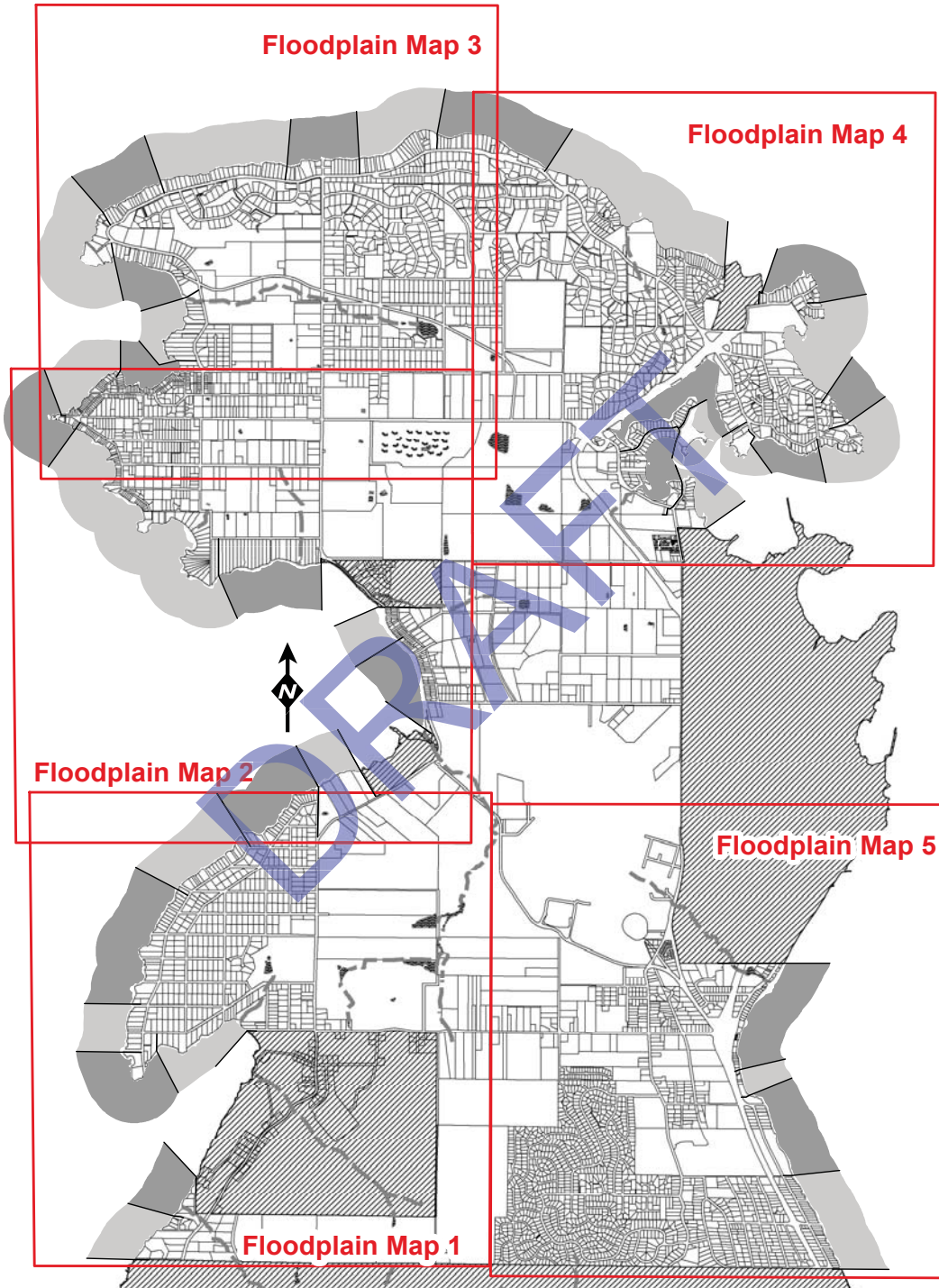
Floodplain Maps for 0.5 m SLR – 5 maps

Floodplain Maps for 1.0 m SLR – 5 maps

DRAFT



Official Community Plan Bylaw 1130
Amendment Bylaw 1442
Schedule J Floodplain Maps
Key Map



This Map provides the key to detailed mapping showing the extent of the floodplain expected over existing ground in the District of North Saanich.

The detailed maps of the floodplain are provided in Schedule J of OCP Bylaw 1130.

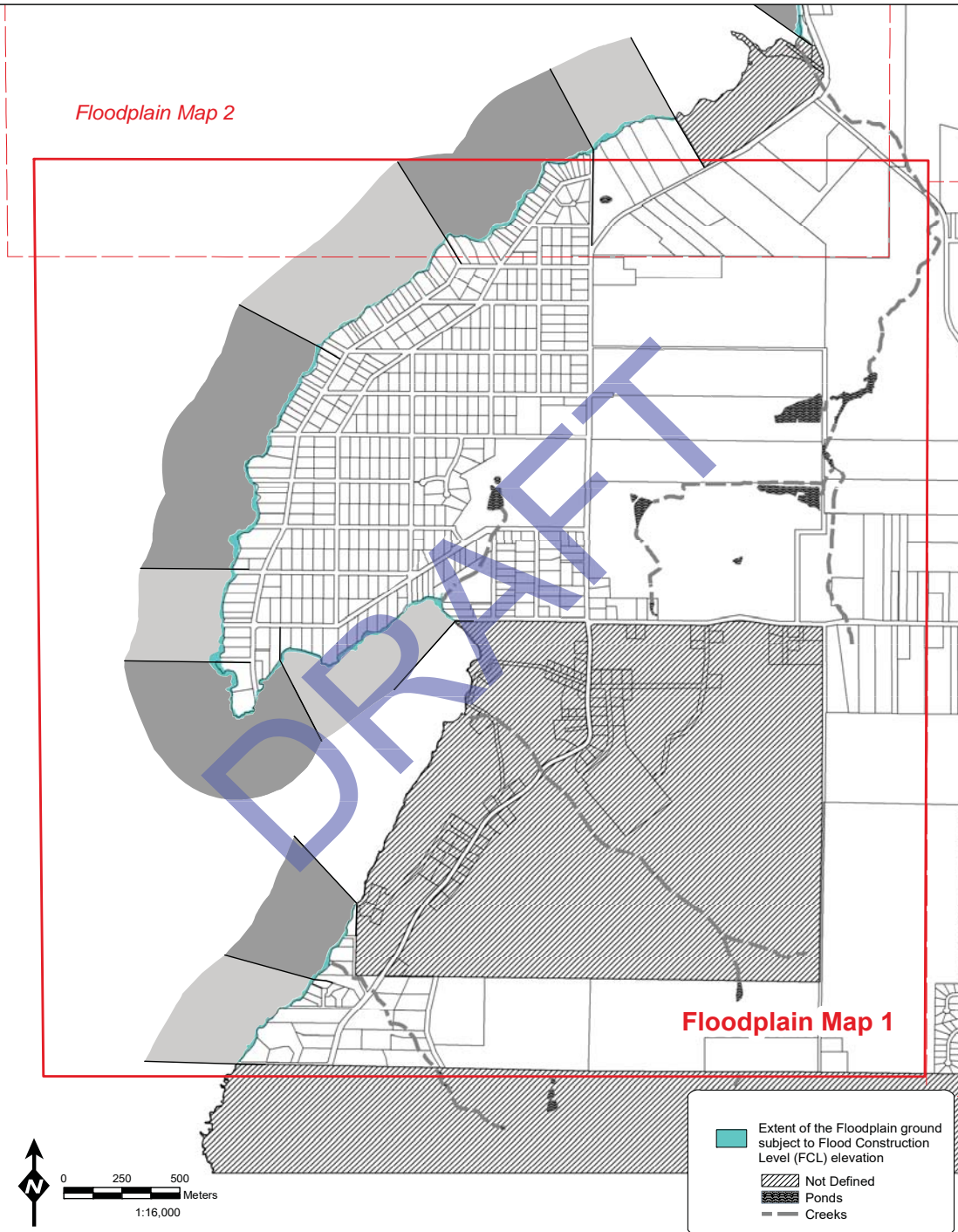
Details of the Flood Construction Levels in the floodplain are provided in Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 1
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
0.5 m Sea Level Rise

Floodplain Map 2



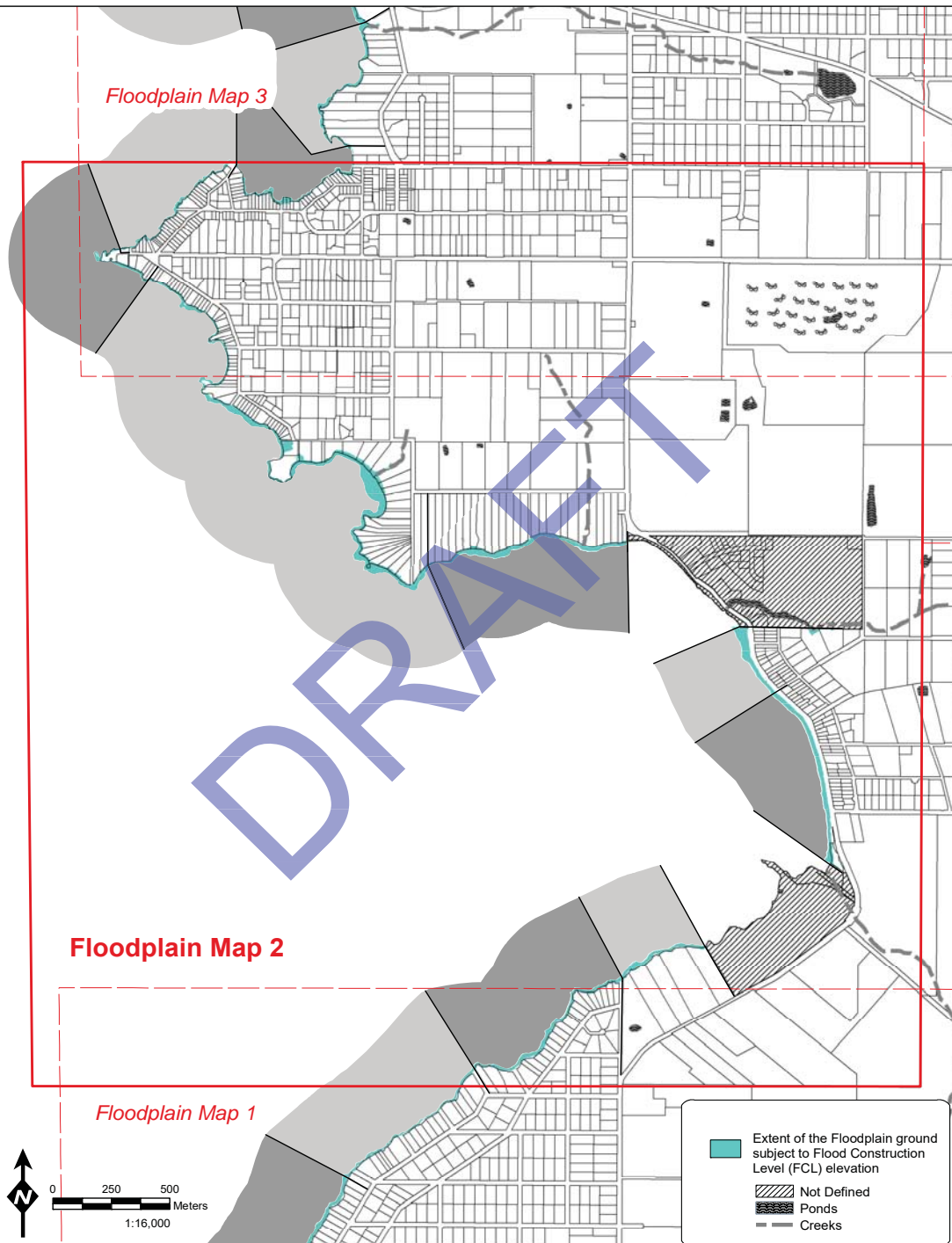
This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 2
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
0.5 m Sea Level Rise



This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

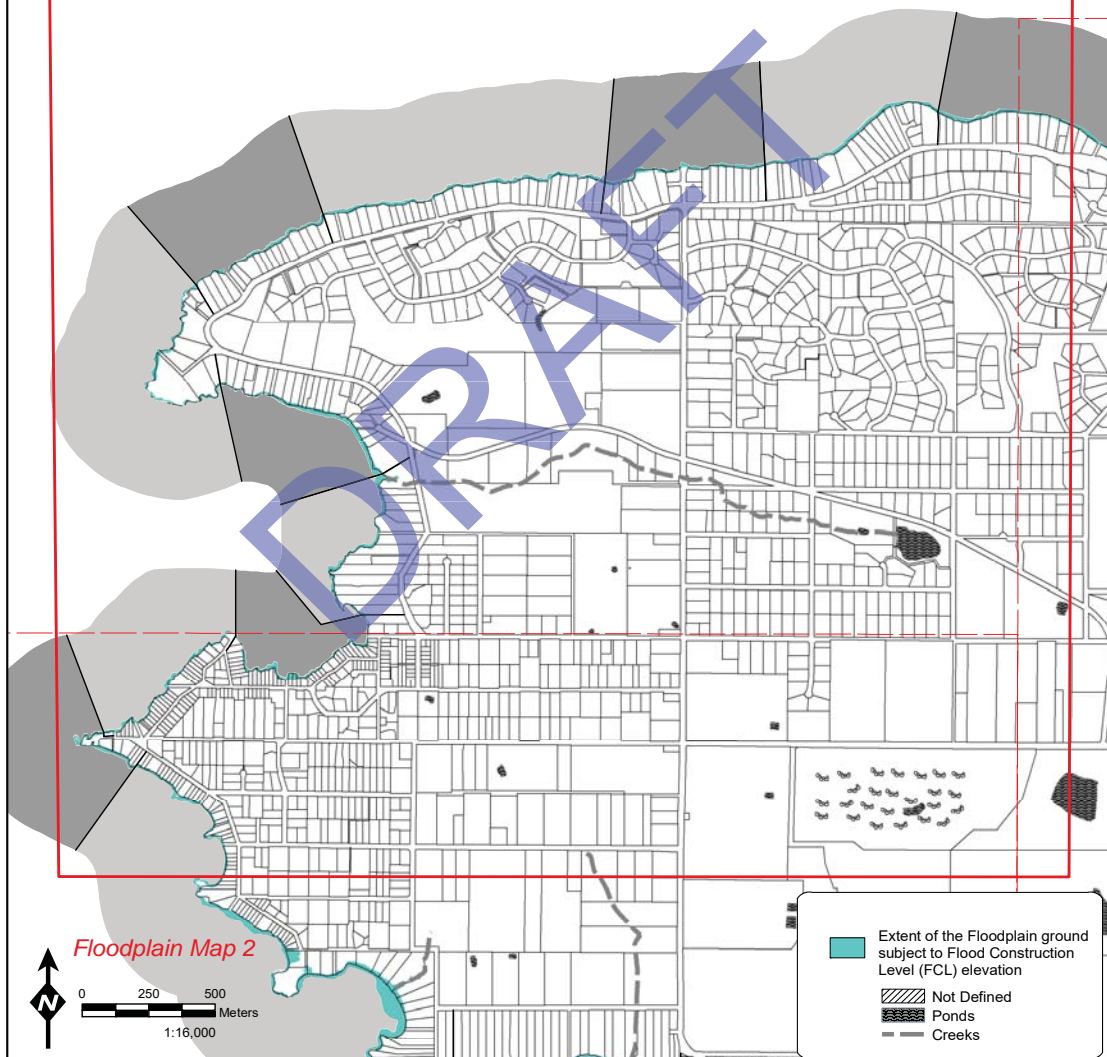
Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 3
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
0.5 m Sea Level Rise

Floodplain Map 3



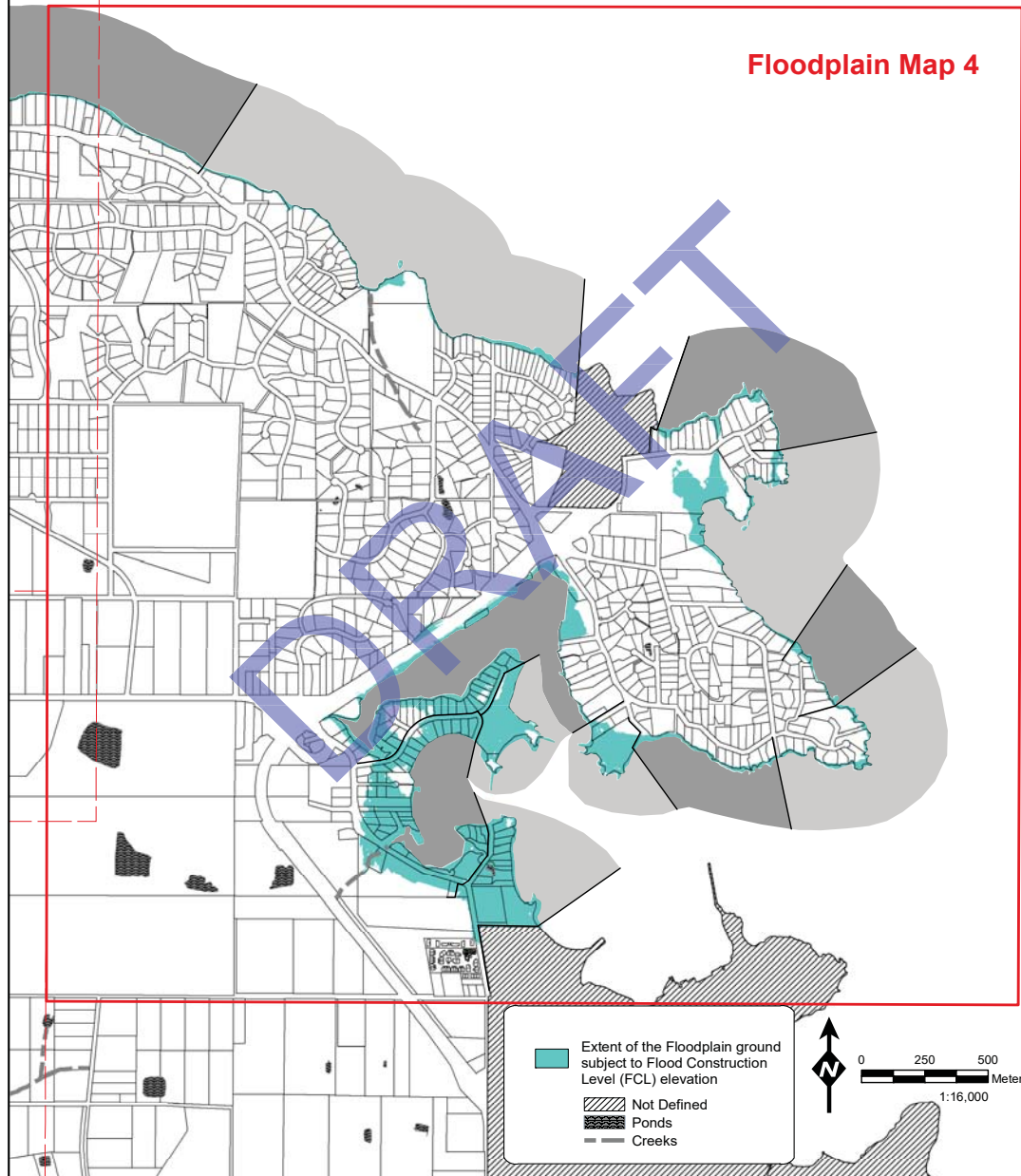
This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 4
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
0.5 m Sea Level Rise



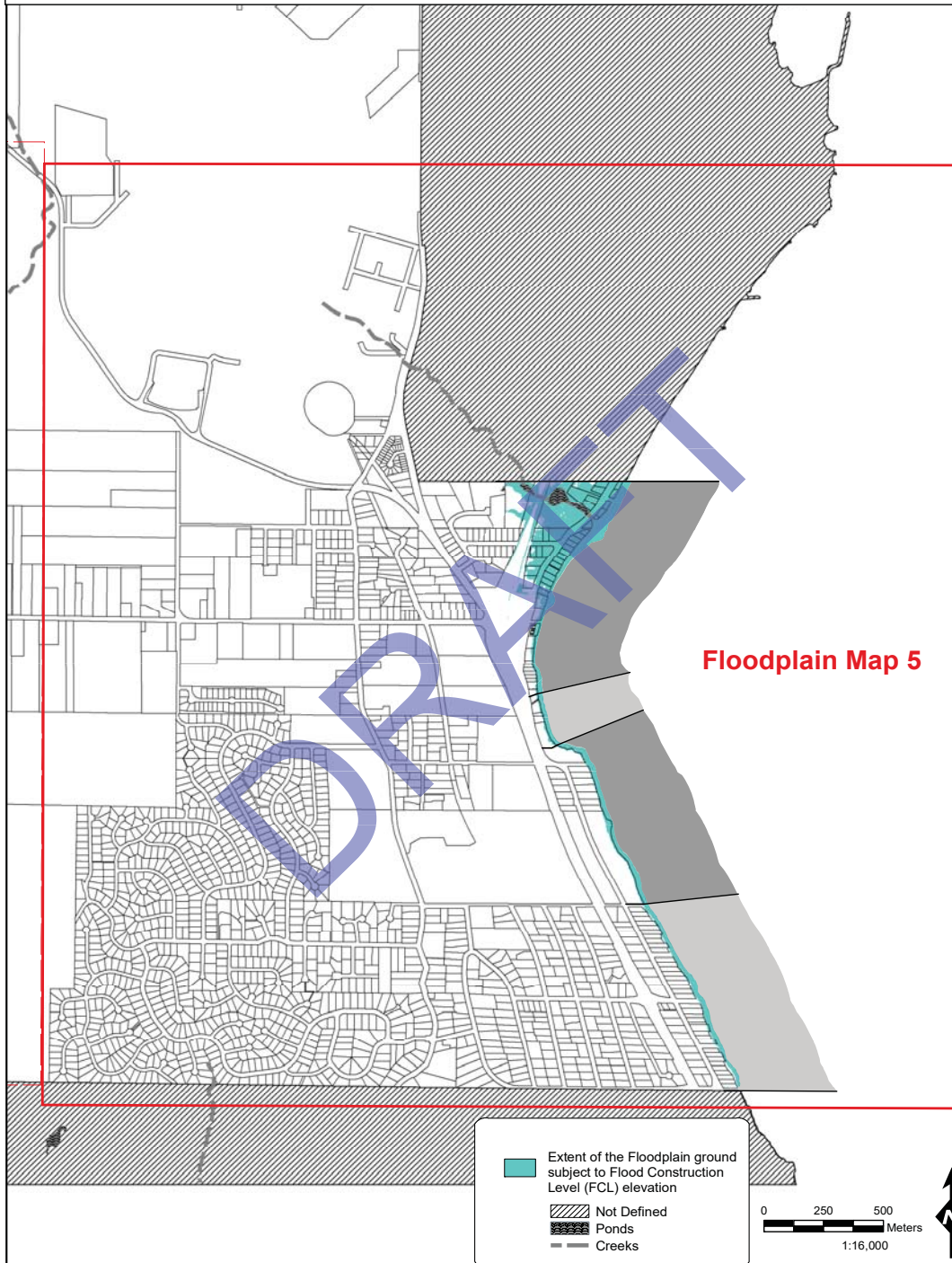
This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 5
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
0.5 m Sea Level Rise



This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

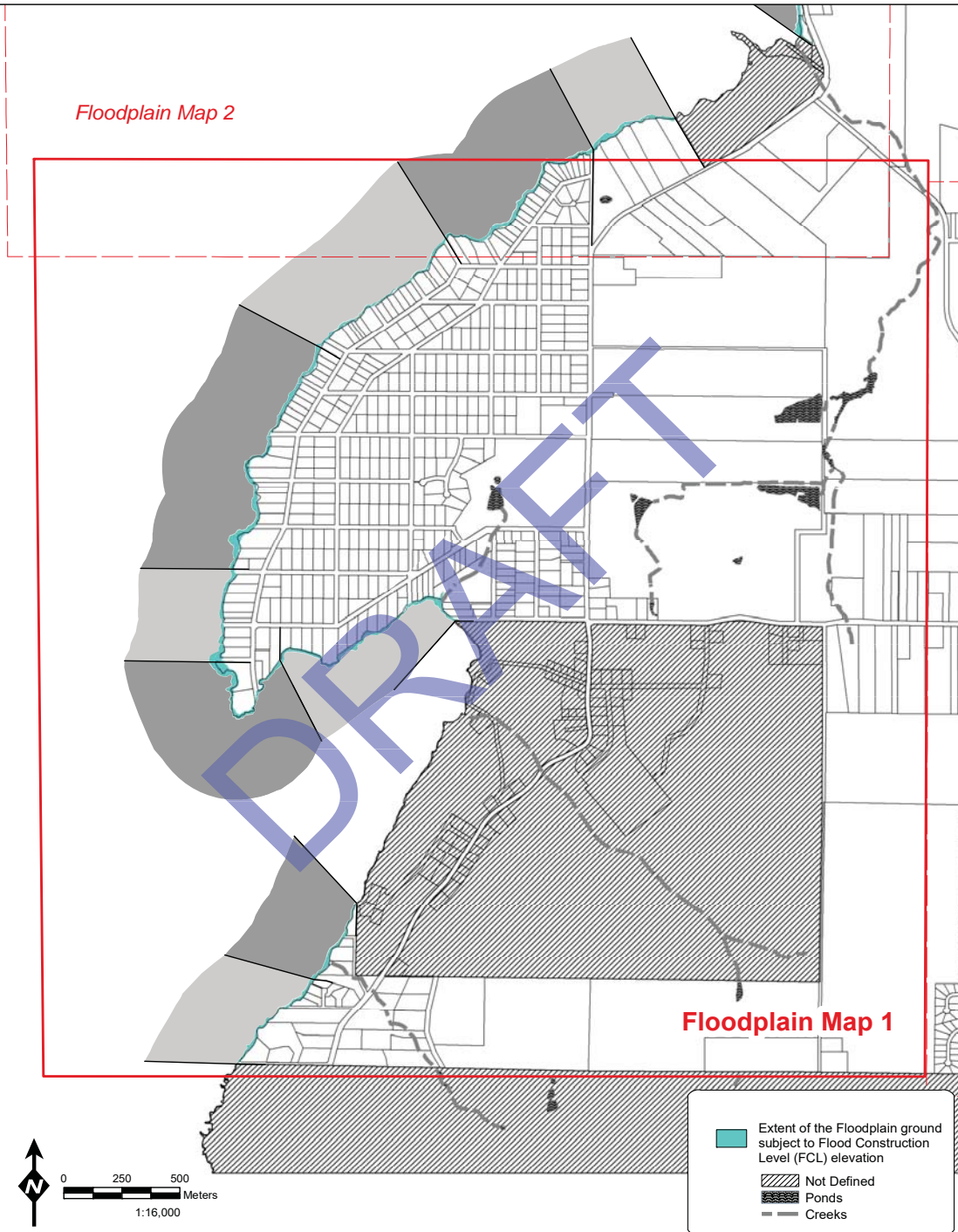
Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 1
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
1 m Sea Level Rise

Floodplain Map 2



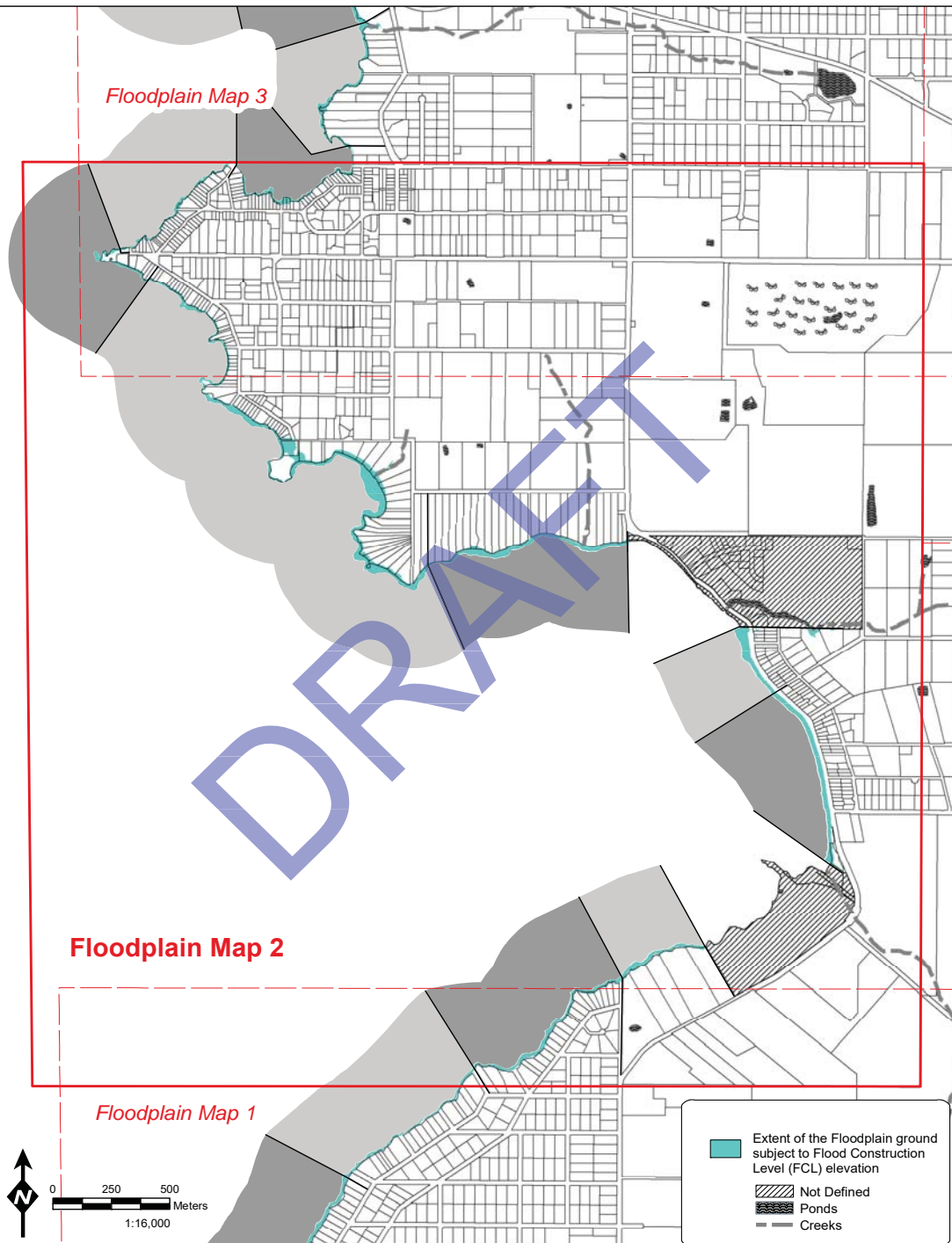
This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 2
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
1 m Sea Level Rise



This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

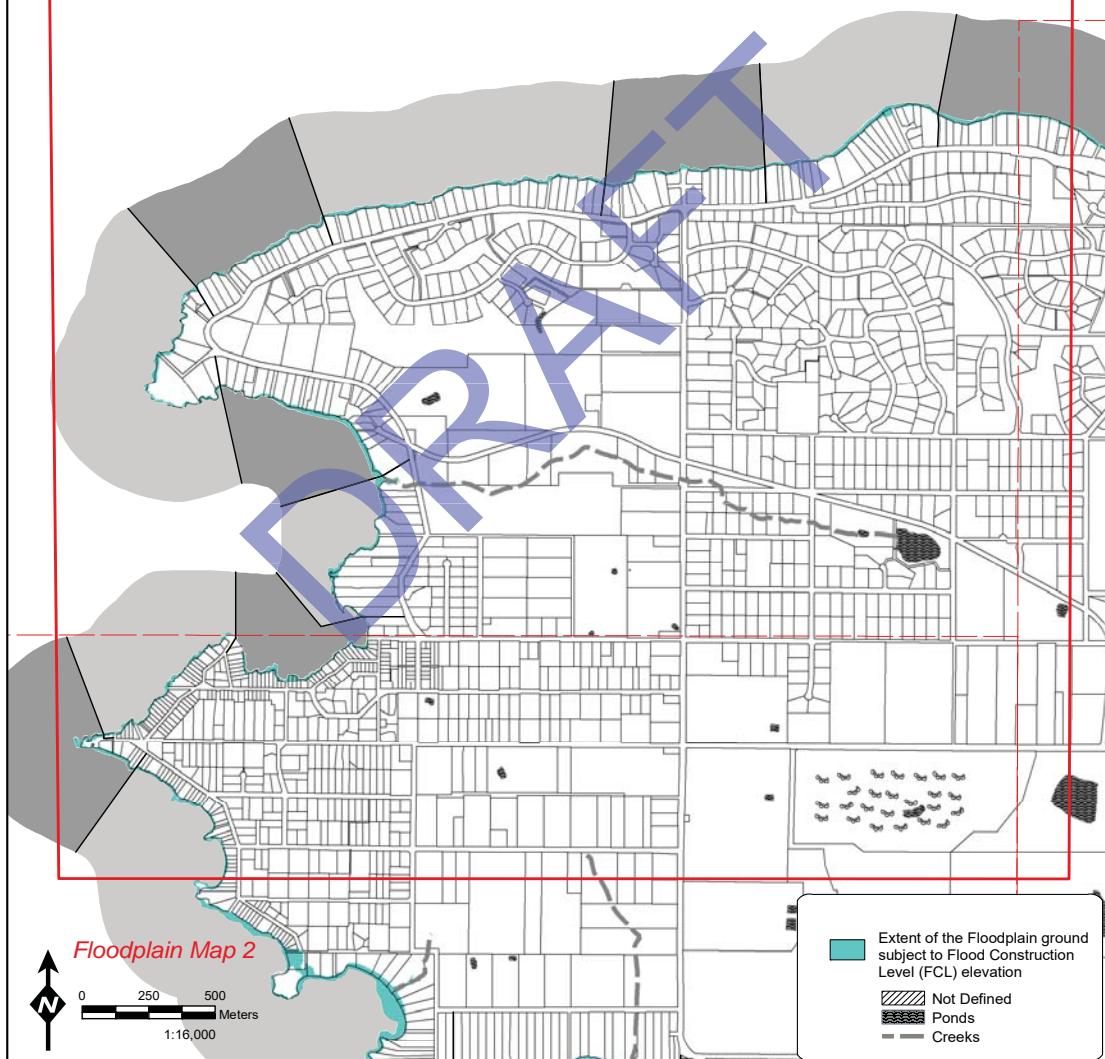
Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 3
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
1 m Sea Level Rise

Floodplain Map 3



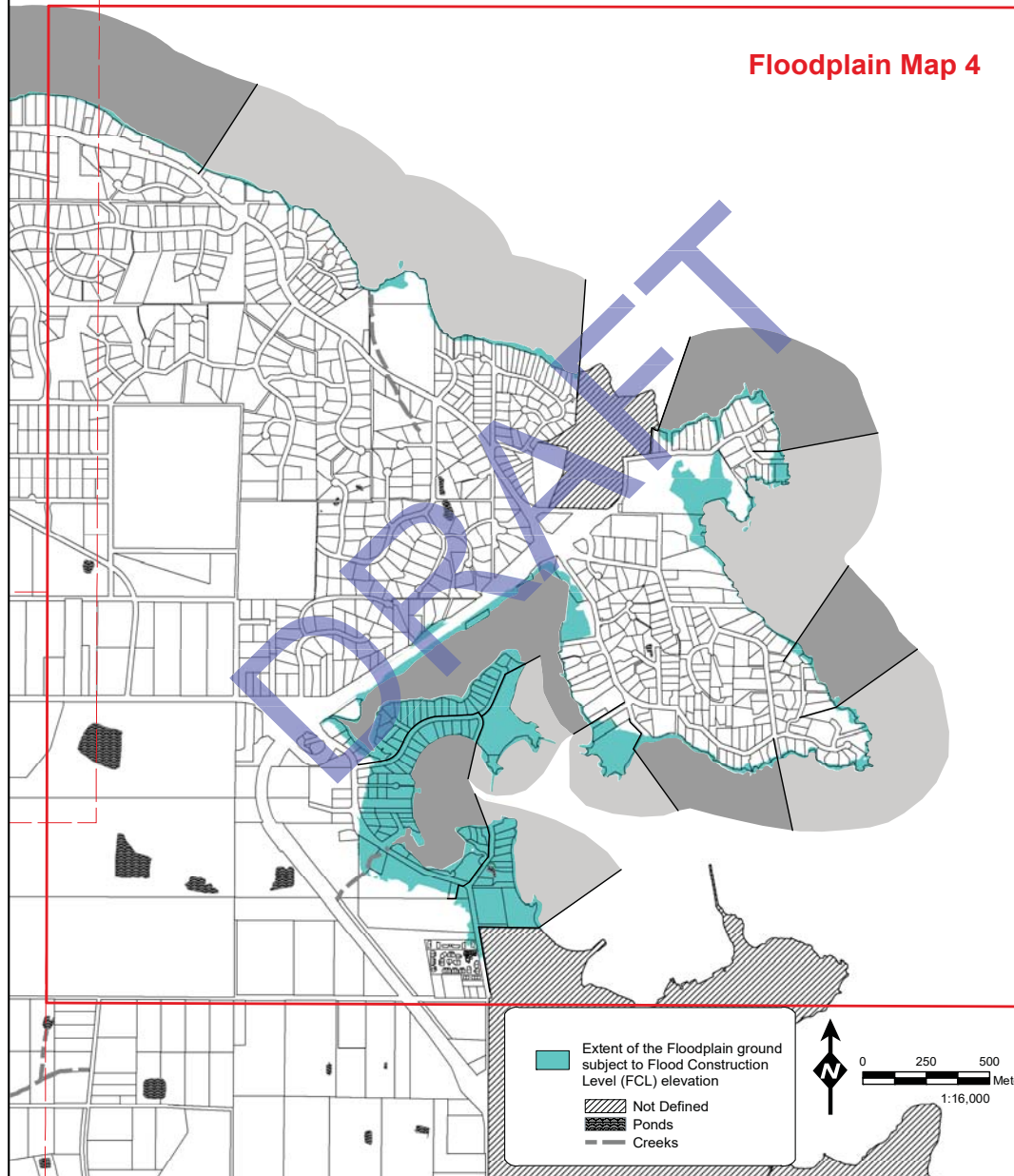
This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 4
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
1 m Sea Level Rise



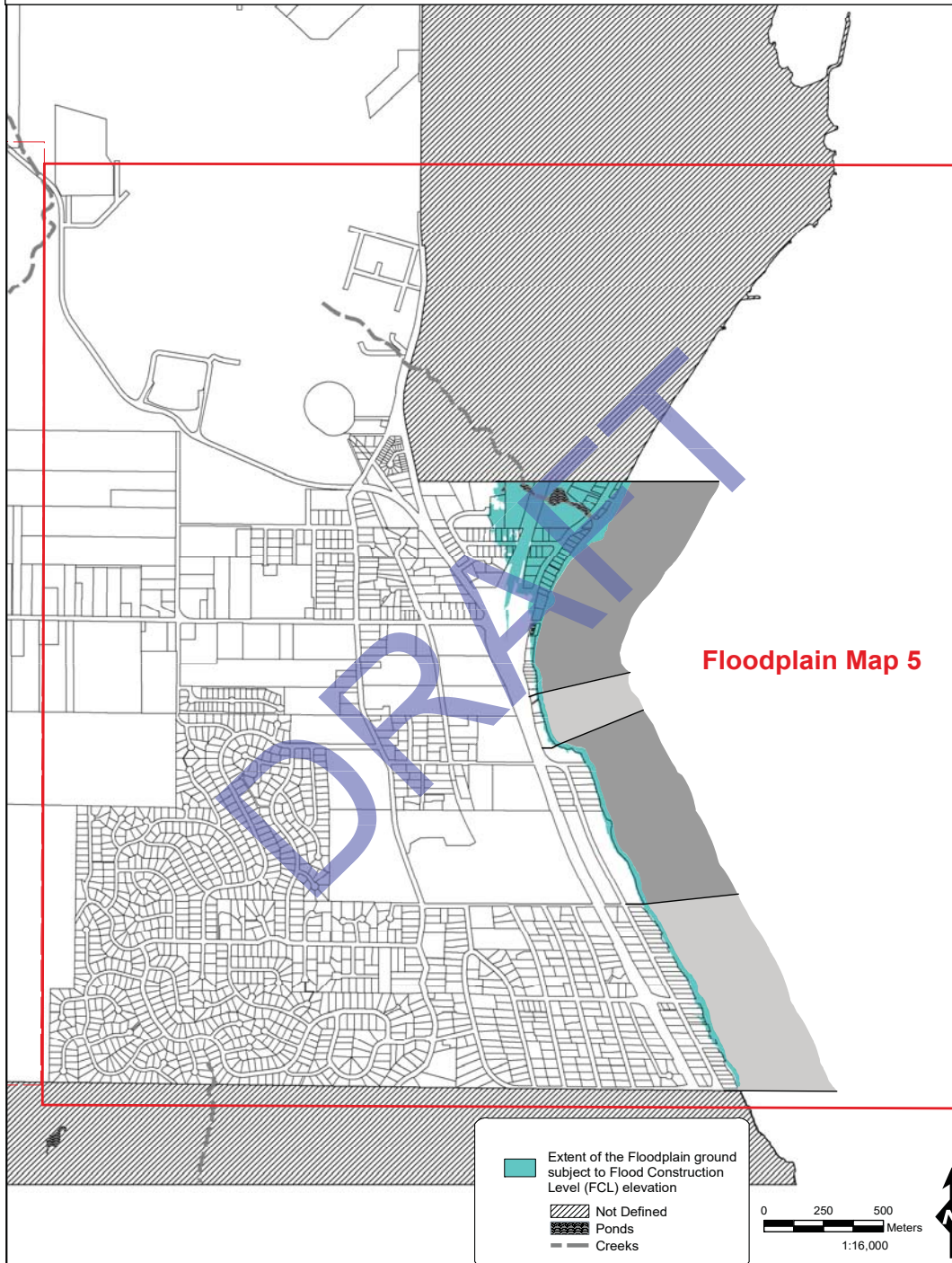
This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 5
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
1 m Sea Level Rise



This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018

District of North Saanich

OCP Marine Policy and Guideline Recommendations



End of Document

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Appendix B

Amendment Sections 3.5 and 3.6 "Flood Hazard Area Land Use Management Guidelines"

AMENDMENT

Section 3.5 and 3.6 – Flood Hazard Area Land Use Management Guidelines

3.5 The Sea

3.5.1 Background and Reference Documents

The content for this Amendment is drawn primarily from, "Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use – Guidelines for Management of Coastal Flood Hazard Land Use", Ausenco Sandwell, report to BC Ministry of Environment, January 27, 2011 (AS (2011b)) and the companion reports, "Sea Dike Guidelines" and "Draft Policy Discussion Paper", also dated January 27, 2011.

These 2011 reports, including terminology, definitions and explanatory figures, supplement this Amendment to the "Flood Hazard Area Land Use Management Guidelines". Definitions for the terms used in this Amendment are provided in Appendix A of AS (2011b). Where there is any inconsistency between the Ausenco Sandwell (2011) reports and this Amendment document, the Amendment document shall govern. These reports are referenced in this Amendment as:

"Draft Policy Discussion Paper" - AS(2011a)

"Guidelines for Management of Coastal Flood Hazard Land Use" - AS (2011b)

"Sea Dike Guidelines" - AS (2011c)

These reports are available on the ministry web page:

http://www.env.gov.bc.ca/wsd/public_safety/flood/fhm-2012/draw_report.html

The definition of and method(s) of determination of Flood Construction Level (FCL) for coastal areas has been modified for the purposes of this Amendment (also see definitions in AS 2011b). The FCL is used to establish the elevation of the underside of a wooden floor system or top of concrete slab for habitable buildings, but does not relate to the crest level of a sea dike.

The management of land use in coastal flood hazards may require flood hazard assessments to be completed by suitably qualified Professional Engineers, experienced in coastal engineering. The standards of practice that these Professionals should follow include those outlined in the most recent revision of the "Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC", first published by the Association of Professional Engineers and Geoscientists of BC (APEGBC) in 2012.

The APEGBC Professional Practice Guidelines describe and provide for use of risk assessment methodologies, however, this Amendment does not consider how risk based approaches might be incorporated into sea level rise area planning, determination of setbacks and FCLs, or long term flood protection strategies. Should local governments, land use managers and approving officers choose to base approval decisions on risk assessments prepared by Professional Engineers, the changes in risk over time due to sea level rise must be fully taken into account.

3.5.2 Design and Planning Time Frame

Requirements for buildings, subdivision, and zoning should allow for sea level rise (SLR) to the year 2100.

Land use adaptation strategies as set out in Official Community Plans (OCPs) and Regional Growth Strategies (RGSs) should allow for sea level rise to the year 2200 and beyond.

3.5.3 Recommended Sea Level Rise Scenario for BC

Allow for Global Sea Level Rise of 0.5 m by 2050, 1.0 m by 2100 and 2.0 m by 2200 relative to the year 2000 as per Figure 1.

Adjust for regional uplift and subsidence using the most recent and best information available. Where no information is available, assume neutral conditions (i.e. no uplift or subsidence).

The scenario in Figure 1 is intended to be reviewed every 10 years or sooner if there is significant new scientific information.

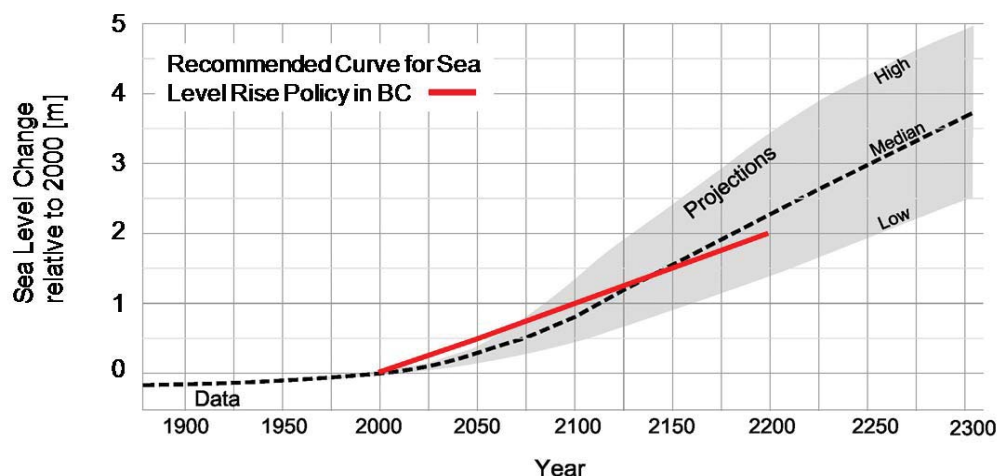


Figure 1. Recommended Global Sea Level Rise Curve for Planning and Design in BC

3.5.4 Sea Level Rise Planning Areas

Local Governments should consider defining SLR Planning Areas and developing land use planning strategies integrating both flood protection (sea dikes) and flood hazard management tools. These areas should include areas exposed to coastal flood hazards, diked areas and inland floodplains adjacent to tidally influenced rivers where potential flood levels will be increased by sea level rise.

As one possible management tool, lands included within SLR Planning areas may be designated by local governments as floodplains under Section 524 of the *Local Government Act*

and if land is so designated, local governments may, by bylaw, specify flood levels and setbacks to address sea level rise.

3.5.5 Strait of Georgia - Areas Not Subject to Significant Tsunami Hazard¹

3.5.5.1 Standard FCLs and Setbacks

The Year 2100 FCL should be established for specific coastal areas by a suitably qualified Professional Engineer, experienced in coastal engineering. This work could be completed as part of regional floodplain mapping, SLR Planning Area studies, or as part of development approval processes. The Year 2100 FCL should be the minimum elevation for the underside of a wooden floor system or top of concrete slab for habitable buildings, and should be determined (see Figure 2) as the sum of:

- The 1:200, or 1:500² Annual Exceedance Probability (AEP) total water level as determined by probabilistic analyses³ of tides and storm surge;
- Allowance for future SLR to the year 2100;
- Allowance for regional uplift, or subsidence to the year 2100;
- Estimated wave effects associated with the Designated Storm with an AEP of 1:200, or 1:500; and
- A minimum freeboard of 0.6 metres.

Alternatively, the Year 2100 FCL can be determined by a more conservative "Combined Method" as described in the Ausenco Sandwell (2011) reports (see Figure 3). Example calculations of FCLs for specific areas in coastal BC are provided in Table 3-2 AS(2011b) where the FCL is determined as the sum of:

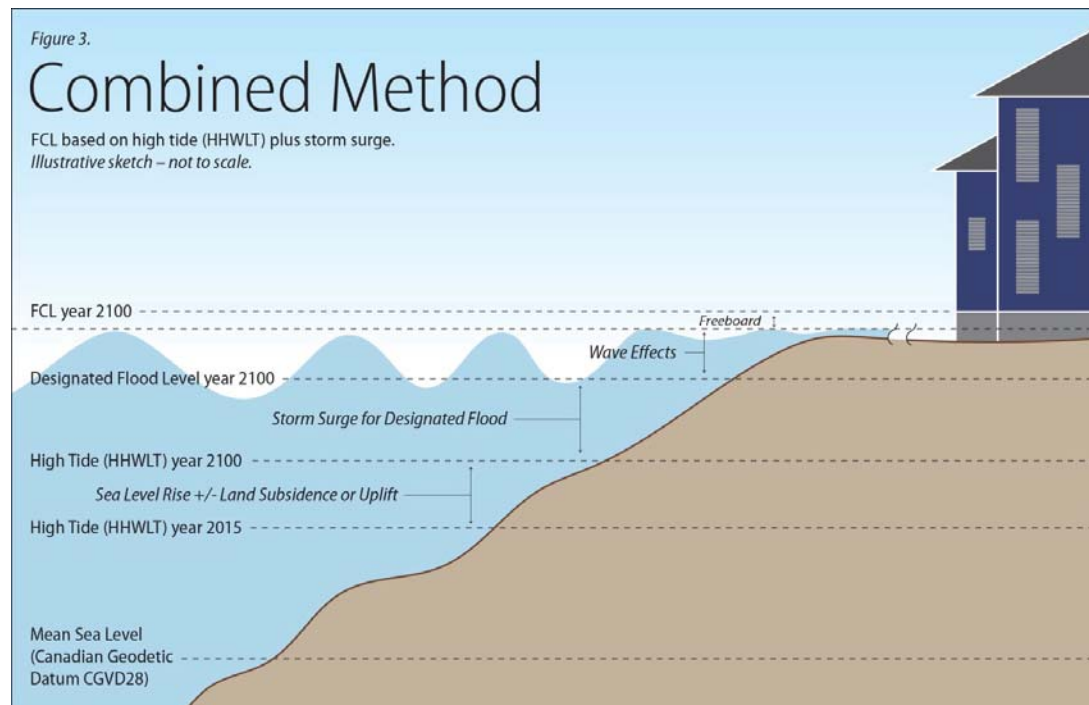
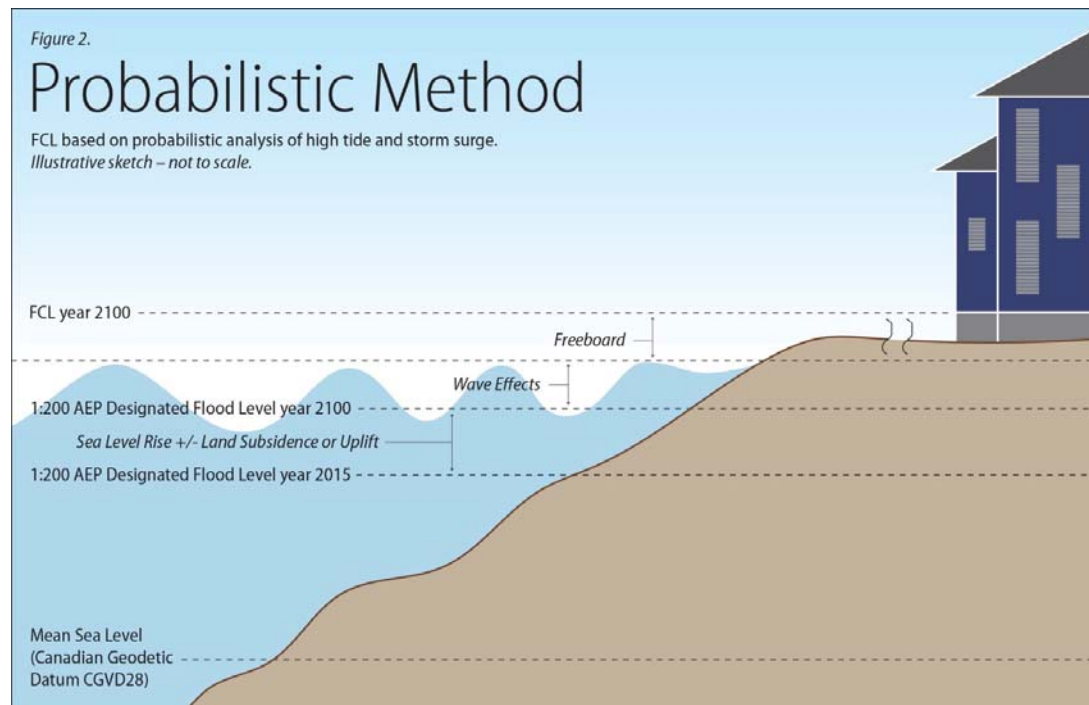
- Allowance for future SLR to the year 2100;
- Allowance for regional uplift, or subsidence to the year 2100;
- Higher high water large tide (HHWLT);
- Estimated storm surge for the Designated Storm with an AEP of 1:200, or 1:500 as per Table 6-1 in AS(2011a);
- Estimated wave effects associated with the Designated Storm; and
- A minimum freeboard of 0.3 metres.⁴

¹ Refers to "Zone E" as shown on the "Tsunami Notification Zones for BC" map published by Emergency Management BC, November, 2015 and includes the Strait of Georgia, Gulf Islands, Greater Vancouver, Johnstone Strait but not including the east side of the Saanich Peninsula and Greater Victoria.

² While a 1:200 AEP is the minimum provincial standard, local governments may decide to adopt more stringent criteria for heavily populated and built-up areas.

³ Because of the variation along the BC Coast in the availability of reliable long term water level gauge data and site specific effects including uplift, subsidence and wave effects, the decision on selection of an appropriate methodology to determine the FCL is up to the local government jurisdiction based on recommendations from a suitably qualified Professional Engineer, experienced in coastal engineering. Where studies are required to determine sea dike design levels, the design level analyses and dike design must be reviewed and approved by the Inspector, or Deputy Inspector of Dikes, as part of the *Dike Maintenance Act* approval process.

⁴ Given that the "Combined Method" provides conservative values for Year 2100 Designated Flood Levels (because the method assumes the Designated Storm occurs in conjunction with a high tide) the freeboard may be reduced from 0.6 m to 0.3 m for this method for situations where the full FCL may be difficult to achieve.



The building setback should be at least the greater of 15 m from the future estimated Natural Boundary of the sea at Year 2100, or landward of the location where the natural ground elevation contour is equivalent to the Year 2100 FCL (refer to Figure 2-2 in AS (2011b) for a definition sketch – except that the Year 2100 Designated Flood Level and future FCL as shown in this sketch can be determined by either probabilistic analyses, or the "Combined Method").

Where the sea frontage is protected from erosion by a natural bedrock formation, the development approving official may agree to modify setback requirements as recommended by a suitably qualified Professional Engineer experienced in coastal engineering. The Professional Engineer should fully consider all aspects of the coastal flood hazard associated with Year 2100 water levels including potential wave, debris and related splash impacts on buildings. This approval should be augmented through a restrictive covenant describing the hazard and building requirements, and including the Professional Engineer's report and a liability disclaimer.

The setback may be increased on a site-specific basis such as for exposed erodible beaches and/or in areas of known erosion hazard.

3.5.5.2 Subdivision

All lots created through subdivision should have viable building sites on natural ground that is above the Year 2100 FCL and comply with the setback guidelines noted above.

To regulate redevelopment at the end of the building lifespan, the development approving officer should require a restrictive covenant stipulating that any future reconstruction must meet the FCL and setbacks requirements in force at the time of redevelopment.

Subdivision may be approved within a Sea Level Rise Planning Area in areas where the natural ground is lower than the Year 2100 FCL where the local government has developed and adopted a long term flood protection strategy completed by a suitably qualified Professional Engineer experienced in coastal engineering and referencing applicable professional practice (APEGBC) and provincial guidelines available at the time. The strategy should incorporate mitigation to address all relevant risks including flood risk due to sea level rise to the year 2200 and beyond⁵ and is to be comprised of **both** raising of ground elevations with fill and adequate provisions for future dike protection, including sufficient land and/or rights of way for the future dike (also see Appendix 1).

Subdivision may also be approved in areas where the natural ground is lower than the Year 2100 FCL where all of the following conditions have been met:

- The subdivision development involves a maximum of 2 lots;
- The site is located on the coastal floodplain fringe adjacent to high ground;
- The building site ground elevations have been raised to the Year 2100 FCL and the fill extends to and is contiguous with natural ground above the Year 2100 FCL;

⁵ The long term flood protection strategy should be reviewed and updated as necessary every 10 years, or as a change to an OCP or RGS warrants. Updates should continue to consider flood risks a minimum of 100 years in the future.

- The fill is adequately protected from the sea by erosion protection works, with consideration of wave impacts associated with Year 2100 sea levels;
- The building setbacks comply with the setback guidelines noted above;
- A suitably qualified Professional Engineer, with experience in coastal engineering has prepared a detailed design for the fill and erosion protection works including a report considering all of the above and has concluded that the site may be suitable for the use intended;
- The Professional Engineers' report forms part of the restrictive covenant registered on the title of each lot; and
- The restrictive covenant registered on title stipulates that the landowners are responsible for maintenance of the erosion protection works on their own land.

3.5.5.3 Development on Existing Lots

Standard setbacks and elevations apply. To regulate redevelopment at the end of the building lifespan, the development approving official should require a restrictive covenant stipulating that any future reconstruction must meet the FCL and setbacks requirements in force at the time of redevelopment.

On existing lots, if meeting the setback guidelines noted above would sterilize the lot (i.e., not allow even one of the land uses or structures permitted under the current zoning), the development approving official may agree to modify setback requirements as recommended by a suitably qualified Professional Engineer experienced in coastal engineering, provided that this is augmented through a restrictive covenant stipulating the hazard, building requirements, and liability disclaimer.

The Year 2100 FCL requirements would still apply to new habitable building construction.

3.5.5.4 Lots with Coastal Bluffs

For lots containing coastal bluffs that are steeper than 3(H):1(V) and susceptible to erosion from the sea, setbacks should be determined as follows:

1. If the future estimated Natural Boundary is located at least 15 m seaward of the toe of the bluff, then no action is required and the setback should conform with other guidelines that adequately address terrestrial cliff and slope stability hazards.
2. If the future estimated Natural Boundary is located 15m or less seaward of the toe of the bluff, then the setback from the future estimated Natural Boundary should be located at a horizontal distance of at least 3 times the height of the bluff, measured from 15 m landwards from the location of the future estimated Natural Boundary.

In some conditions, setbacks may require site-specific interpretation and could result in the use of a minimum distance measured back from the crest of the bluff. The setback may be modified provided the modification is supported by a report, giving consideration to the coastal erosion that may occur over the life of the project, prepared by a suitably qualified Professional Engineer experienced in coastal engineering.

3.5.6 Outside the Strait of Georgia Area - Areas Subject to Significant Tsunami Hazard⁶

Tsunami setbacks and elevations should be required for new lots created through the subdivision approval process. Tsunami hazard requirements and regulations for existing lots may be determined by local governments on a site specific or regional basis.

The "standard" setbacks and elevations in sections 3.5.5.1 to 3.5.5.4 above apply to all coastal areas outside of the Strait of Georgia, except for new subdivisions subject to significant tsunami hazards, in which case the tsunami setbacks and elevations shall apply. Where the tsunami hazard is low, the greater FCLs and setbacks shall apply.

A subdivision application in a tsunami prone area must include a report by a suitably qualified Professional Engineer, experienced in coastal engineering who must formulate safe building conditions for each proposed lot based on a review of recent Tsunami hazard literature including the report, "Modelling of Potential Tsunami Inundation Limits and Run-Up", by AECOM for the Capital Regional District, dated June 14, 2013, plus the historical report, "Evaluation of Tsunami Levels Along the British Columbia Coast", by Seaconsult Marine Research Ltd., dated March 1988.

At a minimum, building conditions should protect improvements from damage from a tsunami of equal magnitude to the March 28, 1964 tsunami that resulted from the Prince William Sound, Alaska earthquake and a possible Cascadia Subduction Zone earthquake.

Setback –

Setback requirements should be established on a site-specific basis and take into account tsunami hazards.

The setback must be sufficient to protect buildings and must be at least 30 metres from the Year 2100 estimated natural boundary.

FCL –

FCL requirements should be established on a site-specific basis and take into account tsunami hazards.

Reductions to these requirements should only be considered where the building can be built to the Tsunami FCL on bedrock.

3.6 Areas Protected by Dikes

Residential, commercial and institutional developments in areas protected by dikes are required to comply with full flood proofing requirements for their respective categories, with a possible exception for development within Sea Level Rise Planning Areas as noted below.

Setback –

Buildings should be located a minimum of 7.5 metres away from any structure for flood protection or seepage control or any dike right-of-way used for protection works. In addition, fill

⁶Refers to "Zones A, B,C and D" as shown on the "Tsunami Notification Zones for BC" map published by Emergency Management BC, November, 2015 and includes the North Coast, Central Coast, and Juan de Fuca Strait including Greater Victoria and the east side of the Saanich Peninsula.

for floodproofing should not be placed within 7.5 metres of the inboard toe of any structure for flood protection or seepage control or the inboard side of any dike right of-way used for protection works, unless approved by the Inspector of Dikes as part of a dike upgrading plan.

Additional dike right of way and building set back requirements should be defined for Sea Level Rise Planning Areas to accommodate the widening and raising of dikes for sea level rise.

Any change to these conditions requires the approval of the Inspector of Dikes.

FCL –

Buildings and manufactured homes in areas protected by dikes should meet minimum FCLs prescribed for the primary stream, lake or sea adjacent to the dike and the FCL requirements for any internal drainage (minimum ponding elevations). FCLs for diked coastal areas may also be determined through a comprehensive, site-specific dike breach modeling study, completed by a suitably qualified Professional Engineer, and based on a minimum 1:200 AEP sea water level in the Year 2100, inclusion of a minimum 0.6 m freeboard above modelled water levels and conservative modelling assumptions.

Relaxation of FCL requirements for new development in coastal areas protected by dikes may be appropriate for Sea Level Rise Planning Areas where the local government has developed and adopted a long term flood protection strategy completed by a suitably qualified Professional Engineer experienced in coastal engineering and referencing applicable professional practice (APEGBC) and provincial guidelines available at the time (see Appendix 1). This relaxation should be augmented through a restrictive covenant stipulating the hazard and protection strategy, building requirements, and liability disclaimer.

3.6.1 Secondary sources of flooding

Where there are secondary sources of flooding within diked areas, the appropriate requirements as set out in Clauses 3.1 through 3.5 should be applied. These should include consideration of minimum ponding elevations behind the dike to protect against internal drainage.

Amended: October 1, 2016

APPENDIX 1 – LONG TERM FLOOD PROTECTION STRATEGY

Section 3.6 states that "Relaxation of FCL requirements for new development in coastal areas protected by dikes may be appropriate for Sea Level Rise Planning Areas where the local government has developed and adopted a long term flood protection strategy completed by a suitably qualified Professional Engineer experienced in coastal engineering and referencing applicable professional practice (APEGBC) and provincial guidelines available at the time." Similarly section 3.5.2 provides for subdivision approvals in low lying coastal floodplain areas where the local government has developed a long term flood protection strategy. This appendix outlines the steps involved in developing a long-term flood protection strategy and the issues that should be addressed at the various stages of development of the strategy.

1. General

- Relaxation of FCL requirements for new development in the protected area and intensification of development through subdivision of land has significant long term implications. The future reliance on the sea dikes and consequences of dike failure will increase as development occurs and sea level rises. Therefore, the extent of work required to establish a successful long term dike upgrading program is demanding and costly. This approach should only be undertaken where the extent of community development in the floodplain justifies the high cost and level of effort.
- While additional site specific factors and flood hazards may be relevant for specific areas, the criteria and work outlined herein must generally be completed to justify relaxation of requirements.

2. Feasibility Study

The objective of the feasibility study is to help select a conceptual design option or options and to support a decision to proceed with preliminary design for Phase 1. The feasibility study should include the following steps:

- Collect background data and assess information needs including:
 - Wind and wave
 - Geotechnical (including seismic)
 - Land ownership/rights of way
 - Long term subsidence information for the site/area
 - Environmental
 - Proximity and availability of construction materials
- Review regulations and permits required
- Define design parameters
 - Dike safety standards and guidelines
 - Decision on minimum Annual Exceedance Probability (AEP) of design water level
 - Sea level rise scenario(s) and planning horizons (i.e. year 2100 and 2200) based on the Recommended Sea Level Rise Planning Curve presented in Figure 1.
- Develop options and complete conceptual designs. Design options may include:
 - Offshore breakwater, erosion protection and various overtopping designs

-
- Wide landfills (i.e. "superdike" concept)
 - Conventional earth dike (minimal use of floodwall closure sections)
 - Sea barrier/tide gate
 - other
 - Assess adaptability of option for very long term upgrading (i.e. year 2200)
 - Assess environmental impact of options
 - Assess social impact of options
 - Develop cost estimates
 - Develop recommendations for detailed engineering and environmental studies
 - Prepare draft report
 - Define key stakeholders and engage to get feedback
 - Complete public consultation process
 - Compare alternatives with respect to cost/ social acceptance/environment
 - Develop draft short term and long term implementation plans
 - Prepare final report
 - Present to local government council/board and funding agencies (Province) for approval in principle

3. Preliminary Design for Phase 1

Preliminary design for a Phase 1 of the flood protection program is required to support funding commitments.⁷ The Phase 1 project scope would typically include at least 25% of the dike upgrading work required to meet the year 2100 flood protection requirements.

- Complete detailed engineering studies as recommended by the feasibility study (such as geotechnical, land acquisition, environmental etc.):
- Phasing should be planned so that the minimum design AEP is maintained or exceeded at all times, considering up to date SLR curve information.
- Complete preliminary design for Phase 1
- Prepare detailed cost estimates to support funding commitments by both local and senior governments
- Before any design work is initiated, local governments are encouraged to contact the regional Deputy Inspector of Dikes to discuss proposed design projects.

4. Long Term Flood Protection Strategy

- Outline construction phasing plan – while work can proceed incrementally, preliminary designs and major components (i.e. land assembly) should be completed in no more than 4 phases by 2100. (As previously noted, phasing should be planned so that the

⁷ Where subdivision development is being contemplated in areas where the natural ground is lower than the Year 2100 FCL, the long term flood protection strategy is to be comprised of both raising of ground elevations with fill and adequate provisions for future dike protection. Phasing of land filling and dike construction would be established on a site specific basis.

minimum design AEP is maintained or exceeded at all times, considering up to date SLR curve information.)

- Land Ownership and Legal Access – confirm detailed plans to acquire lands for at least Phase 1 as a minimum, and a strategy to acquire lands for Phases 2, 3 and 4 (if needed).
- Dike Operation and Maintenance – prepare detailed operation and maintenance plan.
- *Dike Maintenance Act* (DMA) Approval for Phase 1 – apply for and obtain approval from the regional Deputy Inspector of Dikes
- Financial Plan – confirm funding approval in place for Phase 1 through established cost share programs. Confirm political commitment by both local and senior governments to long term support for the Flood Protection Strategy.

5. Governance

Local governments may wish to establish appropriate governance or committees to provide direction, technical input, and public consultation throughout the process. The province may participate in an advisory capacity, providing guidance and information on provincial policies, standards, regulations and design criteria. The province's participation does not guarantee approval of applications required under the *Dike Maintenance Act*. Applications will be assessed on their own merit and the decision maker will consider the application within the context of the long term strategy.

Appendix C



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Ports and Marine

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TECHNICAL MEMO

TO:	To File / For Discussion	DATE:	April 03, 2018
C.C.:	John Readshaw, Sherry Lim	FROM:	Jessica Wilson
PROJECT:	634533 - DNS – FCL Study	MEMO NO:	0008
SUBJECT:	Legend for Highlights to Mark Changes to FCL Report	DOCUMENT NO:	634533-0000-4PEN-0008

1. INTRODUCTION

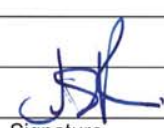
Project: 634533 – DNS - Flood Construction Levels (FCL) Study
Purpose: Legend for highlights to mark changes to the Flood Construction Level Study Report
References:

Superseded Report: Flood Construction Levels for 0.5m and 1.0m Sea Level Rise, Dated 04 January 2017, Document No.: 634533-3000-41ER-0001 Rev. No.: PC

Revised Report: Flood Construction Levels for 0.5m and 1.0m Sea Level Rise, Dated 27 March 2018, Document No.: 634533-3000-41ER-0001 Rev. No.: 00

2. LEGEND

- Text – Revisions based on new information/analysis
- Text – Edits for wording, grammar, and clarity

Prepared by:	Jessica Wilson, EIT	
Reviewed by:	Sherry Lim, P.Eng	
Approved by:	John Readshaw, P.Eng	
	Name	 Signature



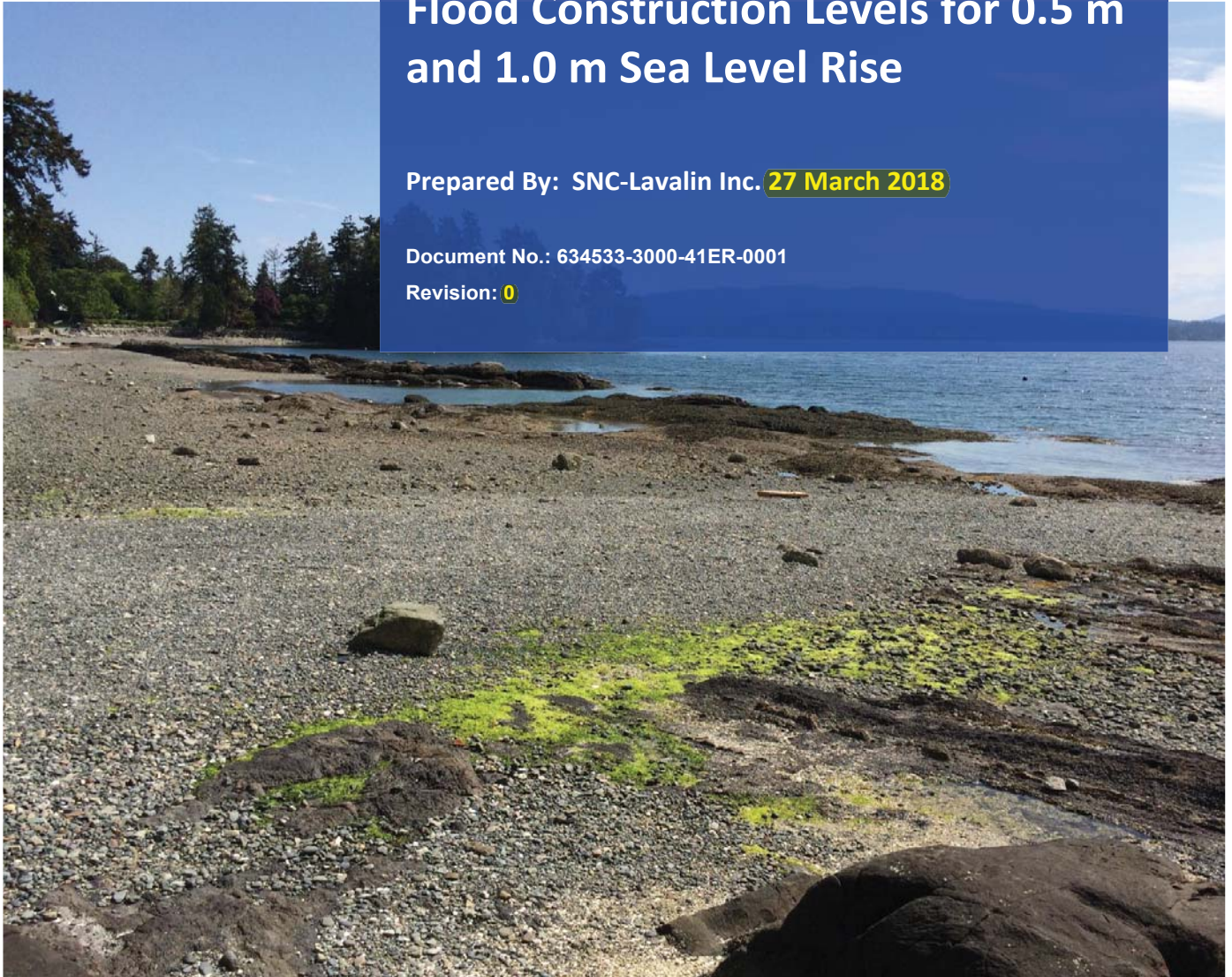
District of North Saanich

Flood Construction Levels for 0.5 m and 1.0 m Sea Level Rise

Prepared By: SNC-Lavalin Inc. **27 March 2018**

Document No.: 634533-3000-41ER-0001

Revision: **0**



EXECUTIVE SUMMARY

Background

SNC-Lavalin was retained by the District of North Saanich (DNS) to review and refine Flood Construction Levels (FCLs) previously developed for the District of North Saanich by the CRD.

The existing CRD FCL estimate for the District of North Saanich was 5.04 m for one meter of sea level rise, relative to the present Canadian Geodetic Vertical Datum (CGVD28). The CGVD28 reference datum is notionally the same as mean sea level today.

The Flood Construction Level is defined as the underside elevation of a wooden floor system, or the top elevation of a concrete slab, for habitable buildings, and is calculated from the sum of the following components:

- The Designated Flood Level (DFL), which includes tide, storm surge, and sea level rise,
- The effects of waves at the shoreline during a Designated Storm, and
- A freeboard allowance, that accounts for uncertainties in the methodology.

Flood Construction Levels (FCL's) are intended to provide safety and security against flooding or related damage in habitable levels of buildings along the shoreline. The extent of flooding or the risk to personnel is directly related to the quantity of water that crosses the shoreline during a storm and for this reason the main focus of this refinement of FCLs has focused on the specific wave effects to be expected at specific locations around the shoreline of the DNS.

Approach and Methodology

The 2011 Provincial Guidelines recommend consideration of 1 m of Sea Level Rise, adjusted for local land movement, for estimating the Designated Flood Level (DFL) for 2100. However, the rate of rise of sea level is now generally expected to occur faster than previously estimated in 2011. To allow for these uncertainties and to aid in both short- and long-term sea level rise response planning, a net rise in sea level of 0.5 m and 1.0 m, independent of any particular year of occurrence, have been used for this assessment.

In order to define the Designated Flood Level, an analysis of storm conditions and related water levels was initially undertaken to establish the expected storm surge and associated wind and resulting wave conditions during the Designated Storm for distinct reaches along the DNS shoreline. The Designated Storm was based on a storm that has an average annual probability (AEP) of being equalled or exceeded of 1/500, or a 0.2% chance of occurring or being exceeded in any given year. This level of probability was selected, based on guidance in the Provincial Guideline documents, to minimize and equalize risk to exposed residential properties around the peninsula.

The shoreline of the DNS is exposed to winds and waves from various directions depending on the location, and the type of storm that produces severe (1/500 AEP condition) on that portion of the shoreline. In some cases, depending on the direction of exposure, severe winds (and resulting waves) can come from several different types of storms. The dominant storm patterns include winter outflow conditions that typically produce NE winds, and more typical and relatively frequent, mid-latitude Pacific Ocean storms that generally produce SE, SW, or NW winds.

Detailed analysis found that winter outflow conditions (NE winds) are typically associated with negative storm surges while mid-latitude storms are generally associated with large positive storm surges. It was also found that the peak storm surge generally occurs several hours after the peak wind speed and that the surge can change rapidly as the storm passes over or by the area.

Nearshore wave conditions during the Designated Storm were estimated using a detailed wave generation and propagation numerical wave model (SWAN) for six specific storm scenarios that are capable of producing 1/500 AEP conditions at the shoreline of the DNS. The resulting wave fields vary significantly around the shoreline. The image below shows the expected wave field for a SE storm in Haro Strait.

The DNS shoreline was subdivided into 39 reaches, defined by the typical shoreline characteristics and the wave exposure on each reach. The nearshore wave climate results were then used to establish a governing storm condition for each reach and to then estimate the corresponding wave effects on the shoreline. Wave effects are defined by the wave run-up on the shoreline and/or wave overtopping of **characteristic** shoreline features **including** seawalls or rock revetments.

For the purpose of calculating FCL's, a threshold of 10 L/m/s (Litres/meter/second) for acceptable quantities of water at the shoreline was **considered**. **This threshold** value provides safety and security of personnel and property. A freeboard allowance of 0.6 m, as recommended in the 2011 Provincial Guidelines, was also included.

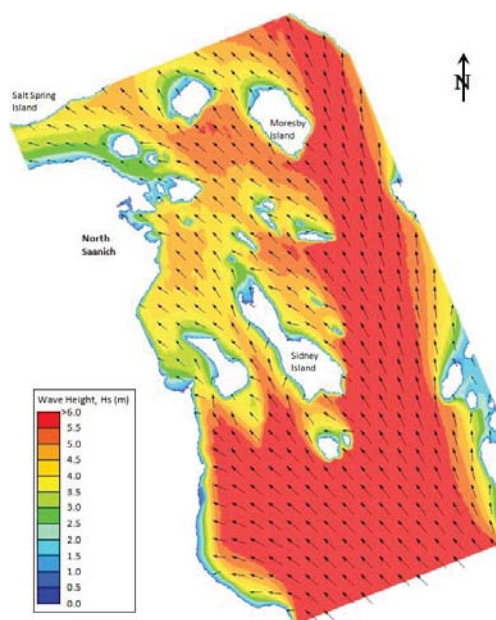
Results

The 1m Sea Level Rise scenario resulted in 25 shoreline reaches with FCL's that are lower than the existing uniform CRD estimate of 5.04 m, CGVD28. The remaining 14 reaches have higher FCL's. These changes from the CRD estimate are largely due to the particular characteristics of each reach, including specific shoreline exposure or shoreline characteristics, which includes the type and character of the inter-tidal portion of the shoreline and the nature of the shoreline at the high water line.

The 0.5m SLR scenario resulted in FCL's that are between 0.4m and 1.1m lower than the FCL's for the 1.0m SLR scenario. This reduction is largely due to the lower water level which essentially limits the seastate that can exist at the shoreline during the Designated Storm. For 0.5 m of sea level rise, 30 reaches have FCL's lower than the CRD estimate of 5.04m and 9 reaches have higher FCL's.

The overall reductions in FCL elevations can be largely attributed to the detailed definition of storm scenarios, associated storm surges and the specifics of each shoreline reach. These details are very important when defining specific FCL's on a shoreline as variable as the DNS.

Detailed maps of the resulting FCLs for each shoreline reach are provided in Appendix C.



Expected Seastate in a 1/500 AEP SE storm

Implications to the District of North Saanich

There are approximately 713 waterfront lots on the coastline of the District of North Saanich.

For a 0.5m SLR scenario, the revised wave effects and flooding are confined to the shoreline or the first 15 m of setback (Criteria 1 & 2) on approximately 582 lots. Partial flooding, including in some cases, complete inundation (Criteria 3 & 4) is expected on 131 properties.

For the 1.0m SLR scenario, minor flooding (Criteria 1 & 2) is expected on approximately 550 lots. Partial flooding, including in some cases complete inundation (Criteria 3 & 4) is expected on 163 lots.

A potential 77 lots are indirectly exposed to the risk of flooding during a 1.0m SLR scenario, either from an adjacent waterfront property or because flooding may extend landward from the waterfront properties. For a 0.5m SLR scenario, a potential 54 lots are indirectly exposed to flooding. The flooding and safety of these indirectly affected lots is dependent on the action taken on the adjacent lots.

End of Executive Summary

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1. INTRODUCTION

SNC-Lavalin Inc. (SLI) was retained to define the Flood Construction Levels (FCL) for the District of North Saanich, considering district specific conditions such as wave exposure, shoreline type and a range of expected sea level rise scenarios. This report details the methodology and findings of this work and supersedes the previous SLI FCL Report; Document 634533-1000-41ER-001, dated May 2016.

Background

This study refines the Flood Construction Levels (FCLs) previously presented by the Capital Regional District (CRD) In-house Assessment Methodology for the District of North Saanich (DNS). These existing CRD FCLs are described in reports prepared by AECOM [4], CRD [5] and Groundrush Consulting [6].

The existing CRD FCLs were estimated based on the procedures recommended in the 2011 Provincial Guideline documents, BCMOE [1][2][3] and a single value of 5.04 m, CGVD28 was recommended for Zone 4, which includes the DNS. The CRD values were based on a global average sea level rise of 1 m, estimated to occur by the year 2100 [5]. This included a single value of 0.65 m for all areas in the DNS to estimate the Wave Effects component of the FCL. It is expected that the regional application of a single value of wave effects is not accurate, considering the close inter-relationship between the storm surge, wave exposure, Wave Effects, and the varying shoreline types around the DNS shoreline.

Scope

The scope of this assignment was to examine and define the storm surge and wave effect components at a finer resolution than that used for the CRD FCLs and provide revised FCLs specific to the DNS shoreline (shown in Figure 1) for 0.5 m and 1.0 m and of sea level rise.

The following areas were specifically excluded from the study:

- First Nations Lands
- Federal Lands within Patricia Bay (The Institute of Ocean Sciences Marine Facility)
- BC Ferries terminal at Swartz Bay
- Town of Sidney

Vertical Datum

Unless noted otherwise, all elevations are in meters with respect to Geodetic Datum (CGVD28).

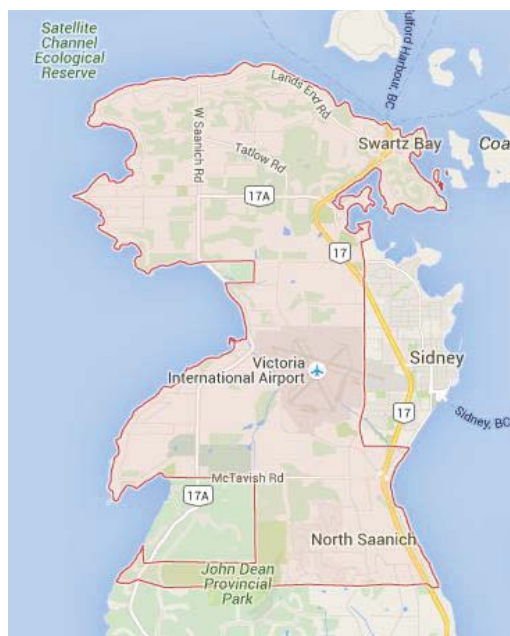


Figure 1: District of North Saanich
source: Google Maps 2015

2. METHODOLOGY

In order to estimate the FCL's for the DNS, we used the following methodology, which is consistent with the Provincial Guideline documents and is discussed further in the following sub-sections:

1. Define the Designated Storm(s) and the associated winds and storm surge
2. Determine the Designated Flood Level, considering sea level rise, tide conditions, and storm surge
3. Characterize the incident wave climate approaching the shoreline
4. Determine Wave Effects and overtopping rates at the shoreline
5. Calculate the Flood Construction Levels
6. Determine the number of affected lots in the DNS

2.1. Designated Storms

The Saanich peninsula is exposed to winds and waves from six principle directions; NE, E and SE, SW, W and NW, but in general terms, the east shoreline is only exposed to NE, E and SE, E winds, the west shoreline is only exposed to SW, W and NW winds and the north shoreline is only exposed to NE, N and NW winds. In order to define FCLs around the entire shoreline of the DNS, it is therefore necessary to consider different combinations of wind speed, direction, and related storm surge to determine the governing case for each section of the DNS shoreline.

Definition of the Designated Storm

The 2011 Provincial Guideline Documents provide some flexibility in the choice of the appropriate annual exceedance probability (AEP) for the Designated Storm, based on the type and value of land use along the shoreline. For the purpose of this project, an annual exceedance probability (AEP) for the Designated Storm (DS) of 1/500, which corresponds to a 0.2% chance of occurring in a given year, was selected.

This AEP value was chosen for the following reasons:

- The CRD based results [6] indicated the most vulnerable lands (in the Tsehum Harbour area) were generally high value residential waterfront properties
- Other vulnerable areas on the west side of the peninsula were also mainly residential properties.

Storm Types and Wind Field

Due to the exposure of the DNS to winds and waves from various directions, typical storm patterns that could produce 1/500 AEP winds and waves – i.e.: the Designated Storm – at different locations around the shoreline, could come from two primary sources: winter outflow conditions, which generally produce NE storms or more typical and more frequent mid-latitude storms, from the Pacific Ocean basin, which generally produce SE, SW, and then NW winds, as the storm system propagates towards and across the south coast of British Columbia.

Typical patterns for the storm types are shown in Figure 2. The left hand side shows the typical wind directions around an intense mid-latitude low pressure system as it approaches the coast of British Columbia from the Pacific. This direction of approach initially brings strong E to SE winds that change to SW winds as the associated warm front passes and then often produce strong W to NW winds when the associated cold

front crosses the coast. Severe mid-latitude storms typically bring large storm surges, reflecting the effect of the storm, that, within the Straits of Juan de Fuca and Georgia, often occur after the strongest E or SE winds have occurred. The right hand image in Figure 2 shows a typical outflow condition where a ridge of high pressure north of Vancouver Island results in pressure contours that drive strong NE outflow winds across the Strait of Georgia towards Vancouver Island and the DNS.

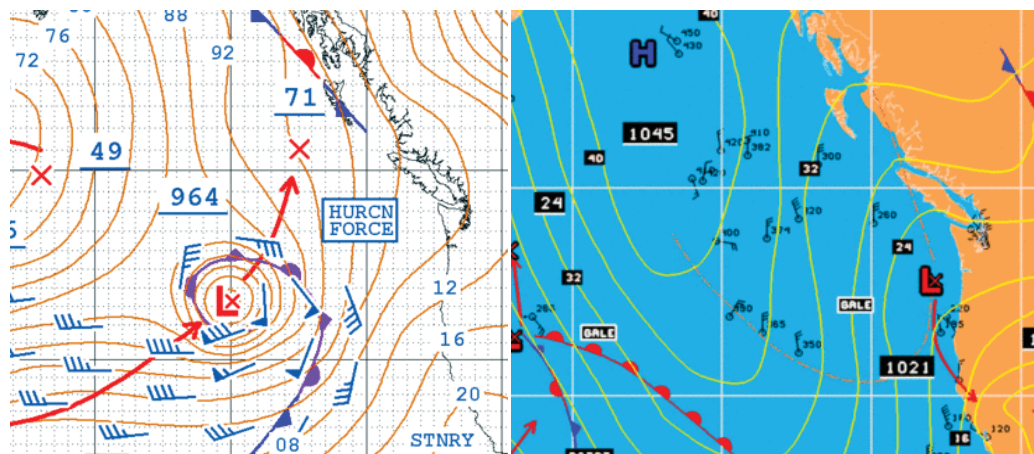


Figure 2: (left) Forecast for a typical mid-latitude storm 17 Jan. 2016 - (right) Forecast for a typical outflow condition 14 Feb 2006

Source: NOAA

Review of the local overwater wind fields in the vicinity of the Saanich peninsula during severe storms also shows that generally during SE storms; the wind speed progressively decreases in strength as the winds approach the Sidney area. Winds in the eastern end of Juan de Fuca strait are consistently stronger than the winds at Kelp Reef, at the north end of Haro Strait. Winds in the area between James Island and Sidney Island and the Sidney shoreline are less than the wind speeds recorded at Kelp Reef.

The expected wind speeds associated with severe storms, and specifically the Designated Storms, (with an AEP of 1/500), were evaluated for this assignment using data from the Environment Canada Victoria Airport anemometer, due to its proximity to most of the DNS shorelines and its long record, supplemented by data from the Environment Canada anemometer at Kelp Reef, for SE events and from the Environment Canada Wind and Wave recording buoy in Patricia Bay for SW and NW events. Anemometer locations are shown in Figure 3.

Wind speed data from Victoria Airport was adjusted to account its over-land location using standard procedures for overland to overwater modification.

A peak over threshold extreme value analysis was completed to estimate the 1/500 AEP wind events for each directional sector for the modified Victoria Airport winds and the unmodified Kelp Reef winds. The results of the extreme value analysis for the modified Victoria Airport data, by major direction, are provided in Figure 4.

District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise



The extreme value analysis results confirmed that peak winds at Kelp Reef are stronger, for the same AEP event, than the modified Victoria Airports winds, which supports the qualitative description of SE overwater wind fields above.



*Figure 3: Environment Canada wind stations referenced for DNS project
source: Google Earth*

District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise

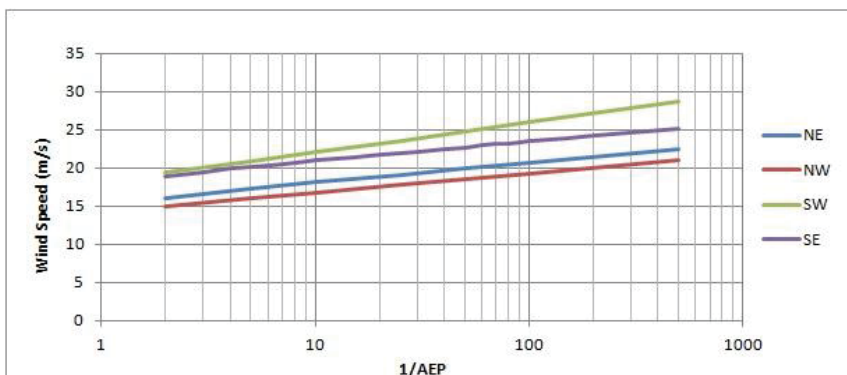


Figure 4: Extreme Value Analysis Results for Wind Speed

Storm Surge during the Designated Storms

In the 2011 Provincial Guidelines, the expected storm surge for a generalized 1/500 AEP storm event in the Strait of Juan de Fuca or the Strait of Georgia is 1.3 m. However, detailed examination of the correlation between the storm surge event and the winds during the related storm event shows that the correlation between the timing of wind speeds in the Straits and the arrival of a storm surge varies significantly. As an example the recorded data shows that the peak wind speed during a recent severe SE storm on the south coast preceded the peak storm surge by approximately 6 hours at Point Atkinson, Figure 5. A similar lag can be expected around the DNS shoreline.

Examination of the top 7 storm surge events in the last 20 years showed that:

- In general, winds during storms tend to peak several hours before the maximum storm surge arrives.
- In most cases, winds have already shifted from a SE to a SW direction and the wind speeds have generally decreased from the peak wind speed.
- In the most severe storm surge event in the record, the winds peaked when the direction had already shifted into the SW.

An examination of the storm surge associated with strong NE or NW winds, which directly affect the north and west sides of the DNS shoreline, shows there are further significantly different correlations between wind strength, as described further below.

It is overly conservative, for the DNS area, to pair the 1/500 AEP storm surge (1.3 m) with a 1/500 yr AEP wind for all Designated Storm direction scenarios.

District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise

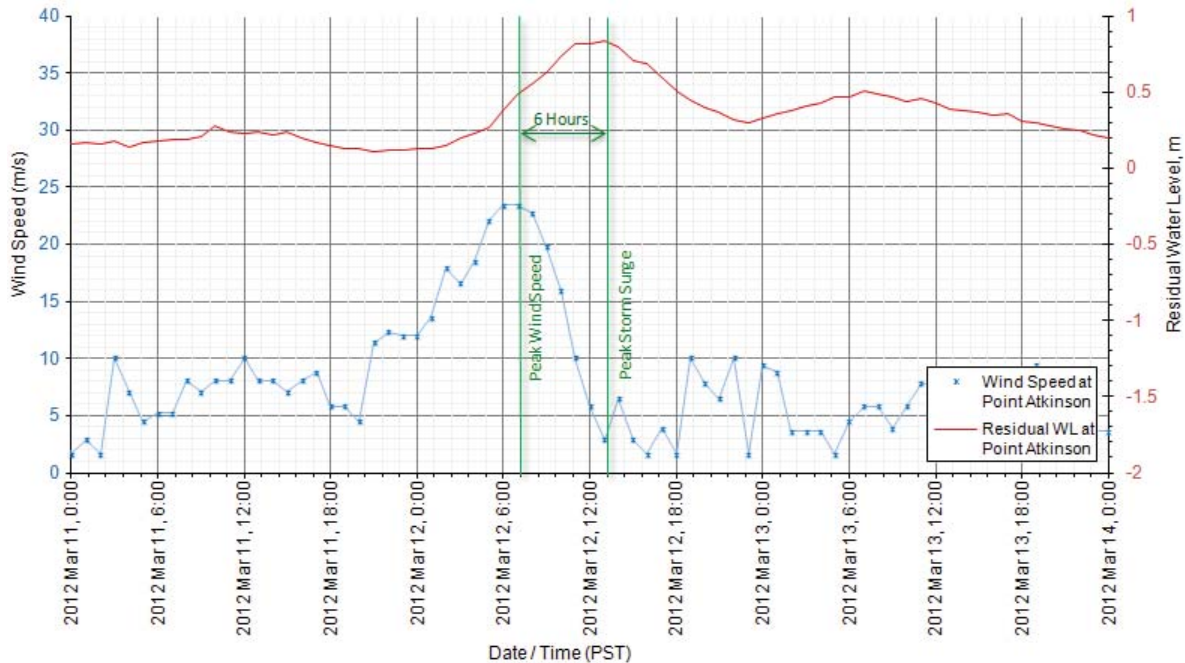


Figure 5: Correlation of Residual water level and wind speed during a SE storm event

For the purpose of this assignment, a specific assessment was conducted correlating wind events with storm surges by directional sector, and specifically for the NE, NW, SW, and SE sectors.

The analysis was based on the top 10 storms on record and a relationship was determined between peak wind speeds in the Sidney area and the corresponding storm surge, for each directional sector. The relationships for the top 10 SE and NE storms in the record are shown in Figure 6 and Figure 7, respectively. The expected wind speed for the Designated Storm is also shown.

District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise

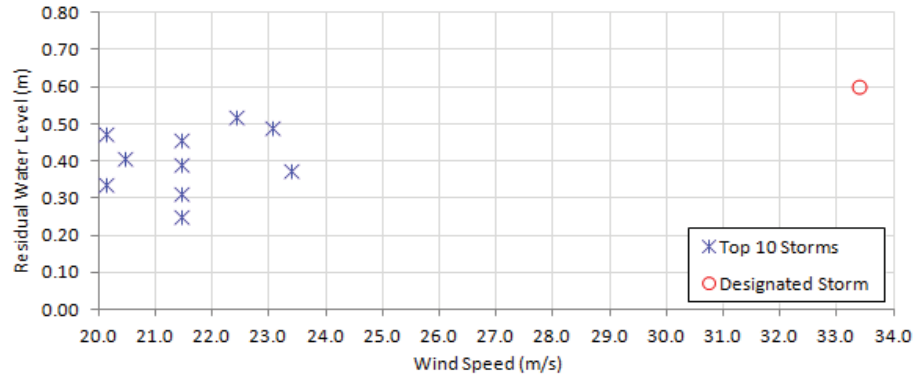


Figure 6: Residual water levels at the time of peak winds for a SE storm.

Source: modified Victoria Airport winds

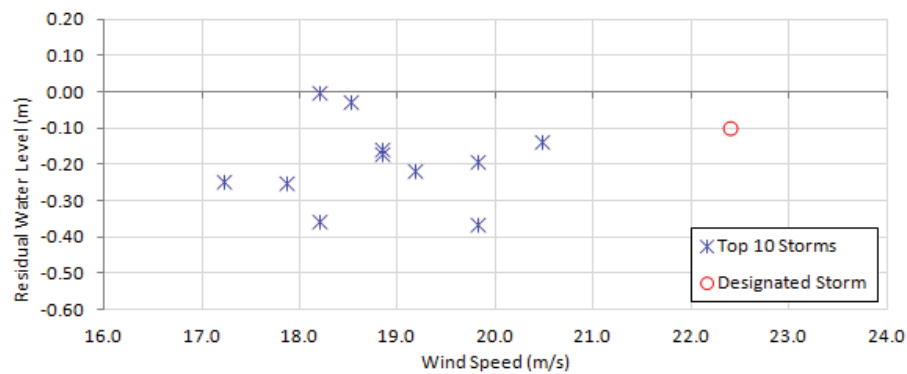


Figure 7: Residual water levels at the time of peak winds for a NE storm event.

Source: modified Victoria Airport winds

The results in Figure 6 suggest that significantly lower storm surge amplitude, compared to the Provincial Guideline of 1.3 m, can be expected when winds actually peak in the waters offshore of Sidney.

Analysis of the top 10 NE storms, Figure 7 suggests that there is a negative storm surge (residual) during severe NE storm events. Analysis of strong NW events provided similar correlations.

Analyses of SW storms showed that the correlation between peak SW winds and residual water levels is similar to that found for the SE storms – the expected storm surge at the time of maximum SW winds is also less than suggested by the Provincial Guideline documents. However, it was noticed that at the time of the largest recorded storm surge on record (0.9 m), winds at Victoria Airport (and Kelp Reef) had swung to the SW.

These results suggest that there is more than one storm scenario that could produce governing storm related Wave Effects around the Saanich peninsula:

- The time at which winds (and related waves) peak and the storm surge is not a maximum
- The time when the storm surge is a maximum but winds (and related waves) have either not yet peaked or they have already started to decrease.

In reality, there are many possible combinations of water levels (astronomical tide plus storm surge) and waves which could produce governing Wave Effects around the peak of the storm for several hours. For the purpose of this assignment we have concentrated on the likely governing scenarios that could define appropriated FCLs.

2.2. Designated Flood Level

The designated flood level (DFL), which does not include the effect of waves at the shoreline, is the sum of the following components [2]:

- Future SLR Allowance
- Maximum high tide (HHWLT)
- Total storm surge during the Designated Storm

The DFL will vary around the shoreline perimeter of the DNS, depending on the exposure of each section of shoreline and the timing of the Designated Storm, winds, storm surge and resulting waves for the particular shoreline exposure.

Sea Level Rise

The existing 2011 Provincial Guideline documents are based on an estimated linear rate of SLR through 2200. The recommended planning curve is shown in Figure 8 as the BC 2011 Planning Curve.

The BC 2011 Planning curve suggests that 1 m of SLR should be expected by the year 2100. However, the weight of science and data related to ongoing sea level rise strongly suggests that 1 m of SLR may occur sooner, as suggested by more recent projections, also shown in Figure 8.

One component of local SLR is the influence of land uplift or subsidence, due either to tectonic effects or glacial isostatic rebound. The current measured land uplift rate in the DNS area is approximately +1.4 mm/yr [1]. This rate, if projected to the year 2100, will result in land uplift of roughly +0.1 m and a slightly slower rate of local SLR than indicated in Figure 8

If the more aggressive SLR projection curves in Figure 8 are representative, then in the most aggressive scenario (the red dashed curve in Figure 8) one meter (1 m) of global SLR may occur by approximately 2065. In this case, the effect of local uplift will be much less and only represents a small fraction of the expected duration until 1 m of local SLR actually occurs.

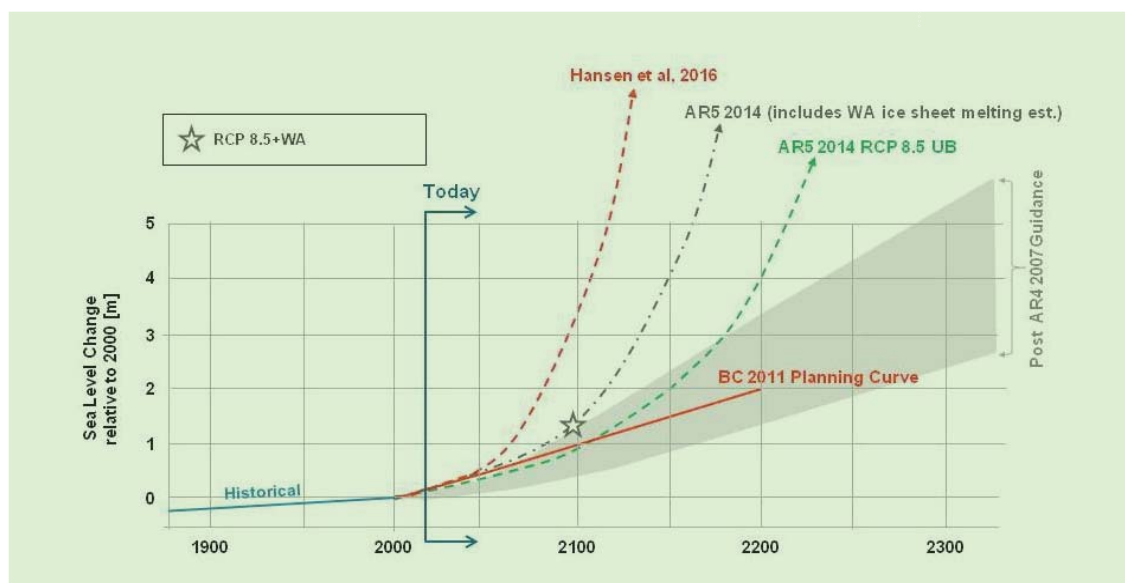


Figure 8: Mean Global Sea Level Rise Projection Curves

For this reason, we have considered two local sea level rise scenarios, 0.5m and 1.0m of net local SLR. These values generally correspond to the estimates for SLR in the year 2050 and 2100 by the 2011 BC Provincial Guideline documents [1], but most likely will occur sooner. The combined interaction of the actual future rate of rise of global sea levels and the appropriate allowance for local land uplift effect is considered to be a part of the inherent uncertainty in the predicted SLR values.

Tidal Water Level

Tide levels vary slightly around the DNS peninsula, with HHWLT ranging from 1.4 m CGVD28 to 1.6 m CGVD28. The specific HHWLT from various local CHS tidal stations are listed in Table 2-1. For the purpose of estimating the DFL, a HHWLT elevation of 1.5m CGVD28, is used.

Table 2-1: Tide Levels at Patricia Bay [8]

Tidal Station	HHWLT (m, CGVD28)
Brentwood Bay	1.6
Patricia Bay	1.4
Swartz Bay	1.5
Sidney	1.4
Saanichton Bay	1.4

2.3. Storm Scenarios during the Designated Storm

The assessment of winds, waves and storm surges undertaken for this assignment has shown there are different scenarios that can affect the various parts of the DNS shoreline depending on the shoreline exposure. In particular, during typical mid-latitude storms, the highest water levels (high tide plus storm surge) may occur after the strongest winds have started to decrease or alternatively after the wind direction has switched, for example from SE to SW. In these cases the incident wave climate and therefore the expected Wave Effects can change significantly and the governing total effect may occur at several moments during the storm that do not exactly coincide with either the time of strongest winds or highest surge.

A summary of the governing conditions is provided in Table 2-2 and Table 2-3 for 0.5 m and 1.0 of SLR, respectively.

Table 2-2: Summary of Designated Flood Levels for 0.5m of SLR

Storm Wind Direction Scenario	Case	Description	SLR Allowance (m)	Tide (m, CGVD28)	Storm Surge (m)	DFL (m, CGVD28)
NE	1	Peak wind	0.5	1.5	-0.1	1.9
NW	1	Peak wind	0.5	1.5	-0.1	1.9
SW	1	Peak wind	0.5	1.5	0.4	2.4
SW	2	Peak surge	0.5	1.5	0.9	2.9
SE	1	Peak wind	0.5	1.5	0.6	2.6
SE	2	Peak surge	0.5	1.5	1.3	3.3

Table 2-3: Summary of Designated Flood Levels for 1m of SLR

Storm Wind Direction Scenario	Case	Description	SLR Allowance (m)	Tide (m, CGVD28)	Storm Surge (m)	DFL (m, CGVD28)
NE	1	Peak wind	1.0	1.5	-0.1	2.4
NW	1	Peak wind	1.0	1.5	-0.1	2.4
SW	1	Peak wind	1.0	1.5	0.4	2.9
SW	2	Peak surge	1.0	1.5	0.9	3.4
SE	1	Peak wind	1.0	1.5	0.6	3.1
SE	2	Peak surge	1.0	1.5	1.3	3.8

2.4. Incident Wave Climate

Definition of Local Wind Climate

Wave generation during a storm is dependent on the wind speed, the related duration, and the extent of open water (fetch) upwind from the shoreline in question.

For the NE, NW, and SW cases, the wind speed and available fetch is almost fully constrained by adjacent land areas and limited open water fetch is available for wave generation. The estimation of incident waves at the shoreline and any resulting wave effects during the Designated Storm is relatively straightforward.

For the NE, NW, and SW-Case 1 scenarios, the 1/500 AEP wind speed based on modified Victoria Airport data, was used. To estimate the incident sea state during a potential 1/500 AEP SW maximum storm surge scenario, a 1/5 AEP wind speed was used for the SW-Case 2 scenario to avoid compounding probabilities unreasonably.

However; for the SE storm scenarios, the incident sea state is initially generated by strong winds blowing across eastern Juan de Fuca Strait from Admiralty Inlet on the US side of the Strait and then further affected by the winds in Haro Strait and then again by the wind in the waters between Haro Strait and the east shoreline of the Saanich peninsula. As the sea state propagates between James Island and Sidney Island in particular, wave dissipation will occur and the dissipated sea state can be re-generated by the decreased winds in this area.

For this assignment, the incident sea states for SE storm scenarios were first estimated in Haro Strait, using a fetch limited assumption across the east end of Juan de Fuca Strait and Haro Strait and then further modified to reflect the influence of Sidney and James Islands and the modification of the wind field in this area. A detailed definition of a wind speed dominated case for the SE direction is beyond the scope of this assignment as it involves estimating overwater wind fields across the entire east of Juan de Fuca Strait during a 1/500 AEP Storm. For this assignment, we have used a conservative scenario of a hurricane force wind speed in the Strait. The estimated 1/500 AEP wind speed, based on modified Victoria Airport data was used for the SE maximum storm surge scenario.

A summary of the wind and offshore wave related parameters for the Designated Storm scenarios is provided in Table 2-4. These scenarios and cases were used to define the expected wave climate at the shoreline, which is further described below.

Table 2-4: Summary of Designated Storm Parameters

Storm Scenario	Case	Description	Wind		Incident Waves		Storm Surge (m)
			Wind Speed (m/s)	Direction (from, °T)	Wave Height, H_s (m)	Period, T_p (s)	
NE	1	Peak wind	22.4	45	-	-	-0.1
NW	1	Peak wind	20.9	320	-	-	-0.1
SW	1	Peak wind	28.6	240	-	-	0.4
SW	2	Peak surge	20.8	240	-	-	0.9
SE	1	Peak wind	33.4	135	5.7	8.4	0.6
SE	2	Peak surge	25.2	135	3.9	7.4	1.3

Definition of the Local Incident Wave Climate

An industry standard wave modeling software, Simulating WAVes Nearshore (SWAN) was used to estimate the expected incident wave climate around the shoreline of the Saanich peninsula.

SWAN is a third-generation numerical wave model developed by Delft University of Technology, which computes the generation and propagation of random, short-crested wind-generated waves in coastal regions and inland waters. It is a spectral (phase averaged) model that is valid on mild slopes for the propagation of waves influenced by shoaling, refraction, currents, and wind forcing. Dissipation of waves due to white-capping, bottom friction, and depth-induced breaking is accounted for in the software. For this project we have utilized SWAN version 41.01A.

Bathymetry and Grids

Bathymetry data for the SWAN model was obtained from an in-house bathymetric model of the SW coast of British Columbia, which was then refined near the Saanich peninsula. The existing model has various sources of bathymetric data, including data available from NOAA, for US waters in Juan de Fuca Strait and the Canadian Hydrographic Services (CHS) for Canadian waters. For this assignment, CHS Chart 3441 and Chart 3447 were digitized and used as references for bathymetric data in the vicinity of the DNS shoreline. An image of the refined bathymetric model is shown in Figure 9.

Three different computational SWAN grids were used for the different storm scenarios as shown in Figure 9. Sensitivity runs were completed to determine the grid size needed to appropriately define the wave climate at the -10m contour.

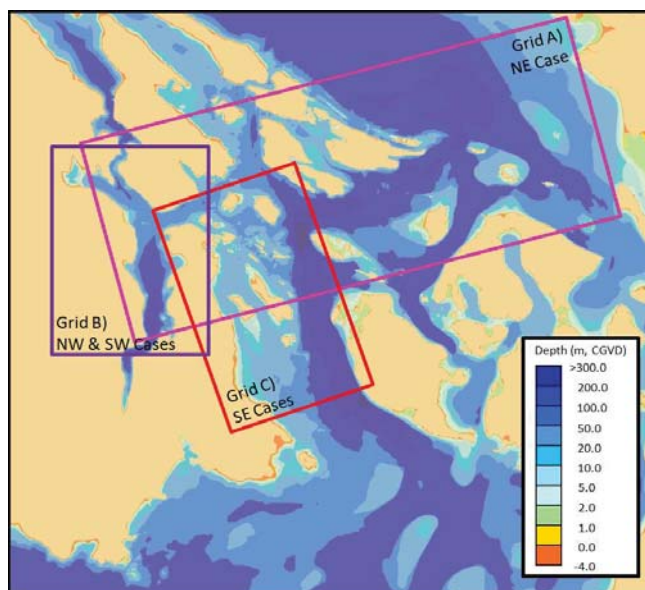


Figure 9: Bathymetric model and SWAN grid extents for designated storm cases

Model Run Scenarios

For the purpose of this project, the six storm scenario cases in Table 2-4 were used to determine the resultant incident wave climate around the Saanich Peninsula.

Whenever possible, it is useful to calibrate numerical wave models with long-term, measured data. The wave buoy in Patricia Bay, which has an approximately 20 year record, was used to calibrate SW and NW winds in order to achieve realistic wave heights during the related model runs. Sensitivity tests were completed to reproduce actual storm events measured at the Patricia Bay Buoy. The tests resulted in the following conclusions:

- SW and NW wind speeds can be reduced to 85% of the modified Victoria Airport wind speeds for numerical modeling purposes to account for the duration-limited wind conditions and stationary modeling methods used for these directions.
- Governing SW winds predominantly occur from 240°, rather than directly down the longer fetch in Saanich Inlet. The shorter 240° fetch results in a more realistic nearshore wave climate in the affected areas.

NE and SE designated storm wind speeds were not reduced, as the Patricia Bay wave buoy is not located in an area indicative of the wind and wave climate on the East side of the Peninsula

A summary of the modeled scenarios and their respective inputs is included in Table 2-5.

Table 2-5: Summary of Model Run Inputs

Storm Scenario	Case	Grid	Winds		Incident Waves at Boundary		Water Level
			Wind Speed (m/s)	Direction (°T from)	H _s (m)	T _p (s)	DFL (m, CGVD)
NE	1	A	22.4	45	-	-	2.4
NW	1	B	17.8	320	-	-	2.4
SW	1	B	24.3	240	-	-	2.9
SW	2	B	17.7	240	-	-	3.4
SE	1	C	33.4	135	5.7	8.4	3.1
SE	2	C	25.2	135	3.9	7.4	3.8

Nearshore Wave Climate

The resulting wave fields for the SW peak wind speed, and SE peak wind speed scenarios, are shown in Figure 10. These images illustrate how the nearshore wave climate can vary significantly along the shoreline for a specific storm scenario. Images showing the resulting wave fields for all storm scenarios are provided in Appendix A.

The nearshore wave characteristics, generally along the -10 m CGVD28 contour, but in some cases, in shallow water areas, along the -5 m or -2 m CGVD28 contour, are shown in Figure 11 for the SW peak wind speed and SE peak wind speed scenarios for 1m of SLR. Summaries of the nearshore sea states along specific reaches of the DNS shoreline, for all scenarios, are provided in Appendix B.

It should be noted these summaries of the nearshore wave climate do not include the potential influence of floating structures (docks or moored vessels) which in some cases, especially near marinas, could attenuate wave energy.

District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise

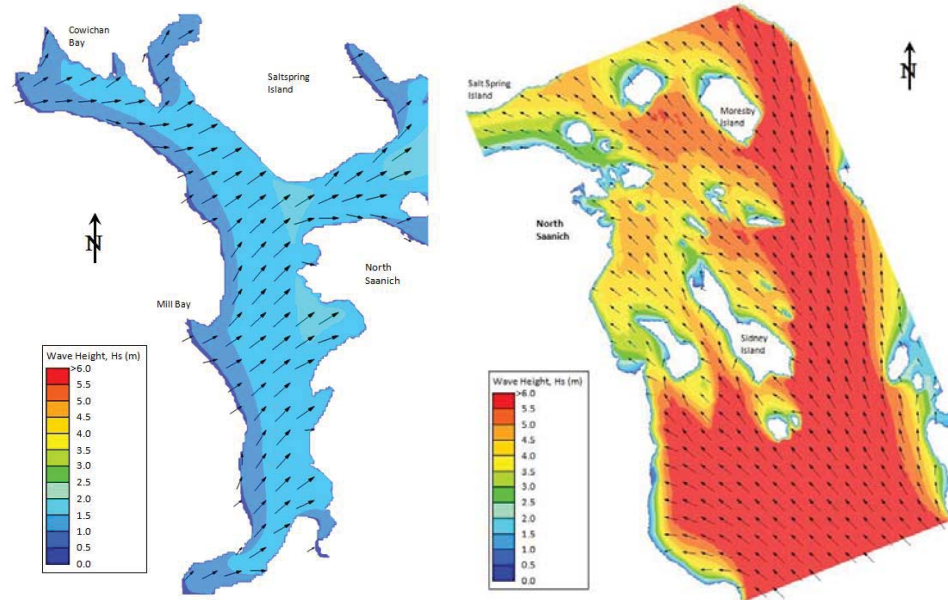


Figure 10: SWAN results for SW peak wind speed (left), and SE peak wind speed (right), 1m SLR

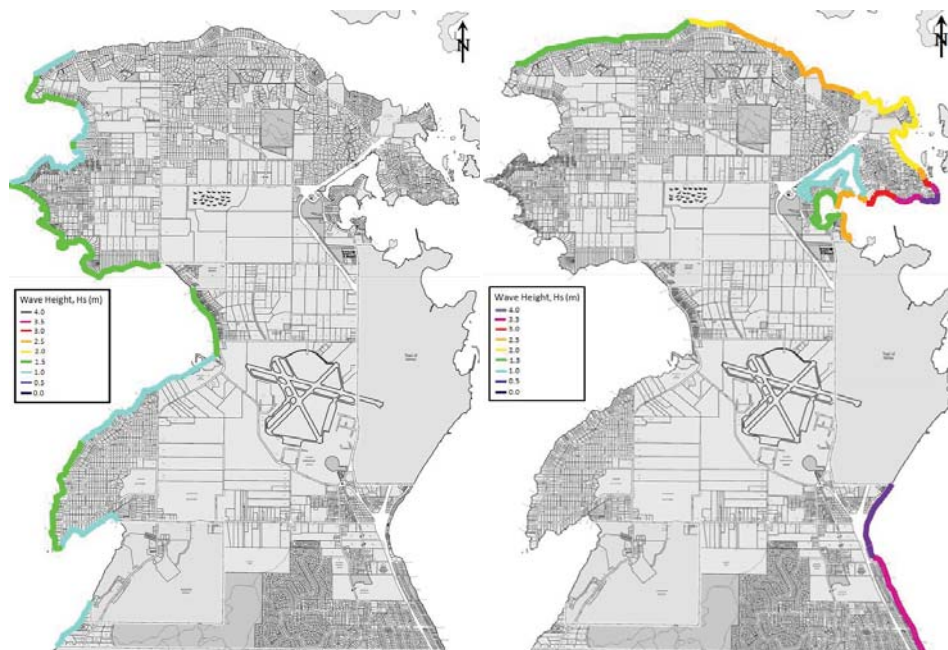


Figure 11: Compiled nearshore seastate, SW peak wind speed (left) and SE peak wind speed (right), 1m SLR

2.5. Wave Effects

The nearshore wave climate results described in Section 2.4 were then used to define the expected Wave Effects around the DNS shoreline for the governing storm scenarios. Wave effects are site and shoreline dependent, and reflect the interaction of the incident waves with a particular shoreline feature. In general terms the Wave Effects will either be wave run-up on the shoreline or wave overtopping of shoreline features such as seawalls or rock revetments. The Wave Effects can result in flooding depending on the elevation of the lands adjacent to the shoreline.

Wave run-up is the vertical distance that water runs up the shoreline/structure slope during the Designated Storm. Wave overtopping is the volume of water that travels over the structure crest and can range from a small amount of spray to a sufficiently large volume capable of damaging structures or flooding of the land. Wave overtopping can be quantified by an average discharge rate, q , in L/m/s (liters/meter of shoreline/second). The average rate of overtopping is essentially defined by the crest elevation of the shoreline structure crest elevation. It should be noted that actual overtopping will occur in individual wave related pulses of water, which, averaged over time, will equal the average discharge rate.

The shoreline types utilized in estimating wave effects are discussed below. A discussion on the appropriate overtopping threshold for defining FCLs is also provided in the following sections.

Shoreline Types

A site visit was conducted by boat on January 14, 2016, to identify the different shoreline types above the high water line around the DNS shoreline. In general, shoreline types range from tall vertical cliffs to mildly sloping beaches. In general, the characteristics of the DNS shoreline can be classified into 3 main types, as illustrated in Figure 12:

- Erodible natural shorelines (green)
- Non-erodible natural shorelines (grey)
- Seawall or revetments (black)

Reaches

The DNS shoreline was divided into 39 reaches, based on the observed shoreline composition and the characteristics of the nearshore wave climate as summarized in Section 2.4. The reaches, alternating in red and blue, are illustrated in Figure 12.

District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise

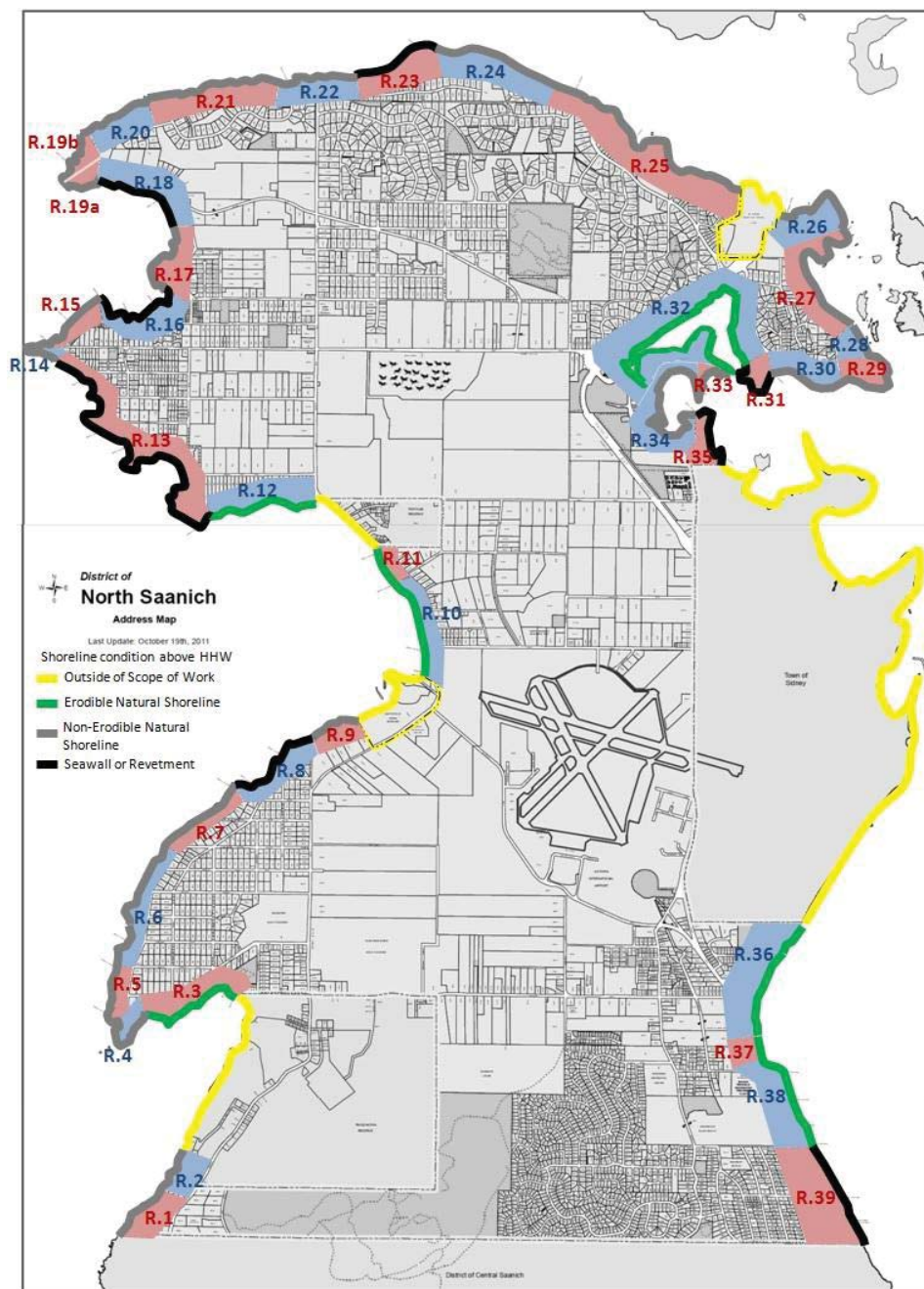


Figure 12: Shoreline Reaches R.1 to R.39

Overtopping Thresholds

In order to determine crest elevations, and therefore FCLs, a threshold for overtopping must be specified. Generally, an overtopping threshold of $q = 10 \text{ L/m/s}$ results in a crest elevation that provides safety and security against flooding to personnel or property behind the shoreline. A threshold of $q = 100 \text{ L/m/s}$ assumes a lower crest elevation and results in more flooding and overtopping. This can mean that it is very dangerous for pedestrians and/or trained staff. This higher threshold also implies wave overtopping that is sufficient to result in damage to any shoreline structures and flooding, with standing water, up to the same elevation as the FCL.

Figure 1312 illustrates the level of flooding associated with these two thresholds.

For the purpose of this study, an overtopping threshold of $q = 10 \text{ L/m/s}$, was used, which is associated with significantly less risk to people and structures.

Sensitivity tests were also completed using a set of identical nearshore wave conditions to determine the sensitivity of FCL's to the chosen overtopping threshold. The results from these tests are detailed in Appendix D. In Reaches 1 and 32, for example, the overtopping threshold had no effect because wave heights and effects are almost negligible. In highly exposed areas, such as Reach 36, an overtopping rate of 10 L/m/s increases the FCL to 1.5 times the 100 L/m/s FCL; however it implicitly implies a much safer scenario on the related reaches.

Wave Effects

The estimated Wave Effects for each Designated Storm scenario on each shoreline reach for an average overtopping rate (q) of 10 L/m/s were assessed using the industry standard software BREAKWAT, which is capable of assessing all types of shore structure types. BREAKWAT was used to calculate the crest elevation required above the Designated Flood Level (DFL) to limit the average rate of overtopping to the previously mentioned thresholds. The following additional assumptions were made in estimating the Wave Effects:

- The maximum intertidal slope, from the toe of any shoreline feature to the nearshore contour = 1:10
- Wave Effects are based on common shoreline feature for each reach



Figure 13: Recent overtopping events in BC corresponding to approximately $q = 10 \text{ L/m/s}$ (top) and $q = 100 \text{ L/m/s}$ (bottom)

3. FINDINGS

Flood Construction Levels define either the underside elevation of a wooden floor system for habitable buildings, or the top elevation of a concrete slab for habitable buildings. FCLs should not be interpreted as a required ground elevation surrounding a building intended for human habitation. Other measures, including drainage or wet or dry flood proofing measures may be appropriate where ground levels are lower than the FCL.

Flood Construction Levels were calculated as the sum of the following components for any given reach [2]:

- Designated Flood Level (DFL)
- Estimated Wave Effects during Designated Storm
- Freeboard Allowance

A freeboard allowance of 0.6 m, as recommended in the 2011 Provincial Guidelines is included unless otherwise noted. The factors included in the Freeboard Allowance are discussed further below.

3.1. Revised Flood Construction Levels

The revised FCLs are provided in **Figure 15 Figure 14 and Figure 15** for a future sea level rise of 0.5m and 1.0m, respectively, for a overtopping rate $q = 10 \text{ L/m/s}$. As noted above, the overtopping threshold of $q = 10 \text{ L/m/s}$ results in an elevation that provides safety and security against flooding to personnel or property behind the shoreline.

At this threshold, 25 reaches have FCL's for a 1.0m Sea Level Rise scenario that are lower than the existing uniform CRD estimate of 5.04 m. The remaining 14 reaches have higher FCL's largely due to the shoreline exposure or shoreline characteristics.

The 0.5m SLR scenario resulted in reaches with FCL's that are between 0.4m and 1.1m lower than the 1.0m SLR scenario FCL's, depending on location. This reduction is largely due to a reduction in water depth which also serves to limit nearshore wave heights. For this scenario, 30 reaches have revised FCL's lower than the CRD estimate and only 9 reaches have higher FCL's.

District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise

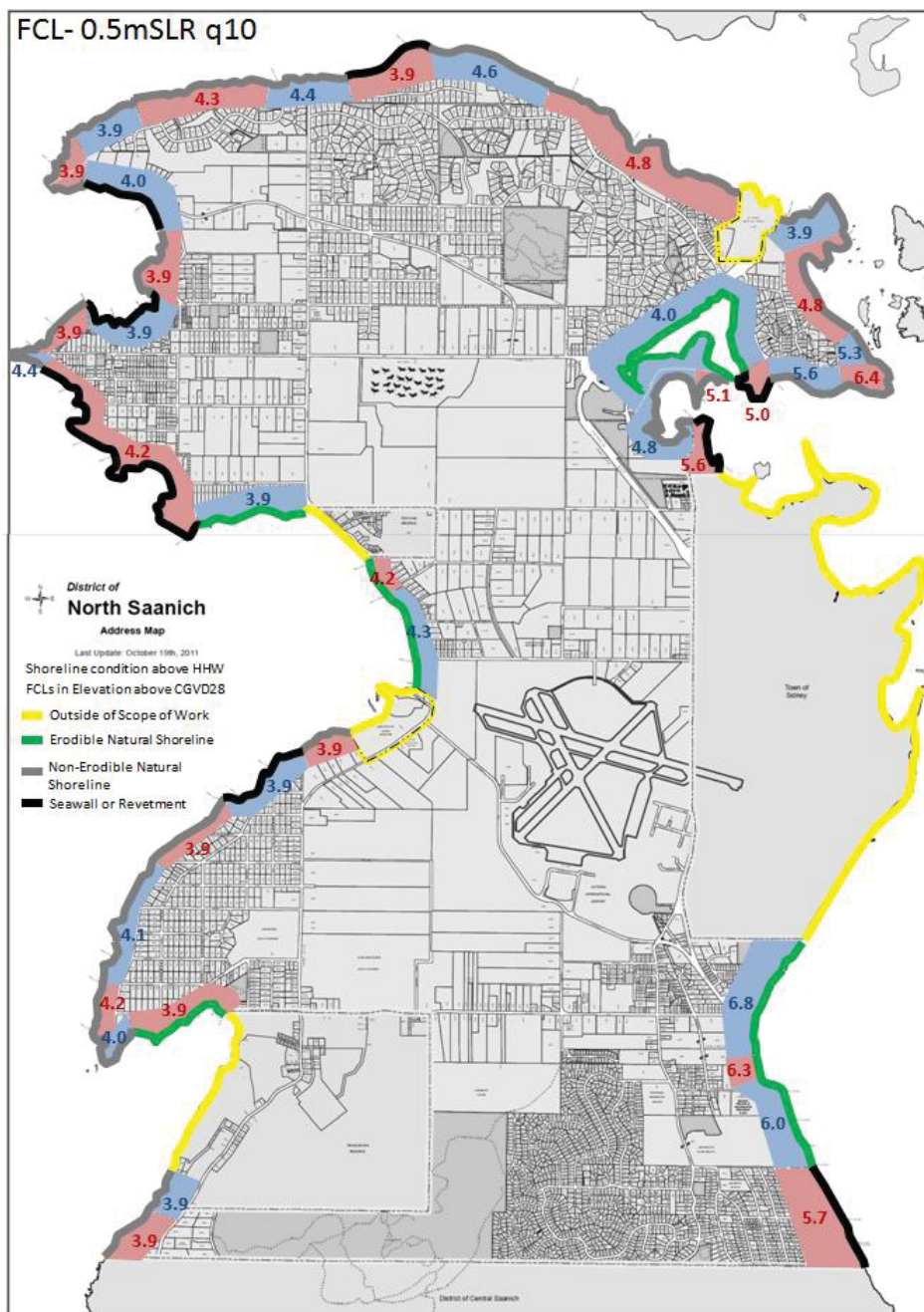


Figure 14: FCL's for 0.5m Sea Level Rise

District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise

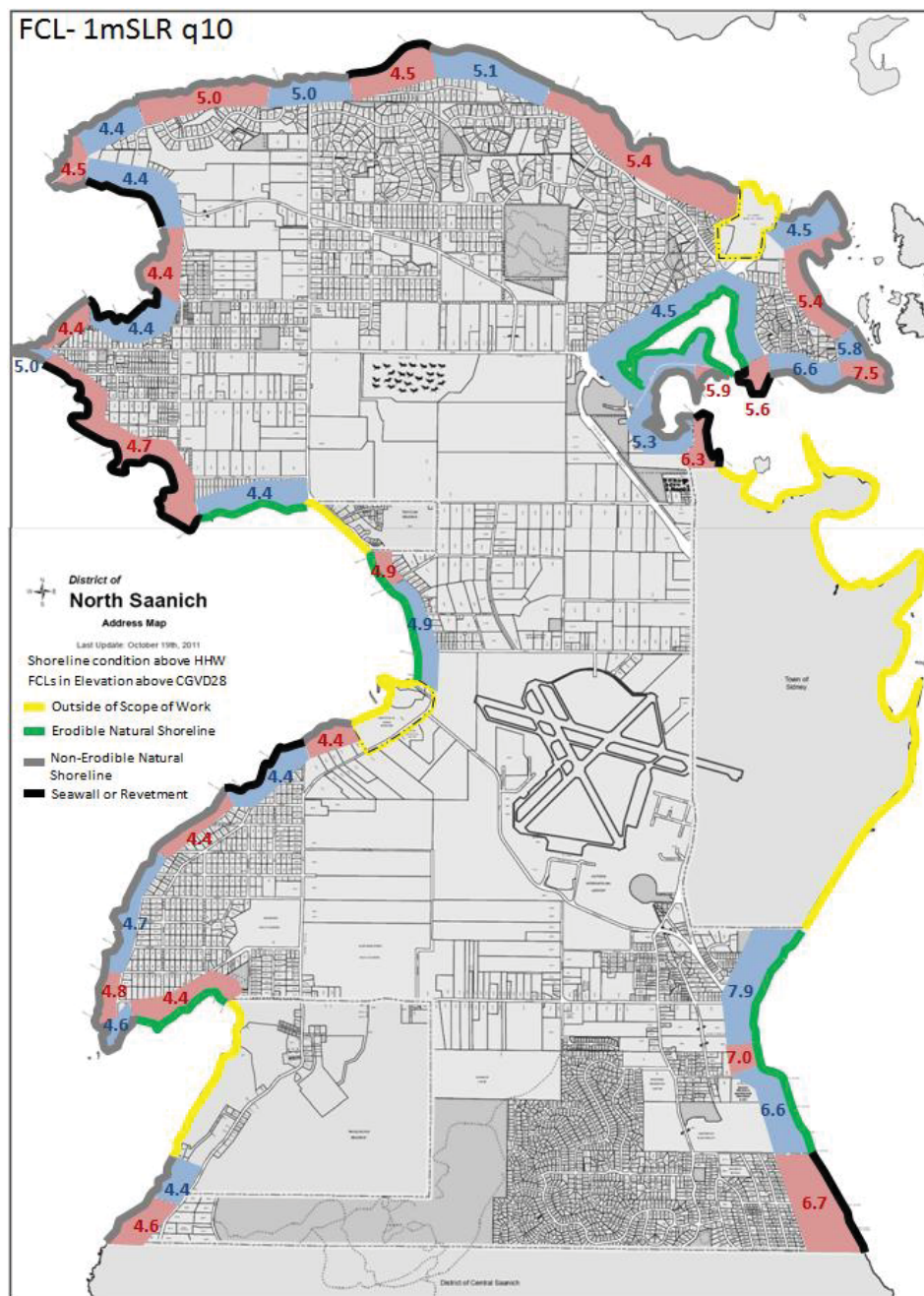


Figure 15: FCL's for 1.0m Sea Level Rise

3.2. Affected Lots

There are approximately 713 properties along the DNS shoreline that are exposed to the future threat of sea level rise and the associated wave related effects. For the purpose of understanding how these lots are affected by the FCL's, we have used the following criteria:

Directly Affected:

1. Lot is not affected: The FCL elevation does not encroach into the lot.
2. Lot is partially affected: The FCL elevation encroaches less than a 15m setback on the lot.
3. Lot is partially flooded: The FCL encroaches beyond a 15m setback, but does not inundate the entire lot.
4. Lot is completely inundated: The FCL elevation encroaches on the entire lot and possibly further landward.

Indirectly Affected:

1. Lot is adjacent to a lot where flooding is expected, which is substantially greater than the flooding for the reference lot.
2. Lot is adjacent to a completely inundated lot.

The levels of inundation were defined using a digital elevation model (DEM) of the District of North Saanich based on LiDAR measurements of District topography. The DEM was provided by the DNS. Lot boundaries are based on Cadastral mapping also provided by the DNS.

Criteria 1 implies that the FCL will have little to no effect on applicable lots and mainly occurs where the shoreline is steep and high.

Lots where Criteria 2 is applicable will have limited flooding or wave interaction, provided that the main building is landward of a 15m setback. Lots affected by Criteria 3 and 4, may require protection or other measures.

Indirectly affected lots are dependent on the action of the adjacent lots. For example, if a waterfront lot constructs a sea wall, the adjacent lots may be impacted by overtopping.

The number of lots affected by 1m and 0.5m FCL's for an overtopping threshold of 10 L/m/s are summarized in Table 3-1. These values are based on the map of the revised FCL's for the entire Peninsula, included in Appendix C.

It is important to note that the total number of directly affected lots is equal to the total number of waterfront lots in the DNS. For the purpose of this analysis, waterfront lots are defined as properties directly adjoined to the ocean, not including parks or areas out of the Scope of Work as defined in Section 1. We also assumed that for properties affected by more than one FCL, the higher FCL governs.

The indirectly affected lots includes lots already counted as directly affected and lots that are typically inland (generally across a road right of way) of a waterfront lot.

Table 3-1: Summary of lots affected by the revised FCL's

Criteria	Number of Lots	
	0.5m SLR	1.0m SLR
Directly Affected Lots		
Criteria 1	83	48
Criteria 2	499	502
Criteria 3	67	81
Criteria 4	64	82
Total	713	713
Indirectly Affected Lots		
Criteria 5	17	31
Criteria 6	37	46
Total	54	77

3.3. Uncertainties

As discussed previously, a freeboard allowance of 0.6 m was included in the FCL's to account for uncertainties, which include the following:

- A uniform 1:10 intertidal slope was used based on observations during the field reconnaissance. Steeper slopes could increase the Wave Effects.
- Although the shoreline is sub-divided into 39 reaches, variation in shoreline type, slope, and orientation still exist within each reach. Some of these variations could result in either higher or lower Wave Effects within each reach.
- Nearshore wave heights and wave effects do not consider the effects of local structures, vessels, or docks.
- The numerical wave model computational grid has 100m grid spacing, which is appropriate when considering a 1-2km reach length, but fails to capture some local complexities, such as rapid changes in bathymetry, narrow channels, or small islands, which may be important for an individual lot assessment.
- Shoreline orientations are averaged over the entire reach and within a reach, some lots may be more exposed or less exposed to the Designated Storms.
- Some reaches may be more exposed to waves generated by another wind direction, other than that considered by the Designated Storms. This is an inherent uncertainty of completing FCL's on a highly variable shoreline at a scale larger than that of the individual lot. However, these risks have been appropriately balanced by using some conservative engineering approaches, such as a lower overtopping threshold of $q = 10 \text{ L/m/s}$, and by applying a 0.6m freeboard.
- The refined FCL's are largely based on modifications of the recorded overland wind measurements from Victoria Airport and calibration with the Patricia Bay Buoy wind and wave data for SW and NW winds. Ideally, overwater wind measurements would also be available on the East side of the peninsula to validate the modifications made in this study for SE and NE winds.

- The Wave Effects are largely based on the wind climate from the last 60 years of measurements made at Victoria Airport. Climate change is expected to increase the frequency of severe weather events and possibly the intensity of these same events.
- There is a significant variation in present estimates of the future rate of SLR. The flow of new information and science related to future rates of SLR consistently indicates that SLR will occur faster than indicated by the 2011 Provincial Planning Curve. There is no scientific information that suggests rates will be lower. The freeboard allowance of 0.6 m provides an allowance for this particular uncertainty, the magnitude of which also depends on the magnitude of other relevant uncertainties in the calculations.

4. GLOSSARY

Abbreviations and definitions of terms used in this report are listed below.

4.1. Abbreviations

AEP	Annual Exceedance Probability	The probability (or % chance) of a specific event occurring or being exceeded in any given year.
CD	Chart Datum	In the DNS area, CD is 2.2m (± 0.1 m) below Geodetic Datum (CGVD28).
CGVD28	Canadian Geodetic Vertical Datum (1928)	In most places in Canada, this is the current reference datum for terrestrial vertical elevations and is generally the same as mean sea level, based on astronomical tides alone. A detailed description is available online at: http://www.nrcan.gc.ca/earth-sciences/geomatics/geodetic-reference-systems/9054# Canadian Geodetic Vertical 1 . CGVD28 is being replaced with a newer datum plane based on a North American common geoid. The new datum is notionally equivalent to the local coastal mean sea level. Details are available online at: http://www.nrcan.gc.ca/earth-sciences/geomatics/geodetic-reference-systems/9054# Benchmarks Information
CRD	Capital Regional District	
DFL	Designated Flood Level	A water surface elevation which includes appropriate allowances for future SLR, land crustal movement, tide, and storm surge during the Designated storm.
DPA	Development Permit Area	Refers to Development Permits as per Division 7 of the LGA or Section 14 of the OCP.
DS	Designated Storm	A storm which includes concurrent time series of winds, storm surge and waves, with a specific AEP.
FCL	Flood Construction Level	Defined as the underside elevation of a wooden floor system or the top elevation of a concrete slab, for habitable buildings [2].
	Floodplain Bylaw	Bylaw designated under Section 524 of the <i>Local Government Act</i> .
HHWLT	Higher High Water Large Tide	The average of the annual highest tide over an 18.6 year complete tidal cycle. In the DNS area, HHWLT is 1.5 m above Geodetic Datum (CGVD28) and 3.7 m above Chart Datum (± 0.2 m).
LGA	Local Government Act	Refers to the updated <i>Local Government Act</i> (RSBC 2015), which was

made current as of October 26, 2016 .

MTF	Marine Task Force	Refers to the individuals responsible for the MTR.
RSBC	Revised Statutes of British Columbia	
SDA	Special Development Area	Refers to Special Development Area as per Section 13 of the OCP.
SLI	SNC Lavalin Inc	
SLR	Sea Level Rise	The rise in sea level including: global sea level rise driven by global warming and local sea level rise driven by regional tectonic or isostatic (glacial) subsidence or uplift.
SWAN	Simulating WAVes Nearshore	Wave modelling software, which can simulate wave generation, propagation, dissipation and transformation to the shoreline.
°T	Degrees, True North	Direction in degrees, with respect to True North.

4.2. Definitions

2011 Provincial Guidelines	Guidelines posted by BCMOE, BCMOE (2011a,b,c), and available online at: http://www.env.gov.bc.ca/wsd/public_safety/flood/fhm-2012/draw_report.html#3
Estimated Future Natural Boundary	The estimated location of the future Natural Boundary after sea level has risen, usually by a defined amount. Defined in the 2011 Provincial Guidelines .
Fetch	The horizontal distance over open water (in the direction of the wind) over which wind generates waves.
Foreshore	That part of the shoreline extending between the upper limit of wave interaction with the shoreline and the low tide elevation. Typically the inland limit of the foreshore would be landward of the Natural Boundary .
Freeboard	A vertical allowance added to the DFL and the Wave Effect allowance to establish the FCL. This allowance is generally included to cover any uncertainties in defining the FCL.
Geodetic Datum	The reference plane for terrestrial vertical elevations in Canada and in general approximately equal to mean sea level.
Natural Boundary	The present Natural Boundary as defined in the British Columbia <i>Land Act, Section 1</i> .

District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise



Nearshore	An indefinite zone extending seawards from the shoreline to deepwater, typically well seaward of the breaker zone and in water depths in the order of 20 m.
Overtopping	The passage of water over the crest of a shoreline or shoreline structure as a result of wave run-up.
Residual Water Level	The component of the measured water level that is not attributed to tidal effects. The residual water level is generally assumed to be approximately equal to the storm surge. Calculated as the measured total water level minus the predicted tides at a given location.
Run-Up	The vertical distance travelled by the action of individual waves that break and travel up the shoreline or slope of a shoreline structure.
Storm Surge	The non-tidal rise/fall in a body of water due to atmospheric effects.

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6. NOTICE TO READERS

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District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise



7. REVISION INDEX AND SIGNATURES

Document No.: 634533-3000-41ER-0001


Issue Code	Rev. No	Date (yyyy-mm-dd)	Description of Changes	Initials
RR	PA	2016-09-19	Released for Internal Review	JW
RR	PB	2016-09-21	Released for Client Information and Comment	JSR
RR	PC	2017-01-04	Comments Incorporated	JSR
RI	0	2018-03-27	Released for Information and Client Use	JSR

Issue Codes:

RC	Released for Construction
RD	Released for Design
RF	Released for Fabrication
RI	Released for Information
RP	Released for Purchase
RQ	Released for Quotation
RR	Released for Review and Comments


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District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results



APPENDIX A – SWAN Results

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results

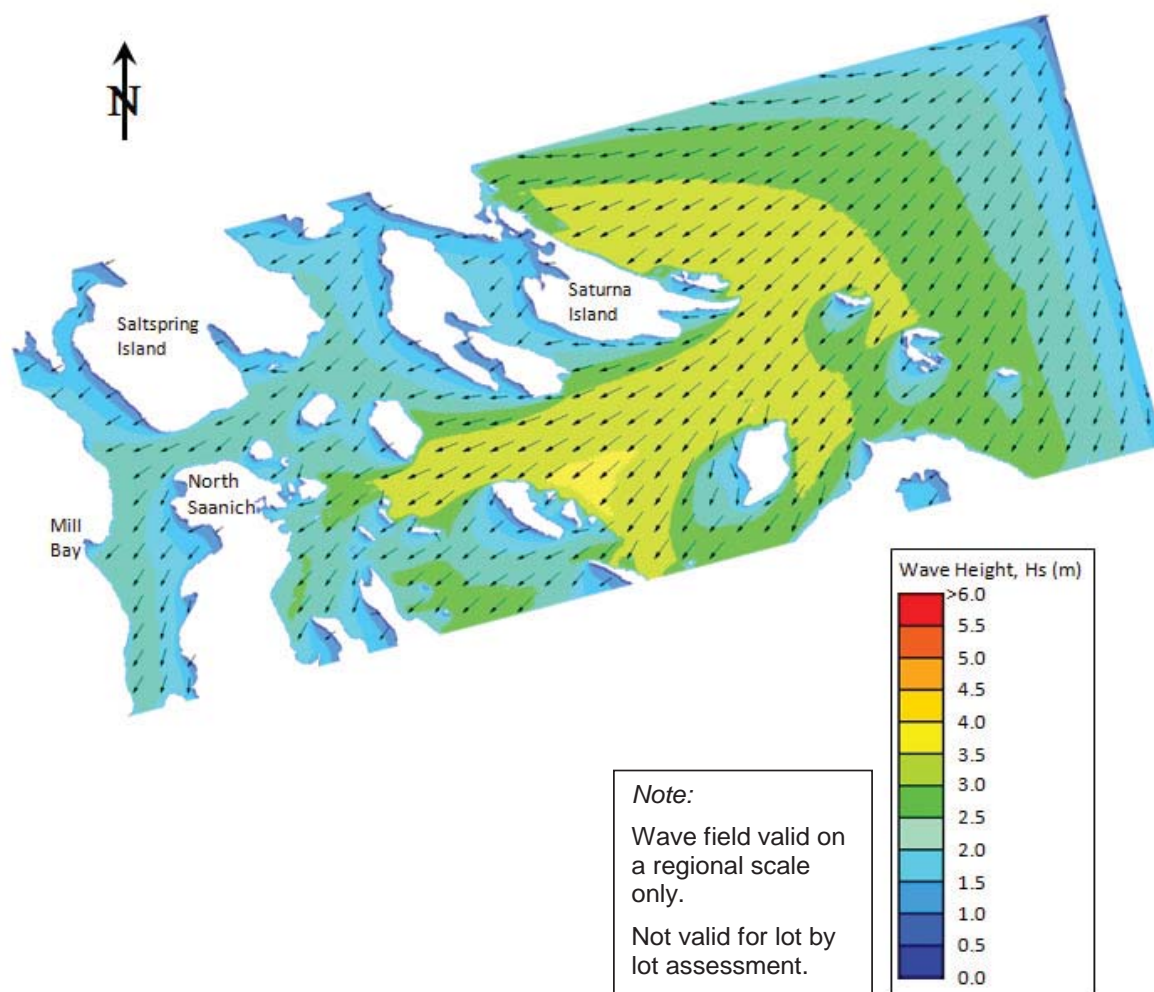


Figure 1: SWAN results for the NE peak wind speed scenario for 0.5m SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results

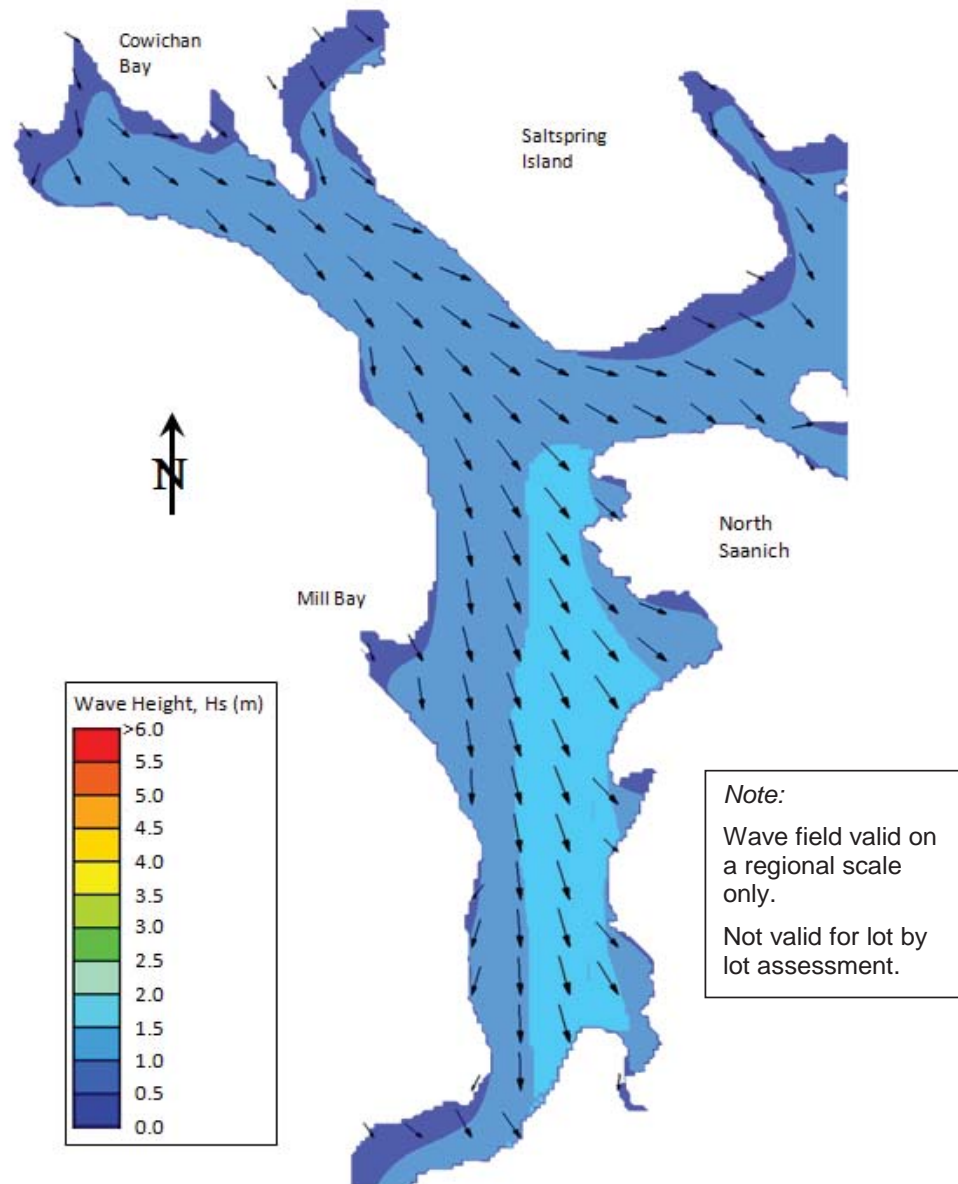


Figure 2: SWAN results for SWAN for the NW peak wind speed scenario for 0.5m SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results

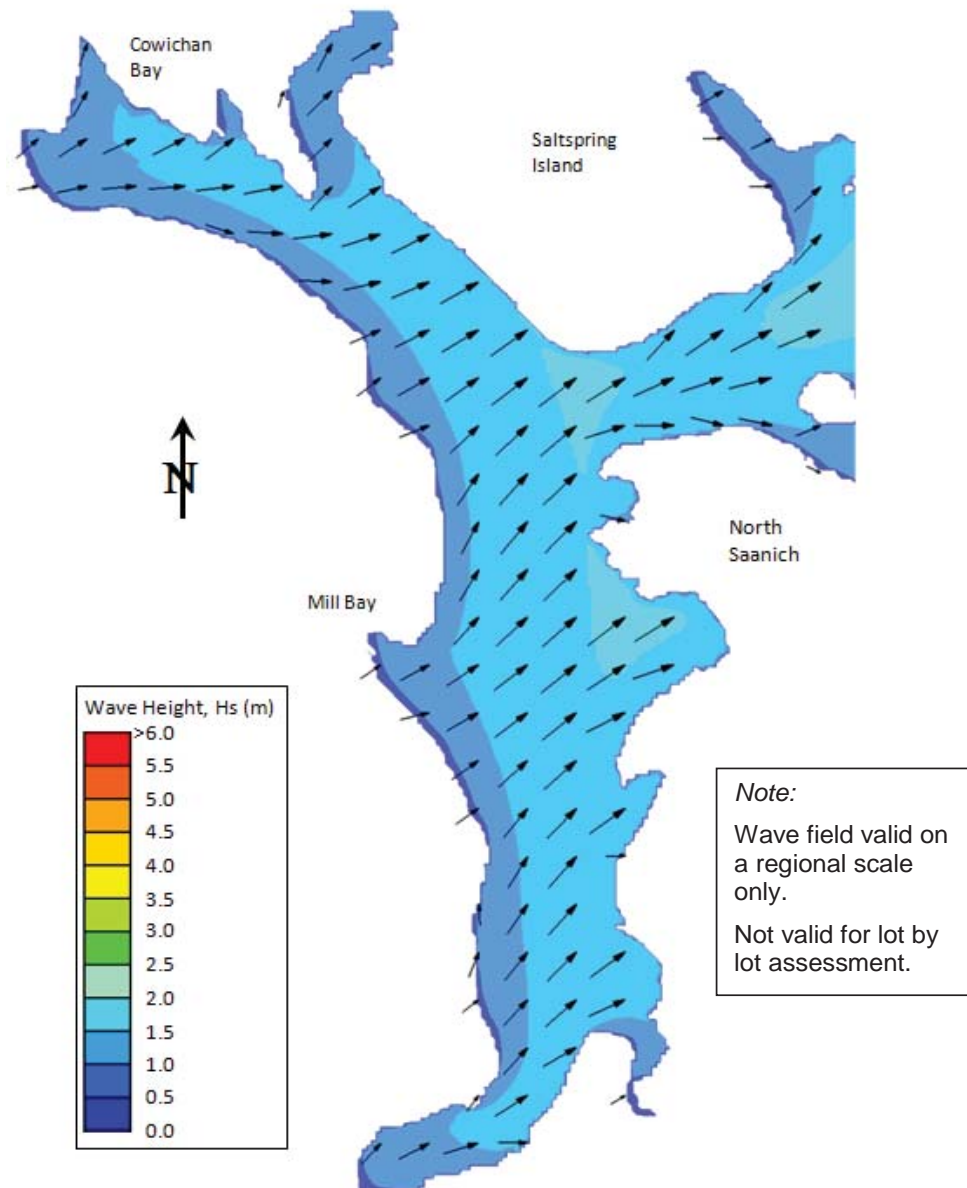


Figure 3: SWAN results for SWAN for the SW peak wind speed scenario for 0.5m SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results

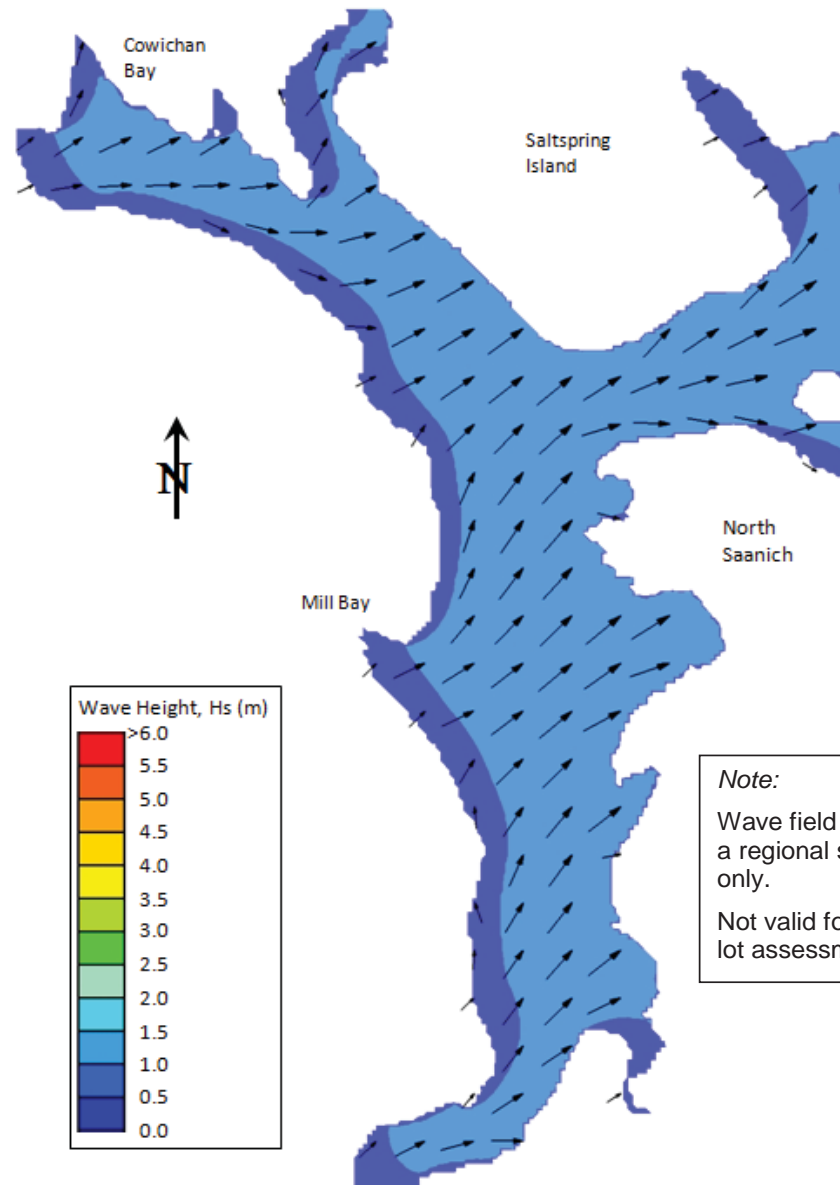


Figure 4: SWAN results for SWAN for the SW peak storm surge scenario for 0.5m SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results

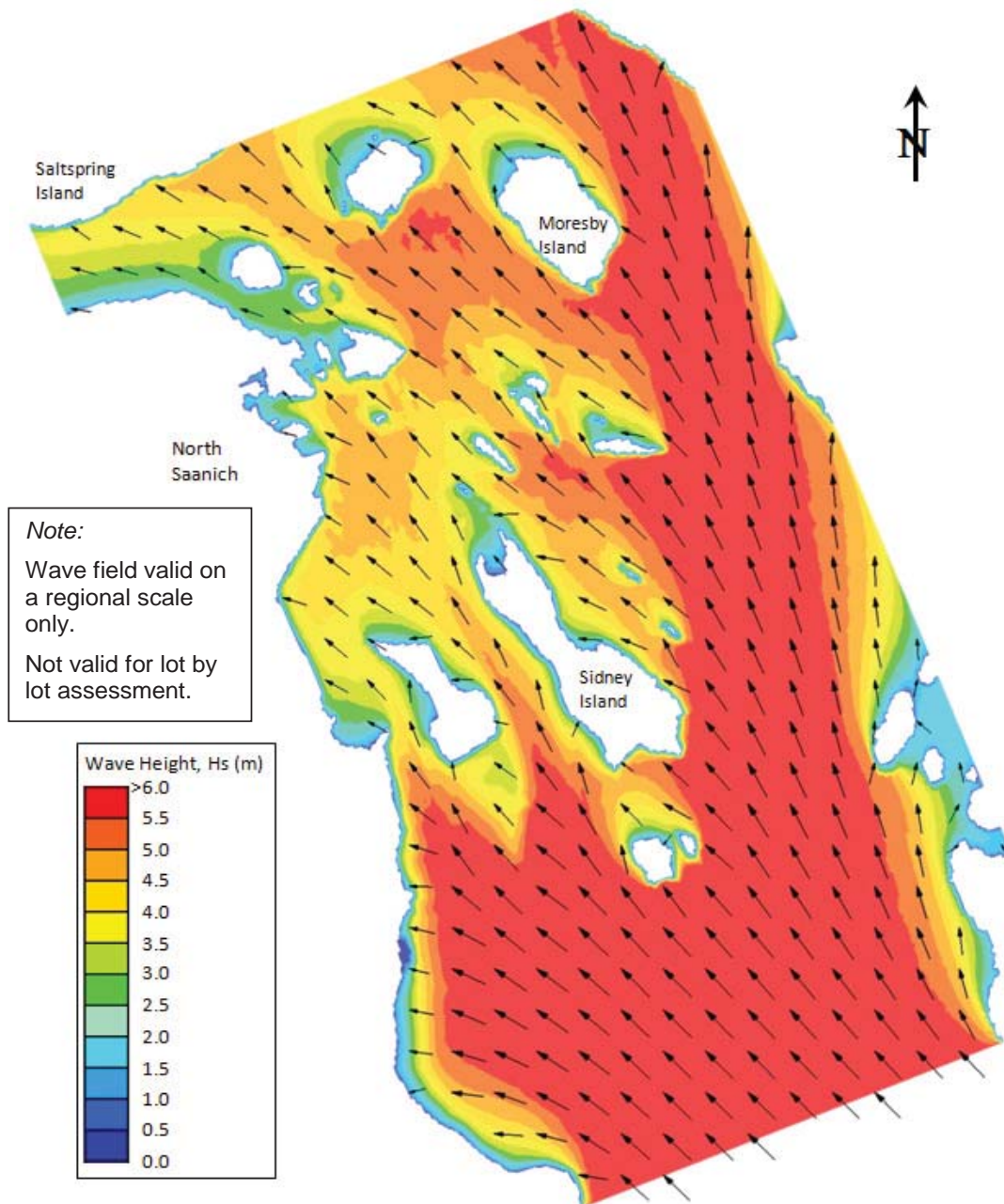


Figure 5: SWAN results for SWAN for the SE peak wind speed scenario for 0.5m SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results

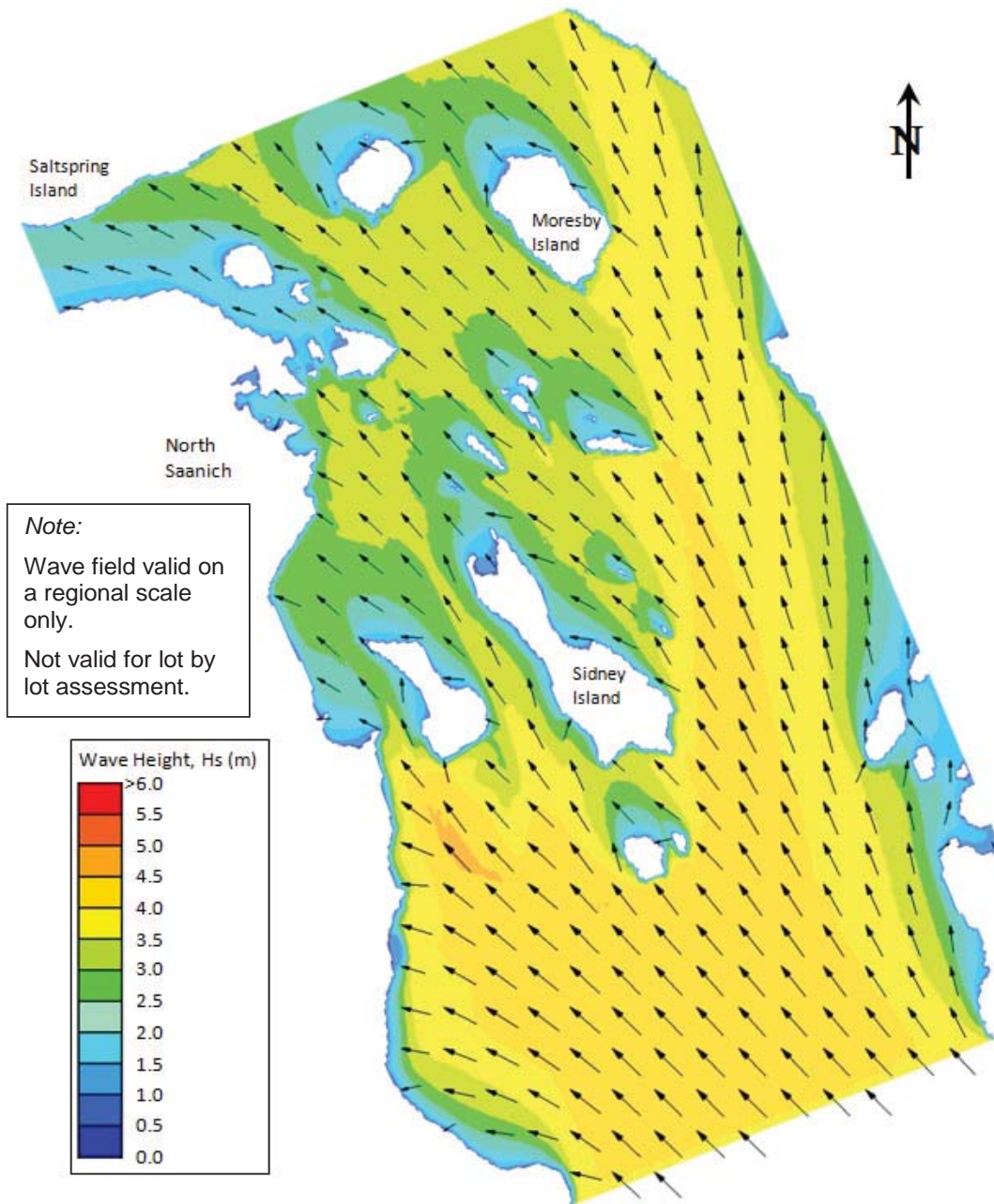


Figure 6: SWAN results for the SE peak storm surge scenario for 0.5m SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results

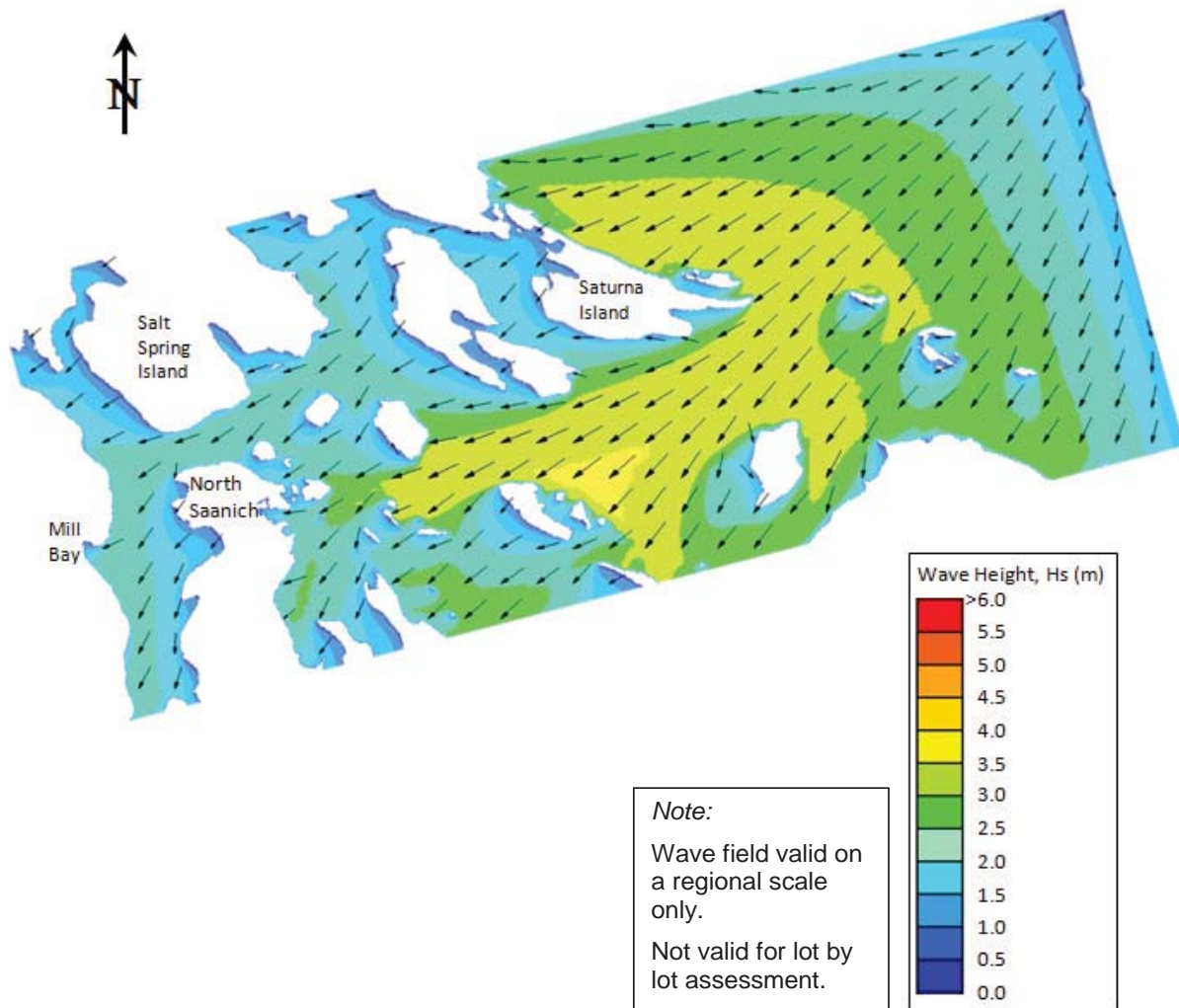


Figure 7: SWAN results for the NE peak wind speed scenario for 1m SLR

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Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results

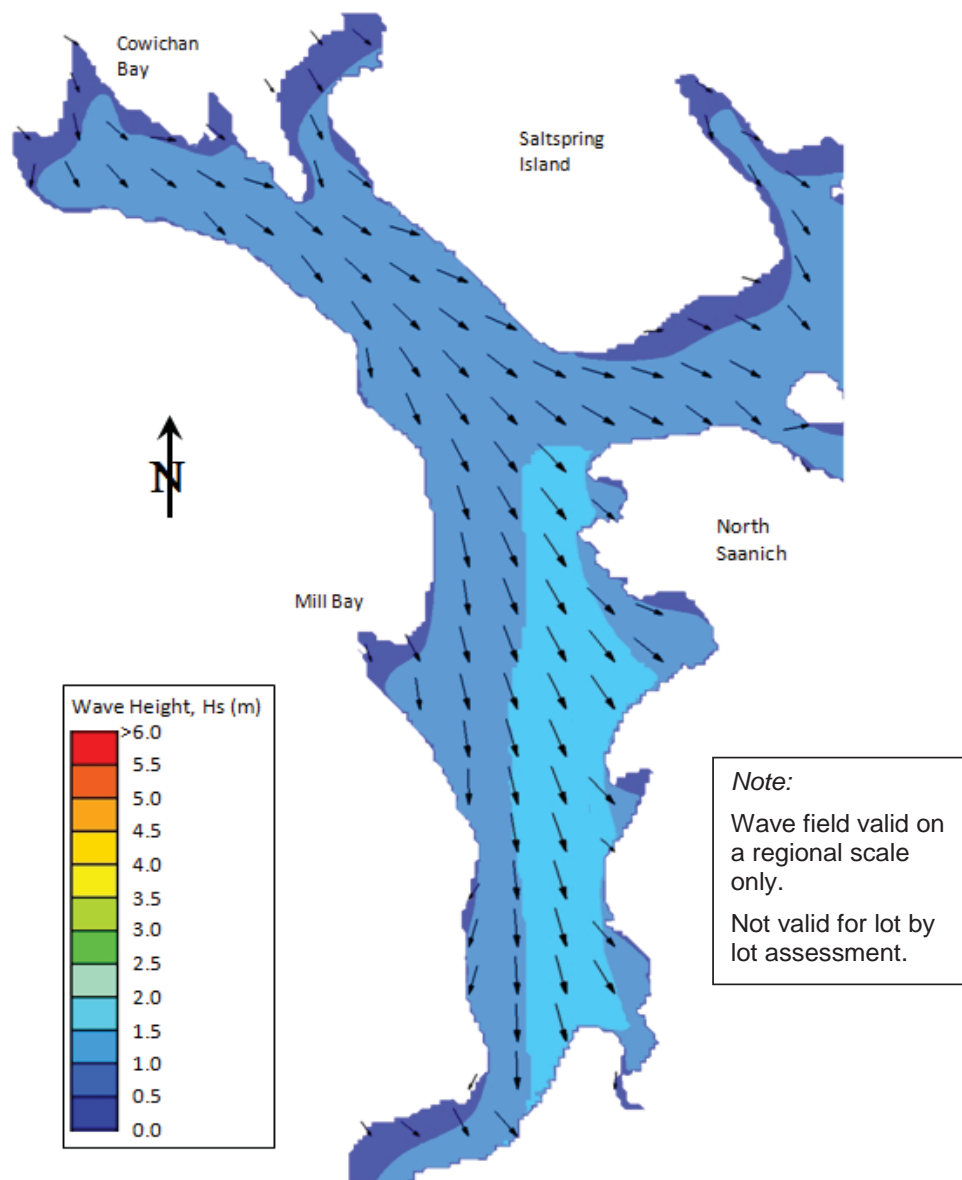


Figure 8: SWAN results for SWAN for the NW peak wind speed scenario for 1m SLR

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APPENDIX A – SWAN Results

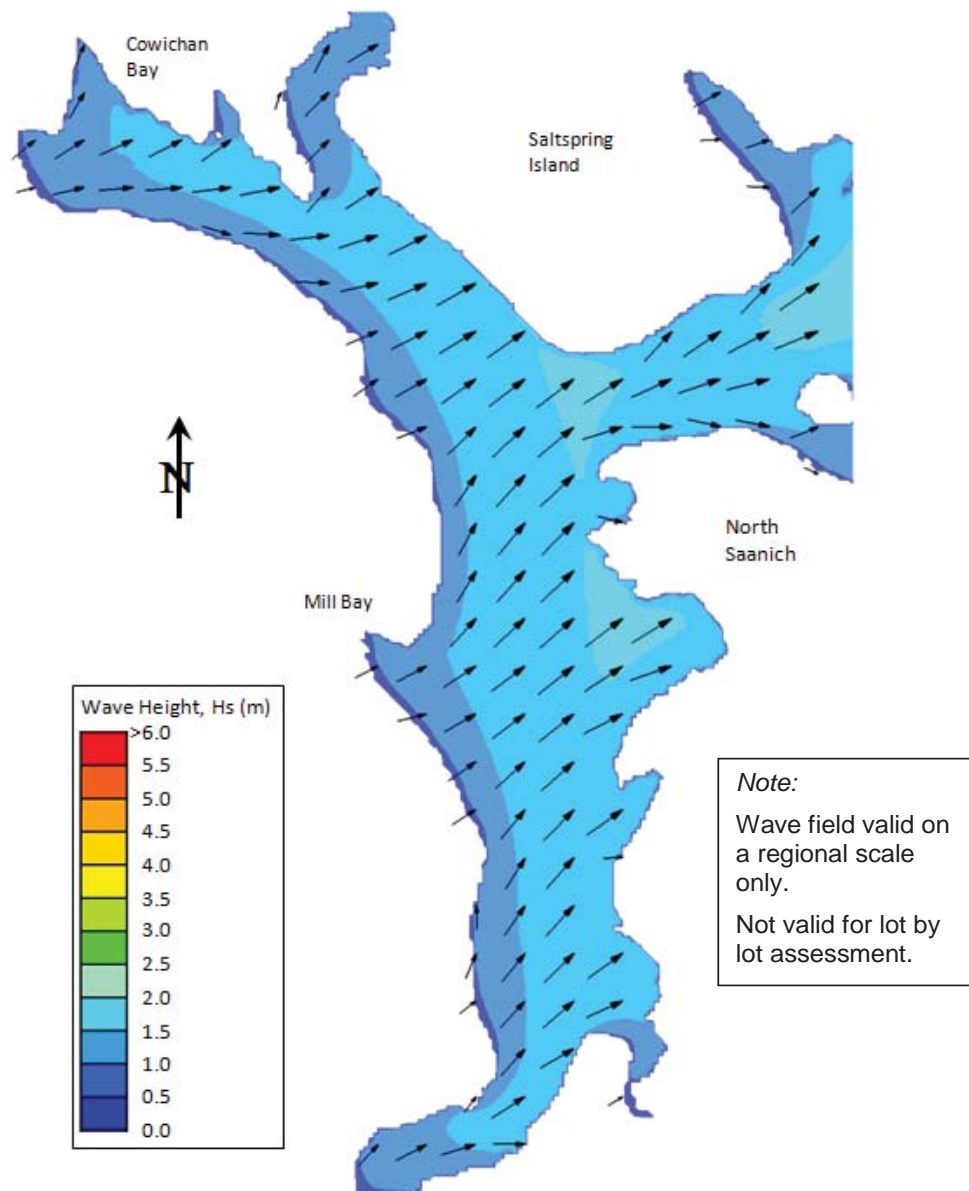


Figure 9: SWAN results for SWAN for the SW peak wind speed scenario for 1m SLR

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Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results

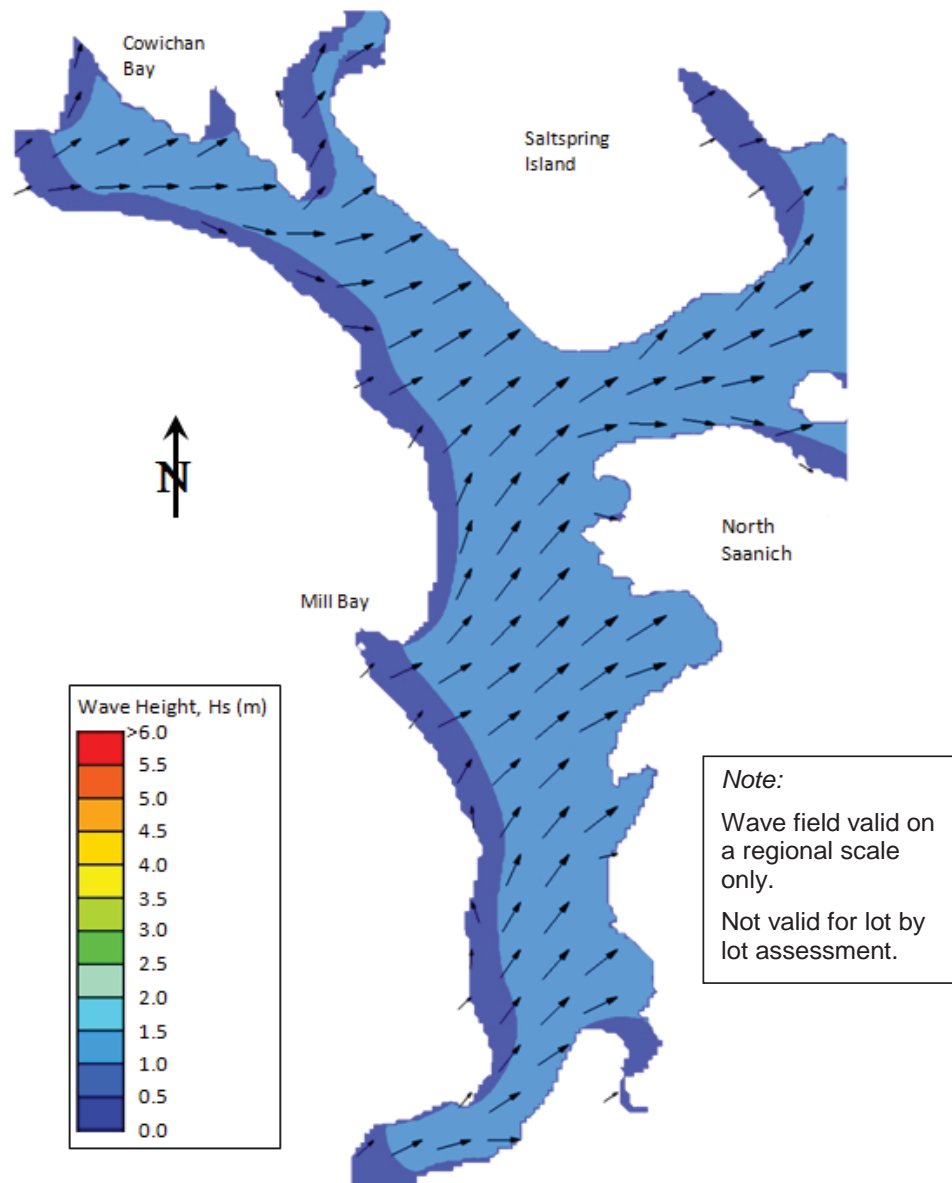


Figure 10: SWAN results for SWAN for the SW peak storm surge scenario for 1m SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results

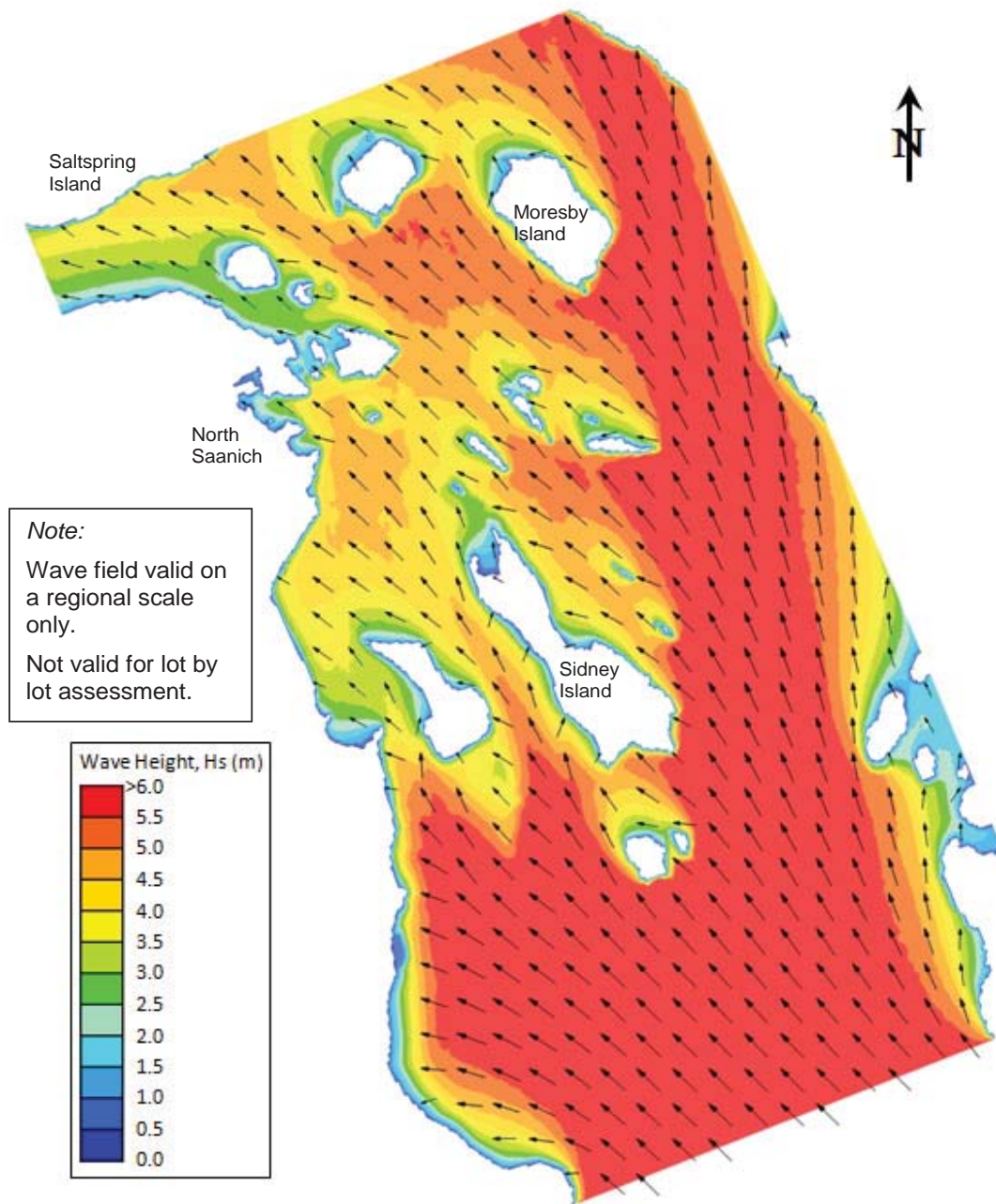


Figure 11: SWAN results for SWAN for the SE peak wind speed scenario for 1m SLR

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APPENDIX A – SWAN Results

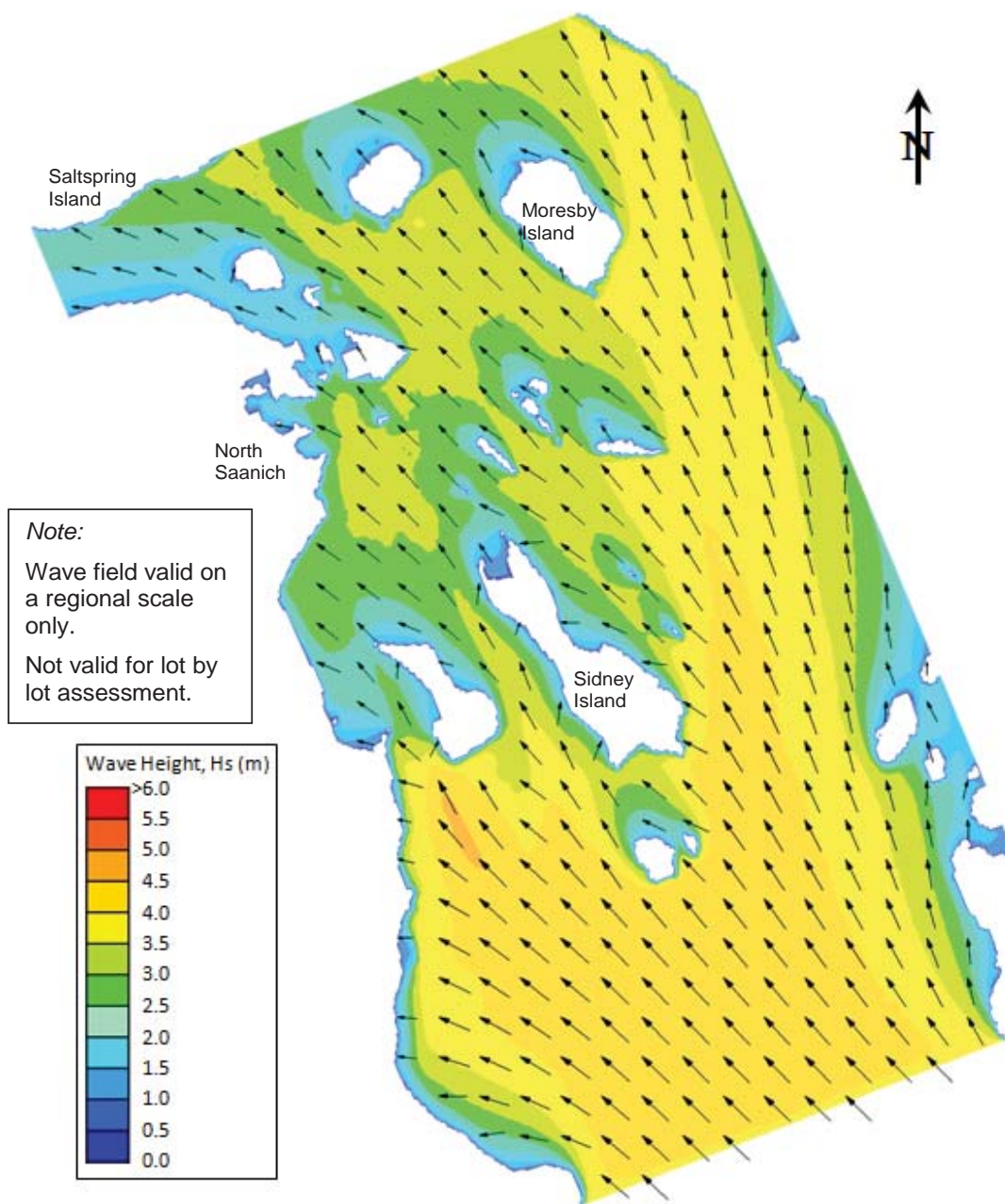


Figure 12: SWAN results for the SE peak storm surge scenario for 1m SLR

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Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results



APPENDIX B – Nearshore Wave Climate

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX B - Incident Wave Climate

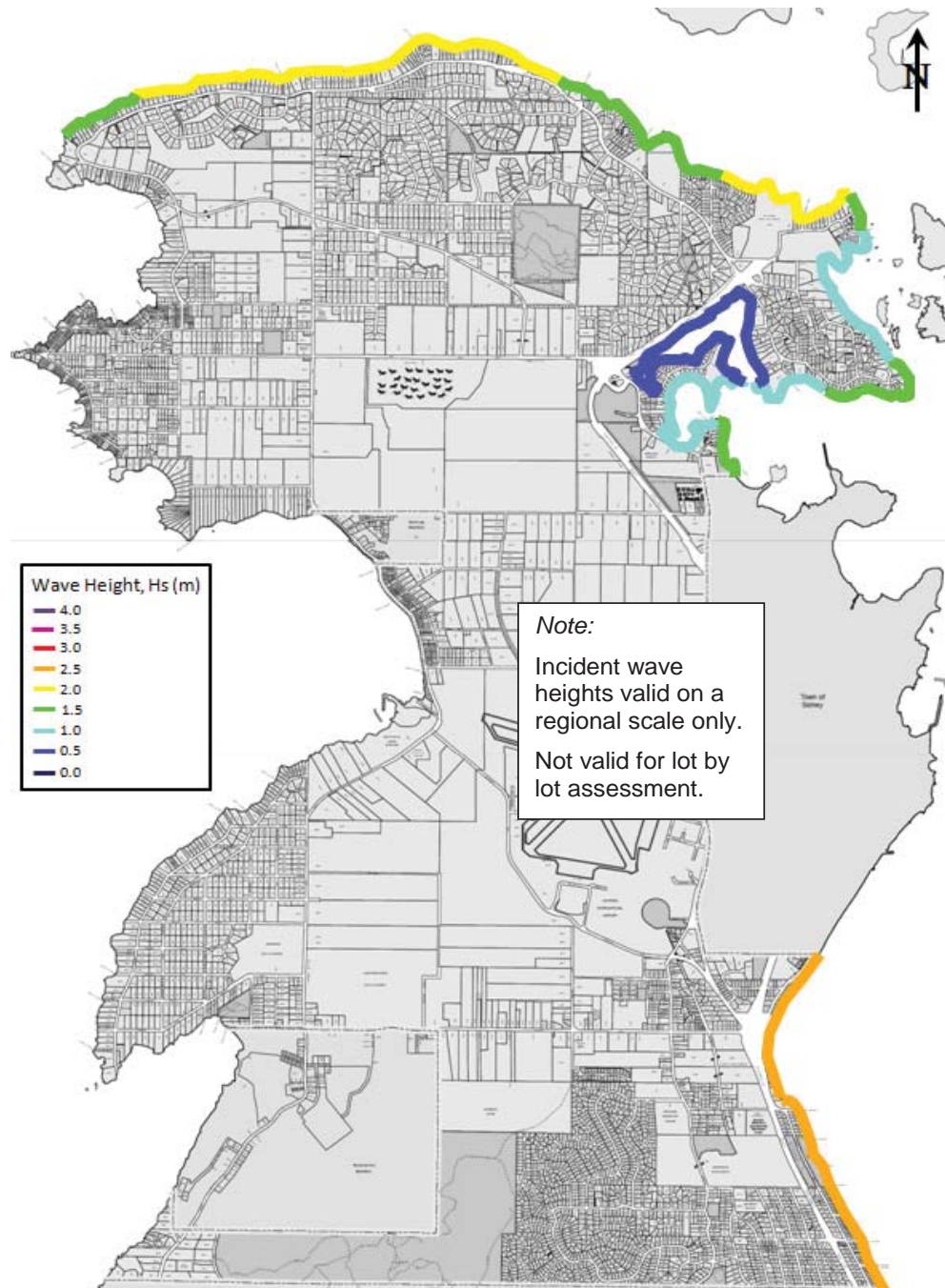


Figure 1: Compiled incident wave heights from SWAN for NE peak wind speed scenario for 0.5m of SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX B - Incident Wave Climate

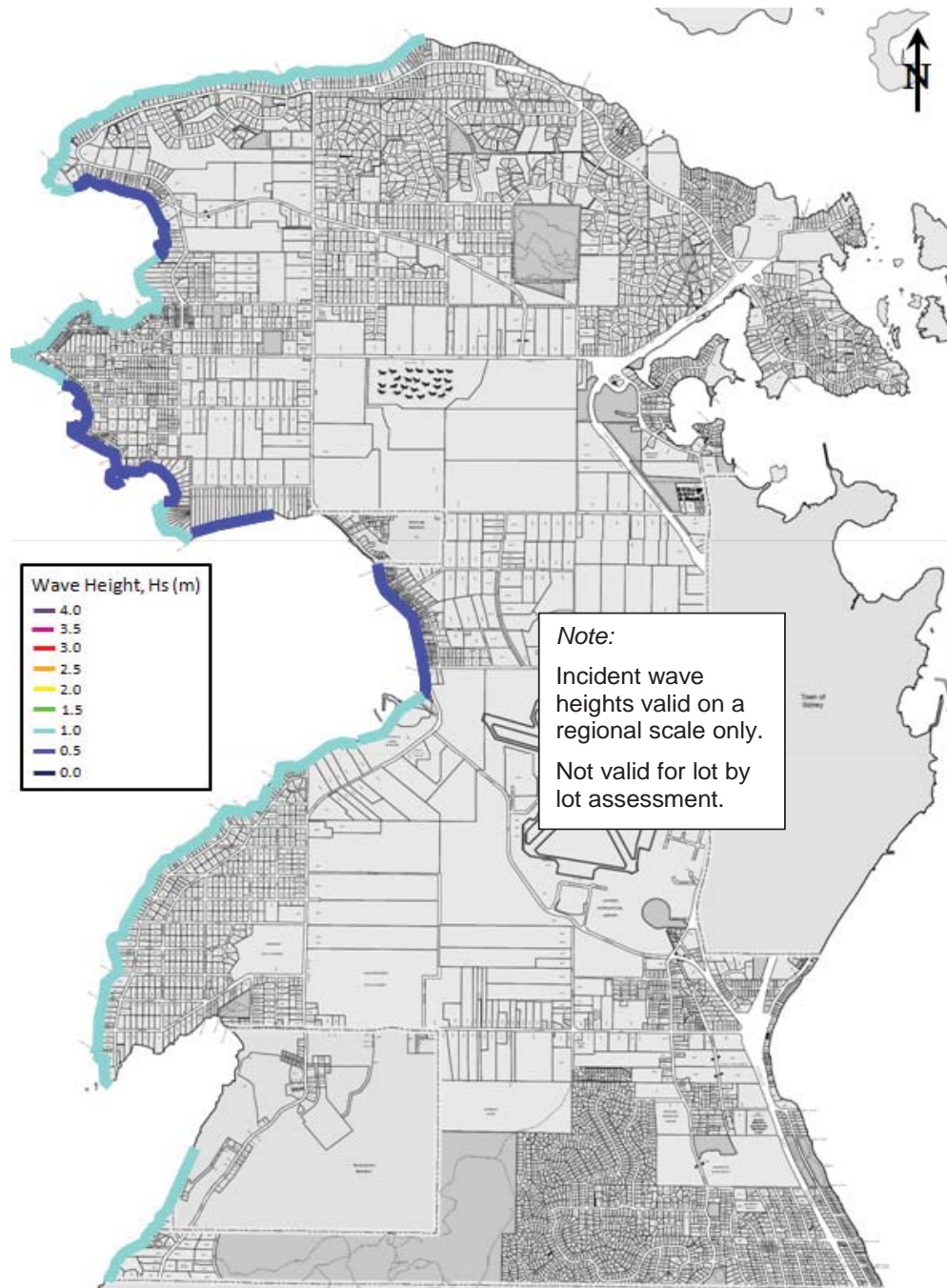


Figure 2: Compiled incident wave heights from SWAN for NW peak wind speed scenario for 0.5m of SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX B - Incident Wave Climate

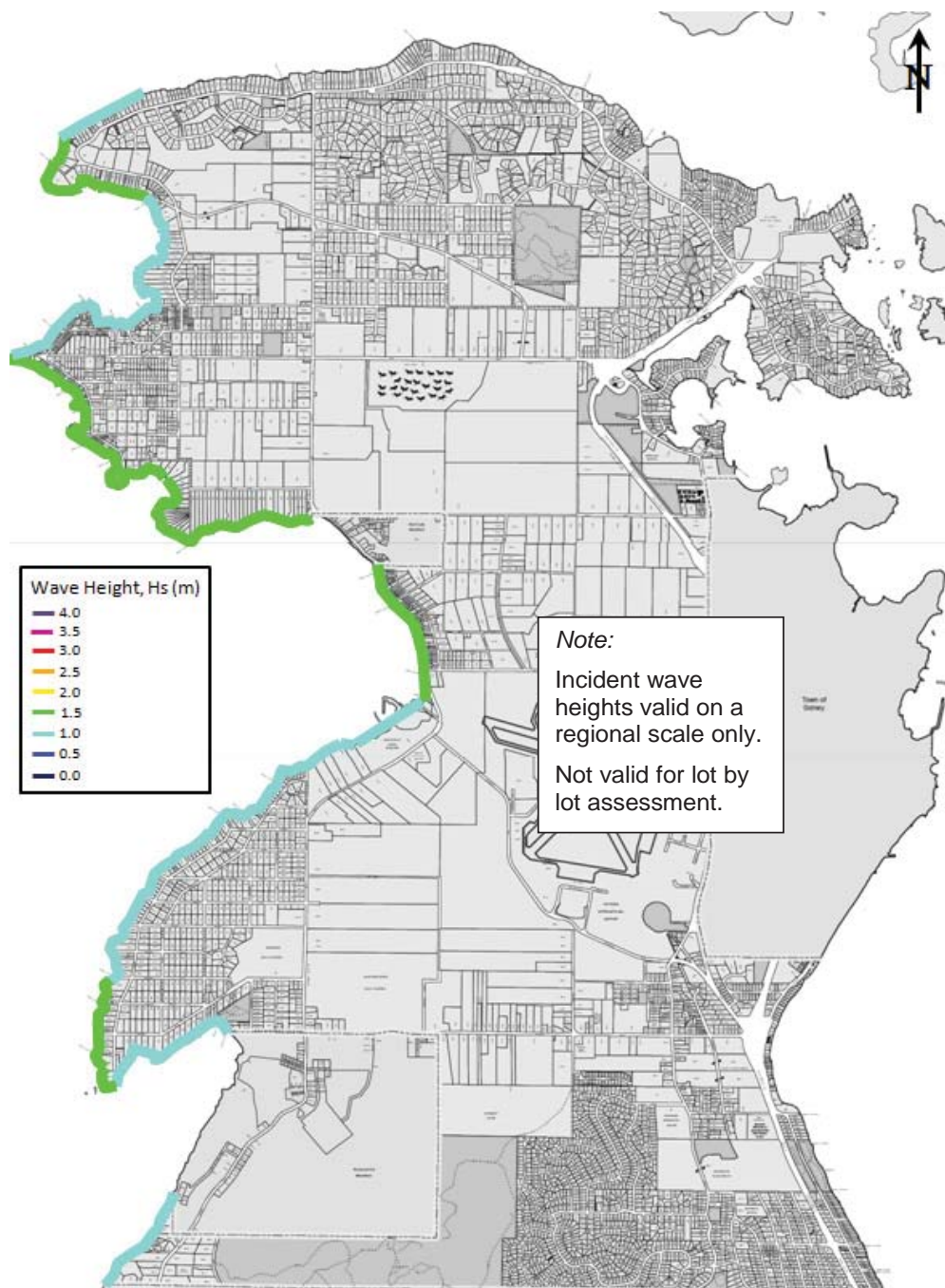


Figure 3: Compiled incident wave heights from SWAN for SW peak wind speed scenario for 0.5m of SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX B - Incident Wave Climate

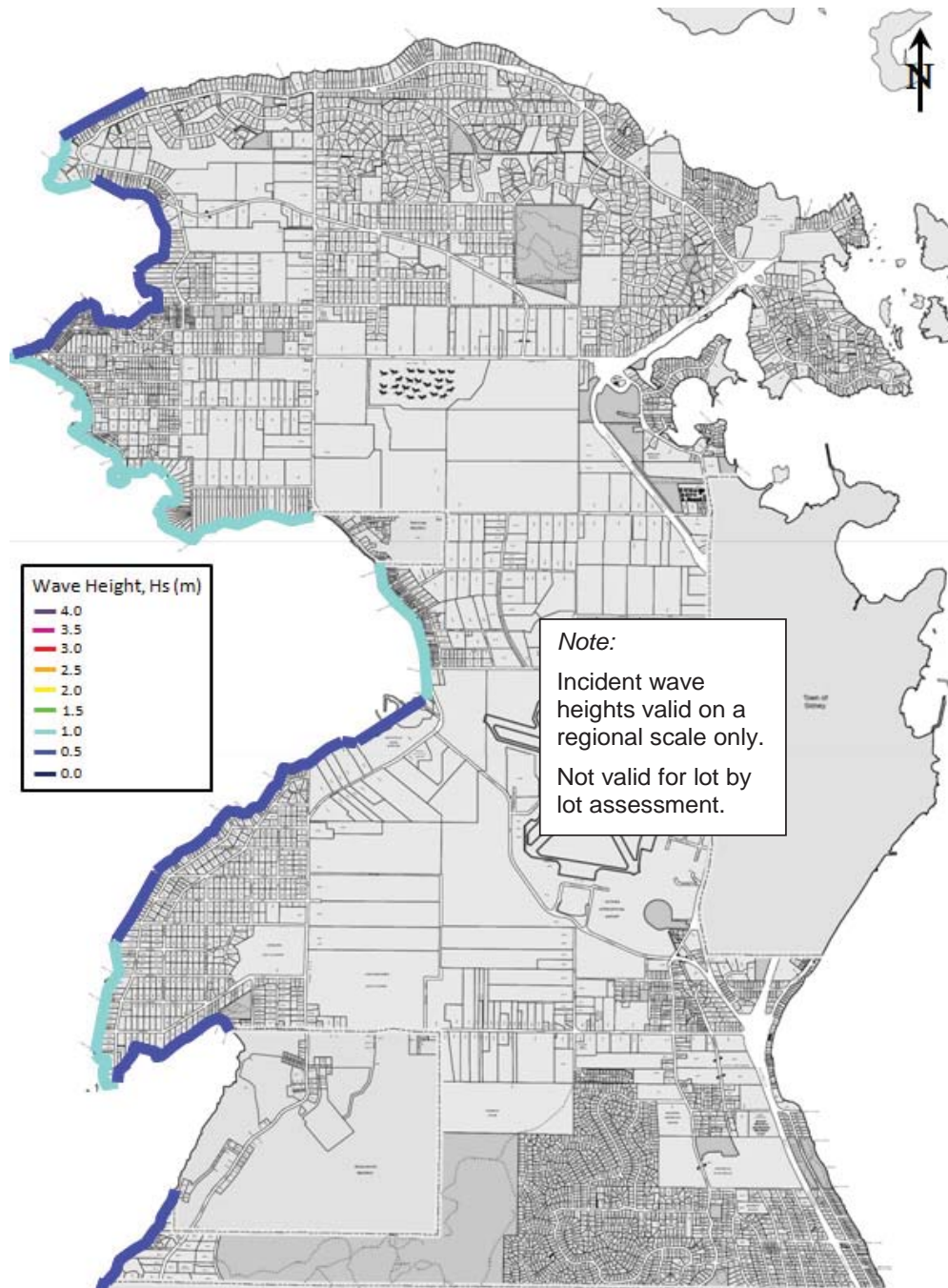


Figure 4: Compiled incident wave heights from SWAN for SW peak storm surge scenario for 0.5m of SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX B - Incident Wave Climate

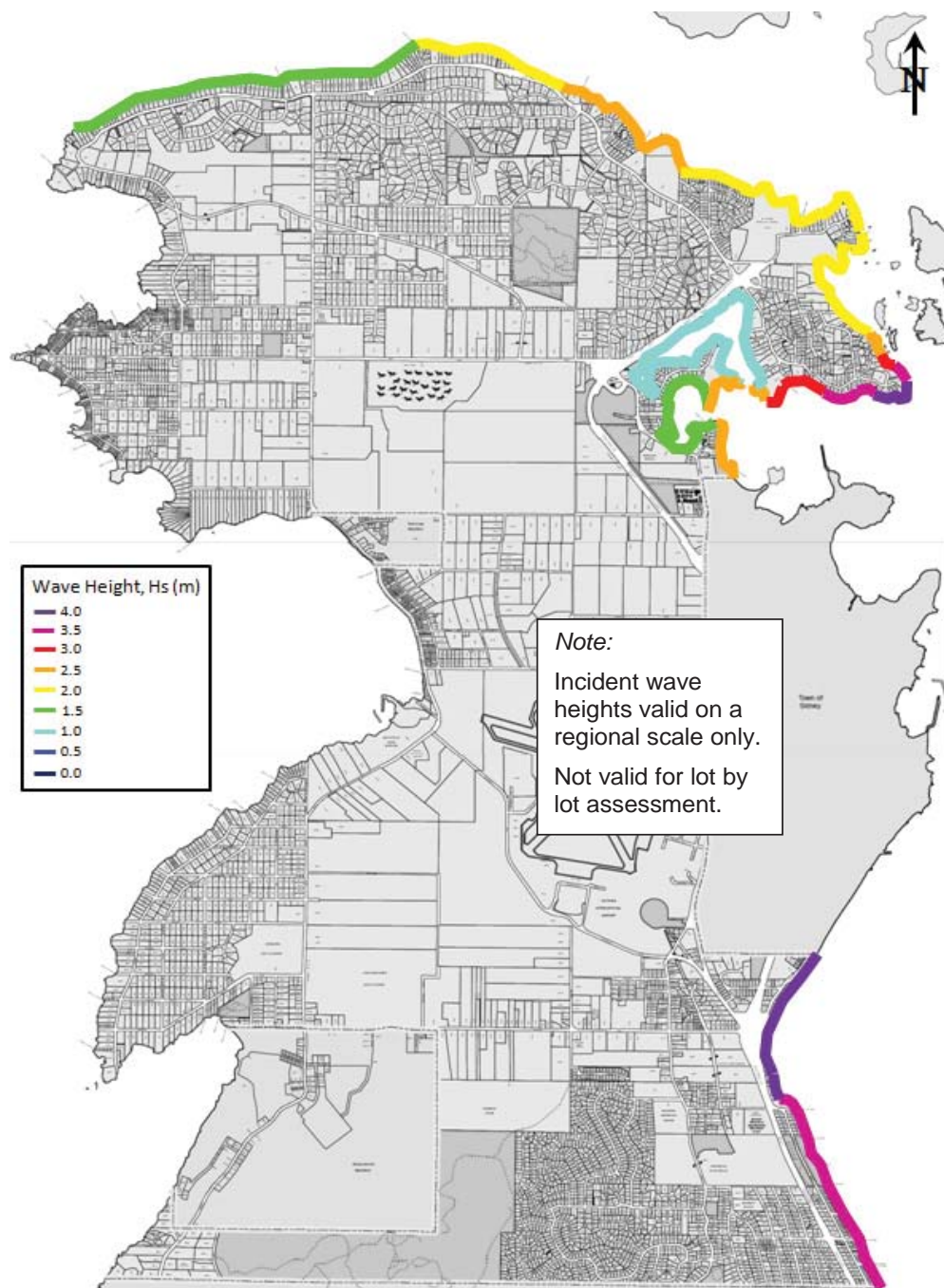


Figure 5: Compiled incident wave heights from SWAN for SE peak wind speed scenario for 0.5m of SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX B - Incident Wave Climate

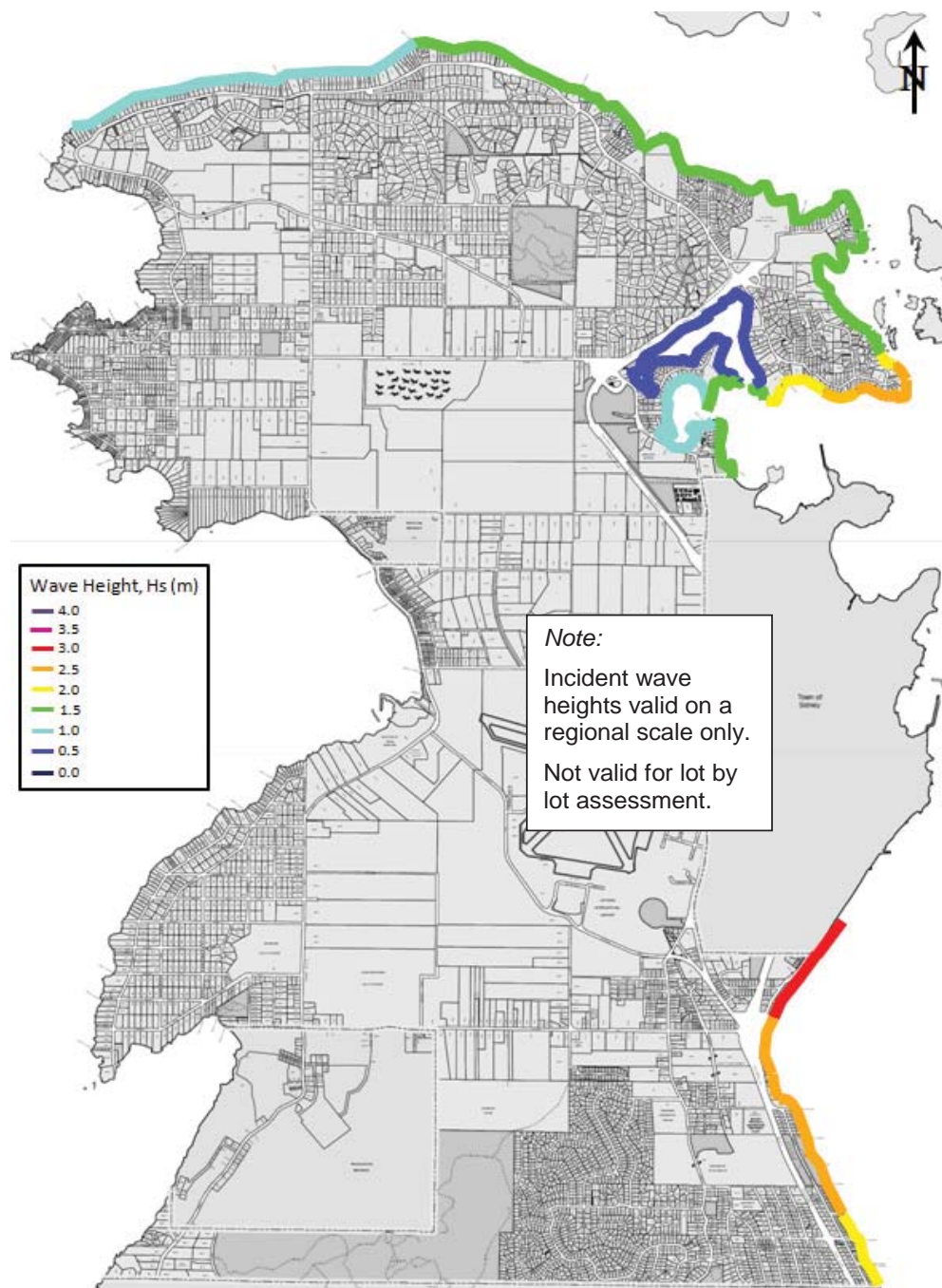


Figure 6: Compiled incident wave heights from SWAN for SE peak storm surge scenario for 0.5m of SLR

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Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX B - Incident Wave Climate

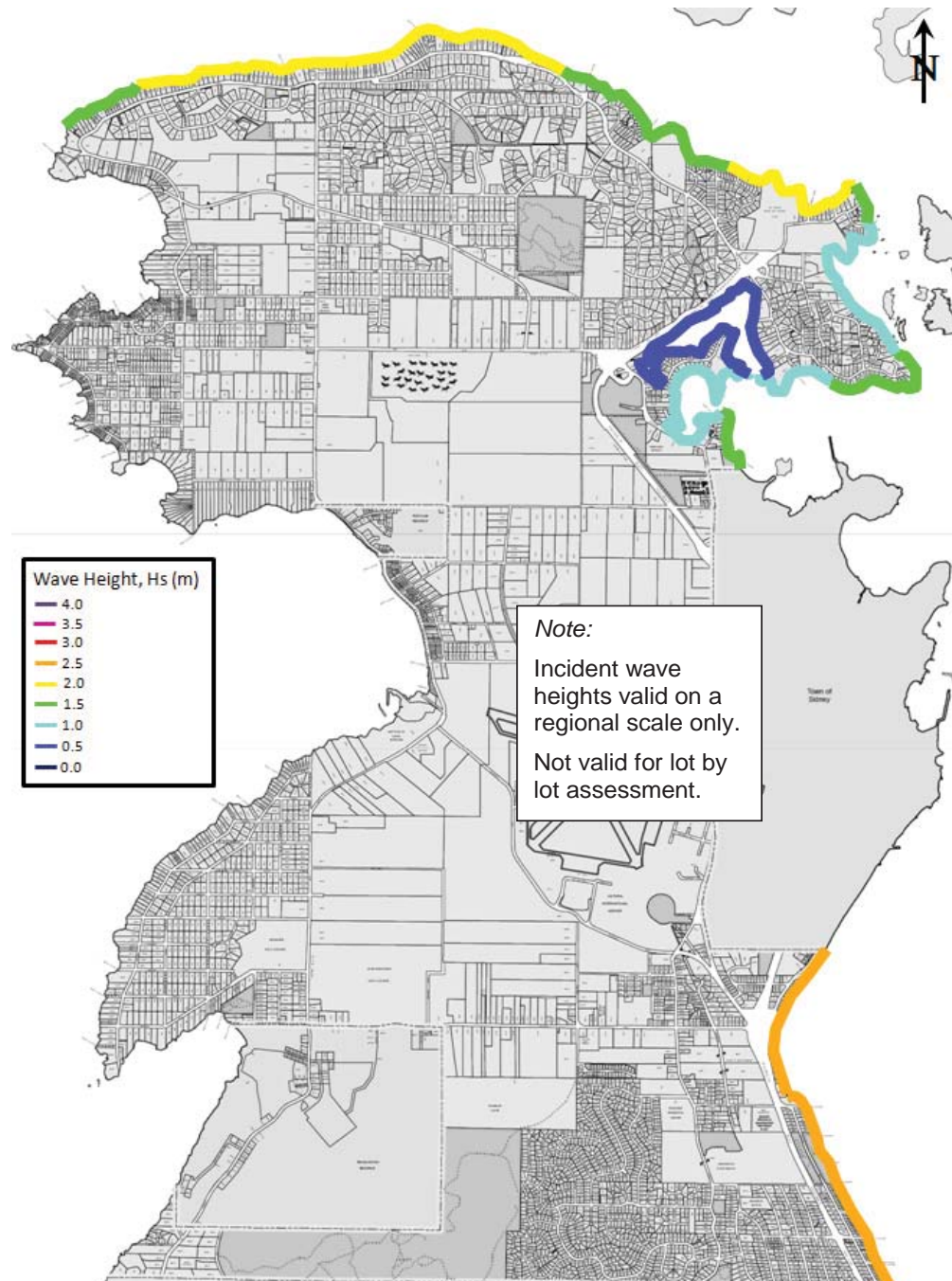


Figure 7: Compiled incident wave heights from SWAN for NE peak wind speed scenario for 1m of SLR

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APPENDIX B - Incident Wave Climate

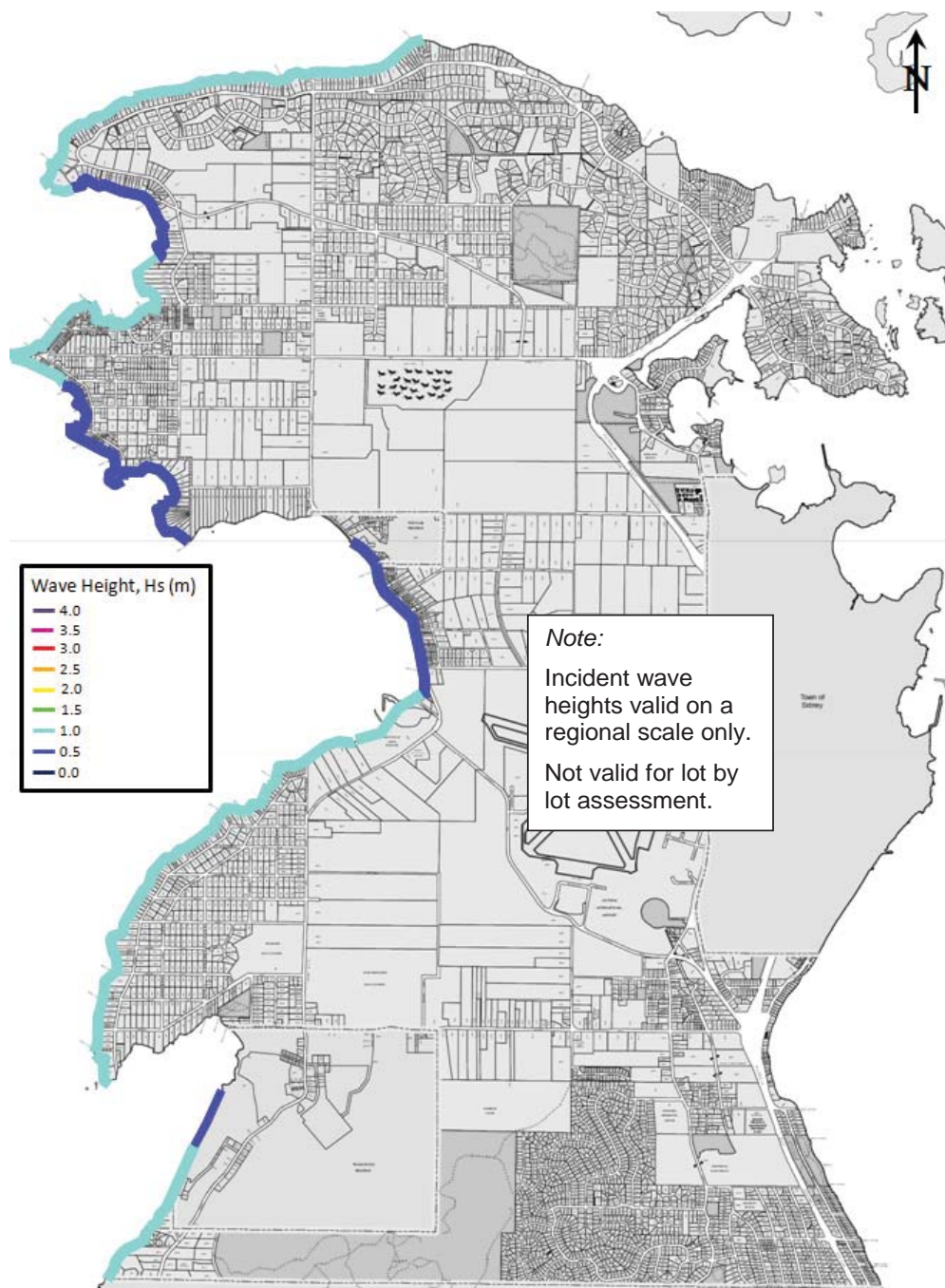


Figure 8: Compiled incident wave heights from SWAN for NW peak wind speed scenario for 1m of SLR

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Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX B - Incident Wave Climate

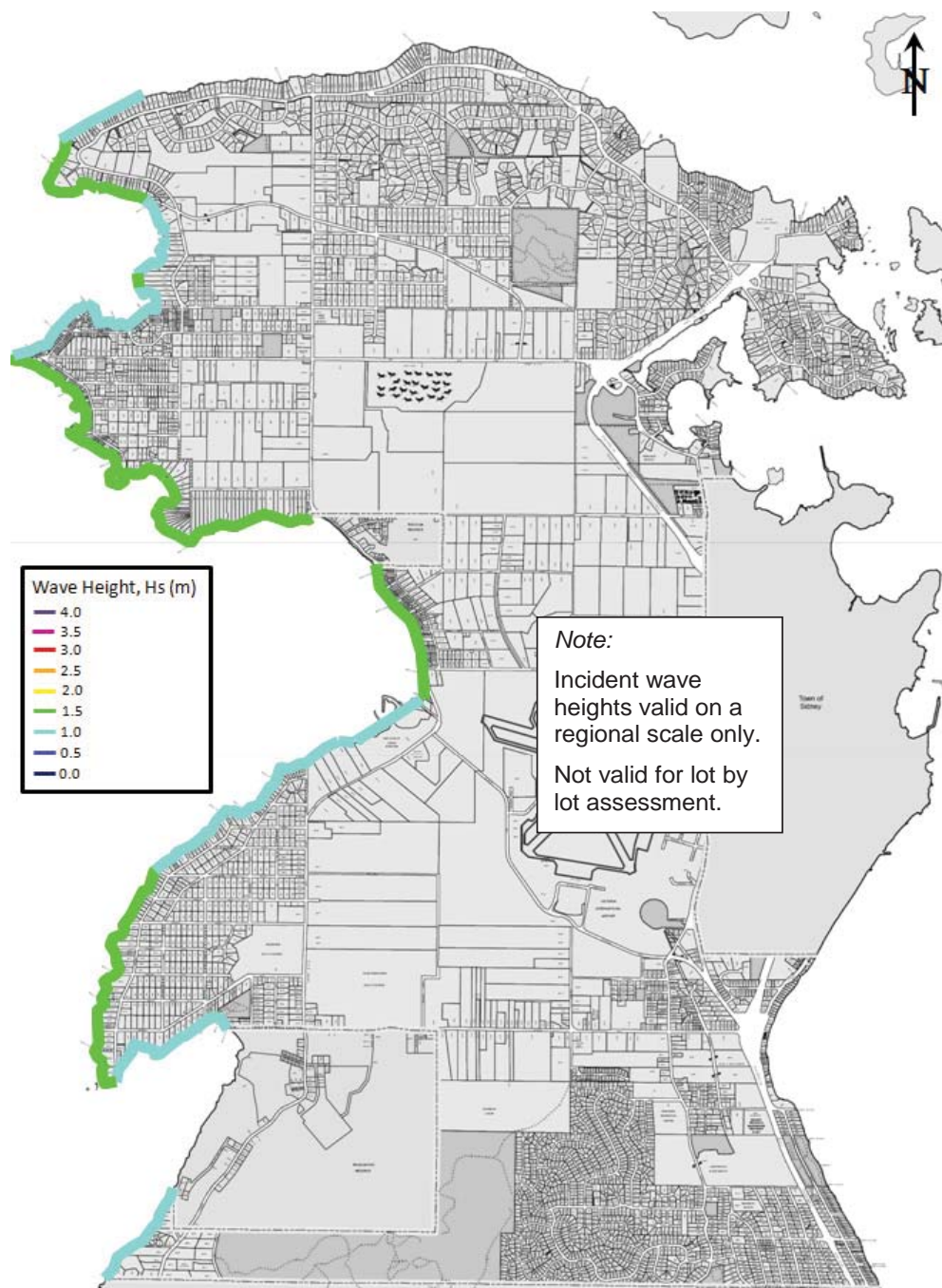


Figure 9: Compiled incident wave heights from SWAN for SW peak wind speed scenario for 1m of SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX B - Incident Wave Climate

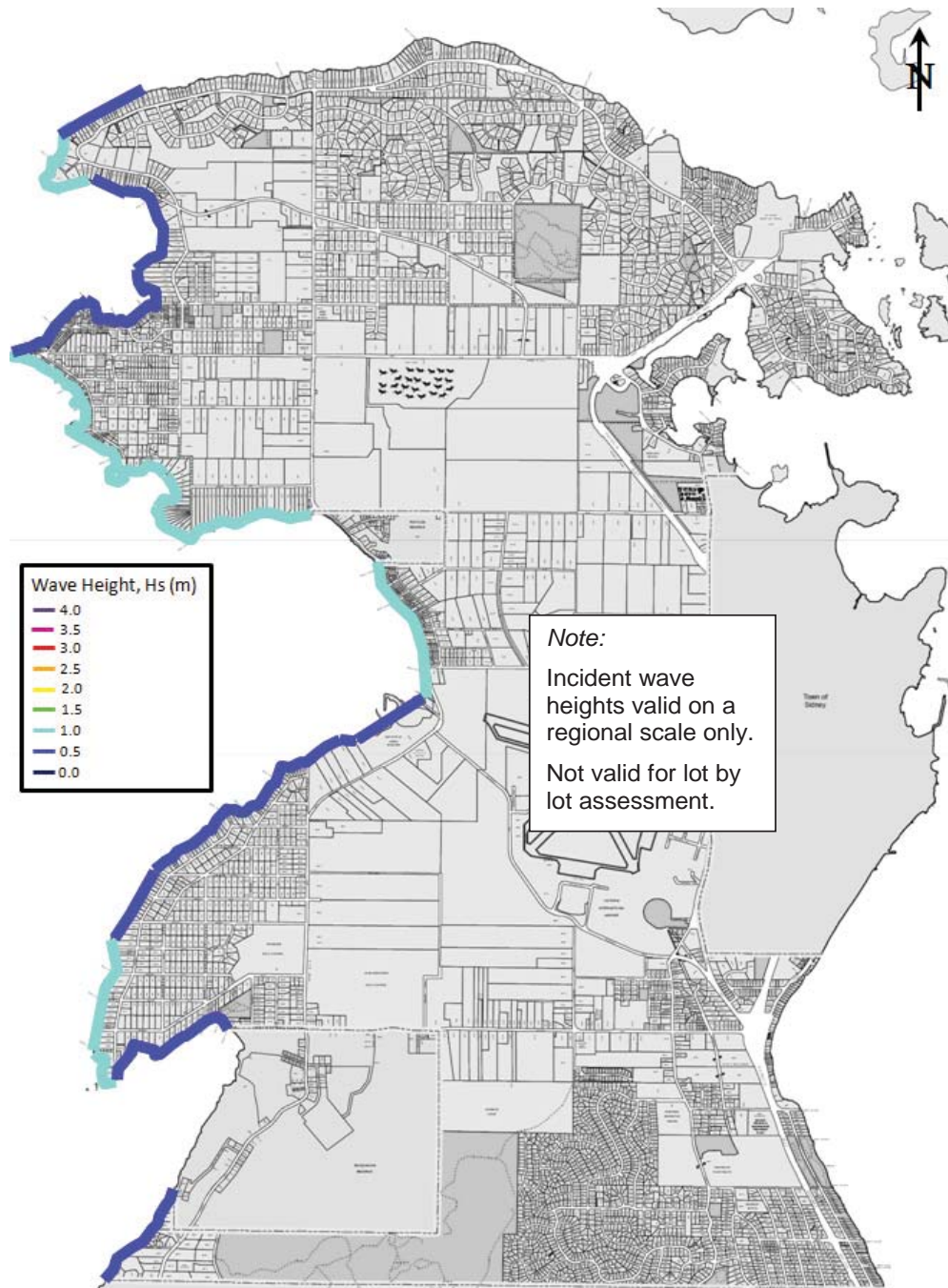


Figure 10: Compiled incident wave heights from SWAN for SW peak storm surge scenario for 1m of SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX B - Incident Wave Climate

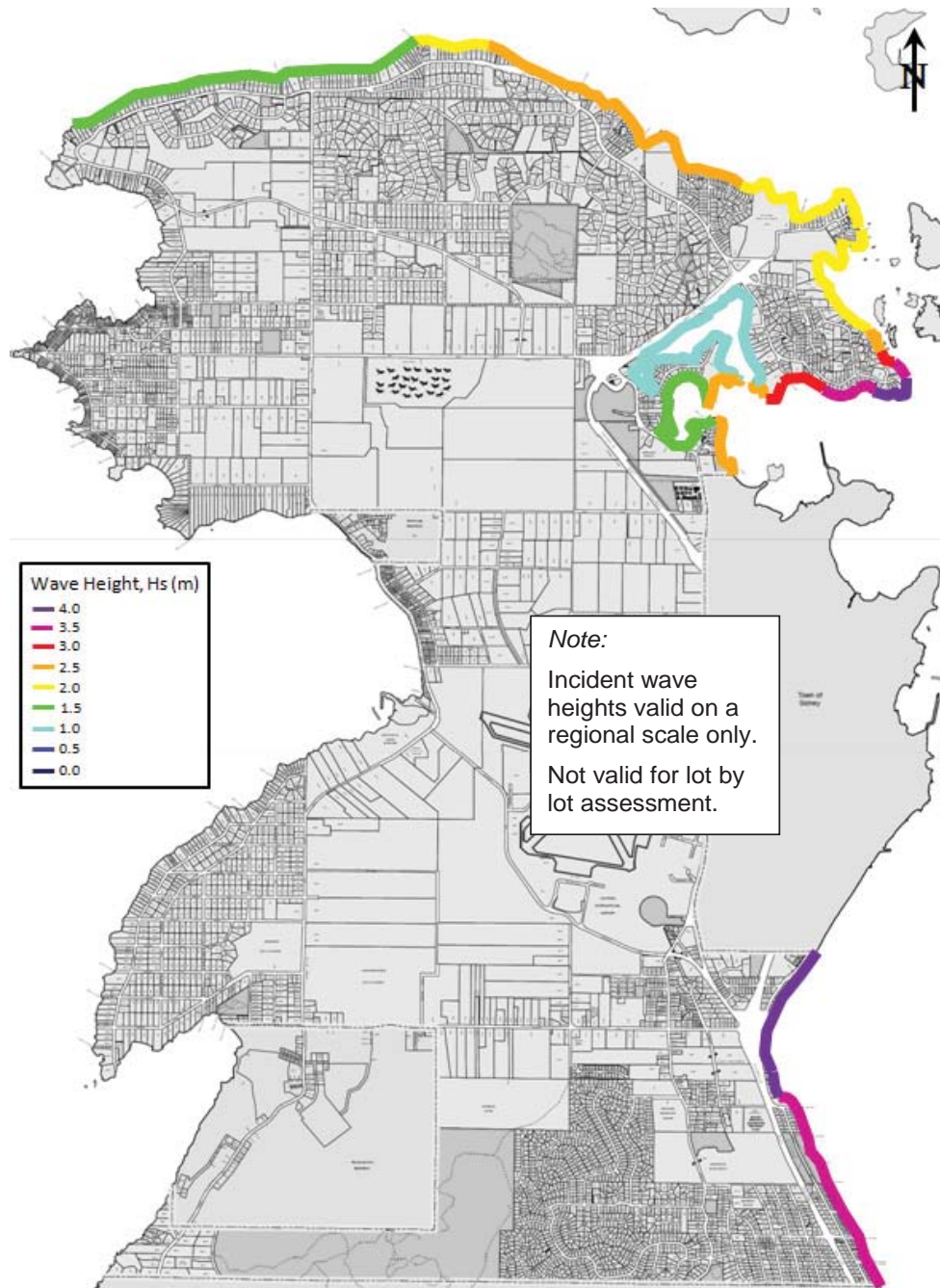


Figure 11: Compiled incident wave heights from SWAN for SE peak wind speed scenario for 1m of SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX B - Incident Wave Climate

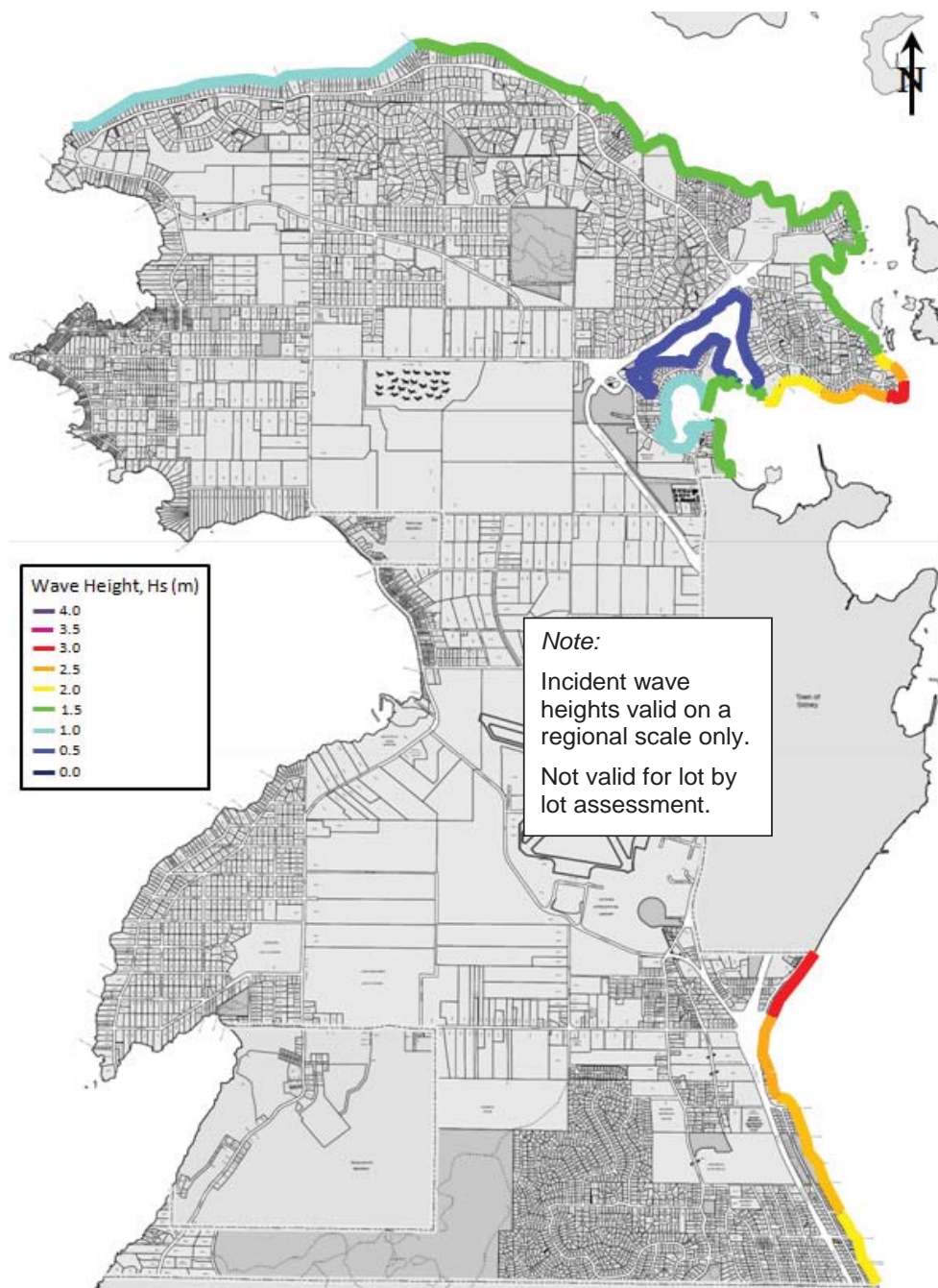


Figure 12: Compiled incident wave heights from SWAN for SE peak storm surge scenario for 1m of SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX C – Mapped Flood Construction Levels

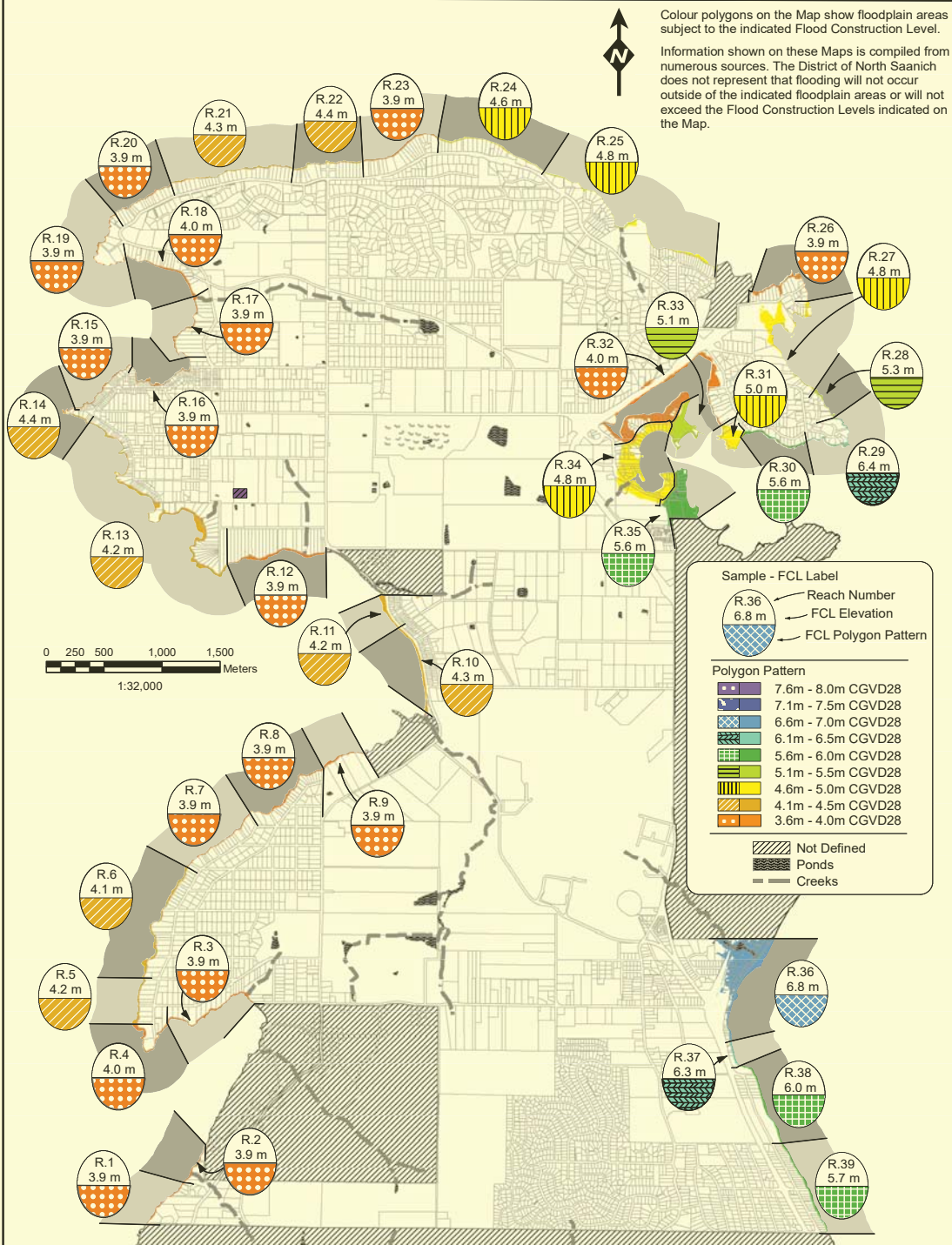


APPENDIX C – Mapped Flood Construction Levels



FLOOD CONSTRUCTION LEVELS 0.5 m SEA LEVEL RISE

Document 634533-3000-41ER-0001, Flood Construction Levels for 0.5m and 1.0m Sea Level Rise, Appendix C.



This Map displays the Flood Construction Level (FCL)¹, by Reach.

The FCL elevations are referenced to Canadian Geodetic Vertical Datum of 1928 (CGVD28)
0 m CGVD28 is equal to + 2.2 m Chart Datum, as measured at Swartz Bay

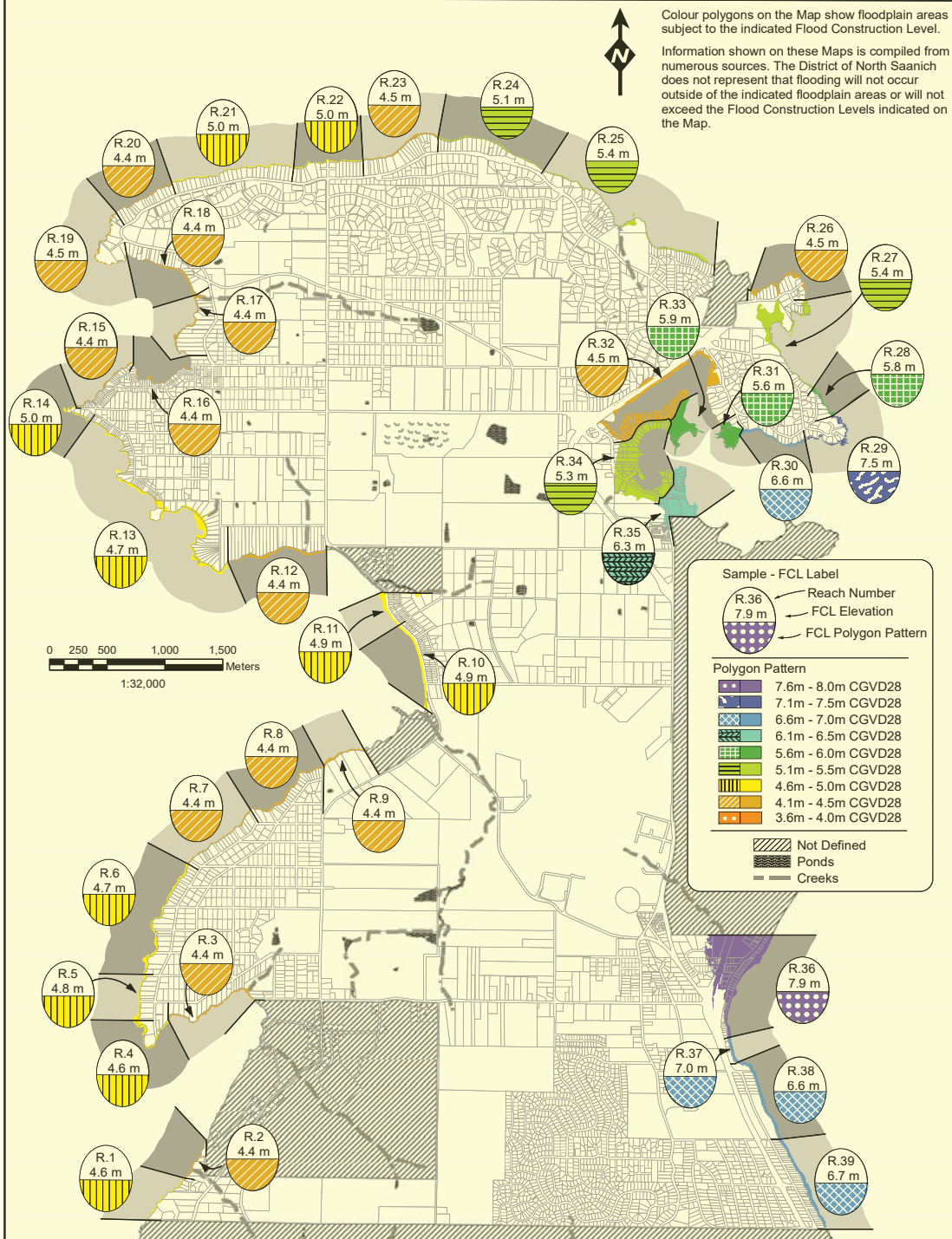
¹ The methodology used to define the FCL is provided in Document No. 634533-3000-41ER-0001 Rev 0
prepared by SNC Lavalin Inc and available from the District of North Saanich

March 2018



FLOOD CONSTRUCTION LEVEL 1.0 m SEA LEVEL RISE

Document 634533-3000-41ER-0001, Flood Construction Levels for 0.5m and 1.0m Sea Level Rise, Appendix C.



This Map displays the Flood Construction Level (FCL)¹, by Reach.

The FCL elevations are referenced to Canadian Geodetic Vertical Datum of 1928 (CGVD28)
0 m CGVD28 is equal to + 2.2 m Chart Datum, as measured at Swartz Bay

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March 2018

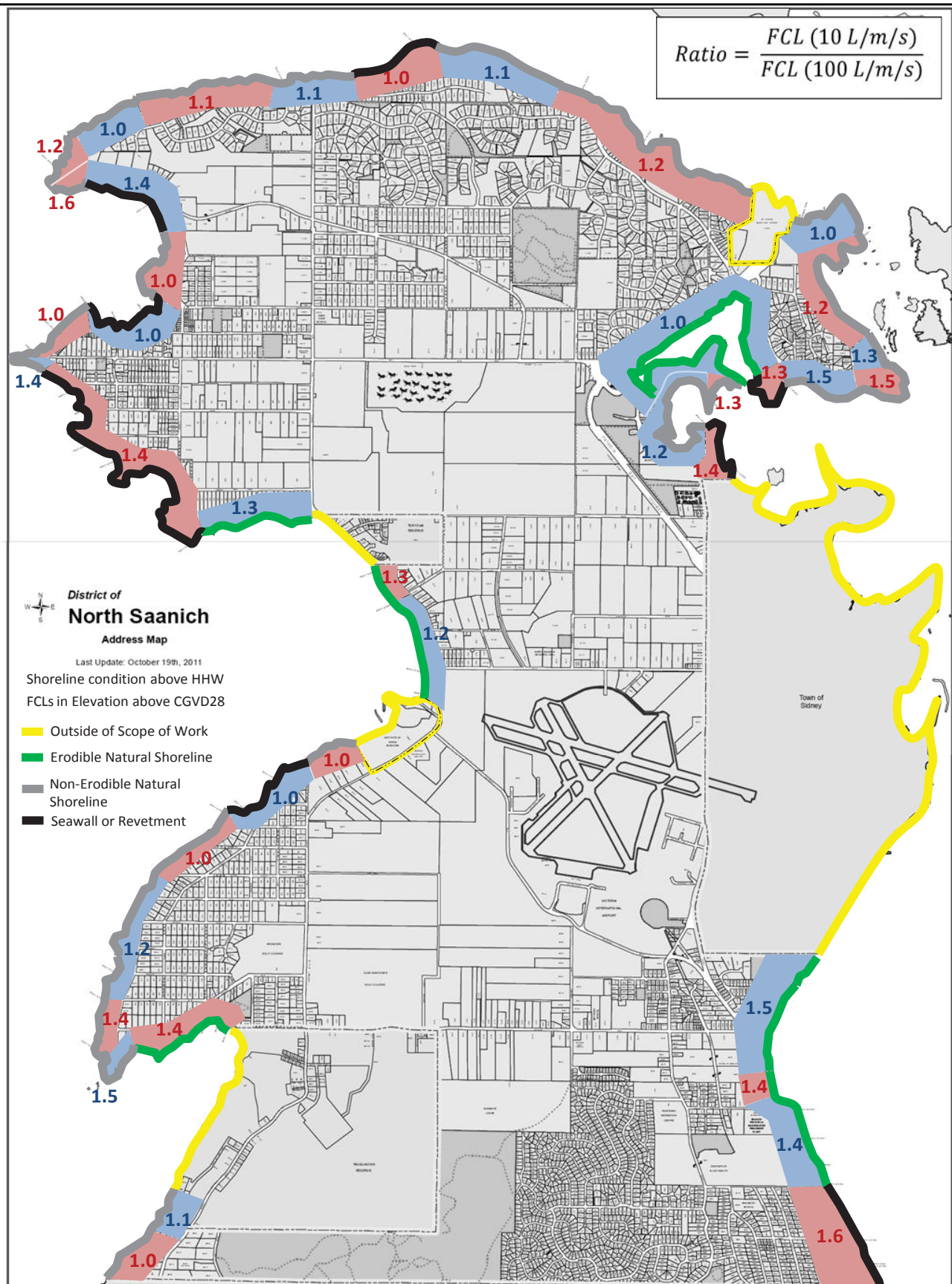
District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX D – Sensitivity Test: Overtopping Rates



APPENDIX D – Sensitivity Test: Overtopping Rates



Appendix C



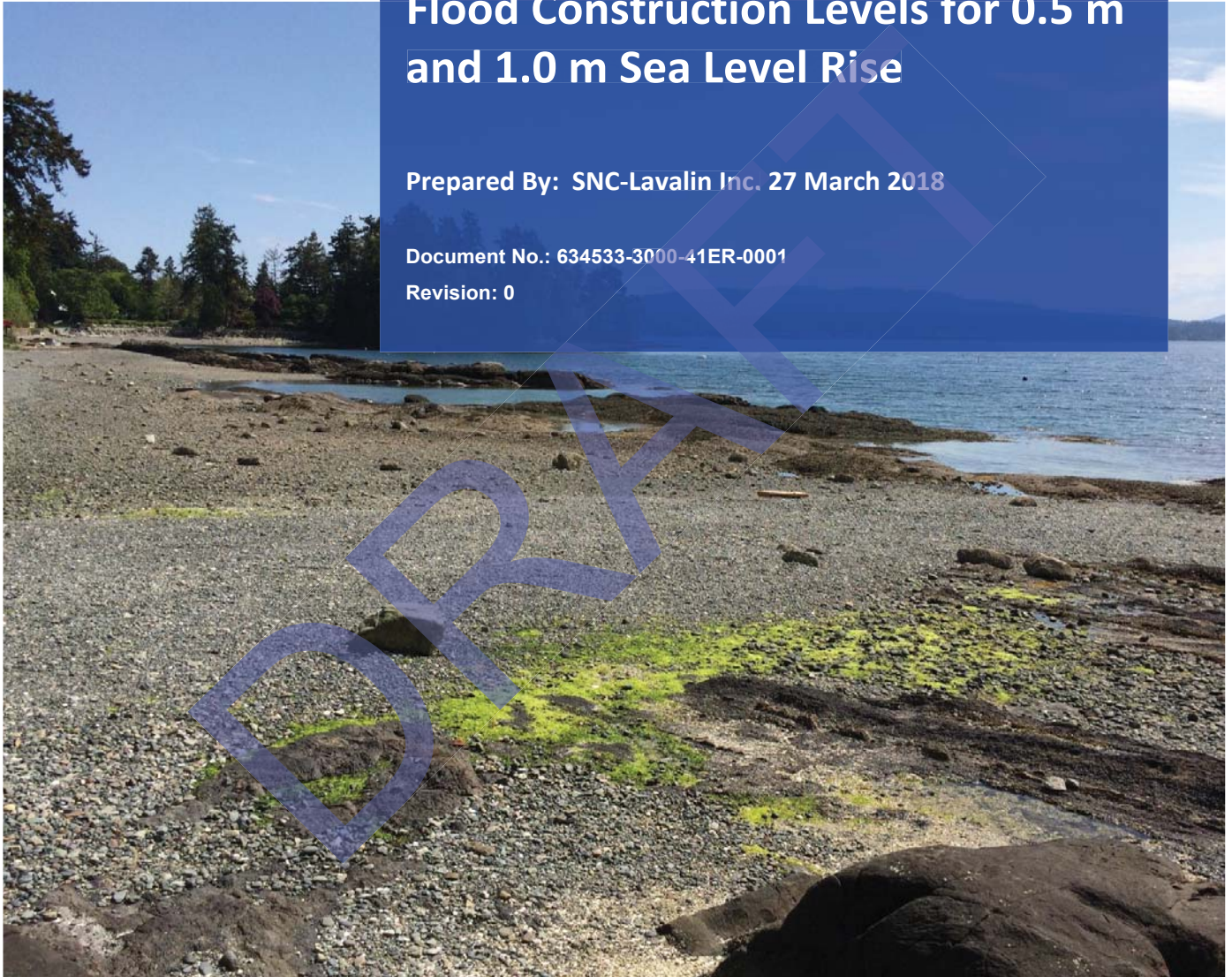
District of North Saanich

Flood Construction Levels for 0.5 m and 1.0 m Sea Level Rise

Prepared By: SNC-Lavalin Inc. 27 March 2018

Document No.: 634533-3000-41ER-0001

Revision: 0



EXECUTIVE SUMMARY

Background

SNC-Lavalin was retained by the District of North Saanich (DNS) to review and refine Flood Construction Levels (FCLs) previously developed for the District of North Saanich by the CRD.

The existing CRD FCL estimate for the District of North Saanich was 5.04 m for one meter of sea level rise, relative to the present Canadian Geodetic Vertical Datum (CGVD28). The CGVD28 reference datum is notionally the same as mean sea level today.

The Flood Construction Level is defined as the underside elevation of a wooden floor system, or the top elevation of a concrete slab, for habitable buildings, and is calculated from the sum of the following components:

- The Designated Flood Level (DFL), which includes tide, storm surge, and sea level rise,
- The effects of waves at the shoreline during a Designated Storm, and
- A freeboard allowance, that accounts for uncertainties in the methodology.

Flood Construction Levels (FCL's) are intended to provide safety and security against flooding or related damage in habitable levels of buildings along the shoreline. The extent of flooding or the risk to personnel is directly related to the quantity of water that crosses the shoreline during a storm and for this reason the main focus of this refinement of FCLs has focused on the specific wave effects to be expected at specific locations around the shoreline of the DNS.

Approach and Methodology

The 2011 Provincial Guidelines recommend consideration of 1 m of Sea Level Rise, adjusted for local land movement, for estimating the Designated Flood Level (DFL) for 2100. However, the rate of rise of sea level is now generally expected to occur faster than previously estimated in 2011. To allow for these uncertainties and to aid in both short- and long-term sea level rise response planning, a net rise in sea level of 0.5 m and 1.0 m, independent of any particular year of occurrence, have been used for this assessment.

In order to define the Designated Flood Level, an analysis of storm conditions and related water levels was initially undertaken to establish the expected storm surge and associated wind and resulting wave conditions during the Designated Storm for distinct reaches along the DNS shoreline. The Designated Storm was based on a storm that has an average annual probability (AEP) of being equalled or exceeded of 1/500, or a 0.2% chance of occurring or being exceeded in any given year. This level of probability was selected, based on guidance in the Provincial Guideline documents, to minimize and equalize risk to exposed residential properties around the peninsula.

The shoreline of the DNS is exposed to winds and waves from various directions depending on the location, and the type of storm that produces severe (1/500 AEP condition) on that portion of the shoreline. In some cases, depending on the direction of exposure, severe winds (and resulting waves) can come from several different types of storms. The dominant storm patterns include winter outflow conditions that typically produce NE winds, and more typical and relatively frequent, mid-latitude Pacific Ocean storms that generally produce SE, SW, or NW winds.

Detailed analysis found that winter outflow conditions (NE winds) are typically associated with negative storm surges while mid-latitude storms are generally associated with large positive storm surges. It was also found that the peak storm surge generally occurs several hours after the peak wind speed and that the surge can change rapidly as the storm passes over or by the area.

Nearshore wave conditions during the Designated Storm were estimated using a detailed wave generation and propagation numerical wave model (SWAN) for six specific storm scenarios that are capable of producing 1/500 AEP conditions at the shoreline of the DNS. The resulting wave fields vary significantly around the shoreline. The image below shows the expected wave field for a SE storm in Haro Strait.

The DNS shoreline was subdivided into 39 reaches, defined by the typical shoreline characteristics and the wave exposure on each reach. The nearshore wave climate results were then used to establish a governing storm condition for each reach and to then estimate the corresponding wave effects on the shoreline. Wave effects are defined by the wave run-up on the shoreline and/or wave overtopping of characteristic shoreline features including seawalls or rock revetments.

For the purpose of calculating FCL's, a threshold of 10 L/m/s (Litres/meter/second) for acceptable quantities of water at the shoreline was considered. This threshold value provides safety and security of personnel and property. A freeboard allowance of 0.6 m, as recommended in the 2011 Provincial Guidelines, was also included.

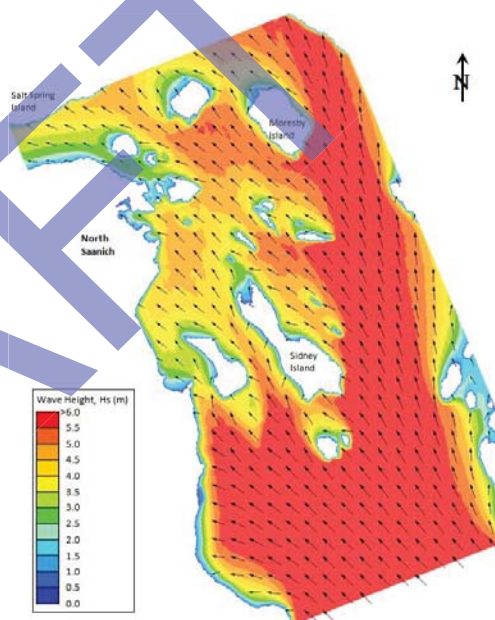
Results

The 1m Sea Level Rise scenario resulted in 25 shoreline reaches with FCL's that are lower than the existing uniform CRD estimate of 5.04 m, CGVD28. The remaining 14 reaches have higher FCL's. These changes from the CRD estimate are largely due to the particular characteristics of each reach, including specific shoreline exposure or shoreline characteristics, which includes the type and character of the inter-tidal portion of the shoreline and the nature of the shoreline at the high water line.

The 0.5m SLR scenario resulted in FCL's that are between 0.4m and 1.1m lower than the FCL's for the 1.0m SLR scenario. This reduction is largely due to the lower water level which essentially limits the seastate that can exist at the shoreline during the Designated Storm. For 0.5 m of sea level rise, 30 reaches have FCL's lower than the CRD estimate of 5.04m and 9 reaches have higher FCL's.

The overall reductions in FCL elevations can be largely attributed to the detailed definition of storm scenarios, associated storm surges and the specifics of each shoreline reach. These details are very important when defining specific FCL's on a shoreline as variable as the DNS.

Detailed maps of the resulting FCLs for each shoreline reach are provided in Appendix C.



Expected Seastate in a 1/500 AEP SE storm

Implications to the District of North Saanich

There are approximately 713 waterfront lots on the coastline of the District of North Saanich.

For a 0.5m SLR scenario, the revised wave effects and flooding are confined to the shoreline or the first 15 m of setback (Criteria 1 & 2) on approximately 582 lots. Partial flooding, including in some cases, complete inundation (Criteria 3 & 4) is expected on 131 properties.

For the 1.0m SLR scenario, minor flooding (Criteria 1 & 2) is expected on approximately 550 lots. Partial flooding, including in some cases complete inundation (Criteria 3 & 4) is expected on 163 lots.

A potential 77 lots are indirectly exposed to the risk of flooding during a 1.0m SLR scenario, either from an adjacent waterfront property or because flooding may extend landward from the waterfront properties. For a 0.5m SLR scenario, a potential 54 lots are indirectly exposed to flooding. The flooding and safety of these indirectly affected lots is dependent on the action taken on the adjacent lots.

End of Executive Summary

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Appendix B – Incident Wave Climate

Appendix C – Mapped Flood Construction Level's

Appendix D – Sensitivity Test: Overtopping Rates

1. INTRODUCTION

SNC-Lavalin Inc. (SLI) was retained to define the Flood Construction Levels (FCL) for the District of North Saanich, considering district specific conditions such as wave exposure, shoreline type and a range of expected sea level rise scenarios. This report details the methodology and findings of this work and supersedes the previous SLI FCL Report; Document 634533-1000-41ER-001, dated May 2016.

Background

This study refines the Flood Construction Levels (FCLs) previously presented by the Capital Regional District (CRD) In-house Assessment Methodology for the District of North Saanich (DNS). These existing CRD FCLs are described in reports prepared by AECOM [4], CRD [5] and Groundrush Consulting [6].

The existing CRD FCLs were estimated based on the procedures recommended in the 2011 Provincial Guideline documents, BCMOE [1][2][3] and a single value of 5.04 m, CGVD28 was recommended for Zone 4, which includes the DNS. The CRD values were based on a global average sea level rise of 1 m, estimated to occur by the year 2100 [5]. This included a single value of 0.65 m for all areas in the DNS to estimate the Wave Effects component of the FCL. It is expected that the regional application of a single value of wave effects is not accurate, considering the close inter-relationship between the storm surge, wave exposure, Wave Effects, and the varying shoreline types around the DNS shoreline.

Scope

The scope of this assignment was to examine and define the storm surge and wave effect components at a finer resolution than that used for the CRD FCLs and provide revised FCLs specific to the DNS shoreline (shown in Figure 1) for 0.5 m and 1.0 m and of sea level rise.

The following areas were specifically excluded from the study:

- First Nations Lands
- Federal Lands within Patricia Bay (The Institute of Ocean Sciences Marine Facility)
- BC Ferries terminal at Swartz Bay
- Town of Sidney

Vertical Datum

Unless noted otherwise, all elevations are in meters with respect to Geodetic Datum (CGVD28).

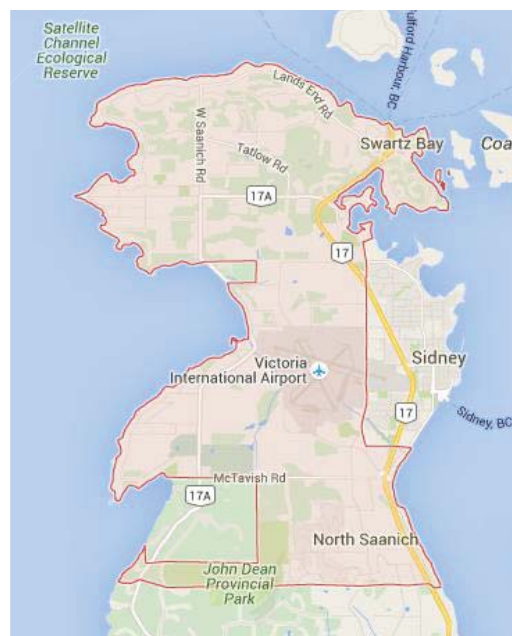


Figure 1: District of North Saanich
source: Google Maps 2015

2. METHODOLOGY

In order to estimate the FCL's for the DNS, we used the following methodology, which is consistent with the Provincial Guideline documents and is discussed further in the following sub-sections:

1. Define the Designated Storm(s) and the associated winds and storm surge
2. Determine the Designated Flood Level, considering sea level rise, tide conditions, and storm surge
3. Characterize the incident wave climate approaching the shoreline
4. Determine Wave Effects and overtopping rates at the shoreline
5. Calculate the Flood Construction Levels
6. Determine the number of affected lots in the DNS

2.1. Designated Storms

The Saanich peninsula is exposed to winds and waves from six principle directions; NE, E and SE, SW, W and NW, but in general terms, the east shoreline is only exposed to NE, E and SE, E winds, the west shoreline is only exposed to SW, W and NW winds and the north shoreline is only exposed to NE, N and NW winds. In order to define FCLs around the entire shoreline of the DNS, it is therefore necessary to consider different combinations of wind speed, direction, and related storm surge to determine the governing case for each section of the DNS shoreline.

Definition of the Designated Storm

The 2011 Provincial Guideline Documents provide some flexibility in the choice of the appropriate annual exceedance probability (AEP) for the Designated Storm, based on the type and value of land use along the shoreline. For the purpose of this project, an annual exceedance probability (AEP) for the Designated Storm (DS) of 1/500, which corresponds to a 0.2% chance of occurring in a given year, was selected.

This AEP value was chosen for the following reasons:

- The CRD based results [6] indicated the most vulnerable lands (in the Tsehum Harbour area) were generally high value residential waterfront properties
- Other vulnerable areas on the west side of the peninsula were also mainly residential properties.

Storm Types and Wind Field

Due to the exposure of the DNS to winds and waves from various directions, typical storm patterns that could produce 1/500 AEP winds and waves – i.e.: the Designated Storm – at different locations around the shoreline, could come from two primary sources: winter outflow conditions, which generally produce NE storms or more typical and more frequent mid-latitude storms, from the Pacific Ocean basin, which generally produce SE, SW, and then NW winds, as the storm system propagates towards and across the south coast of British Columbia.

Typical patterns for the storm types are shown in Figure 2. The left hand side shows the typical wind directions around an intense mid-latitude low pressure system as it approaches the coast of British Columbia from the Pacific. This direction of approach initially brings strong E to SE winds that change to SW winds as the associated warm front passes and then often produce strong W to NW winds when the associated cold

District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise



front crosses the coast. Severe mid-latitude storms typically bring large storm surges, reflecting the effect of the storm, that, within the Straits of Juan de Fuca and Georgia, often occur after the strongest E or SE winds have occurred. The right hand image in Figure 2 shows a typical outflow condition where a ridge of high pressure north of Vancouver Island results in pressure contours that drive strong NE outflow winds across the Strait of Georgia towards Vancouver Island and the DNS.

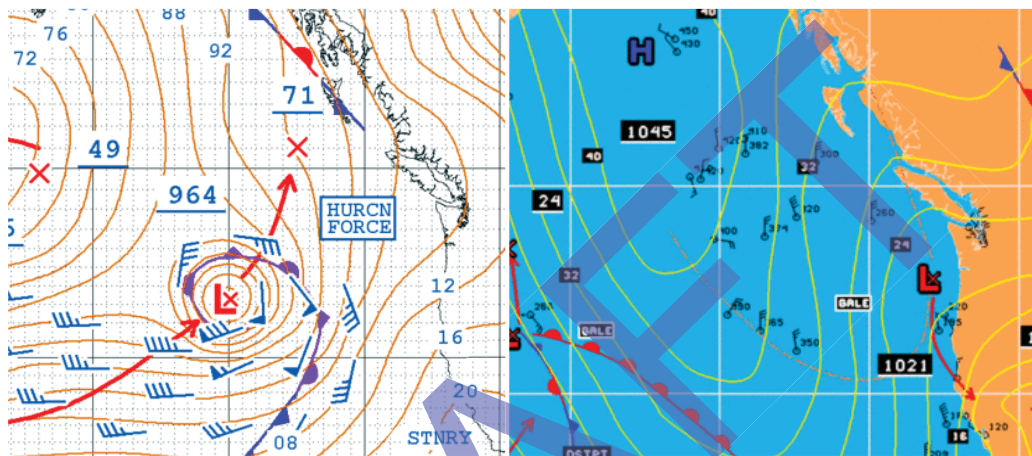


Figure 2: (left) Forecast for a typical mid-latitude storm 17 Jan. 2016 – (right) Forecast for a typical outflow condition 14 Feb 2006

Source: NOAA

Review of the local overwater wind fields in the vicinity of the Saanich peninsula during severe storms also shows that generally during SE storms; the wind speed progressively decreases in strength as the winds approach the Sidney area. Winds in the eastern end of Juan de Fuca strait are consistently stronger than the winds at Kelp Reef, at the north end of Haro Strait. Winds in the area between James Island and Sidney Island and the Sidney shoreline are less than the wind speeds recorded at Kelp Reef.

The expected wind speeds associated with severe storms, and specifically the Designated Storms, (with an AEP of 1/500), were evaluated for this assignment using data from the Environment Canada Victoria Airport anemometer, due to its proximity to most of the DNS shorelines and it's long record, supplemented by data from the Environment Canada anemometer at Kelp Reef, for SE events and from the Environment Canada Wind and Wave recording buoy in Patricia Bay for SW and NW events. Anemometer locations are shown in Figure 3.

Wind speed data from Victoria Airport was adjusted to account its over-land location using standard procedures for overland to overwater modification.

A peak over threshold extreme value analysis was completed to estimate the 1/500 AEP wind events for each directional sector for the modified Victoria Airport winds and the unmodified Kelp Reef winds. The results of the extreme value analysis for the modified Victoria Airport data, by major direction, are provided in Figure 4.

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The extreme value analysis results confirmed that peak winds at Kelp Reef are stronger, for the same AEP event, than the modified Victoria Airports winds, which supports the qualitative description of SE overwater wind fields above.



*Figure 3: Environment Canada wind stations referenced for DNS project
source: Google Earth*

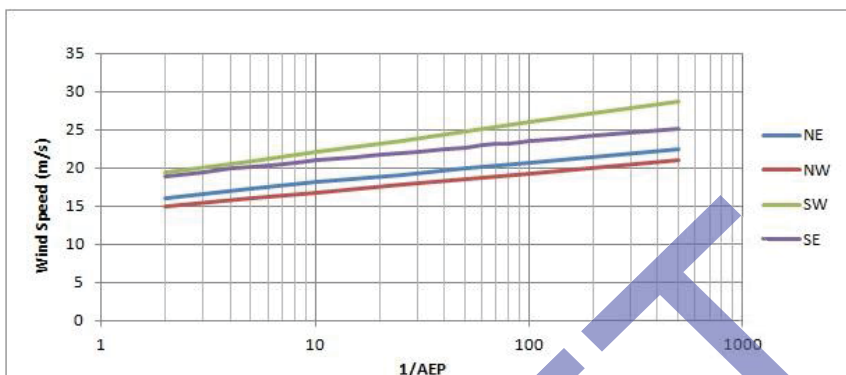


Figure 4: Extreme Value Analysis Results for Wind Speed

Storm Surge during the Designated Storms

In the 2011 Provincial Guidelines, the expected storm surge for a generalized 1/500 AEP storm event in the Strait of Juan de Fuca or the Strait of Georgia is 1.3 m. However, detailed examination of the correlation between the storm surge event and the winds during the related storm event shows that the correlation between the timing of wind speeds in the Straits and the arrival of a storm surge varies significantly. As an example the recorded data shows that the peak wind speed during a recent severe SE storm on the south coast preceded the peak storm surge by approximately 6 hours at Point Atkinson, Figure 5. A similar lag can be expected around the DNS shoreline.

Examination of the top 7 storm surge events in the last 20 years showed that:

- In general, winds during storms tend to peak several hours before the maximum storm surge arrives.
- In most cases, winds have already shifted from a SE to a SW direction and the wind speeds have generally decreased from the peak wind speed.
- In the most severe storm surge event in the record, the winds peaked when the direction had already shifted into the SW.

An examination of the storm surge associated with strong NE or NW winds, which directly affect the north and west sides of the DNS shoreline, shows there are further significantly different correlations between wind strength, as described further below.

It is overly conservative, for the DNS area, to pair the 1/500 AEP storm surge (1.3 m) with a 1/500 yr AEP wind for all Designated Storm direction scenarios.

District of North Saanich

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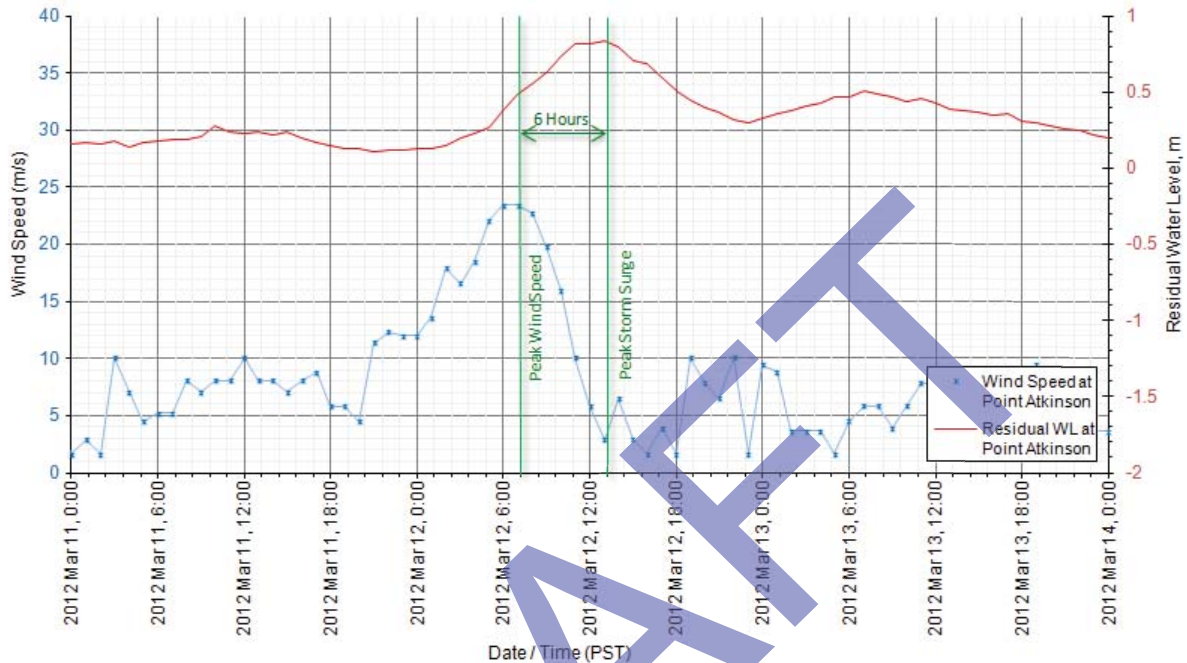


Figure 5: Correlation of Residual water level and wind speed during a SE storm event

For the purpose of this assignment, a specific assessment was conducted correlating wind events with storm surges by directional sector, and specifically for the NE, NW, SW, and SE sectors.

The analysis was based on the top 10 storms on record and a relationship was determined between peak wind speeds in the Sidney area and the corresponding storm surge, for each directional sector. The relationships for the top 10 SE and NE storms in the record are shown in Figure 6 and Figure 7, respectively. The expected wind speed for the Designated Storm is also shown.

District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise

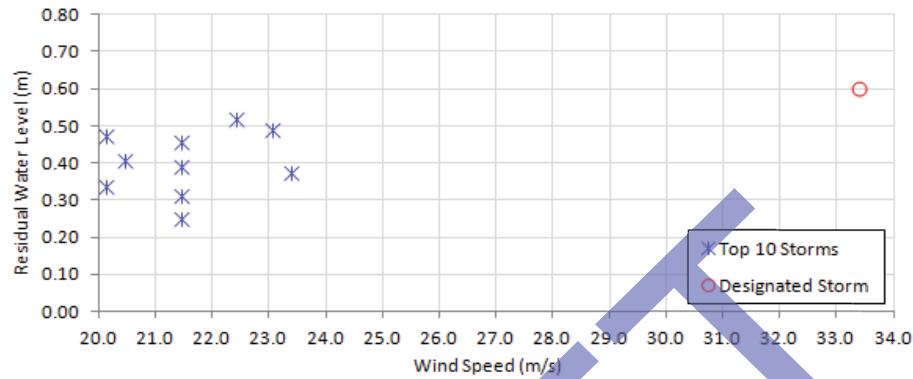


Figure 6: Residual water levels at the time of peak winds for a SE storm.

Source: modified Victoria Airport winds

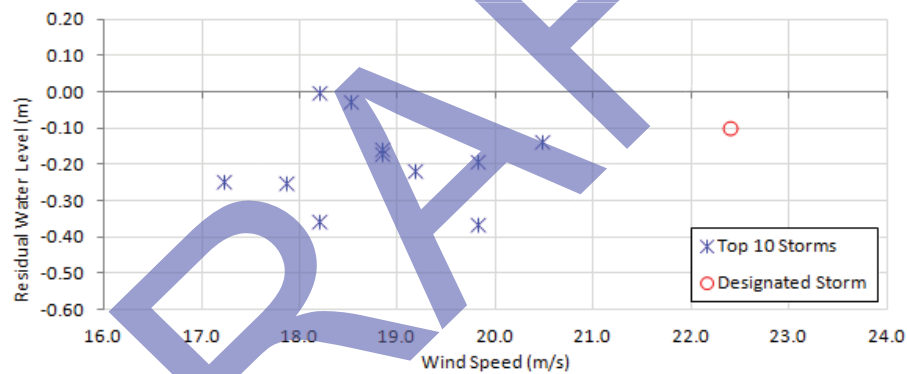


Figure 7: Residual water levels at the time of peak winds for a NE storm event.

Source: modified Victoria Airport winds

The results in Figure 6 suggest that significantly lower storm surge amplitude, compared to the Provincial Guideline of 1.3 m, can be expected when winds actually peak in the waters offshore of Sidney.

Analysis of the top 10 NE storms, Figure 7 suggests that there is a negative storm surge (residual) during severe NE storm events. Analysis of strong NW events provided similar correlations.

Analyses of SW storms showed that the correlation between peak SW winds and residual water levels is similar to that found for the SE storms – the expected storm surge at the time of maximum SW winds is also less than suggested by the Provincial Guideline documents. However, it was noticed that at the time of the largest recorded storm surge on record (0.9 m), winds at Victoria Airport (and Kelp Reef) had swung to the SW.

These results suggest that there is more than one storm scenario that could produce governing storm related Wave Effects around the Saanich peninsula:

- The time at which winds (and related waves) peak and the storm surge is not a maximum
- The time when the storm surge is a maximum but winds (and related waves) have either not yet peaked or they have already started to decrease.

In reality, there are many possible combinations of water levels (astronomical tide plus storm surge) and waves which could produce governing Wave Effects around the peak of the storm for several hours. For the purpose of this assignment we have concentrated on the likely governing scenarios that could define appropriated FCLs.

2.2. Designated Flood Level

The designated flood level (DFL), which does not include the effect of waves at the shoreline, is the sum of the following components [2]:

- Future SLR Allowance
- Maximum high tide (HHWLT)
- Total storm surge during the Designated Storm

The DFL will vary around the shoreline perimeter of the DNS, depending on the exposure of each section of shoreline and the timing of the Designated Storm, winds, storm surge and resulting waves for the particular shoreline exposure.

Sea Level Rise

The existing 2011 Provincial Guideline documents are based on an estimated linear rate of SLR through 2200. The recommended planning curve is shown in Figure 8 as the BC 2011 Planning Curve.

The BC 2011 Planning curve suggests that 1 m of SLR should be expected by the year 2100. However, the weight of science and data related to ongoing sea level rise strongly suggests that 1 m of SLR may occur sooner, as suggested by more recent projections, also shown in Figure 8.

One component of local SLR is the influence of land uplift or subsidence, due either to tectonic effects or glacial isostatic rebound. The current measured land uplift rate in the DNS area is approximately +1.4 mm/yr [1]. This rate, if projected to the year 2100, will result in land uplift of roughly +0.1 m and a slightly slower rate of local SLR than indicated in Figure 8

If the more aggressive SLR projection curves in Figure 8 are representative, then in the most aggressive scenario (the red dashed curve in Figure 8) one meter (1 m) of global SLR may occur by approximately 2065. In this case, the effect of local uplift will be much less and only represents a small fraction of the expected duration until 1 m of local SLR actually occurs.

District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise

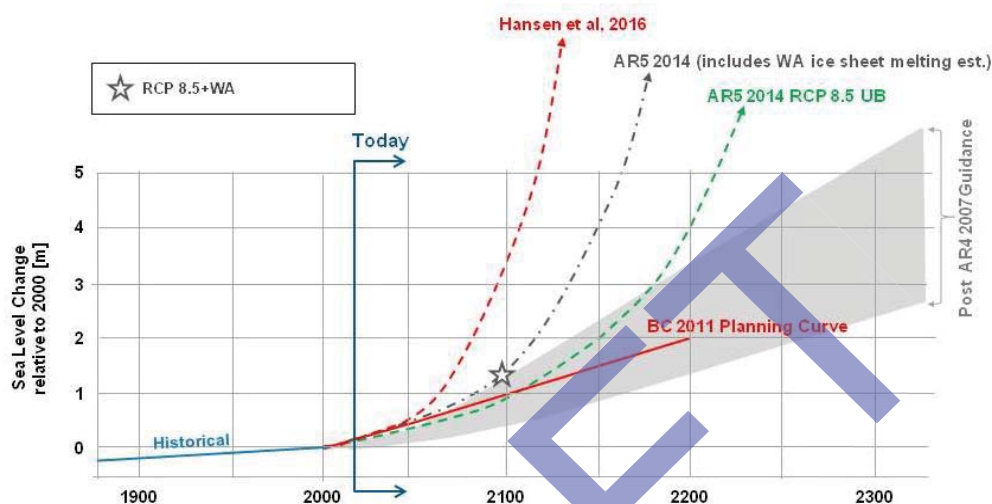


Figure 8: Mean Global Sea Level Rise Projection Curves

For this reason, we have considered two local sea level rise scenarios, 0.5m and 1.0m of net local SLR. These values generally correspond to the estimates for SLR in the year 2050 and 2100 by the 2011 BC Provincial Guideline documents [1], but most likely will occur sooner. The combined interaction of the actual future rate of rise of global sea levels and the appropriate allowance for local land uplift effect is considered to be a part of the inherent uncertainty in the predicted SLR values.

Tidal Water Level

Tide levels vary slightly around the DNS peninsula, with HHWLT ranging from 1.4 m CGVD28 to 1.6 m CGVD28. The specific HHWLT from various local CHS tidal stations are listed in Table 2-1. For the purpose of estimating the DFL, a HHWLT elevation of 1.5m CGVD28, is used.

Table 2-1: Tide Levels at Patricia Bay [8]

Tidal Station	HHWLT (m, CGVD28)
Brentwood Bay	1.6
Patricia Bay	1.4
Swartz Bay	1.5
Sidney	1.4
Saanichton Bay	1.4

2.3. Storm Scenarios during the Designated Storm

The assessment of winds, waves and storm surges undertaken for this assignment has shown there are different scenarios that can affect the various parts of the DNS shoreline depending on the shoreline exposure. In particular, during typical mid-latitude storms, the highest water levels (high tide plus storm surge) may occur after the strongest winds have started to decrease or alternatively after the wind direction has switched, for example from SE to SW. In these cases the incident wave climate and therefore the expected Wave Effects can change significantly and the governing total effect may occur at several moments during the storm that do not exactly coincide with either the time of strongest winds or highest surge.

A summary of the governing conditions is provided in Table 2-2 and Table 2-3 for 0.5 m and 1.0 of SLR, respectively.

Table 2-2: Summary of Designated Flood Levels for 0.5m of SLR

Storm Wind Direction Scenario	Case	Description	SLR Allowance (m)	Tide (m, CGVD28)	Storm Surge (m)	DFL (m, CGVD28)
NE	1	Peak wind	0.5	1.5	-0.1	1.9
NW	1	Peak wind	0.5	1.5	-0.1	1.9
SW	1	Peak wind	0.5	1.5	0.4	2.4
SW	2	Peak surge	0.5	1.5	0.9	2.9
SE	1	Peak wind	0.5	1.5	0.6	2.6
SE	2	Peak surge	0.5	1.5	1.3	3.3

Table 2-3: Summary of Designated Flood Levels for 1m of SLR

Storm Wind Direction Scenario	Case	Description	SLR Allowance (m)	Tide (m, CGVD28)	Storm Surge (m)	DFL (m, CGVD28)
NE	1	Peak wind	1.0	1.5	-0.1	2.4
NW	1	Peak wind	1.0	1.5	-0.1	2.4
SW	1	Peak wind	1.0	1.5	0.4	2.9
SW	2	Peak surge	1.0	1.5	0.9	3.4
SE	1	Peak wind	1.0	1.5	0.6	3.1
SE	2	Peak surge	1.0	1.5	1.3	3.8

2.4. Incident Wave Climate

Definition of Local Wind Climate

Wave generation during a storm is dependent on the wind speed, the related duration, and the extent of open water (fetch) upwind from the shoreline in question.

For the NE, NW, and SW cases, the wind speed and available fetch is almost fully constrained by adjacent land areas and limited open water fetch is available for wave generation. The estimation of incident waves at the shoreline and any resulting wave effects during the Designated Storm is relatively straightforward.

For the NE, NW, and SW-Case 1 scenarios, the 1/500 AEP wind speed based on modified Victoria Airport data, was used. To estimate the incident sea state during a potential 1/500 AEP SW maximum storm surge scenario, a 1/5 AEP wind speed was used for the SW-Case 2 scenario to avoid compounding probabilities unreasonably.

However; for the SE storm scenarios, the incident sea state is initially generated by strong winds blowing across eastern Juan de Fuca Strait from Admiralty Inlet on the US side of the Strait and then further affected by the winds in Haro Strait and then again by the wind in the waters between Haro Strait and the east shoreline of the Saanich peninsula. As the sea state propagates between James Island and Sidney Island in particular, wave dissipation will occur and the dissipated sea state can be re-generated by the decreased winds in this area.

For this assignment, the incident sea states for SE storm scenarios were first estimated in Haro Strait, using a fetch limited assumption across the east end of Juan de Fuca Strait and Haro Strait and then further modified to reflect the influence of Sidney and James Islands and the modification of the wind field in this area. A detailed definition of a wind speed dominated case for the SE direction is beyond the scope of this assignment as it involves estimating overwater wind fields across the entire east of Juan de Fuca Strait during a 1/500 AEP Storm. For this assignment, we have used a conservative scenario of a hurricane force wind speed in the Strait. The estimated 1/500 AEP wind speed, based on modified Victoria Airport data was used for the SE maximum storm surge scenario.

A summary of the wind and offshore wave related parameters for the Designated Storm scenarios is provided in Table 2-4. These scenarios and cases were used to define the expected wave climate at the shoreline, which is further described below.

Table 2-4: Summary of Designated Storm Parameters

Storm Scenario	Case	Description	Wind		Incident Waves		Storm Surge (m)
			Wind Speed (m/s)	Direction (from, °T)	Wave Height, H_s (m)	Period, T_p (s)	
NE	1	Peak wind	22.4	45	-	-	-0.1
NW	1	Peak wind	20.9	320	-	-	-0.1
SW	1	Peak wind	28.6	240	-	-	0.4
SW	2	Peak surge	20.8	240	-	-	0.9
SE	1	Peak wind	33.4	135	5.7	8.4	0.6
SE	2	Peak surge	25.2	135	3.9	7.4	1.3

Definition of the Local Incident Wave Climate

An industry standard wave modeling software, Simulating Waves Nearshore (SWAN) was used to estimate the expected incident wave climate around the shoreline of the Saanich peninsula.

SWAN is a third-generation numerical wave model developed by Delft University of Technology, which computes the generation and propagation of random, short-crested wind-generated waves in coastal regions and inland waters. It is a spectral (phase averaged) model that is valid on mild slopes for the propagation of waves influenced by shoaling, refraction, currents, and wind forcing. Dissipation of waves due to white-capping, bottom friction, and depth-induced breaking is accounted for in the software. For this project we have utilized SWAN version 41.01A.

Bathymetry and Grids

Bathymetry data for the SWAN model was obtained from an in-house bathymetric model of the SW coast of British Columbia, which was then refined near the Saanich peninsula. The existing model has various sources of bathymetric data, including data available from NOAA, for US waters in Juan de Fuca Strait and the Canadian Hydrographic Services (CHS) for Canadian waters. For this assignment, CHS Chart 3441 and Chart 3447 were digitized and used as references for bathymetric data in the vicinity of the DNS shoreline. An image of the refined bathymetric model is shown in Figure 9.

Three different computational SWAN grids were used for the different storm scenarios as shown in Figure 9. Sensitivity runs were completed to determine the grid size needed to appropriately define the wave climate at the -10m contour.

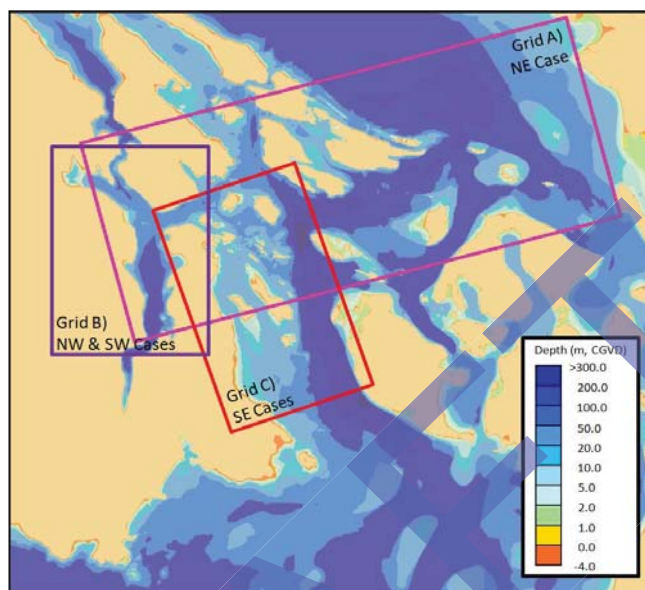


Figure 9: Bathymetric model and SWAN grid extents for designated storm cases

Model Run Scenarios

For the purpose of this project, the six storm scenario cases in Table 2-4 were used to determine the resultant incident wave climate around the Saanich Peninsula.

Whenever possible, it is useful to calibrate numerical wave models with long-term, measured data. The wave buoy in Patricia Bay, which has an approximately 20 year record, was used to calibrate SW and NW winds in order to achieve realistic wave heights during the related model runs. Sensitivity tests were completed to reproduce actual storm events measured at the Patricia Bay Buoy. The tests resulted in the following conclusions:

- SW and NW wind speeds can be reduced to 85% of the modified Victoria Airport wind speeds for numerical modeling purposes to account for the duration-limited wind conditions and stationary modeling methods used for these directions.
- Governing SW winds predominantly occur from 240°, rather than directly down the longer fetch in Saanich Inlet. The shorter 240° fetch results in a more realistic nearshore wave climate in the affected areas.

NE and SE designated storm wind speeds were not reduced, as the Patricia Bay wave buoy is not located in an area indicative of the wind and wave climate on the East side of the Peninsula

A summary of the modeled scenarios and their respective inputs is included in Table 2-5.

Table 2-5: Summary of Model Run Inputs

Storm Scenario	Case	Grid	Winds		Incident Waves at Boundary		Water Level
			Wind Speed (m/s)	Direction (°T from)	H _s (m)	T _p (s)	DFL (m, CGVD)
NE	1	A	22.4	45	-	-	2.4
NW	1	B	17.8	320	-	-	2.4
SW	1	B	24.3	240	-	-	2.9
SW	2	B	17.7	240	-	-	3.4
SE	1	C	33.4	135	5.7	8.4	3.1
SE	2	C	25.2	135	3.9	7.4	3.8

Nearshore Wave Climate

The resulting wave fields for the SW peak wind speed, and SE peak wind speed scenarios, are shown in Figure 10. These images illustrate how the nearshore wave climate can vary significantly along the shoreline for a specific storm scenario. Images showing the resulting wave fields for all storm scenarios are provided in Appendix A.

The nearshore wave characteristics, generally along the -10 m CGVD28 contour, but in some cases, in shallow water areas, along the -5 m or -2 m CGVD28 contour, are shown in Figure 11 for the SW peak wind speed and SE peak wind speed scenarios for 1m of SLR. Summaries of the nearshore sea states along specific reaches of the DNS shoreline, for all scenarios, are provided in Appendix B.

It should be noted these summaries of the nearshore wave climate do not include the potential influence of floating structures (docks or moored vessels) which in some cases, especially near marinas, could attenuate wave energy.

District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise

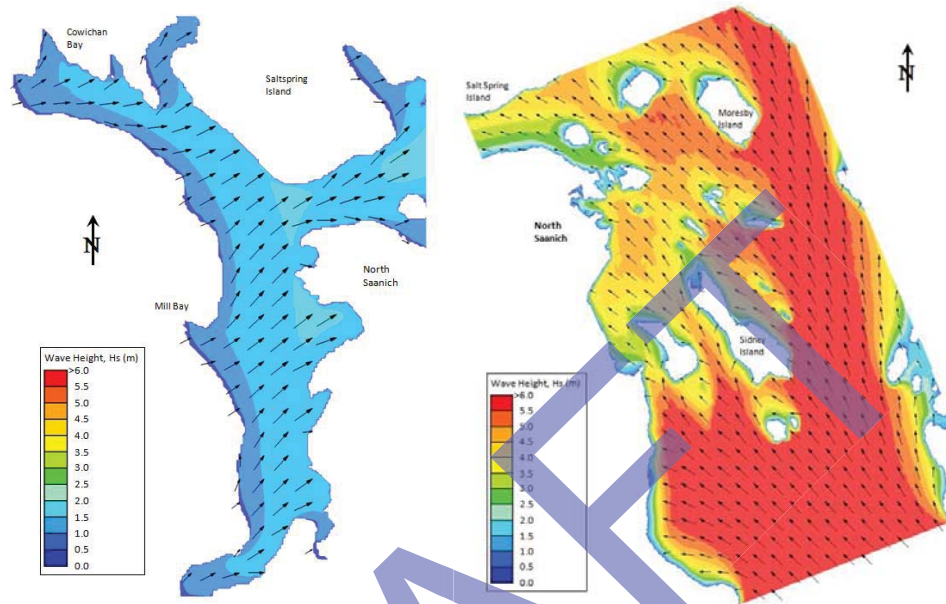


Figure 10: SWAN results for SW peak wind speed (left), and SE peak wind speed (right), 1m SLR

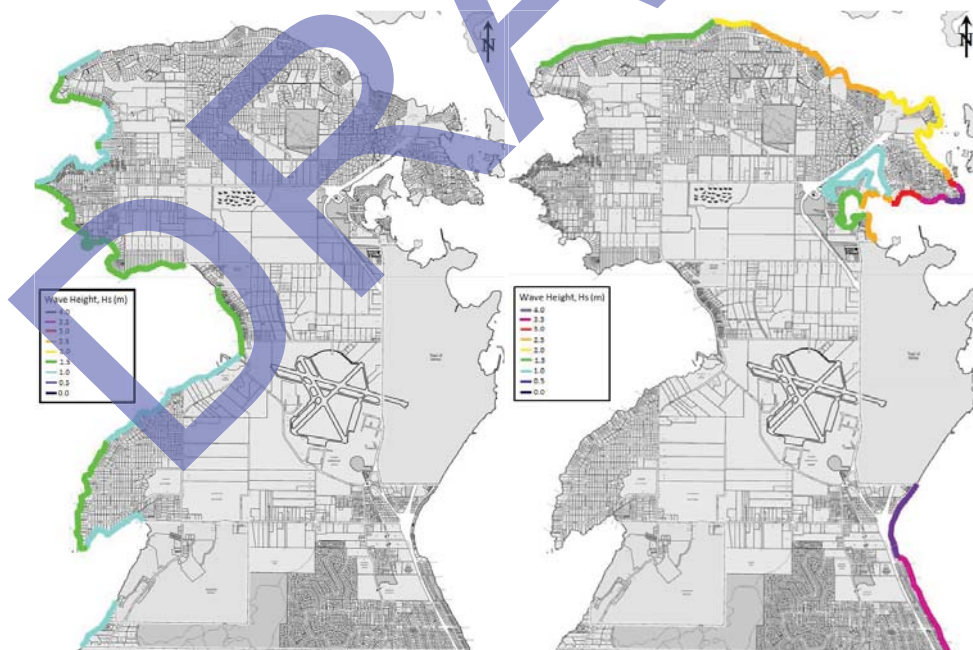


Figure 11: Compiled nearshore seastate, SW peak wind speed (left) and SE peak wind speed (right), 1m SLR

2.5. Wave Effects

The nearshore wave climate results described in Section 2.4 were then used to define the expected Wave Effects around the DNS shoreline for the governing storm scenarios. Wave effects are site and shoreline dependent, and reflect the interaction of the incident waves with a particular shoreline feature. In general terms the Wave Effects will either be wave run-up on the shoreline or wave overtopping of shoreline features such as seawalls or rock revetments. The Wave Effects can result in flooding depending on the elevation of the lands adjacent to the shoreline.

Wave run-up is the vertical distance that water runs up the shoreline/structure slope during the Designated Storm. Wave overtopping is the volume of water that travels over the structure crest and can range from a small amount of spray to a sufficiently large volume capable of damaging structures or flooding of the land. Wave overtopping can be quantified by an average discharge rate, q , in L/m/s (liters/meter of shoreline/second). The average rate of overtopping is essentially defined by the crest elevation of the shoreline structure crest elevation. It should be noted that actual overtopping will occur in individual wave related pulses of water, which, averaged over time, will equal the average discharge rate.

The shoreline types utilized in estimating wave effects are discussed below. A discussion on the appropriate overtopping threshold for defining FCLs is also provided in the following sections.

Shoreline Types

A site visit was conducted by boat on January 14, 2016, to identify the different shoreline types above the high water line around the DNS shoreline. In general, shoreline types range from tall vertical cliffs to mildly sloping beaches. In general, the characteristics of the DNS shoreline can be classified into 3 main types, as illustrated in Figure 12:

- Erodible natural shorelines (green)
- Non-erodible natural shorelines (grey)
- Seawall or revetments (black)

Reaches

The DNS shoreline was divided into 39 reaches, based on the observed shoreline composition and the characteristics of the nearshore wave climate as summarized in Section 2.4. The reaches, alternating in red and blue, are illustrated in Figure 12.

District of North Saanich

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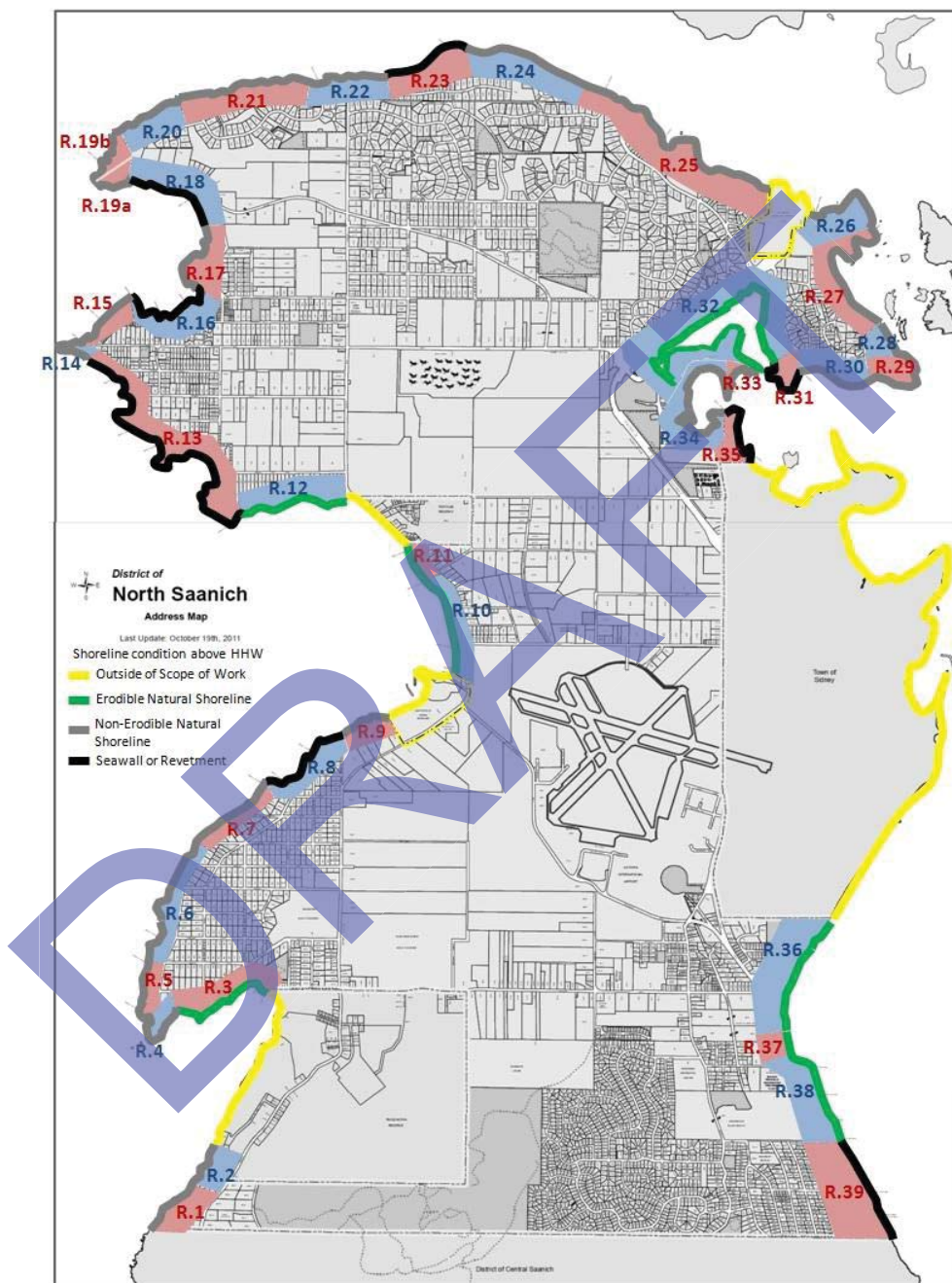


Figure 12: Shoreline Reaches R.1 to R.39

Overtopping Thresholds

In order to determine crest elevations, and therefore FCLs, a threshold for overtopping must be specified. Generally, an overtopping threshold of $q = 10 \text{ L/m/s}$ results in a crest elevation that provides safety and security against flooding to personnel or property behind the shoreline. A threshold of $q = 100 \text{ L/m/s}$ assumes a lower crest elevation and results in more flooding and overtopping. This can mean that it is very dangerous for pedestrians and/or trained staff. This higher threshold also implies wave overtopping that is sufficient to result in damage to any shoreline structures and flooding, with standing water, up to the same elevation as the FCL.

Figure 1312 illustrates the level of flooding associated with these two thresholds.

For the purpose of this study, an overtopping threshold of $q = 10 \text{ L/m/s}$, was used, which is associated with significantly less risk to people and structures.

Sensitivity tests were also completed using a set of identical nearshore wave conditions to determine the sensitivity of FCL's to the chosen overtopping threshold. The results from these tests are detailed in Appendix D. In Reaches 1 and 32, for example, the overtopping threshold had no effect because wave heights and effects are almost negligible. In highly exposed areas, such as Reach 36, an overtopping rate of 10 L/m/s increases the FCL to 1.5 times the 100 L/m/s FCL; however it implicitly implies a much safer scenario on the related reaches.

Wave Effects

The estimated Wave Effects for each Designated Storm scenario on each shoreline reach for an average overtopping rate (q) of 10 L/m/s were assessed using the industry standard software BREAKWAT, which is capable of assessing all types of shore structure types. BREAKWAT was used to calculate the crest elevation required above the Designated Flood Level (DFL) to limit the average rate of overtopping to the previously mentioned thresholds. The following additional assumptions were made in estimating the Wave Effects:

- The maximum intertidal slope, from the toe of any shoreline feature to the nearshore contour = 1:10
- Wave Effects are based on common shoreline feature for each reach



Figure 13: Recent overtopping events in BC corresponding to approximately $q = 10 \text{ L/m/s}$ (top) and $q = 100 \text{ L/m/s}$ (bottom)

3. FINDINGS

Flood Construction Levels define either the underside elevation of a wooden floor system for habitable buildings, or the top elevation of a concrete slab for habitable buildings. FCLs should not be interpreted as a required ground elevation surrounding a building intended for human habitation. Other measures, including drainage or wet or dry flood proofing measures may be appropriate where ground levels are lower than the FCL.

Flood Construction Levels were calculated as the sum of the following components for any given reach [2]:

- Designated Flood Level (DFL)
- Estimated Wave Effects during Designated Storm
- Freeboard Allowance

A freeboard allowance of 0.6 m, as recommended in the 2011 Provincial Guidelines is included unless otherwise noted. The factors included in the Freeboard Allowance are discussed further below.

3.1. Revised Flood Construction Levels

The revised FCLs are provided in Figure 14 and Figure 15 for a future sea level rise of 0.5m and 1.0m, respectively, for a overtopping rate $q = 10 \text{ L/m/s}$. As noted above, the overtopping threshold of $q = 10 \text{ L/m/s}$ results in an elevation that provides safety and security against flooding to personnel or property behind the shoreline.

At this threshold, 25 reaches have FCL's for a 1.0m Sea Level Rise scenario that are lower than the existing uniform CRD estimate of 5.04 m. The remaining 14 reaches have higher FCL's largely due to the shoreline exposure or shoreline characteristics.

The 0.5m SLR scenario resulted in reaches with FCL's that are between 0.4m and 1.1m lower than the 1.0m SLR scenario FCL's, depending on location. This reduction is largely due to a reduction in water depth which also serves to limit nearshore wave heights. For this scenario, 30 reaches have revised FCL's lower than the CRD estimate and only 9 reaches have higher FCL's.

District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise

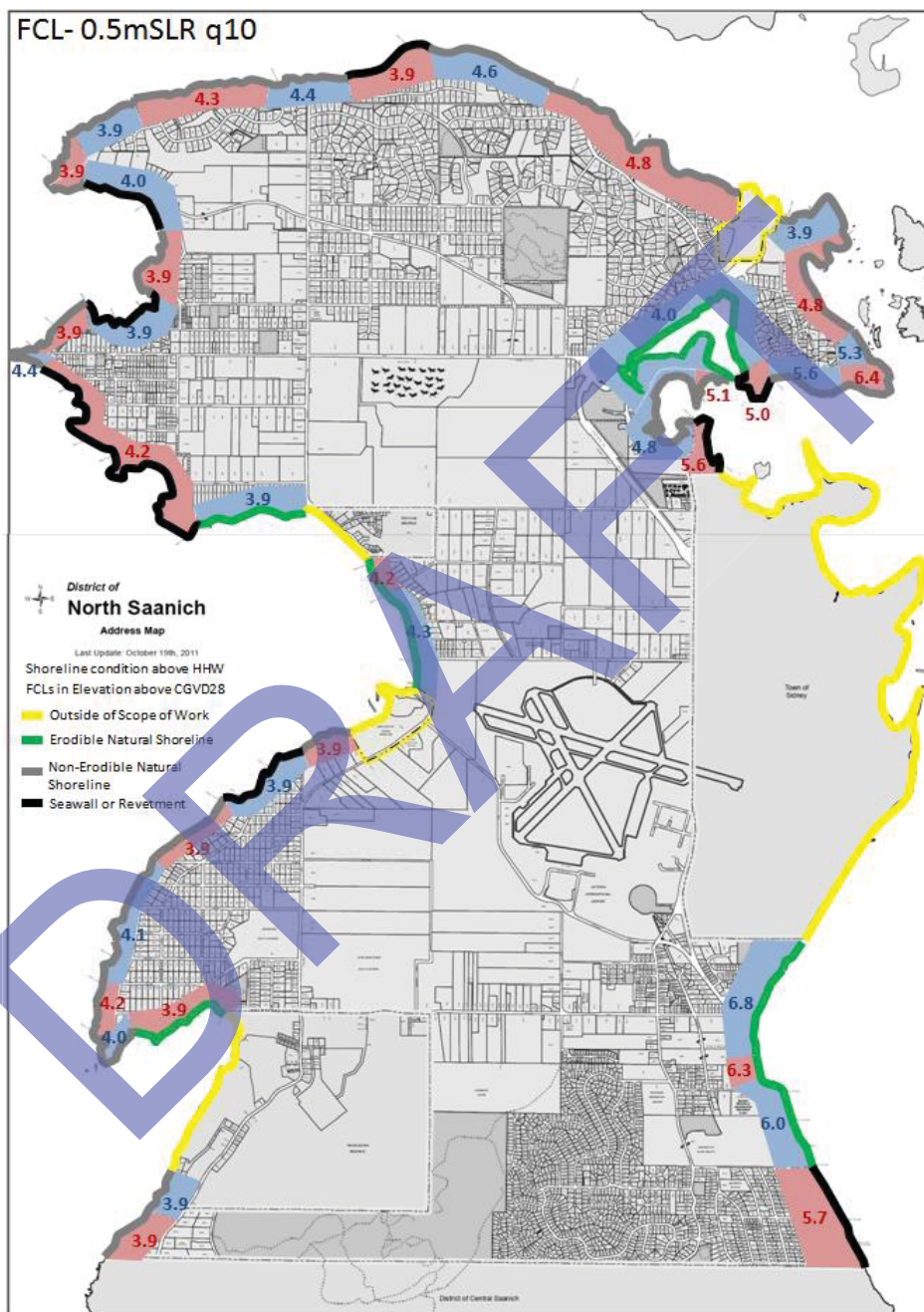


Figure 14: FCL's for 0.5m Sea Level Rise

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Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise

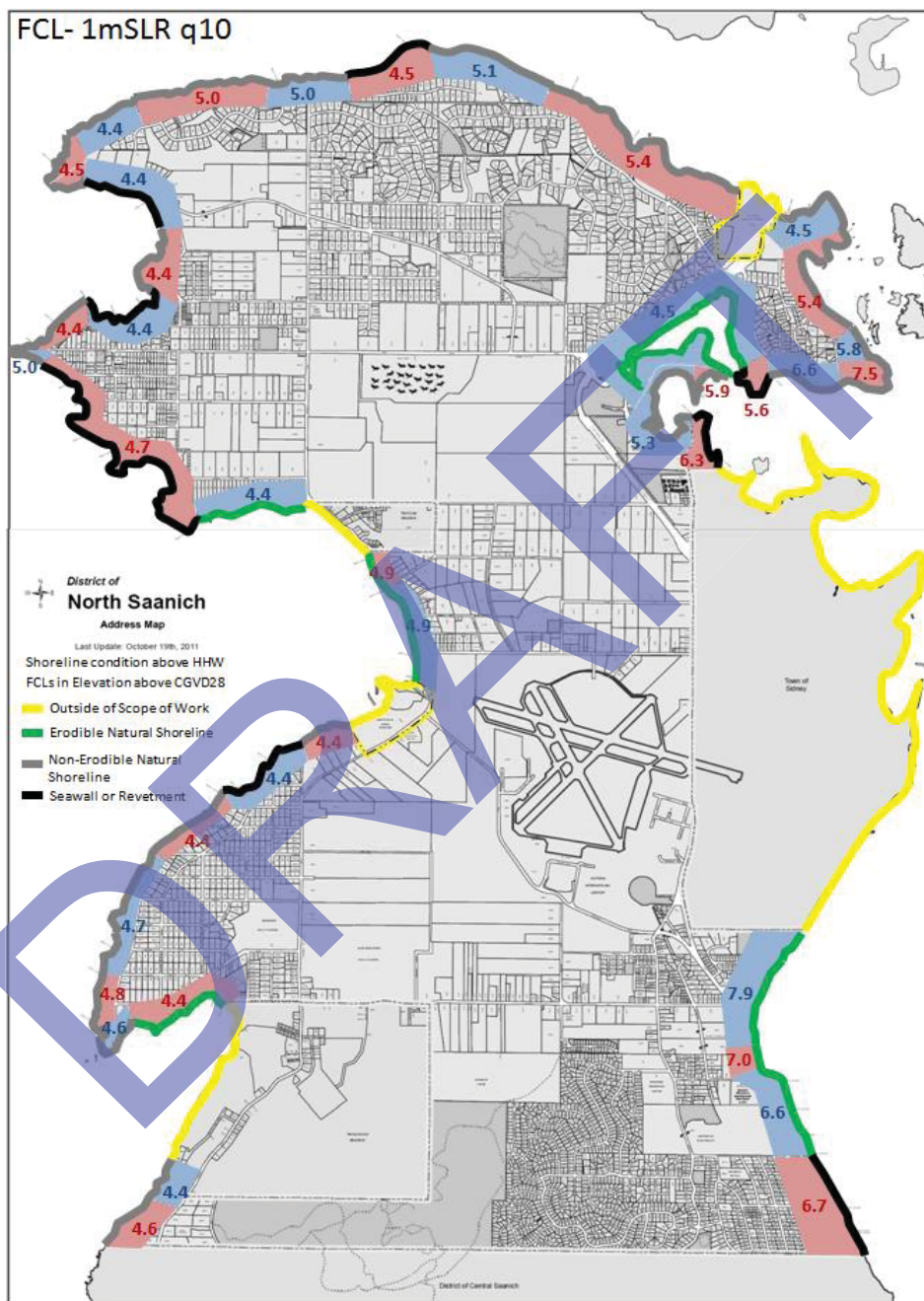


Figure 15: FCL's for 1.0m Sea Level Rise

3.2. Affected Lots

There are approximately 713 properties along the DNS shoreline that are exposed to the future threat of sea level rise and the associated wave related effects. For the purpose of understanding how these lots are affected by the FCL's, we have used the following criteria:

Directly Affected:

1. Lot is not affected: The FCL elevation does not encroach into the lot.
2. Lot is partially affected: The FCL elevation encroaches less than a 15m setback on the lot.
3. Lot is partially flooded: The FCL encroaches beyond a 15m setback, but does not inundate the entire lot.
4. Lot is completely inundated: The FCL elevation encroaches on the entire lot and possibly further landward.

Indirectly Affected:

1. Lot is adjacent to a lot where flooding is expected, which is substantially greater than the flooding for the reference lot.
2. Lot is adjacent to a completely inundated lot.

The levels of inundation were defined using a digital elevation model (DEM) of the District of North Saanich based on LiDAR measurements of District topography. The DEM was provided by the DNS. Lot boundaries are based on Cadastral mapping also provided by the DNS.

Criteria 1 implies that the FCL will have little to no effect on applicable lots and mainly occurs where the shoreline is steep and high.

Lots where Criteria 2 is applicable will have limited flooding or wave interaction, provided that the main building is landward of a 15m setback. Lots affected by Criteria 3 and 4, may require protection or other measures.

Indirectly affected lots are dependent on the action of the adjacent lots. For example, if a waterfront lot constructs a sea wall, the adjacent lots may be impacted by overtopping.

The number of lots affected by 1m and 0.5m FCL's for an overtopping threshold of 10 L/m/s are summarized in Table 3-1. These values are based on the map of the revised FCL's for the entire Peninsula, included in Appendix C.

It is important to note that the total number of directly affected lots is equal to the total number of waterfront lots in the DNS. For the purpose of this analysis, waterfront lots are defined as properties directly adjoined to the ocean, not including parks or areas out of the Scope of Work as defined in Section 1. We also assumed that for properties affected by more than one FCL, the higher FCL governs.

The indirectly affected lots includes lots already counted as directly affected and lots that are typically inland (generally across a road right of way) of a waterfront lot.

Table 3-1: Summary of lots affected by the revised FCL's

Criteria	Number of Lots	
	0.5m SLR	1.0m SLR
Directly Affected Lots		
Criteria 1	83	48
Criteria 2	499	502
Criteria 3	67	81
Criteria 4	64	82
Total	713	713
Indirectly Affected Lots		
Criteria 5	17	31
Criteria 6	37	46
Total	54	77

3.3. Uncertainties

As discussed previously, a freeboard allowance of 0.6 m was included in the FCL's to account for uncertainties, which include the following:

- A uniform 1:10 intertidal slope was used based on observations during the field reconnaissance. Steeper slopes could increase the Wave Effects.
- Although the shoreline is sub-divided into 39 reaches, variation in shoreline type, slope, and orientation still exist within each reach. Some of these variations could result in either higher or lower Wave Effects within each reach.
- Nearshore wave heights and wave effects do not consider the effects of local structures, vessels, or docks.
- The numerical wave model computational grid has 100m grid spacing, which is appropriate when considering a 1-2km reach length, but fails to capture some local complexities, such as rapid changes in bathymetry, narrow channels, or small islands, which may be important for an individual lot assessment.
- Shoreline orientations are averaged over the entire reach and within a reach, some lots may be more exposed or less exposed to the Designated Storms.
- Some reaches may be more exposed to waves generated by another wind direction, other than that considered by the Designated Storms. This is an inherent uncertainty of completing FCL's on a highly variable shoreline at a scale larger than that of the individual lot. However, these risks have been appropriately balanced by using some conservative engineering approaches, such as a lower overtopping threshold of $q = 10 \text{ L/m/s}$, and by applying a 0.6m freeboard.
- The refined FCL's are largely based on modifications of the recorded overland wind measurements from Victoria Airport and calibration with the Patricia Bay Buoy wind and wave data for SW and NW winds. Ideally, overwater wind measurements would also be available on the East side of the peninsula to validate the modifications made in this study for SE and NE winds.

- The Wave Effects are largely based on the wind climate from the last 60 years of measurements made at Victoria Airport. Climate change is expected to increase the frequency of severe weather events and possibly the intensity of these same events.
- There is a significant variation in present estimates of the future rate of SLR. The flow of new information and science related to future rates of SLR consistently indicates that SLR will occur faster than indicated by the 2011 Provincial Planning Curve. There is no scientific information that suggests rates will be lower. The freeboard allowance of 0.6 m provides an allowance for this particular uncertainty, the magnitude of which also depends on the magnitude of other relevant uncertainties in the calculations.

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4. GLOSSARY

Abbreviations and definitions of terms used in this report are listed below.

4.1. Abbreviations

AEP	Annual Exceedance Probability	The probability (or % chance) of a specific event occurring or being exceeded in any given year.
CD	Chart Datum	In the DNS area, CD is 2.2m (± 0.1 m) below Geodetic Datum (CGVD28).
CGVD28	Canadian Geodetic Vertical Datum (1928)	In most places in Canada, this is the current reference datum for terrestrial vertical elevations and is generally the same as mean sea level, based on astronomical tides alone. A detailed description is available online at: http://www.nrcan.gc.ca/earth-sciences/geomatics/geodetic-reference-systems/9054# Canadian Geodetic Vertical 1 . CGVD28 is being replaced with a newer datum plane based on a North American common geoid. The new datum is notionally equivalent to the local coastal mean sea level. Details are available online at: http://www.nrcan.gc.ca/earth-sciences/geomatics/geodetic-reference-systems/9054# Benchmarks Information
CRD	Capital Regional District	
DFL	Designated Flood Level	A water surface elevation which includes appropriate allowances for future SLR, land crustal movement, tide, and storm surge during the Designated storm.
DPA	Development Permit Area	Refers to Development Permits as per Division 7 of the LGA or Section 14 of the OCP.
DS	Designated Storm	A storm which includes concurrent time series of winds, storm surge and waves, with a specific AEP.
FCL	Flood Construction Level	Defined as the underside elevation of a wooden floor system or the top elevation of a concrete slab, for habitable buildings [2].
	Floodplain Bylaw	Bylaw designated under Section 524 of the <i>Local Government Act</i> .
HHWLT	Higher High Water Large Tide	The average of the annual highest tide over an 18.6 year complete tidal cycle. In the DNS area, HHWLT is 1.5 m above Geodetic Datum (CGVD28) and 3.7 m above Chart Datum (± 0.2 m).
LGA	Local Government Act	Refers to the updated <i>Local Government Act</i> (RSBC 2015), which was

made current as of October 26, 2016 .

MTF	Marine Task Force	Refers to the individuals responsible for the MTFR.
RSBC	Revised Statutes of British Columbia	
SDA	Special Development Area	Refers to Special Development Area as per Section 13 of the OCP.
SLI	SNC Lavalin Inc	
SLR	Sea Level Rise	The rise in sea level including: global sea level rise driven by global warming and local sea level rise driven by regional tectonic or isostatic (glacial) subsidence or uplift.
SWAN	Simulating WAVes Nearshore	Wave modelling software, which can simulate wave generation, propagation, dissipation and transformation to the shoreline.
°T	Degrees, True North	Direction in degrees, with respect to True North.

4.2. Definitions

2011 Provincial Guidelines	Guidelines posted by BCMOE, BCMOE (2011a,b,c), and available online at: http://www.env.gov.bc.ca/wsd/public_safety/flood/fhm-2012/draw_report.html#3
Estimated Future Natural Boundary	The estimated location of the future Natural Boundary after sea level has risen, usually by a defined amount. Defined in the 2011 Provincial Guidelines .
Fetch	The horizontal distance over open water (in the direction of the wind) over which wind generates waves.
Foreshore	That part of the shoreline extending between the upper limit of wave interaction with the shoreline and the low tide elevation. Typically the inland limit of the foreshore would be landward of the Natural Boundary .
Freeboard	A vertical allowance added to the DFL and the Wave Effect allowance to establish the FCL. This allowance is generally included to cover any uncertainties in defining the FCL.
Geodetic Datum	The reference plane for terrestrial vertical elevations in Canada and in general approximately equal to mean sea level.
Natural Boundary	The present Natural Boundary as defined in the British Columbia <i>Land Act, Section 1</i> .

Nearshore	An indefinite zone extending seawards from the shoreline to deepwater, typically well seaward of the breaker zone and in water depths in the order of 20 m.
Overtopping	The passage of water over the crest of a shoreline or shoreline structure as a result of wave run-up.
Residual Water Level	The component of the measured water level that is not attributed to tidal effects. The residual water level is generally assumed to be approximately equal to the storm surge. Calculated as the measured total water level minus the predicted tides at a given location.
Run-Up	The vertical distance travelled by the action of individual waves that break and travel up the shoreline or slope of a shoreline structure.
Storm Surge	The non-tidal rise/fall in a body of water due to atmospheric effects.

5. REFERENCES

5.1. Reference Documents

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- [2] BCMoE (2011b). "Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use: Guidelines for Management of Coastal Flood Hazard Land Use". 27 January 2011.
- [3] BCMoE (2011c). "Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use: Sea Dike Guidelines". 27 January 2011.
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5.2. General References

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- [19] USACE. Coastal Engineering Manual. EM 1110-2-1100. 30 April 2002.
- [20] Hansen et al. "Ice Melt, sea level rise and superstorms: evidence from paleoclimate data, climate modelling, and modern observations that 2°C global warming is highly dangerous". Atmos. Chem. Phys. Discuss., 16, 3761-3812, 2016.

6. NOTICE TO READERS

This document contains the expression of the professional opinion of SNC-Lavalin Inc. ("SLI") as to the matters set out herein, using its professional judgment and reasonable care. It is to be read in the context of the Agreement, and the methodology, procedures and techniques used, SLI's assumptions, and the circumstances and constraints under which its mandate was performed. This document is written solely for the purpose stated in the Agreement, and for the sole and exclusive benefit of the Client, whose remedies are limited to those set out in the Agreement. This document is meant to be read as a whole, and sections or parts thereof should thus not be read or relied upon out of context.

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District of North Saanich

Flood Construction Levels for 0.5 and 1.0 m Sea Level Rise



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7. REVISION INDEX AND SIGNATURES

Document No.: 634533-3000-41ER-0001

Issue Code	Rev. No	Date (yyyy-mm-dd)	Description of Changes	Initials
RR	PA	2016-09-19	Released for Internal Review	JW
RR	PB	2016-09-21	Released for Client Information and Comment	JSR
RR	PC	2017-01-04	Comments Incorporated	JSR
RI	0	2018-03-27	Released for Information and Client Use	JSR

Issue Codes:

RC	Released for Construction
RD	Released for Design
RF	Released for Fabrication
RI	Released for Information
RP	Released for Purchase
RQ	Released for Quotation
RR	Released for Review and Comments

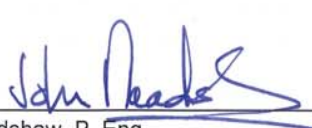
Prepared by:


 Jessica Wilson, EIT
 Project Engineer


 Sherry Lim, P. Eng.
 Project Engineer



Reviewed and Approved By:


 John Readshaw, P. Eng.
 Manager, Coastal Engineering and Dredging



District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results



APPENDIX A – SWAN Results

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Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results

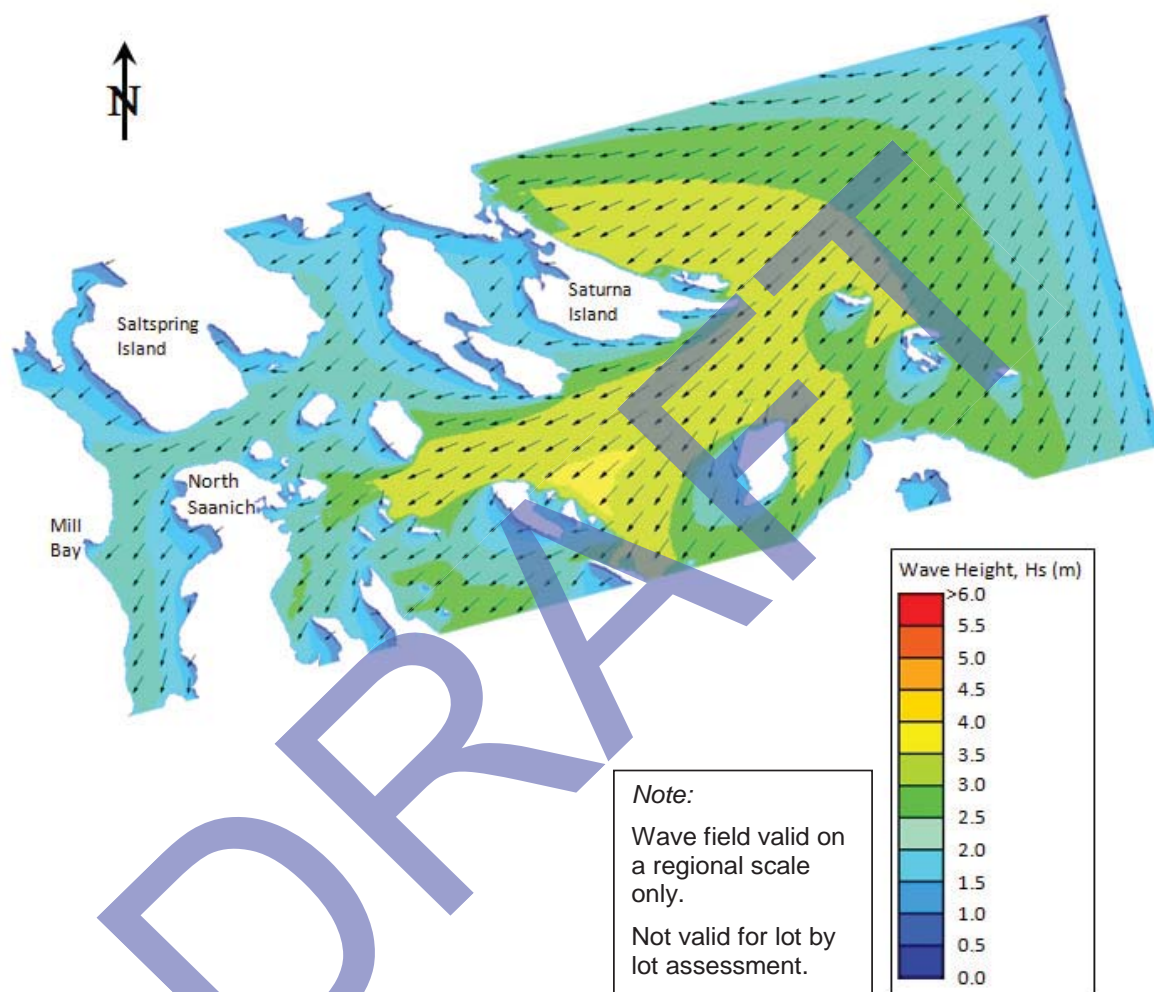


Figure 1: SWAN results for the NE peak wind speed scenario for 0.5m SLR

District of North Saanich

Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results

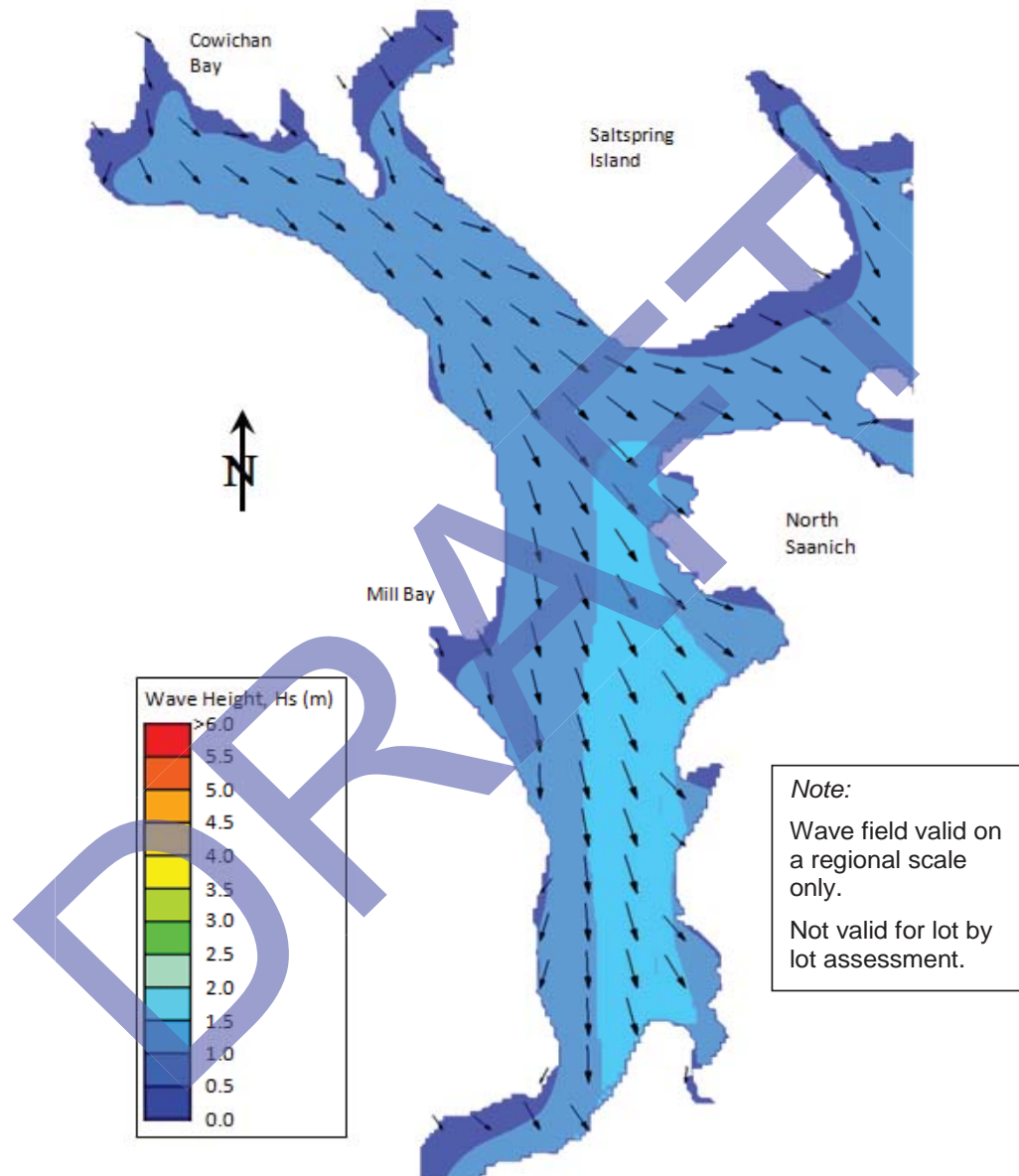


Figure 2: SWAN results for SWAN for the NW peak wind speed scenario for 0.5m SLR

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APPENDIX A – SWAN Results

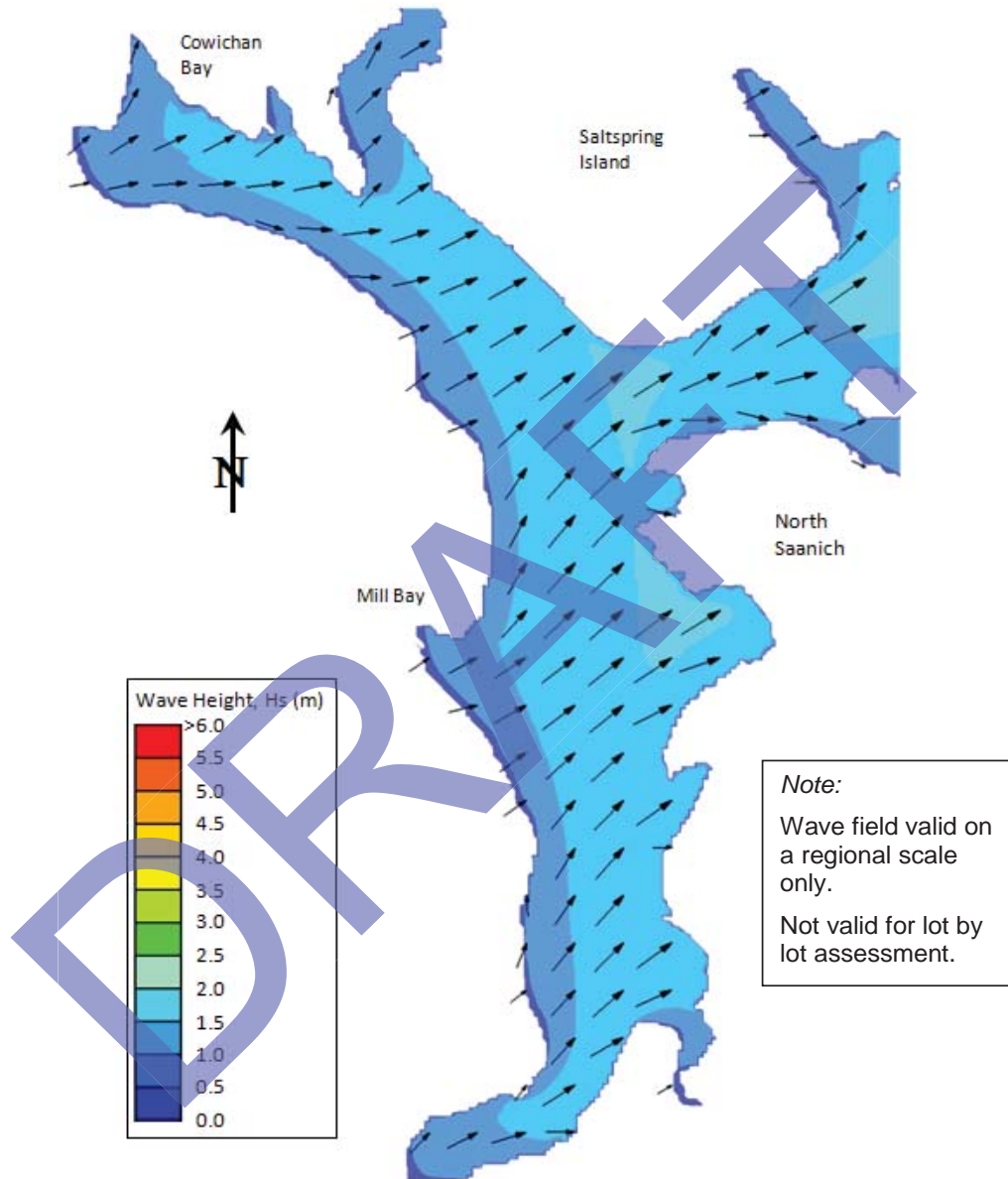


Figure 3: SWAN results for SWAN for the SW peak wind speed scenario for 0.5m SLR

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APPENDIX A – SWAN Results

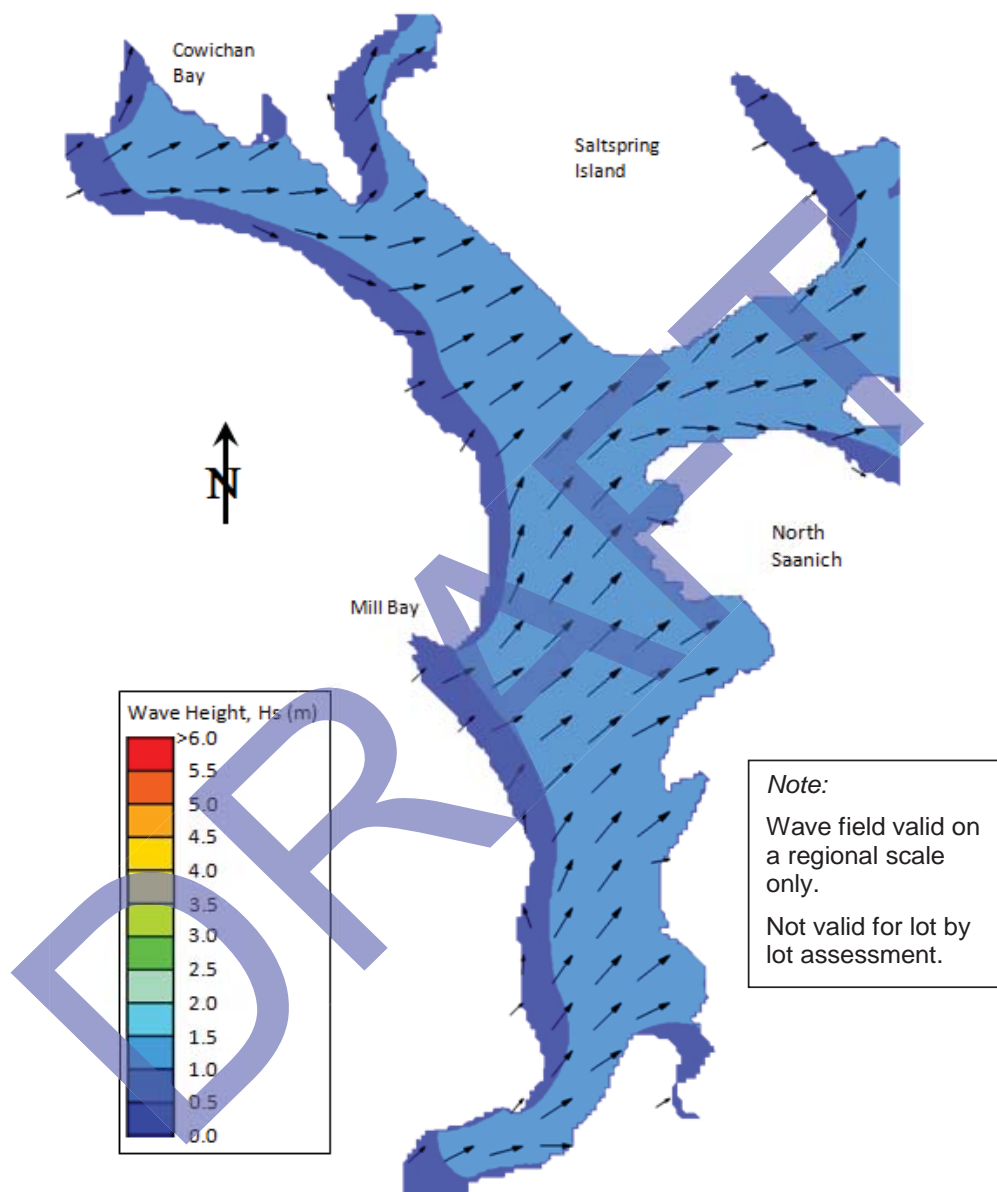


Figure 4: SWAN results for SWAN for the SW peak storm surge scenario for 0.5m SLR

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Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results

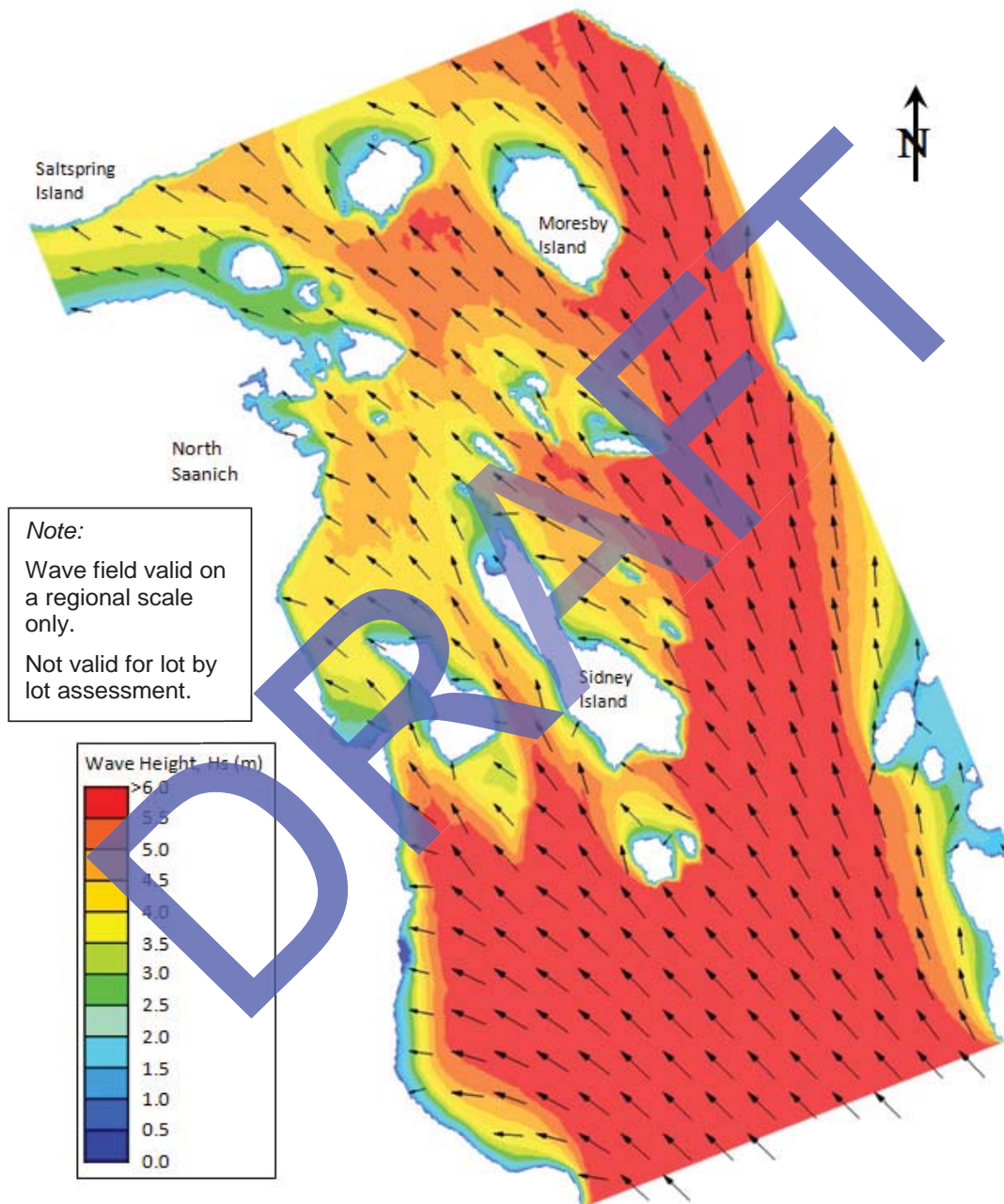


Figure 5: SWAN results for SWAN for the SE peak wind speed scenario for 0.5m SLR

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APPENDIX A – SWAN Results

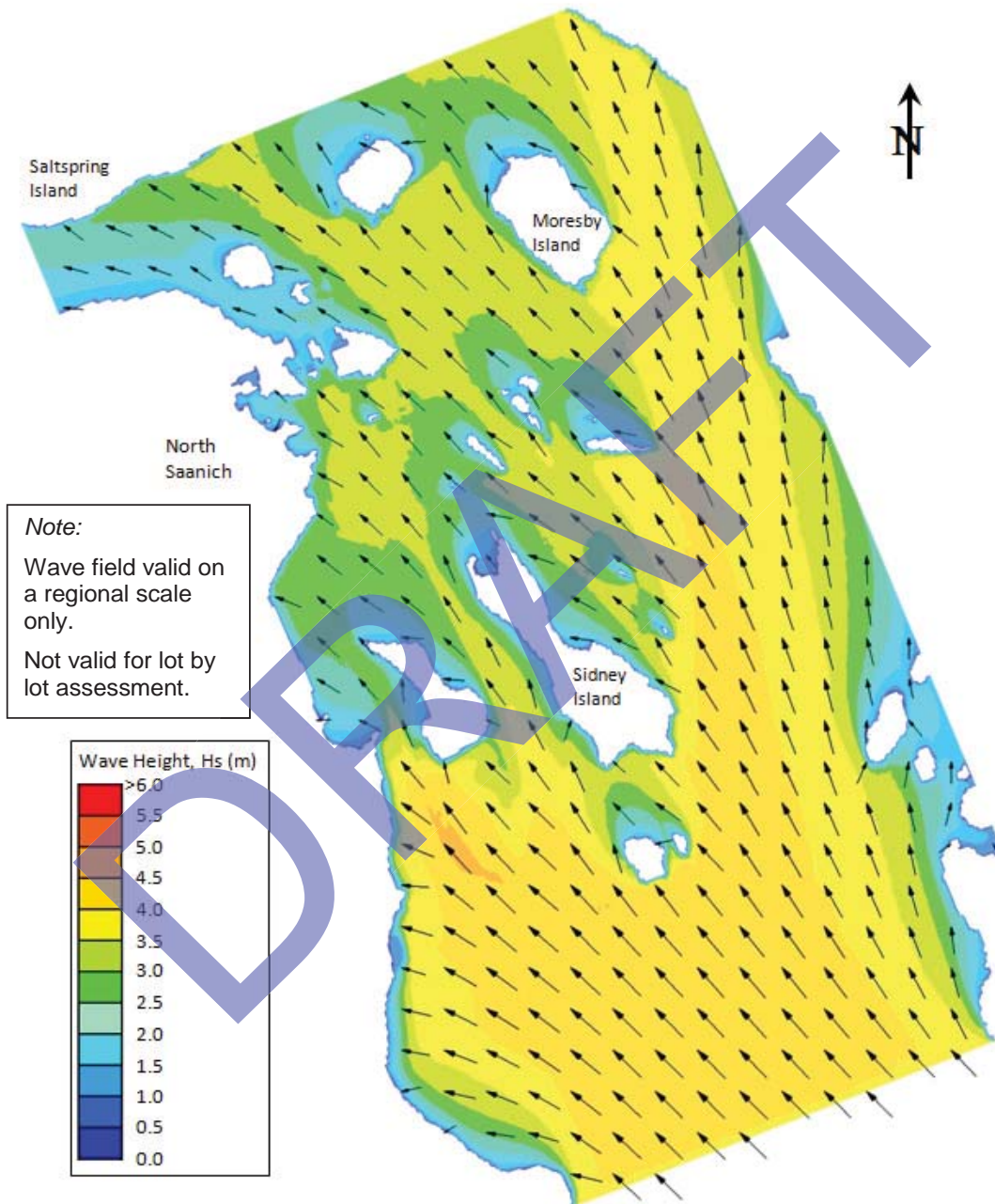


Figure 6: SWAN results for the SE peak storm surge scenario for 0.5m SLR

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APPENDIX A – SWAN Results

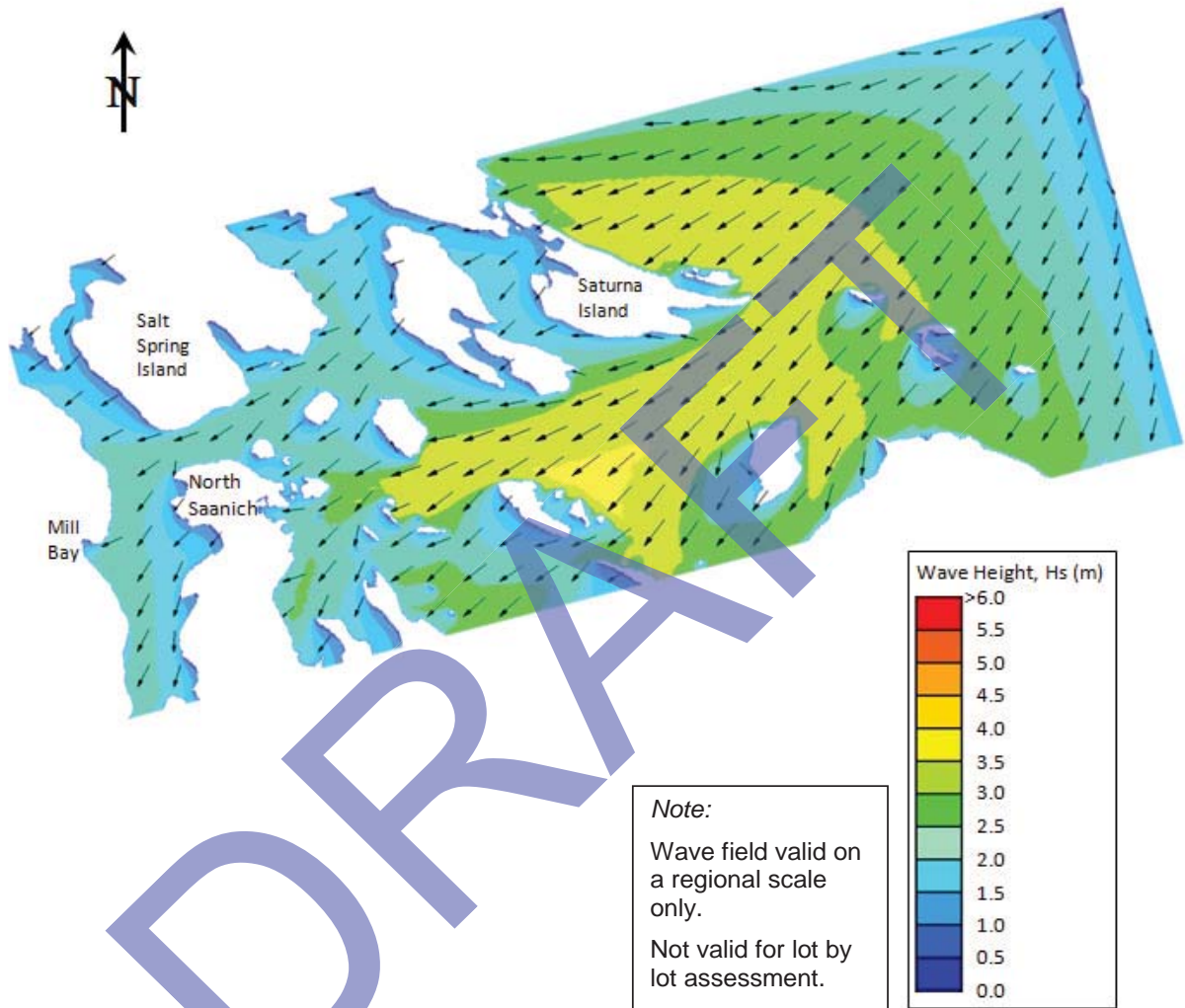


Figure 7: SWAN results for the NE peak wind speed scenario for 1m SLR

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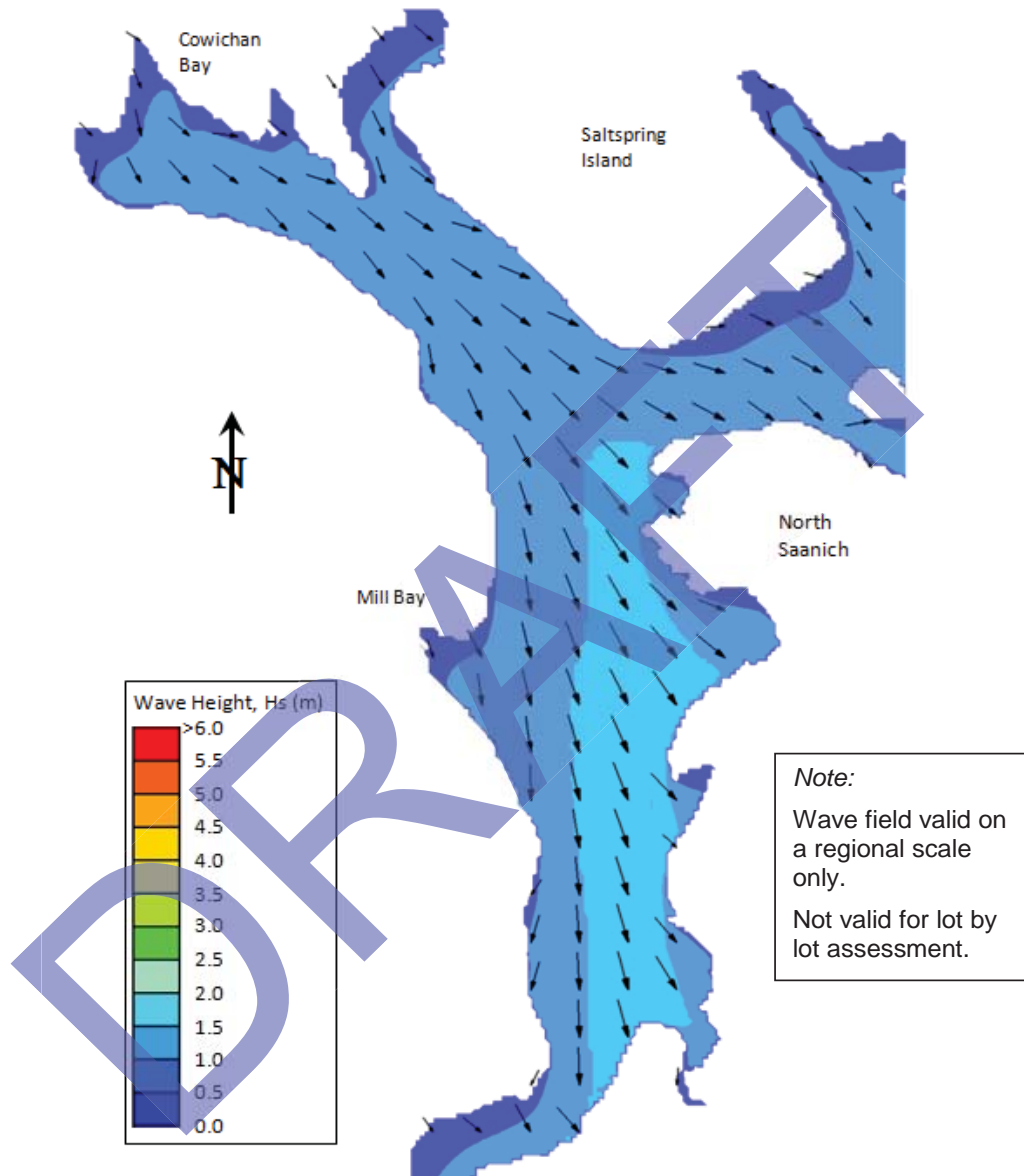


Figure 8: SWAN results for SWAN for the NW peak wind speed scenario for 1m SLR

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Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX A – SWAN Results

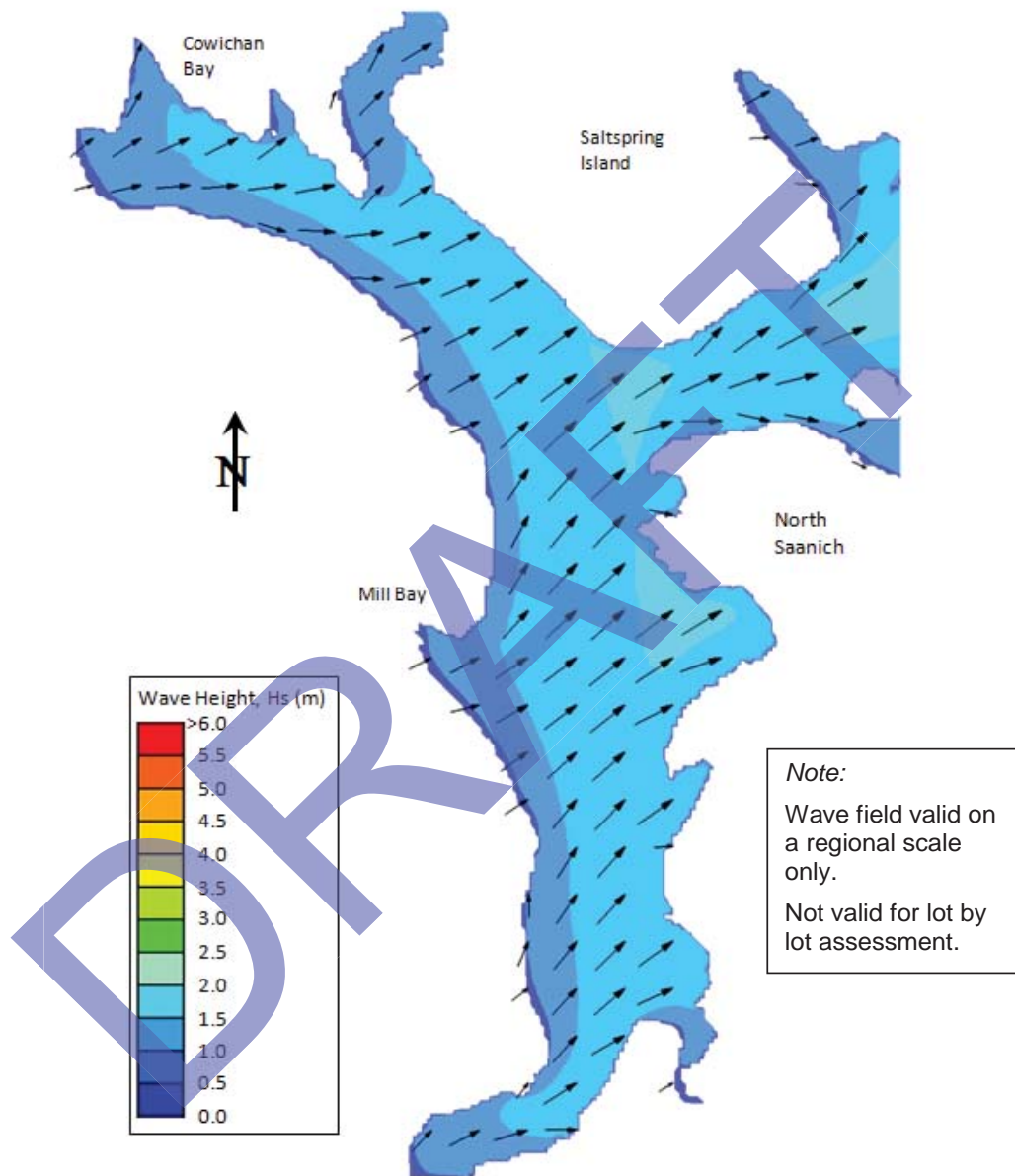


Figure 9: SWAN results for SWAN for the SW peak wind speed scenario for 1m SLR

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APPENDIX A – SWAN Results

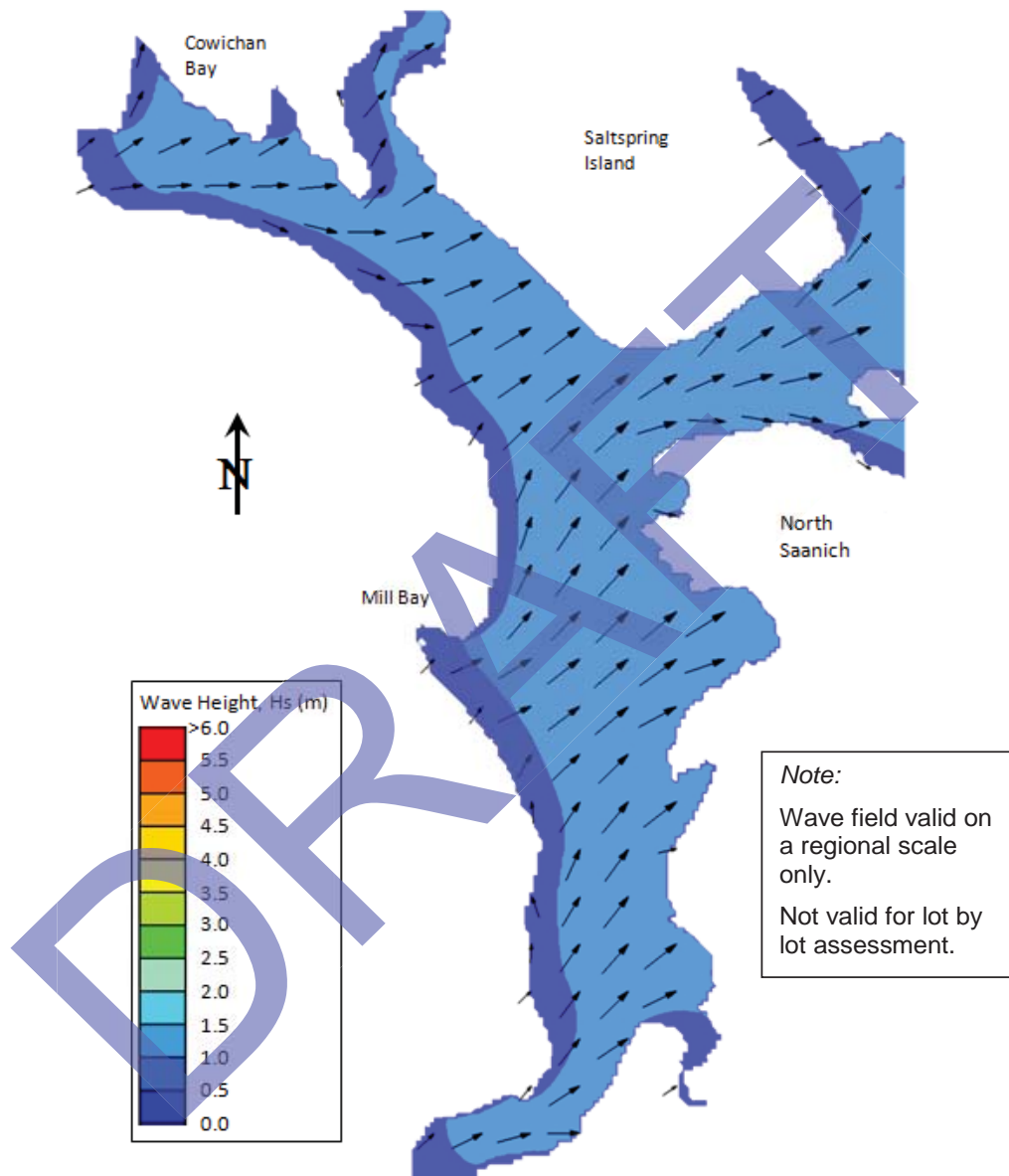


Figure 10: SWAN results for SWAN for the SW peak storm surge scenario for 1m SLR

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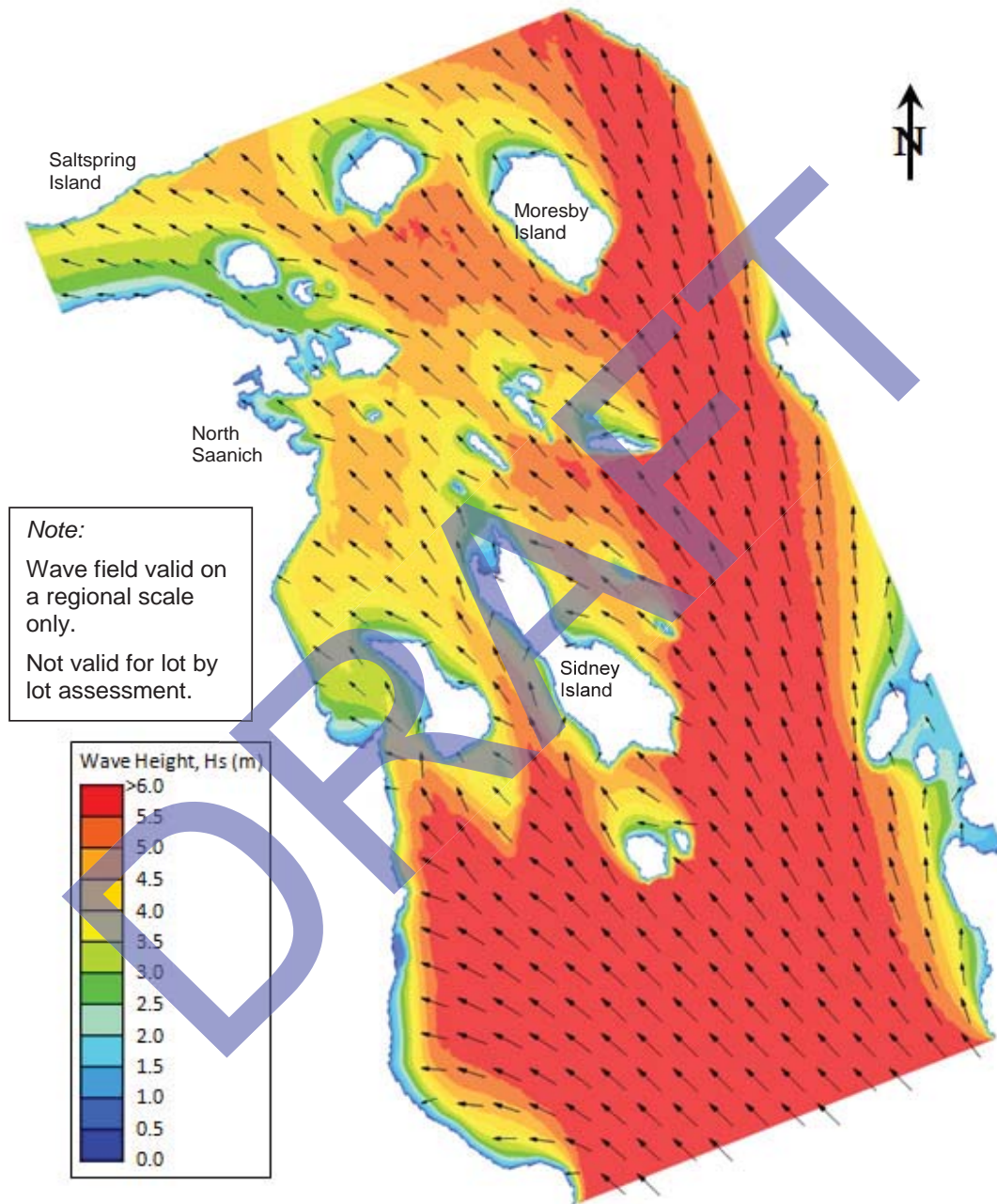


Figure 11: SWAN results for SWAN for the SE peak wind speed scenario for 1m SLR

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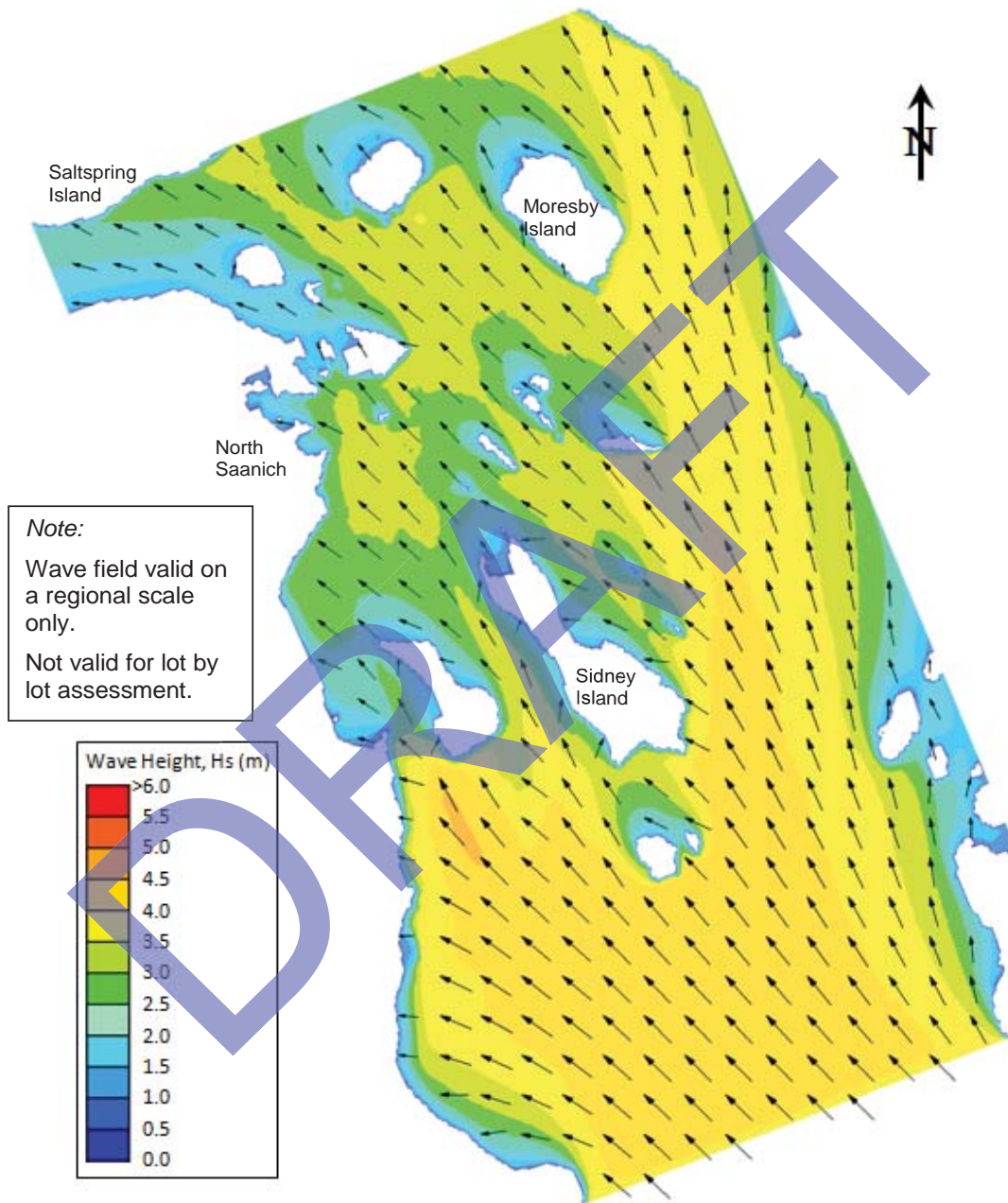


Figure 12: SWAN results for the SE peak storm surge scenario for 1m SLR

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APPENDIX B – Nearshore Wave Climate

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APPENDIX B - Incident Wave Climate

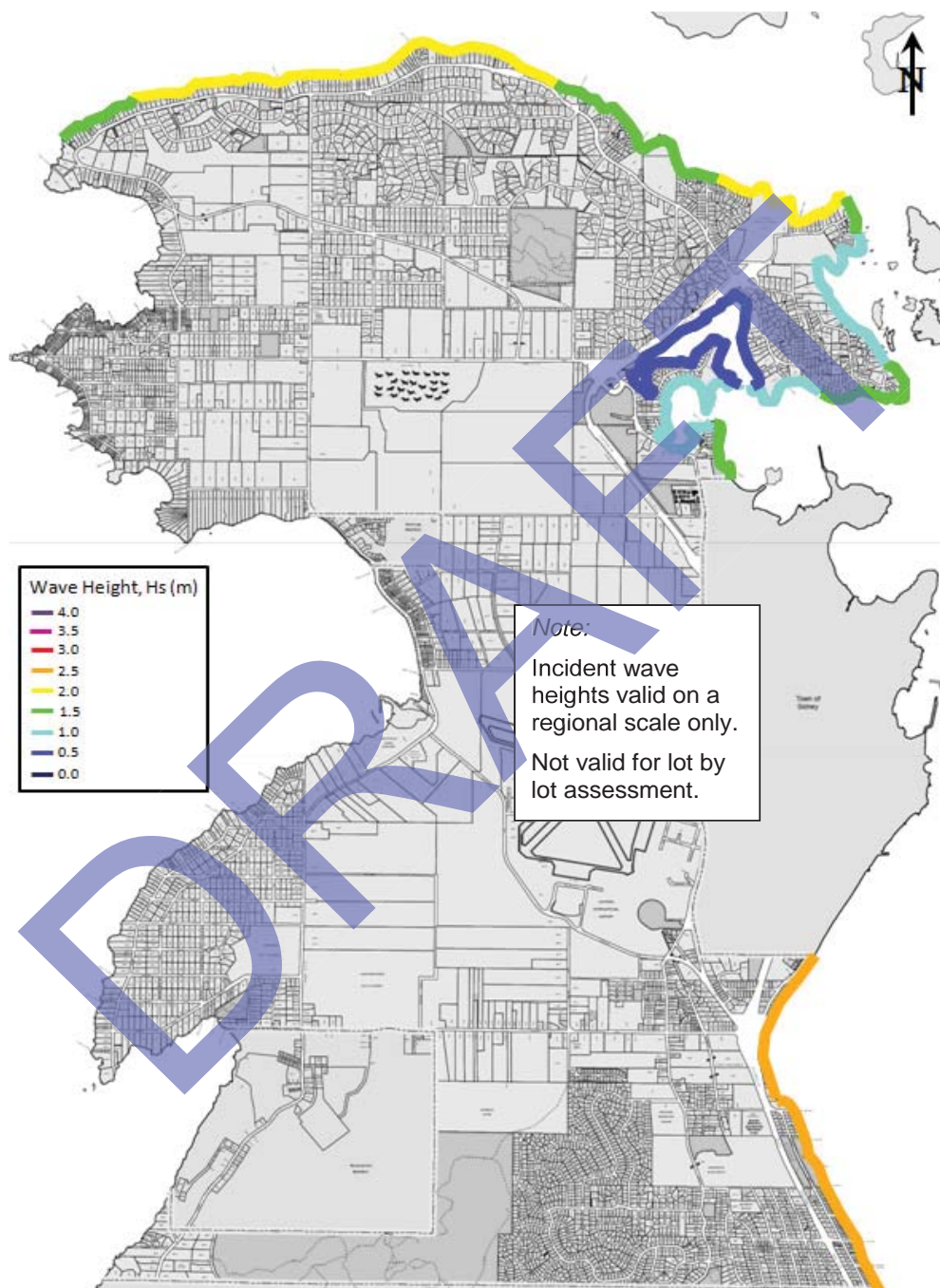


Figure 1: Compiled incident wave heights from SWAN for NE peak wind speed scenario for 0.5m of SLR

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Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX B - Incident Wave Climate

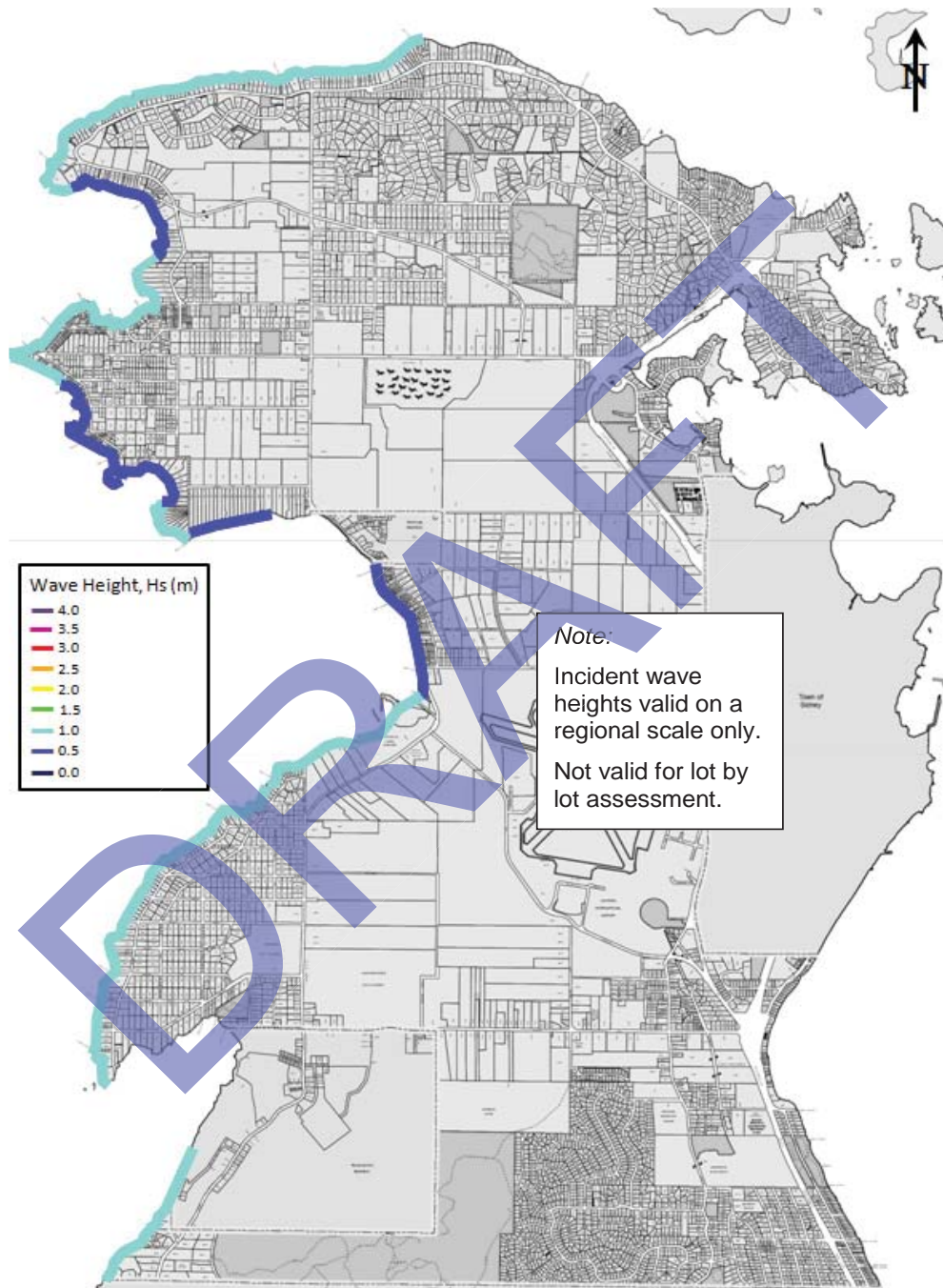


Figure 2: Compiled incident wave heights from SWAN for NW peak wind speed scenario for 0.5m of SLR

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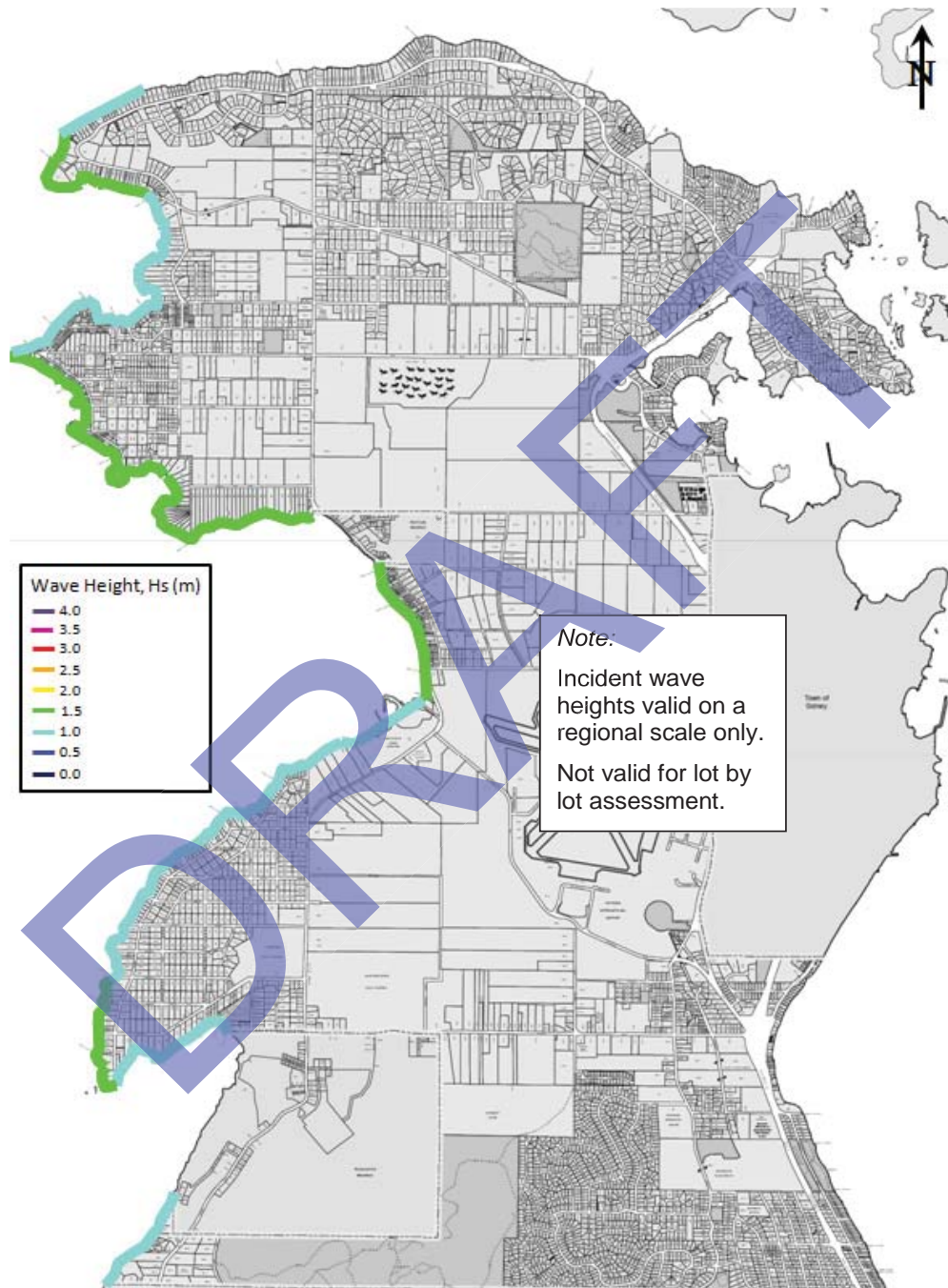


Figure 3: Compiled incident wave heights from SWAN for SW peak wind speed scenario for 0.5m of SLR

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APPENDIX B - Incident Wave Climate

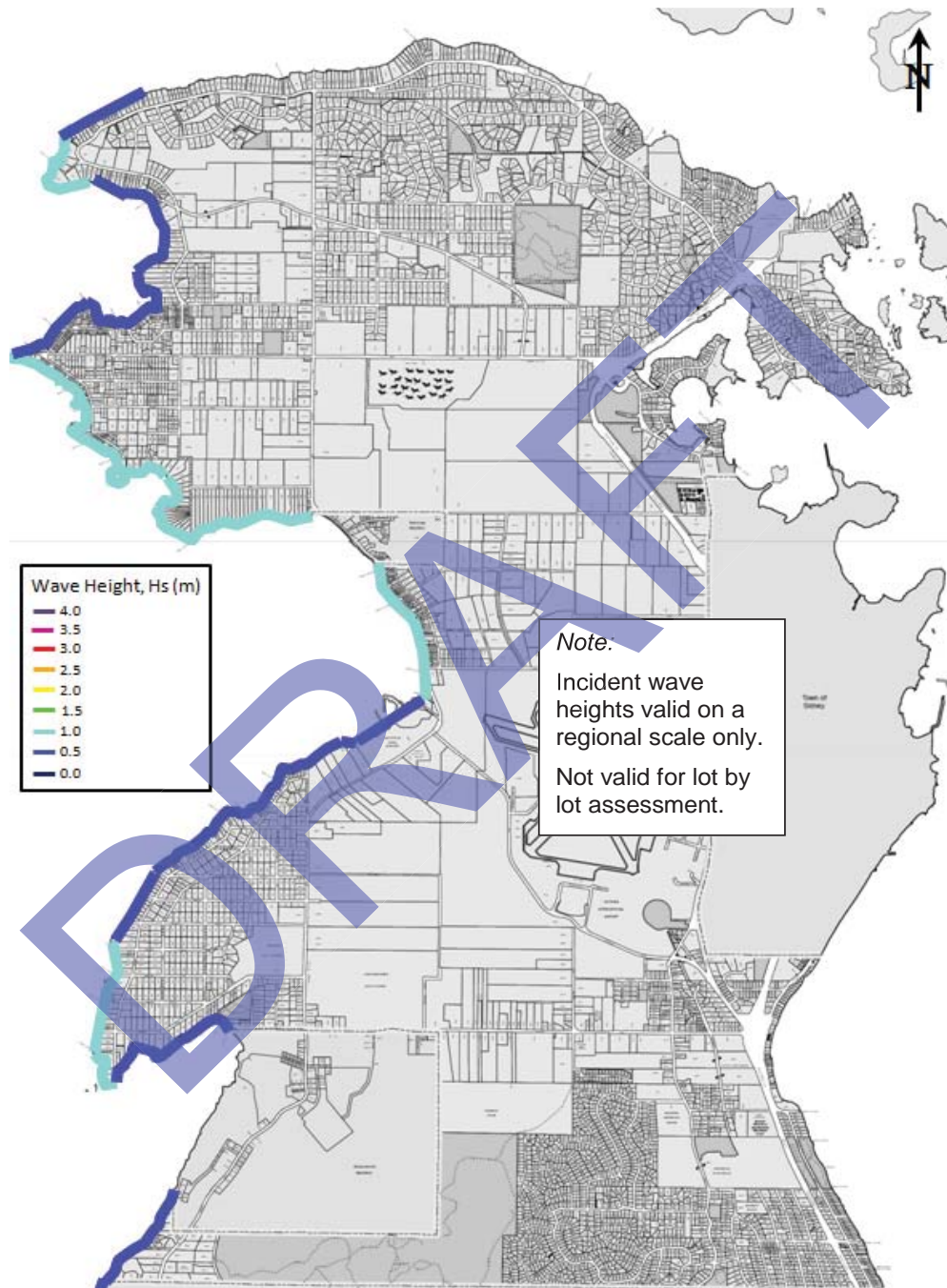


Figure 4: Compiled incident wave heights from SWAN for SW peak storm surge scenario for 0.5m of SLR

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APPENDIX B - Incident Wave Climate

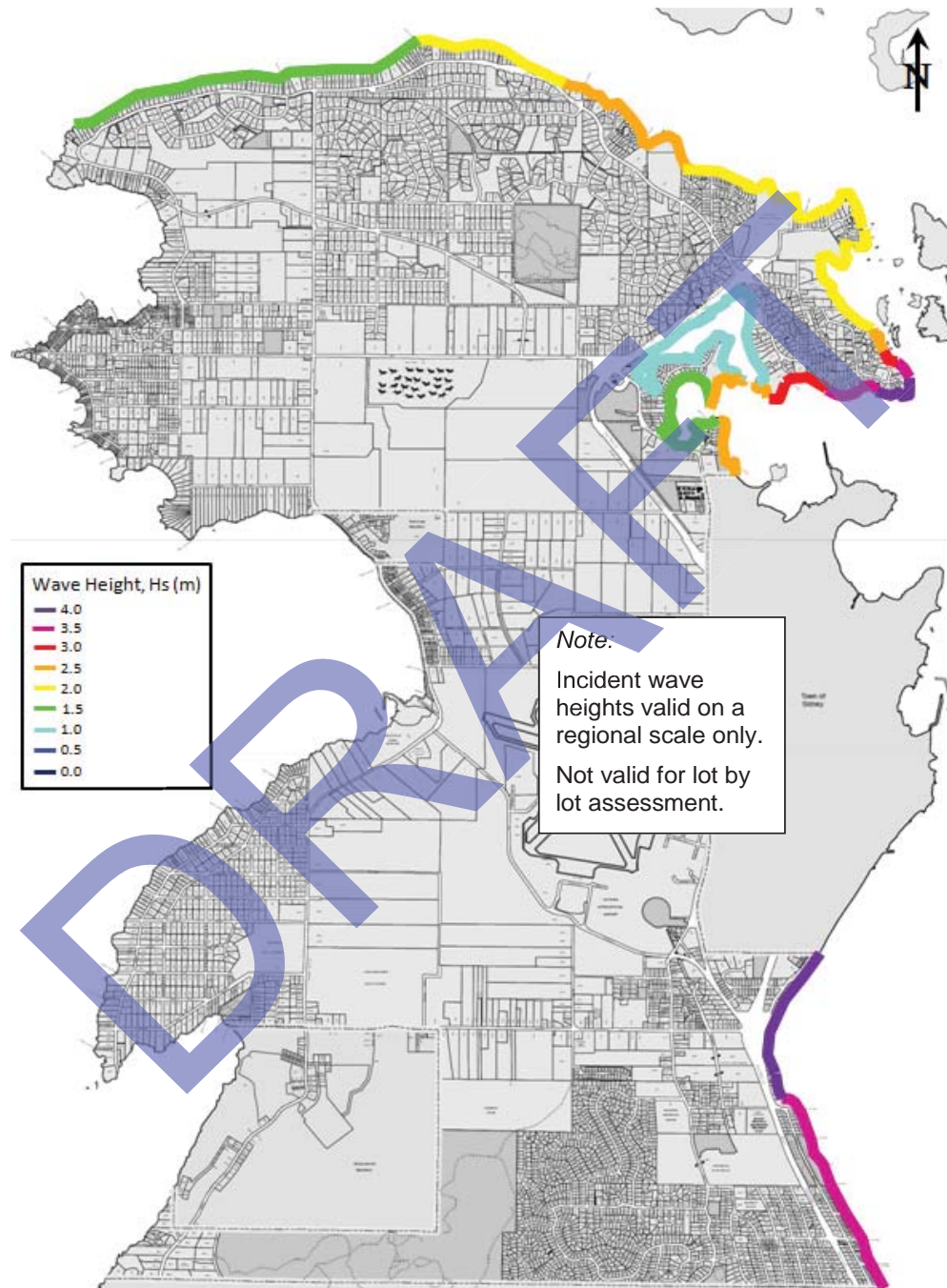


Figure 5: Compiled incident wave heights from SWAN for SE peak wind speed scenario for 0.5m of SLR

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APPENDIX B - Incident Wave Climate

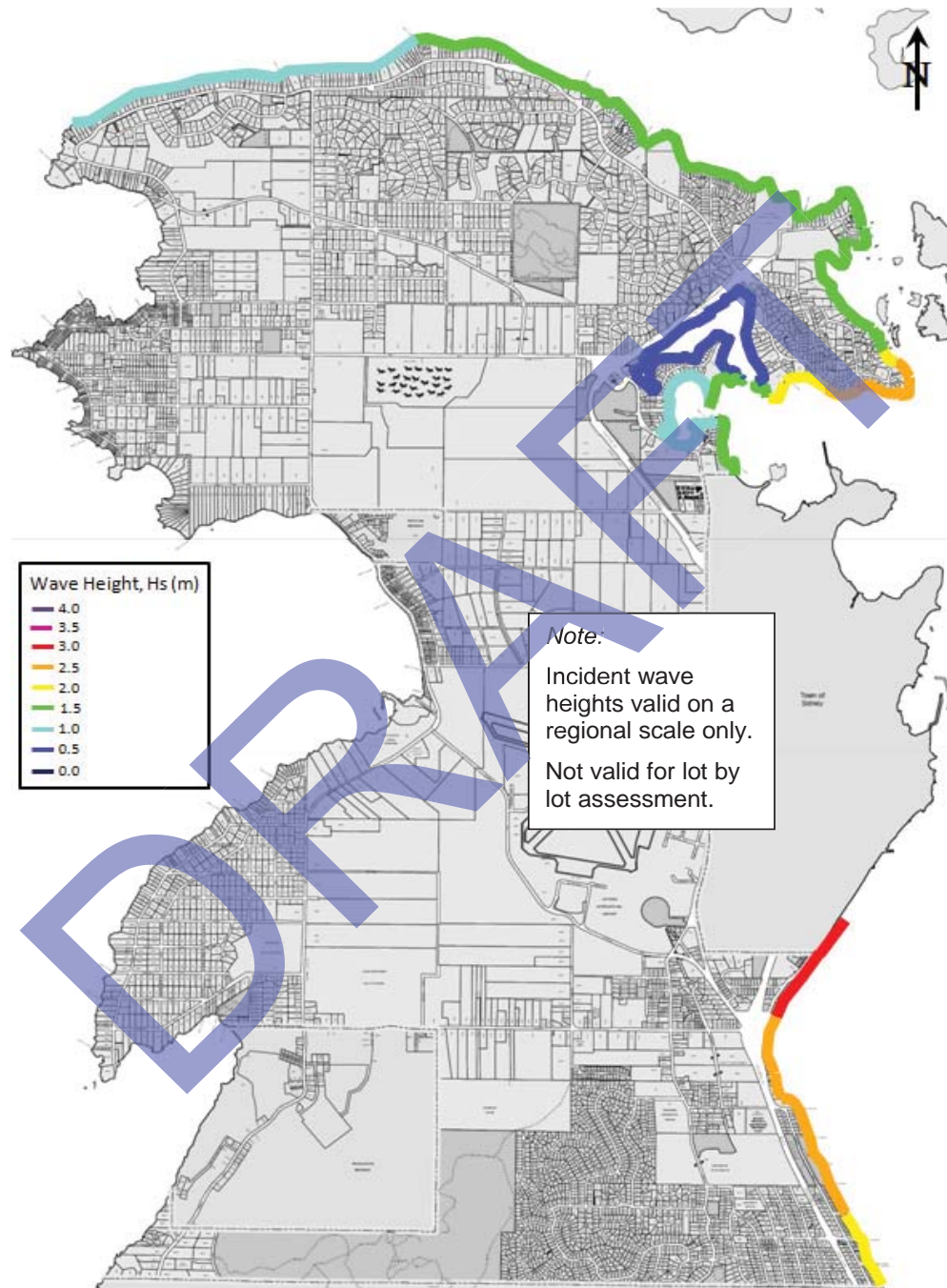


Figure 6: Compiled incident wave heights from SWAN for SE peak storm surge scenario for 0.5m of SLR

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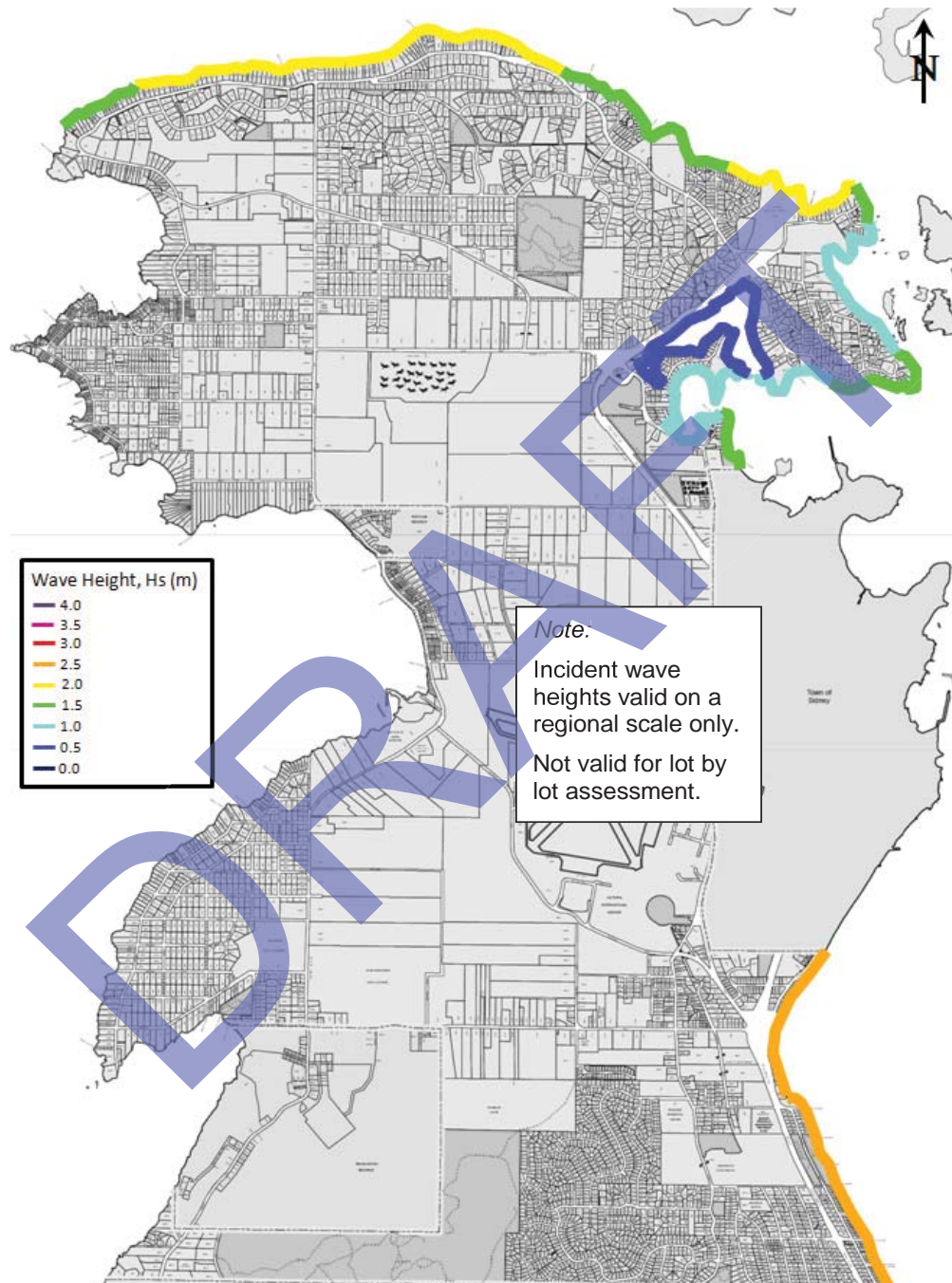


Figure 7: Compiled incident wave heights from SWAN for NE peak wind speed scenario for 1m of SLR

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APPENDIX B - Incident Wave Climate

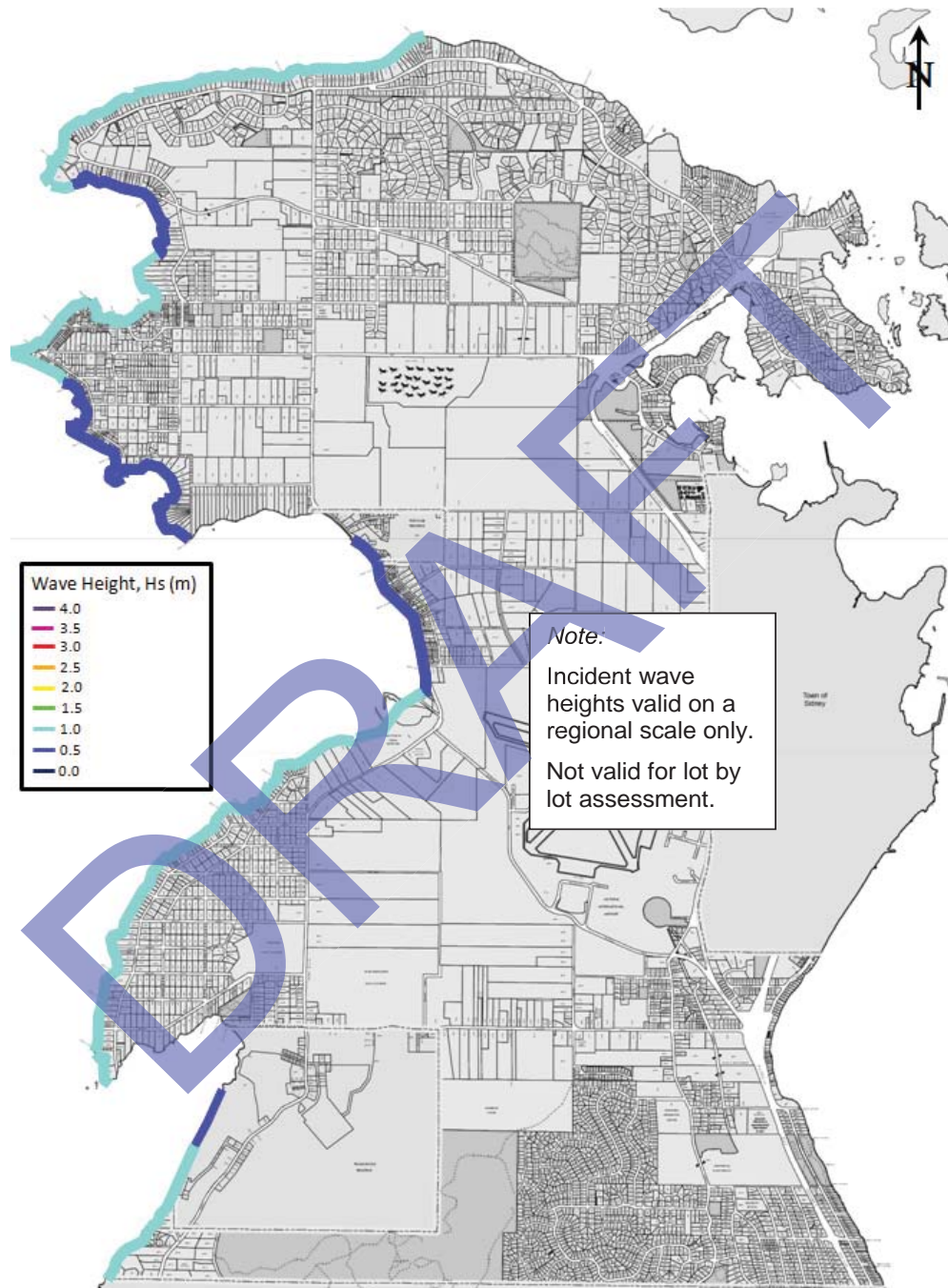


Figure 8: Compiled incident wave heights from SWAN for NW peak wind speed scenario for 1m of SLR

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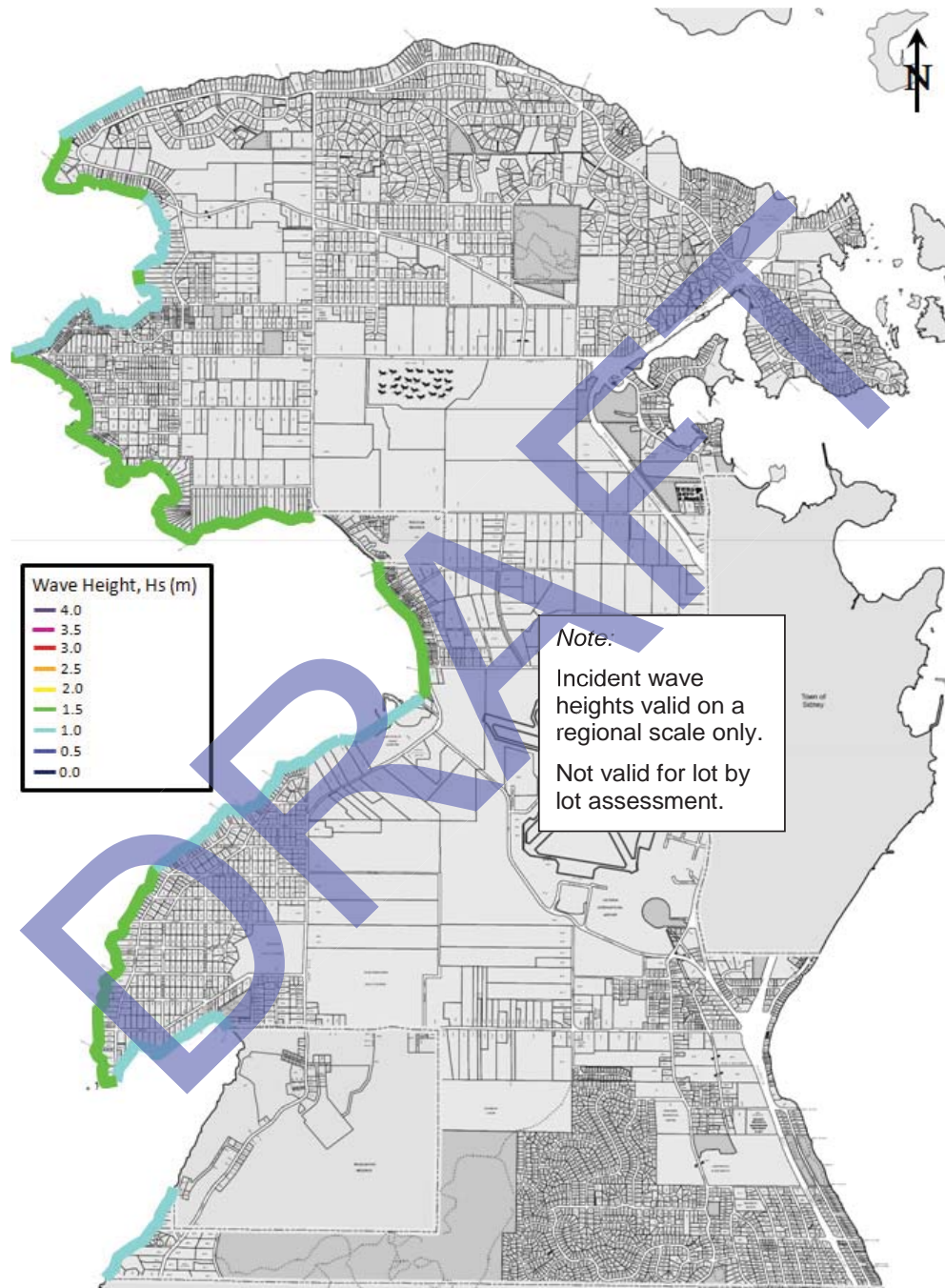


Figure 9: Compiled incident wave heights from SWAN for SW peak wind speed scenario for 1m of SLR

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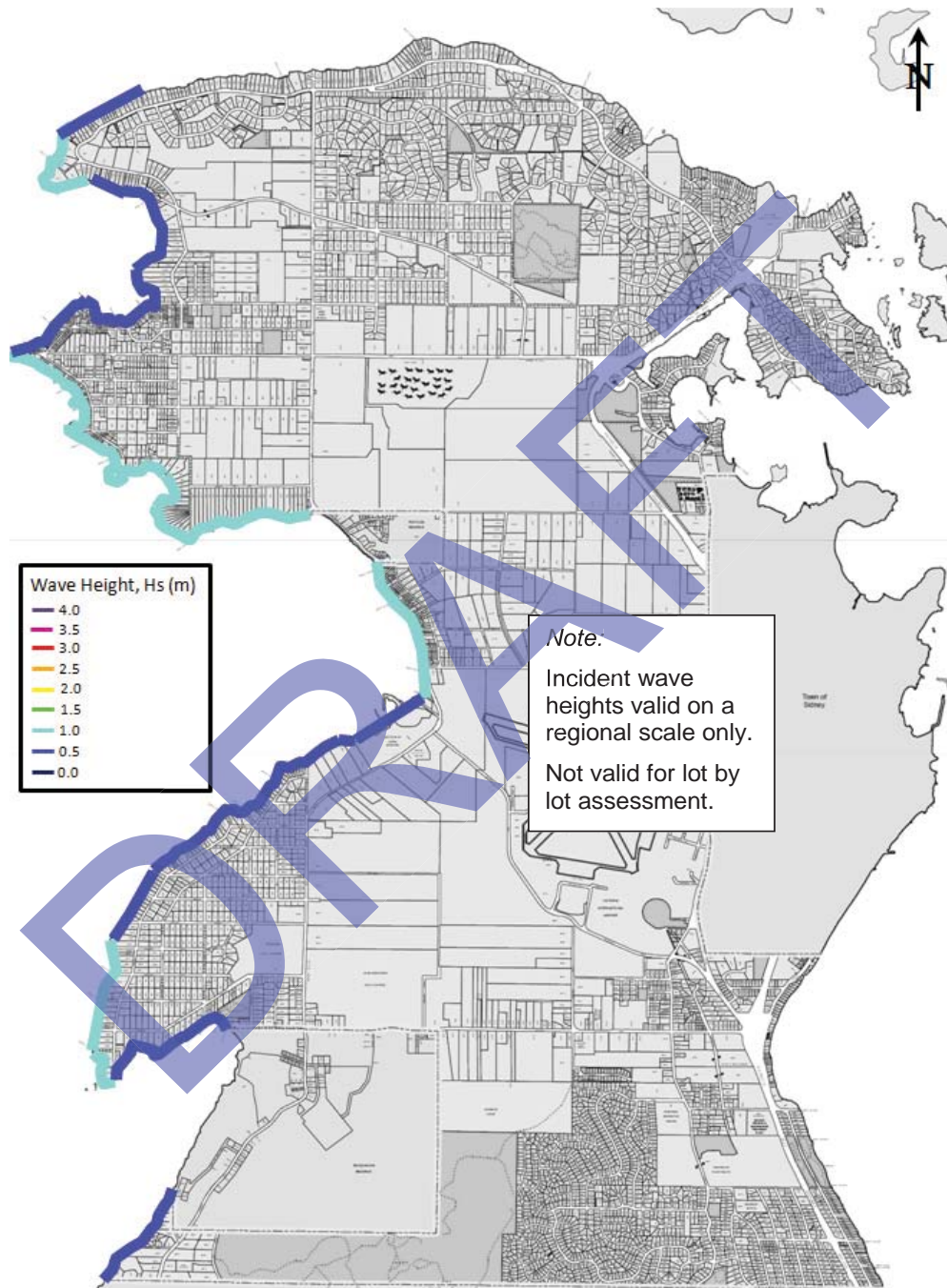


Figure 10: Compiled incident wave heights from SWAN for SW peak storm surge scenario for 1m of SLR

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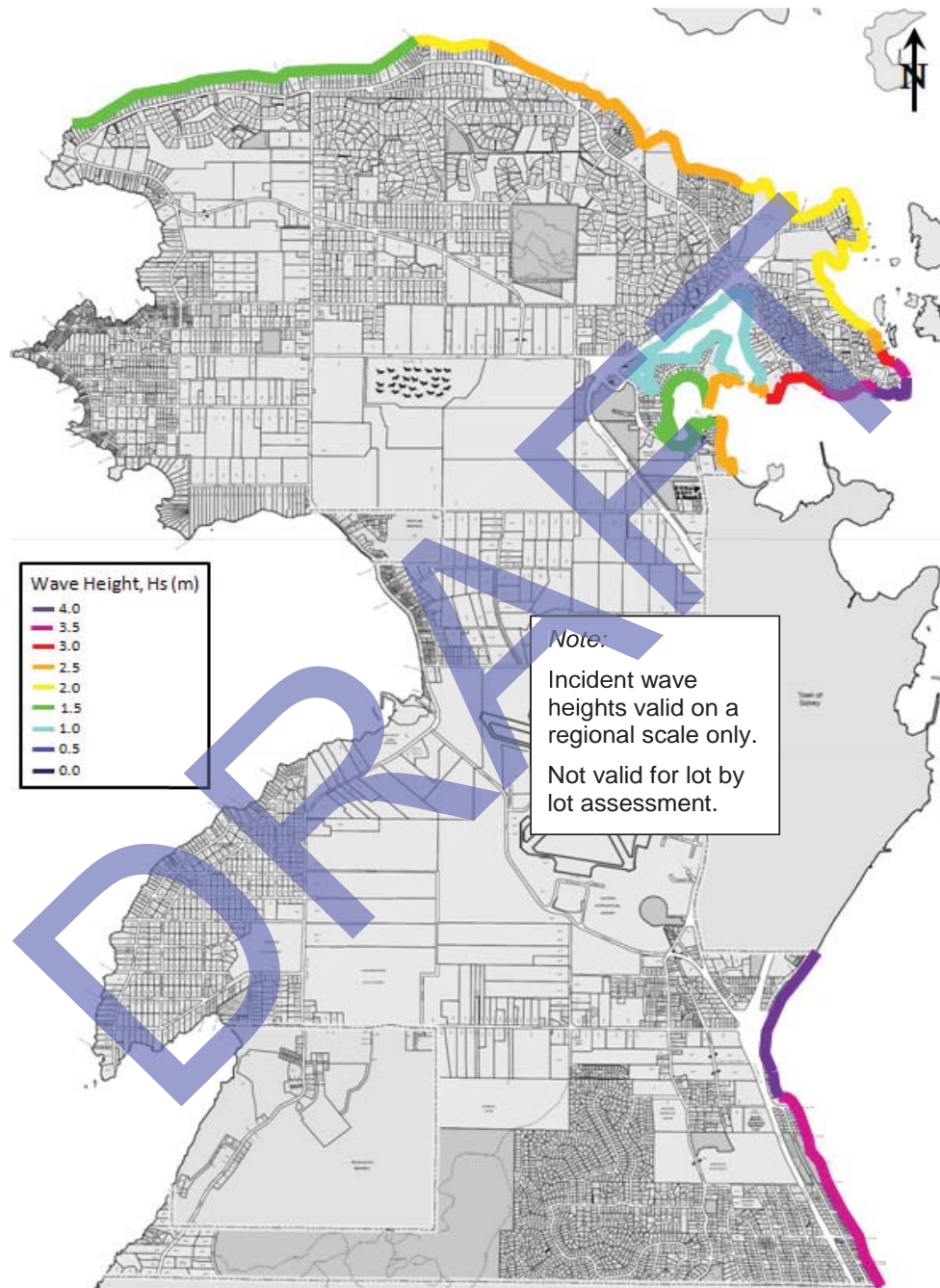


Figure 11: Compiled incident wave heights from SWAN for SE peak wind speed scenario for 1m of SLR

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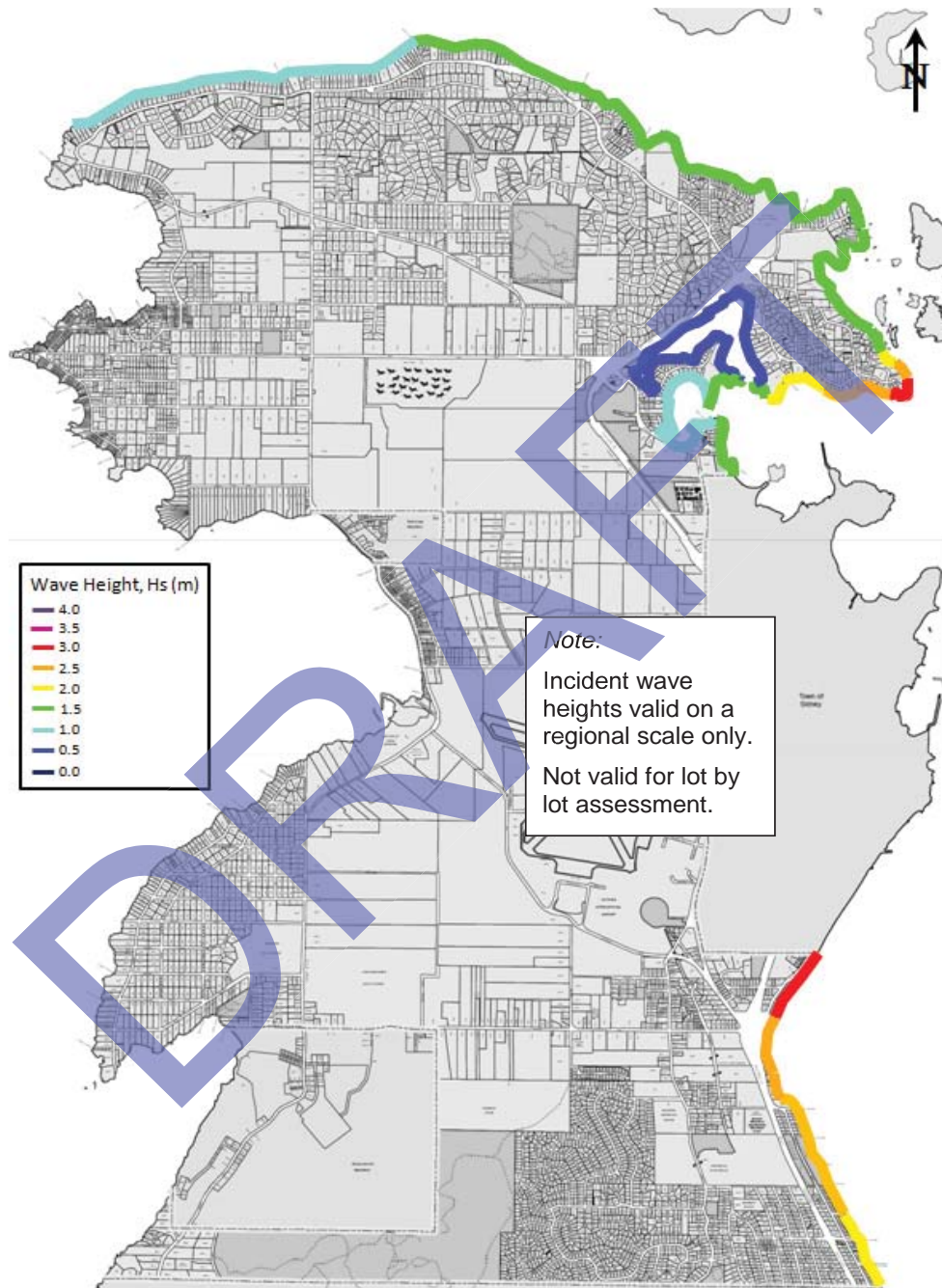


Figure 12: Compiled incident wave heights from SWAN for SE peak storm surge scenario for 1m of SLR

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Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX C – Mapped Flood Construction Levels



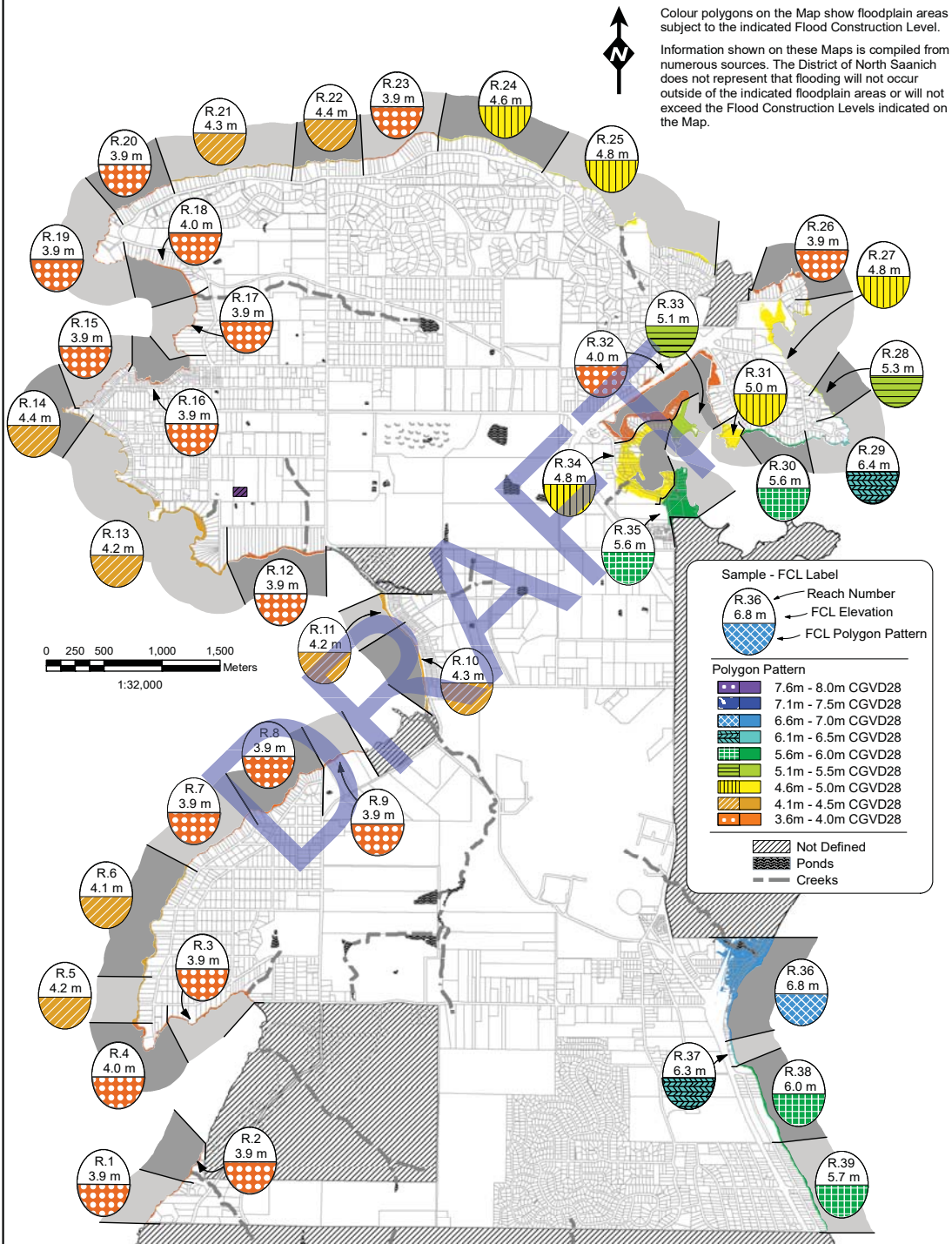
APPENDIX C – Mapped Flood Construction Levels

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FLOOD CONSTRUCTION LEVELS 0.5 m SEA LEVEL RISE

Document 634533-3000-41ER-0001, Flood Construction Levels for 0.5m and 1.0m Sea Level Rise, Appendix C.



This Map displays the Flood Construction Level (FCL)¹, by Reach.

The FCL elevations are referenced to Canadian Geodetic Vertical Datum of 1928 (CGVD28)
0 m CGVD28 is equal to + 2.2 m Chart Datum, as measured at Swartz Bay

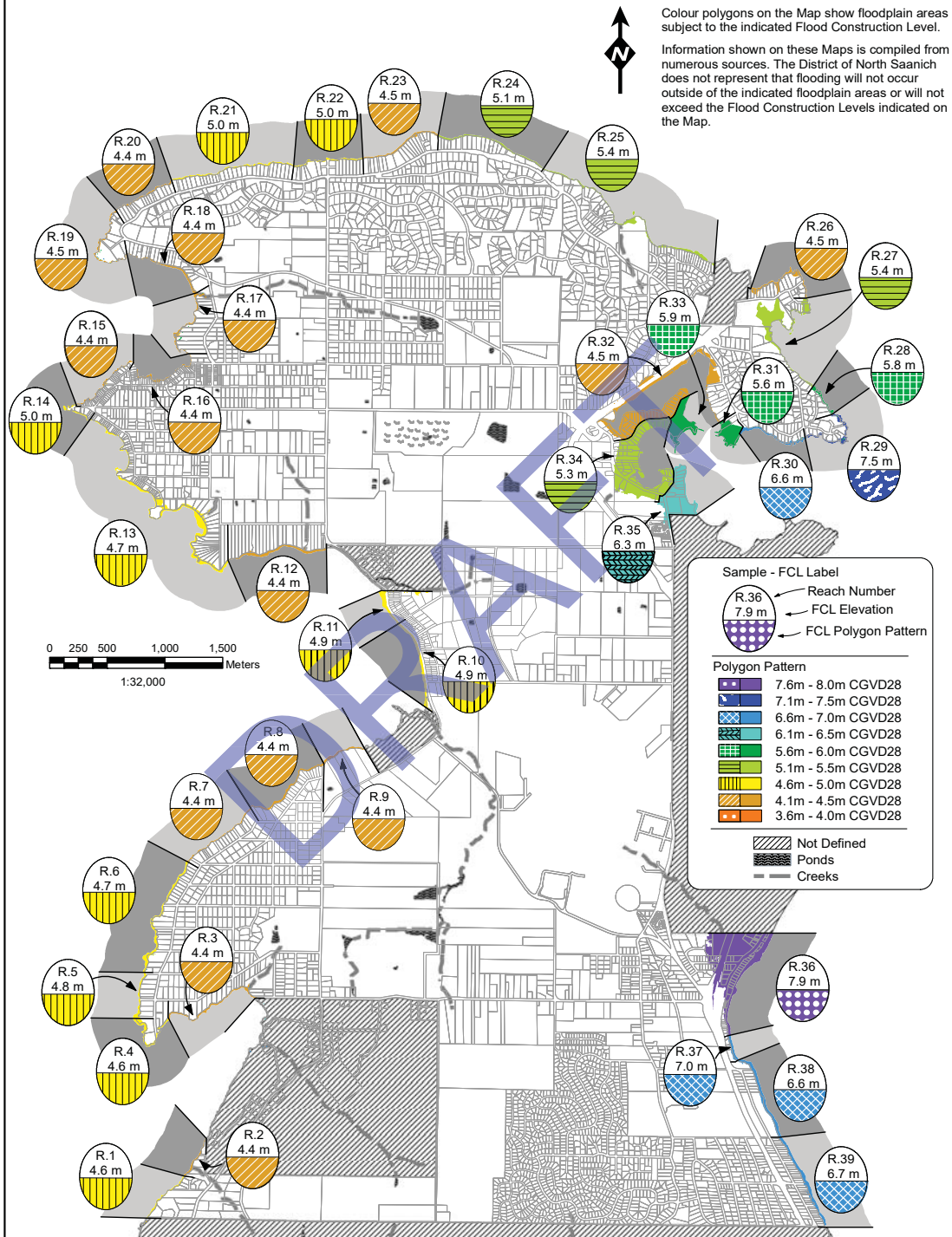
¹ The methodology used to define the FCL is provided in Document No. 634533-3000-41ER-0001 Rev 0
prepared by SNC Lavalin Inc and available from the District of North Saanich

March 2018



FLOOD CONSTRUCTION LEVEL 1.0 m SEA LEVEL RISE

Document 634533-3000-41ER-0001, Flood Construction Levels for 0.5m and 1.0m Sea Level Rise, Appendix C.



This Map displays the Flood Construction Level (FCL)¹, by Reach.

The FCL elevations are referenced to Canadian Geodetic Vertical Datum of 1928 (CGVD28)
0 m CGVD28 is equal to + 2.2 m Chart Datum, as measured at Swartz Bay

¹ The methodology used to define the FCL is provided in Document No. 634533-3000-41ER-0001 Rev 0
prepared by SNC Lavalin Inc and available from the District of North Saanich

March 2018

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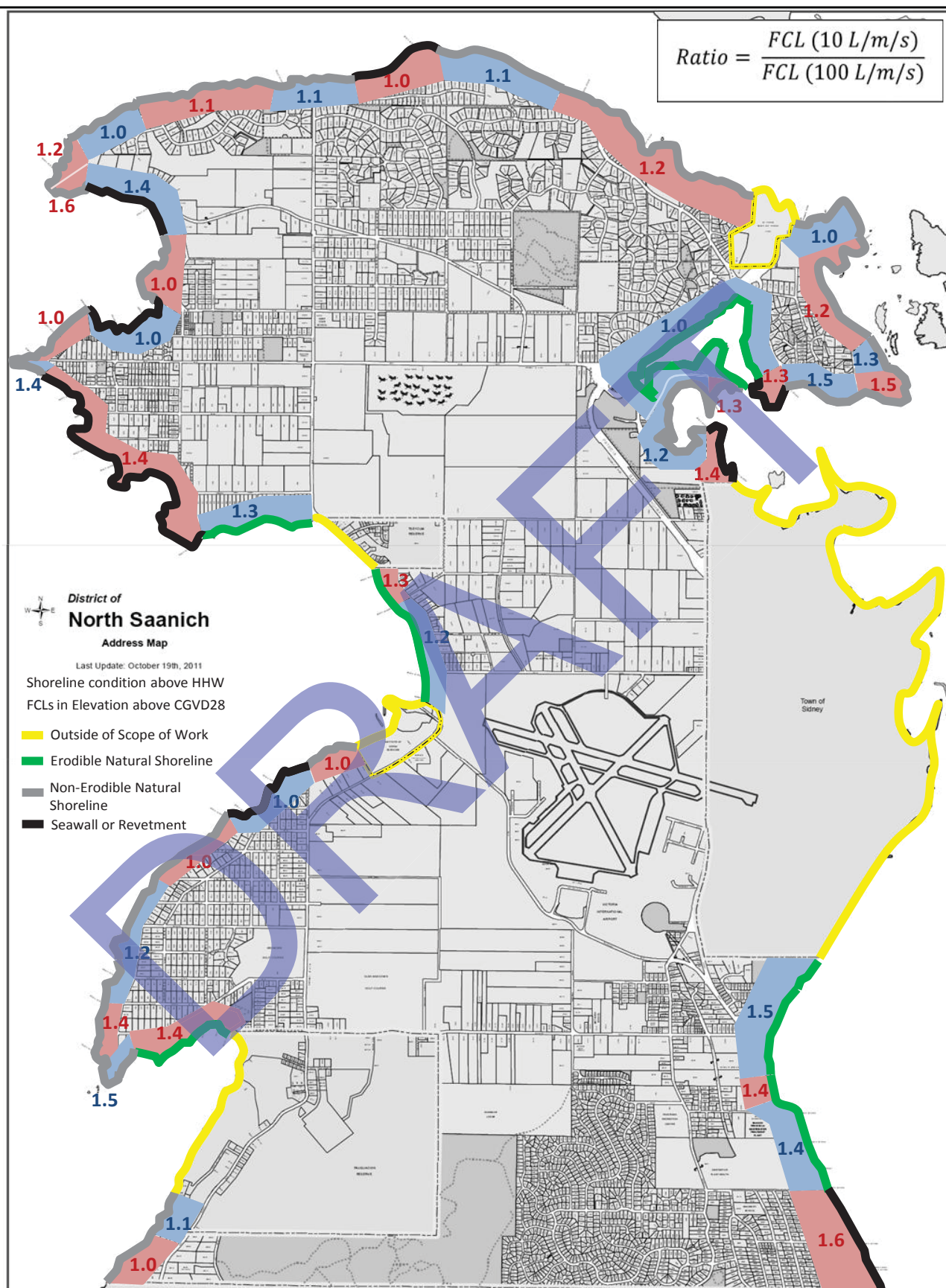
Flood Construction Levels for 0.5 and 1.0m Sea Level Rise

APPENDIX D – Sensitivity Test: Overtopping Rates



APPENDIX D – Sensitivity Test: Overtopping Rates

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Appendix D

DISTRICT OF NORTH SAANICH**B Y L A W N O. 1439****A BYLAW TO MITIGATE COASTAL FLOODING HAZARDS****WHEREAS:**

- A. If a flood plain has been designated in a District bylaw, the *Local Government Act* requires that the underside of any floor system or the top of any pad supporting any habitable floor area be above the flood level specified in the bylaw, and that any landfill required to support a floor system or pad not extend within any applicable setback specified in the bylaw; and
- B. Parcels of land in the District that abut the sea are subject to the coastal flooding hazard, exacerbated by sea level rise, indicated on Maps 1 and 2 attached to and forming part of this Bylaw; and
- C. The Council has considered Sections 3.5 and 3.6 of the Province of British Columbia Flood Hazard Area Land Use Management Guidelines, as amended, which deal with coastal flooding and sea level rise;

THE MUNICIPAL COUNCIL of the District of North Saanich, in open meeting assembled, enacts as follows pursuant to s. 524 of the *Local Government Act*:

APPLICATION

- 1. This Bylaw does not apply to any construction if the scope of work authorized by the building permit is limited to an addition of habitable floor area to an existing building that does not comply with s. 524(6) of the *Local Government Act* and this Bylaw, provided that:
 - a. the addition comprises not more than 25% of the total floor area of the existing building, calculated in accordance with the Zoning Bylaw, considered either independently or in combination with any other floor area added to the building after the date of first reading of this Bylaw;
 - b. no additional habitable floor area is constructed below the lowest elevation of existing habitable floor area in the building; and
 - c. no portion of any additional building area is nearer to the natural boundary of the sea than any portion of the existing building.

FLOOD CONSTRUCTION LEVEL AND SETBACK

2. For the purposes of Section 3, a parcel is deemed to abut the natural boundary of the sea if its location is such that any portion of the parcel would be inundated to any degree by a coastal flood that reaches the flood construction level indicated in respect of the parcel on Map 1 or Map 2, as applicable to the parcel according to Section 6.
3. The flood level specified for the flood plain for any particular parcel of land, for the purposes of s. 524(6)(a) of the *Local Government Act*, is the level specified in respect of the relevant reach of the sea on Map 1 or Map 2 attached to and forming part of this Bylaw that the parcel abuts, depending on the type of building permit application that has been made for the parcel, and for that purpose the reach demarcation lines indicated on the map are determinative of the applicable flood level, despite any indication to the contrary on the map legend. If Map 1 or Map 2 specifies a flood level in respect of a portion of a parcel, the portion to which the flood level applies shall be located by scaling from the map.
4. If a parcel abuts, or is deemed to abut, 2 or more reaches of the sea indicated on Map 1 or Map 2, the applicable flood level is the highest level indicated in respect of any portion of the parcel.
5. For the purposes of this Bylaw:
 - a. Map 1 applies in respect of all buildings and structures for which a building permit is required under the Building Bylaw, other than buildings described in subsection (b); and
 - b. Map 2 applies in respect of the construction of new principal buildings as defined in the Zoning Bylaw, whether or not the principal building is replacing a principal building that existed on the date of first reading of this Bylaw.
6. The minimum horizontal setback from the natural boundary of the sea of any landfill or structural support required to achieve the building elevation required by Section 6 is 15.0 m.

INTERPRETATION

8. In this Bylaw,

“Building Bylaw” means District of North Saanich Building and Plumbing Bylaw No. 1150, 2007 as amended or replaced from time to time.

“Building permit” means a building permit for which an application is made pursuant to the Building Bylaw.

“Habitable floor area” means any space or room, including a manufactured home, that is used for dwelling purposes, business or the storage of goods that are susceptible to damage by floodwater.

“Natural boundary of the sea” means the estimated natural boundary associated with the sea level rise scenario depicted on Map 1 or Map 2 that is applicable to the parcel according to Section 6, determined in accordance with the Flood Hazard Area Land Use Management Guidelines as published and amended from time to time by the Province of British Columbia.

“Zoning Bylaw” means District of North Saanich Zoning Bylaw No. 1255 as amended or replaced from time to time.

CITATION

9. This Bylaw may be cited for all purposes as “North Saanich Coastal Flooding Mitigation Bylaw No. 1439 (2018)”.

READ A FIRST TIME the xxx day of xxx, 2018.

READ A SECOND TIME the xxx day of xxx, 2018.

READ A THIRD TIME the xxx day of xxx, 2018.

FINALLY PASSED AND ADOPTED the xxx day of xxx, 2018.

MAYOR

CORPORATE OFFICER

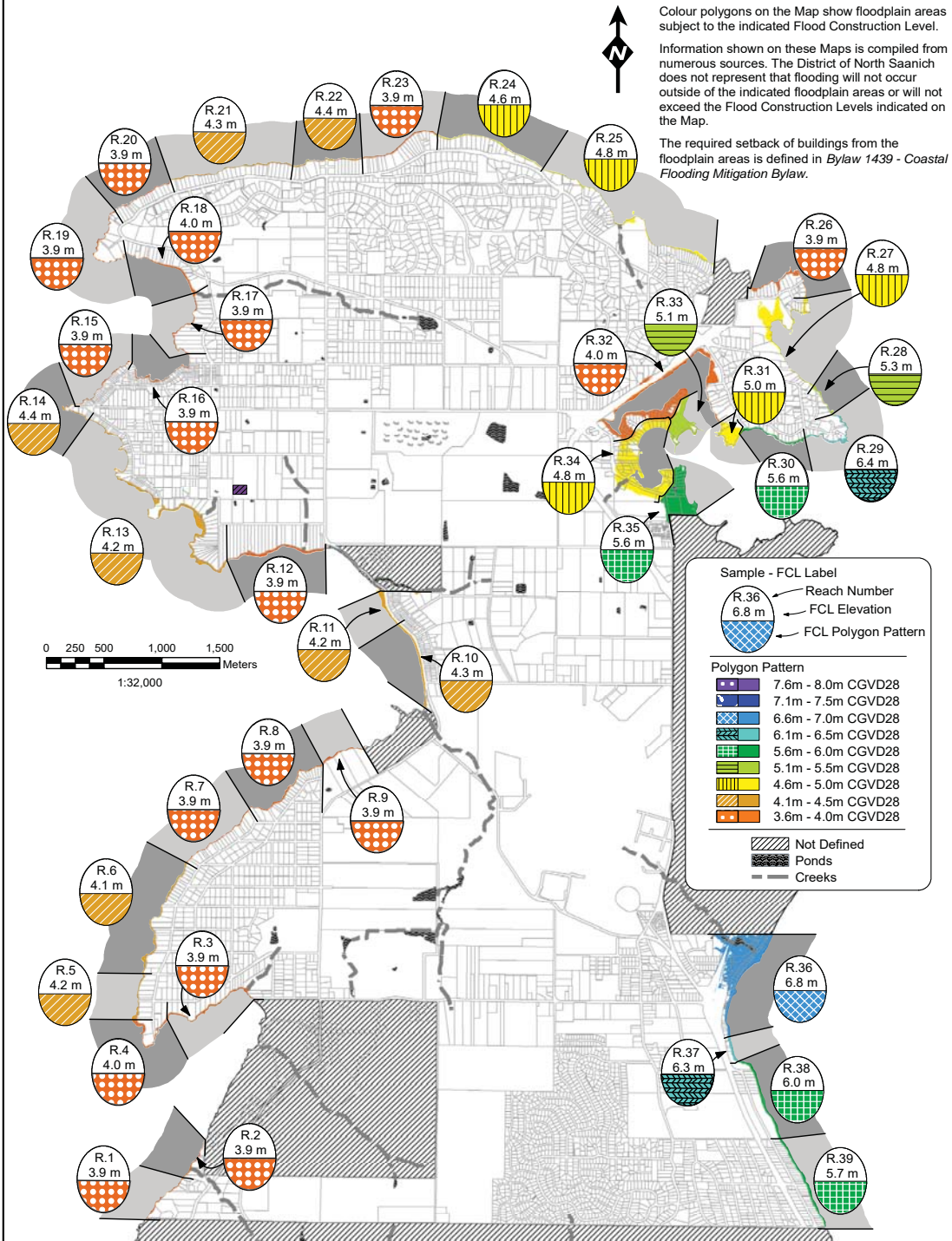


BYLAW 1439 - COASTAL FLOODING MITIGATION BYLAW

MAP 1

FLOOD CONSTRUCTION LEVEL

0.5 m SEA LEVEL RISE



This Map displays the Flood Construction Level (FCL)¹, by Reach, for Section 7.b of
Bylaw 1439 - Coastal Flooding Mitigation Bylaw

The FCL elevations are referenced to Canadian Geodetic Vertical Datum of 1928 (CGVD28)
0 m CGVD28 is equal to + 2.2 m Chart Datum, as measured at Swartz Bay

¹ The methodology used to define the FCL is provided in Document No. 634533-3000-41ER-0001 Rev 0
prepared by SNC Lavalin Inc and available from the District of North Saanich

March 2018

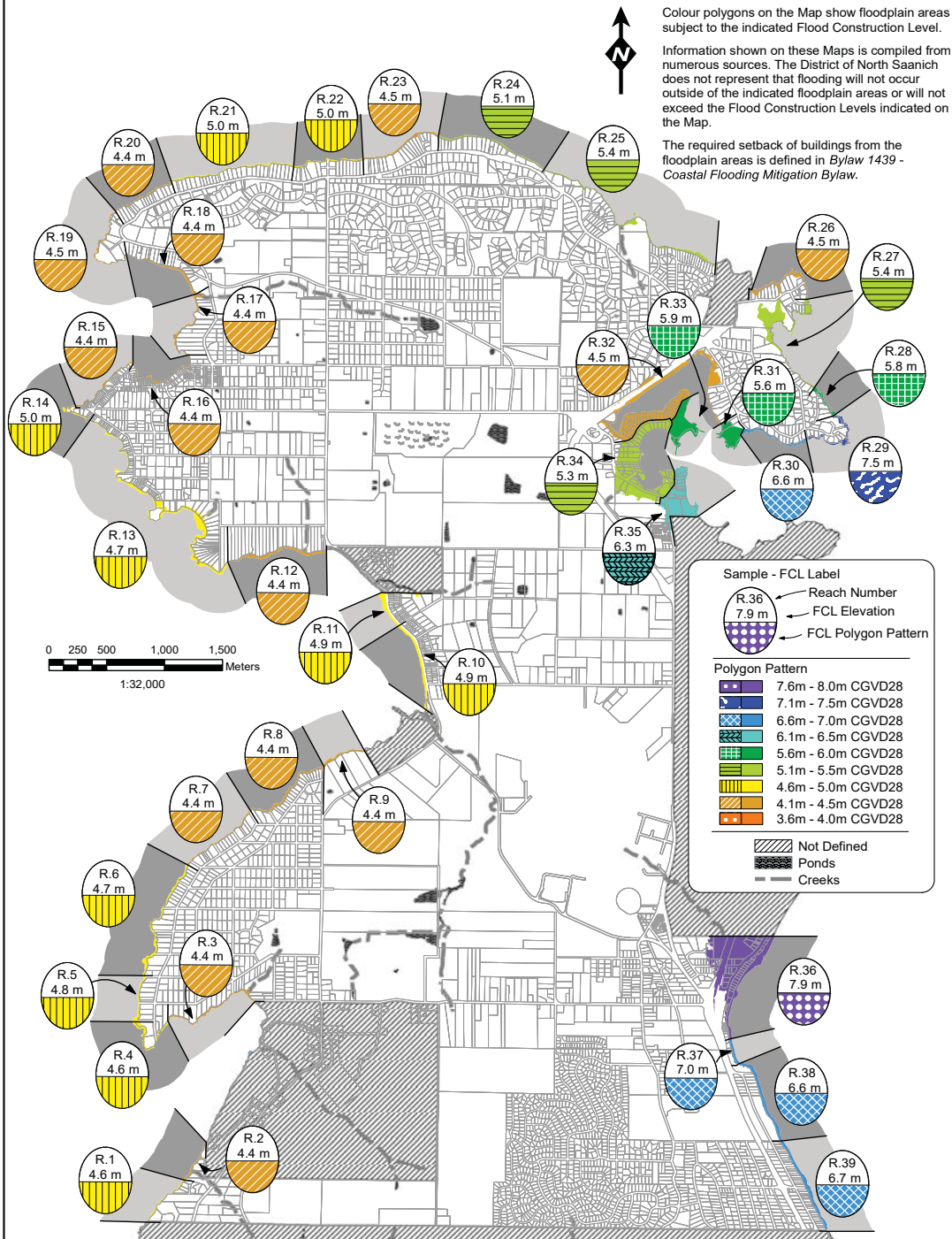


BYLAW 1439 - COASTAL FLOODING MITIGATION BYLAW

MAP 2

FLOOD CONSTRUCTION LEVEL

1.0 m SEA LEVEL RISE



This Map displays the Flood Construction Level (FCL)¹, by Reach, for Section 7.b of *Bylaw 1439 - Coastal Flooding Mitigation Bylaw*

The FCL elevations are referenced to Canadian Geodetic Vertical Datum of 1928 (CGVD28)
0 m CGVD28 is equal to + 2.2 m Chart Datum, as measured at Swartz Bay

¹ The methodology used to define the FCL is provided in Document No. 634533-3000-41ER-0001 Rev 0
prepared by SNC Lavalin Inc and available from the District of North Saanich

March 2018

Appendix E



DISTRICT OF NORTH SAANICH

BYLAW NO. 1442

**A BYLAW TO AMEND THE “DISTRICT OF NORTH SAANICH OFFICIAL
COMMUNITY PLAN BYLAW NO. 1130 (2007)”**

The Municipal Council of the District of North Saanich, in open meeting assembled, enacts as follows:

TEXT AMENDMENTS

1. The text of Schedule ‘A’ of the District of North Saanich Official Community Plan Bylaw No. 1130 (2007) is hereby amended as follows:

- (a) Section 3.1 is replaced with:

Recognize ecologically sensitive areas by identifying and conserving special wildlife, plant and marine shore environments (such as pocket beaches or the Shoal Harbour Migratory Bird Sanctuary) in their natural state. Environmentally Sensitive Areas are mapped on Schedule G and identified through the various development permit requirements. Modifications to Environmentally Sensitive Areas that assist in building resilience to the effects of sea level rise will be permitted.

- (b) Section 4.0 is amended by the addition of the following text:

Coastal Flooding Hazard

Nearly the entire shoreline of the District is exposed to a growing flood hazard related to the expected effects of climate change-related sea level rise. The flood hazard occurs primarily to private properties and differs considerably in character around the shoreline. The most exposed areas of the shoreline are located in the Tsehum Harbour area and along Lochside Drive near the McTavish interchange. In many locations the future flood hazard is concentrated at the toe of steep cliffs and bluffs and in locations where the cliffs or bluffs are grounded on outcropping bedrock. In these latter situations it will be some time before a flooding related hazard materializes. In many other locations, the hazard is concentrated at the toe of existing seawalls and the consequences will be manifested either at or adjacent to the seawall base, on publicly owned foreshore, or at the top of the seawall where overtopping wave action will create an increasing problem either from the flooding by the overtopping volume of water during storms, or from erosion and unravelling of the seawall or from erosion of the land immediately behind the seawall. If structures are located close to the seawall there may be a threat to the safety and security of personnel or to the structure during a coastal storm. A floodplain bylaw should be adopted for the protection of development from the growing flood hazard related to sea level rise.

- (c) Section 4.2.1 is replaced with:

To preserve the natural appearance of the rocky shoreline, no buildings or structures, or soil removal or deposit should be permitted within 15 metres of the estimated future natural boundary, except where it can be demonstrated to the District's satisfaction that a lesser distance is acceptable, or where works are intended and designed to both preserve the shoreline character and limit coastal flood-related effects.

- (d) Section 4.2.4 is replaced with:

Due to active erosion of Class 2 and 3 beaches, building prohibitions and soil deposit and removal restrictions should be placed over lands within 15 metres of the estimated future natural boundary adjoining beach shores, except where it can be demonstrated to the District's satisfaction that a lesser distance is acceptable, or where works are intended and designed to preserve the shoreline character and limit coastal flood-related effects.

- (e) Section 4.2.6 is replaced with:

Building prohibitions and soil removal and fill restrictions should be placed on lands within 15 metres of the estimated future natural boundary adjacent to Class 2 or Pocket Beaches except where it can be demonstrated to the District's satisfaction that a lesser distance is acceptable, or where works are intended and designed to preserve the shoreline character and limit coastal flood-related effects.

- (f) Section 4.2.9 is replaced with:

Development immediately adjacent to a mudflat, marsh or delta area is discouraged. Consideration will be given to developments that enhance ecological values or include measures to limit or reduce coastal flood-related effects while preserving the shoreline character.

- (g) Section 6.2 is replaced with:

To ensure that residential developments are compatible with the physical site conditions of slope, soil types and drainage patterns, and that natural features such as views, tree cover and variety in terrain are retained and enhanced, buildings, roads and utilities should be sited in a manner which does not negatively affect sensitive natural areas of the site and preserves the natural landscape. An exception for slope alteration will be considered if it is designed to help reduce effects of coastal flooding.

- (h) Section 6.7 is replaced with:

To encourage innovative housing and subdivision designs such as detached clustered residential developments, particularly for sloped upland areas, the District will provide flexibility in regulatory bylaws. Amenity bonus, in compliance with Section 482 of the Local Government Act, will be enacted in certain areas if site conditions warrant, in order to, amongst other things,

preserve open space, natural tree cover and environmentally sensitive areas, leaving slopes unaltered.

- (i) Sections 7.9 and 7.15 are replaced with:

Buildings or structures used for commercial use must be buffered from adjacent rural and residential uses and should preserve access and views from adjacent rural and residential uses.

- (j) Section 8.5 is replaced with:

Buildings or structures used for industrial use must be buffered from adjacent rural and residential uses and should preserve access and views from adjacent rural and residential uses.

- (k) Section 11.1 is replaced with:

At the date of adoption of this plan, no new major roads are planned for the District with the exception of those shown on Schedule D. No phasing of any major roads is planned. The location and construction of new roads should take into consideration expected sea level rise.

- (l) Section 11.3 is replaced with:

Serviced areas are identified on Schedule E. No major expansions of municipal services are planned. There will be no expansion of services outside the North Saanich Servicing Area except for health, fire safety, agricultural support, or sea level rise adaptation reasons.

- (m) Section 12.1 is replaced with:

Development must be consistent with the goals and objectives of the Plan. Development shall consider expected coastal flooding, incorporate appropriate adaptation measures and conform with any applicable floodplain bylaw.

- (n) Section 12.3 is replaced with:

Development should be consistent with the retention of the visual landscape of natural areas, especially on or near the waterfront, hilltops and ridges. This principle will be applied flexibly to development that incorporates adaptation measures that reduce the risk or damage associated with the effects of coastal flooding.

- (o) Section 12.6 is replaced with:

No development or site alteration shall be permitted on a wetland, a riparian area or within the buffer zone or related or a floodplain setback, specified in this bylaw for wetlands and riparian areas, except if approved by the District as a sea level rise adaptation measure.

- (p) Add “Section 13.7 Special Development Area Tsehum Harbour

Justification:

The Tsehum Harbour area affected by future sea level rise is identified on Schedule B as a special development area, as mandated by the FHALUMG for the following reasons:

- a) The area contains significant residential, commercial, and light industrial development and parklands.
- b) The area contains significant environmental values to be accommodated in a sensitive manner and which could be protected through innovative design.
- c) The area falls within the scope of recommended provisions related to Sea Level Rise Planning Areas as defined in the FHALUMG.
- d) The area includes important District infrastructure including utilities, sewer, roads and paths and water supply works.
- e) The area forms the boundaries of the Shoal Harbour Migratory Bird Sanctuary, established in 1931 under the *Migratory Birds Convention Act, 1994* (Canada).

Policy Statement:

In designating these parcels of land as a special development area, the following planning principles should be reflected for future development:

- a) Existing land uses should continue to be allowed.
- b) Development should be regulated by a floodplain bylaw.
- c) Development on existing lots should conform with FHALUMG.
- d) The District should develop a Long Term Flood Protection Strategy for this Special Development Area as outlined in Appendix 1 of FHALUMG.
- e) The Long Term Flood Protection Strategy should consider the implications of policies applicable to the adjacent parcels in the Town of Sidney.

The Long Term Flood Protection Strategy considers the benefits that might be realized from active stewardship of the Shoal Harbour Migratory Bird Sanctuary that are consistent with the *Canada Wildlife Act* and *Migratory Birds Convention Act, 1994*.”

- (q) Add “Section 13.8 Special Development Area Lochside-McTavish Interchange

Justification:

The Lochside McTavish Interchange Area affected by future sea level rise is identified on Schedule B as a special development area, as mandated by the FHALUMG:

- a) The area contains significant residential, commercial, and light industrial development, parklands and multi-jurisdictional transportation infrastructure.

- b) The affected lands fall within the scope of recommended provisions related to Sea Level Rise Planning Areas as defined in the FHALUMG.
- c) The area includes important District infrastructure including utilities, sewer, roads and paths and water supply works.

Policy Statement:

In designating these parcels of land as a special development area, the following planning principles should be reflected for future development:

- a) Existing land uses should continue to be allowed.
- b) Development should be regulated by a floodplain bylaw.
- c) Development on existing lots should conform with FHALUMG.
- d) The District should develop a Long Term Flood Protection Strategy for this Special Development Area as outlined in Appendix 1 of FHALUMG.

The Long Term Flood Protection Strategy should consider the implications of policies applicable to the adjacent parcels in the Town of Sidney.

- (r) Section 14.2.1 (c) is replaced with:

in Development Permit Areas, No. 5 and No. 6, for the construction of fencing and accessory structures less than or equal to 40 m² (430.6 ft²) in area, which are accessory to an existing principal structure.

- (s) Section 14.2.1 (d) is replaced with:

in Development Permit Areas No. 1, 2, 3 and 4, for changes to the height of an existing building, including the addition of another storey, except as permitted by any applicable floodplain bylaw;

- (t) Section 14.2.1 (e) is replaced with:

in Development Permit Areas No. 1, 2, 3 and 4, for structures which are 10 m² (107 ft²) or less in area providing they are sited inland of the estimated future natural boundary;

- (u) Section 14.2.1 (f) is replaced with:

emergency works including tree cutting or temporary coastal flood-related mitigation measures necessary to remove an immediate danger or hazard;

- (v) Section 14.2.1 (q) is replaced with:

in Development Permit Area 8, for the construction or alteration of a single family residential dwelling, provided that this exemption does not apply to any parcel having an area equal to or less than five hundred square meters and created by a plan of subdivision registered in the Land Title office after

September 8, 2014.

(w) In Section 14.3 the terms “high water mark” and “natural marine shoreline” are replaced by the term “estimated future natural boundary”.

(x) Section 14.11 the following definition is added in alphabetical order:

“FHALUMG” means the Flood Hazard Area Land Use Management Guidelines published by the B.C. Ministry of Environment as amended effective January 1, 2018.

“Floodplain bylaw” means a bylaw adopted under s. 524 of the *Local Government Act*.

“Future Natural Boundary” means the estimated natural boundary determined in accordance with the FHALUMG.

MAP AMENDMENTS

2. Schedule J attached to and forming part of this bylaw is added as Schedule J.
3. Schedule B is deleted and replaced with Schedule B attached to and forming part of this bylaw.

CITATION

4. This Bylaw may be cited for all purposes as “North Saanich Official Community Plan Bylaw No.1130 (2007) Amendment Bylaw No. 1442 Marine Policy (2018)”.

READ A FIRST TIME the day of , 2018

READ A SECOND TIME the day of , 2018

NOTICE OF PUBLIC HEARING published in the and editions of the *Peninsula News Review*.

PUBLIC HEARING held pursuant to the provisions of the *Local Government Act* at the North Saanich Municipal Hall the , 2018

READ A THIRD TIME the day of

ADOPTED the day of , 2018

Bylaw No. 1442

Page 7

MAYOR

CORPORATE OFFICER

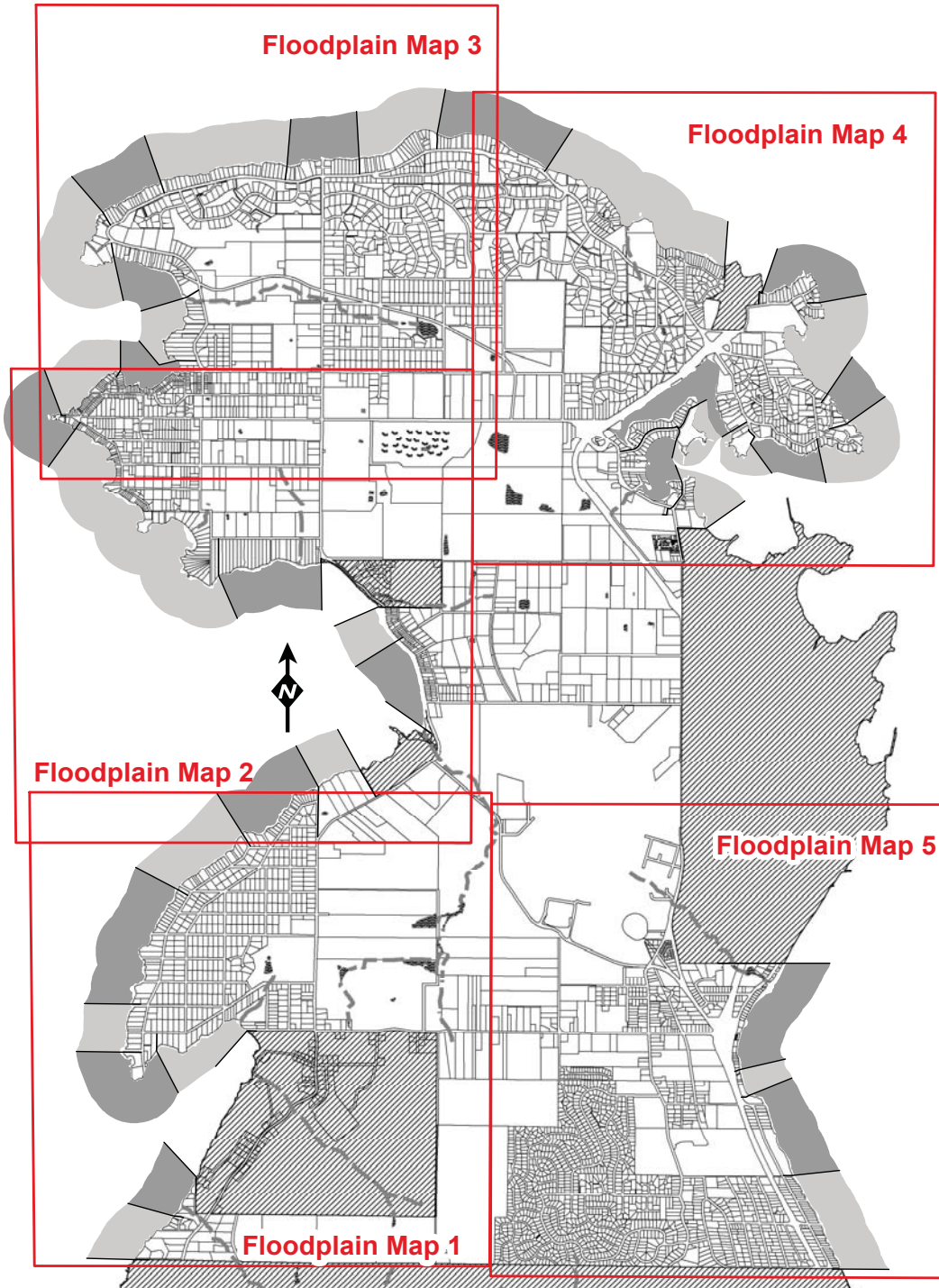
ADD MAPS

AMENDMENT TO SCHEDULE B

LAND USE DESIGNATIONS



Official Community Plan Bylaw 1130
Amendment Bylaw 1442
Schedule J Floodplain Maps
Key Map



This Map provides the key to detailed mapping showing the extent of the floodplain expected over existing ground in the District of North Saanich.

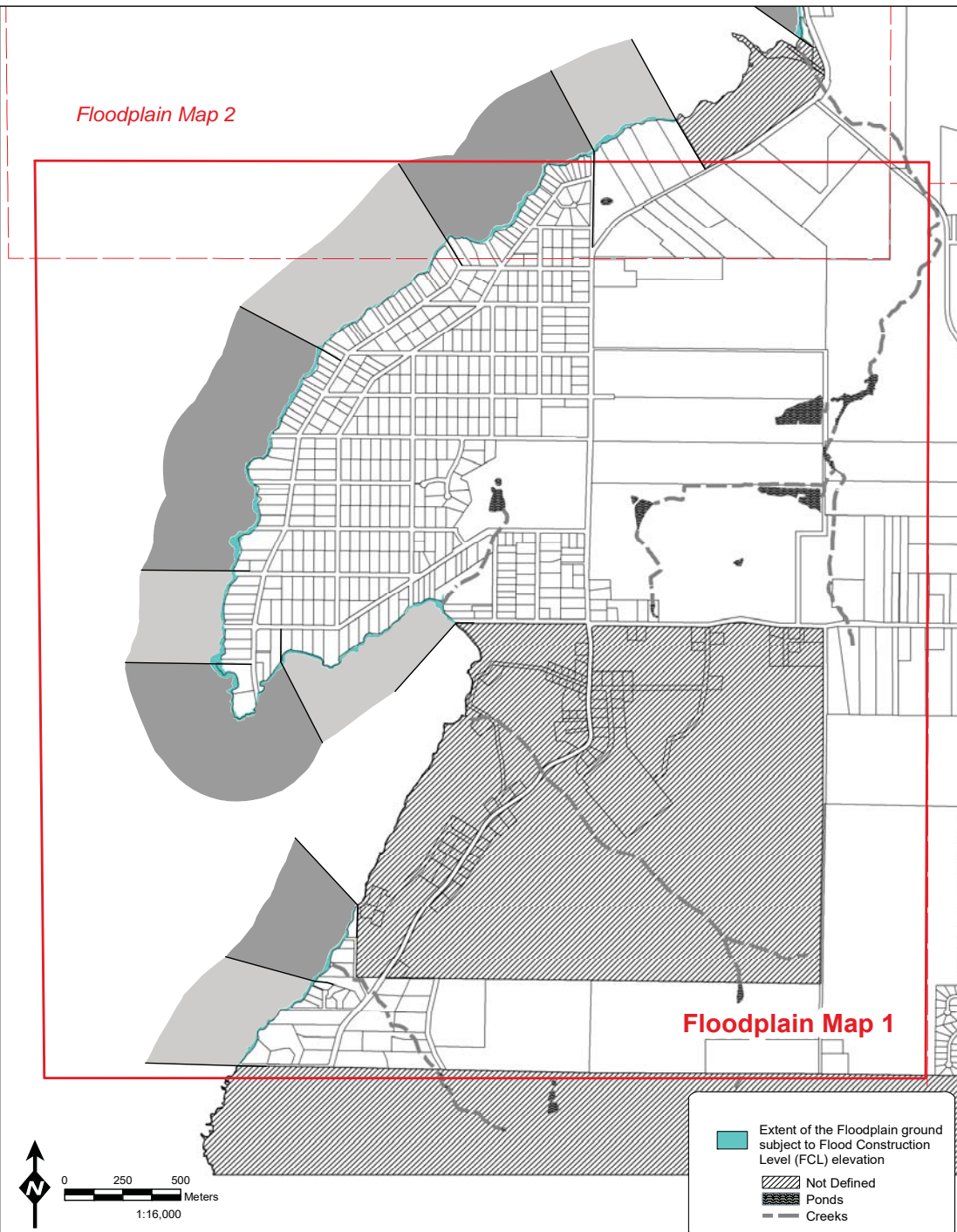
The detailed maps of the floodplain are provided in Schedule J of OCP Bylaw 1130.

Details of the Flood Construction Levels in the floodplain are provided in Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 1
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
0.5 m Sea Level Rise



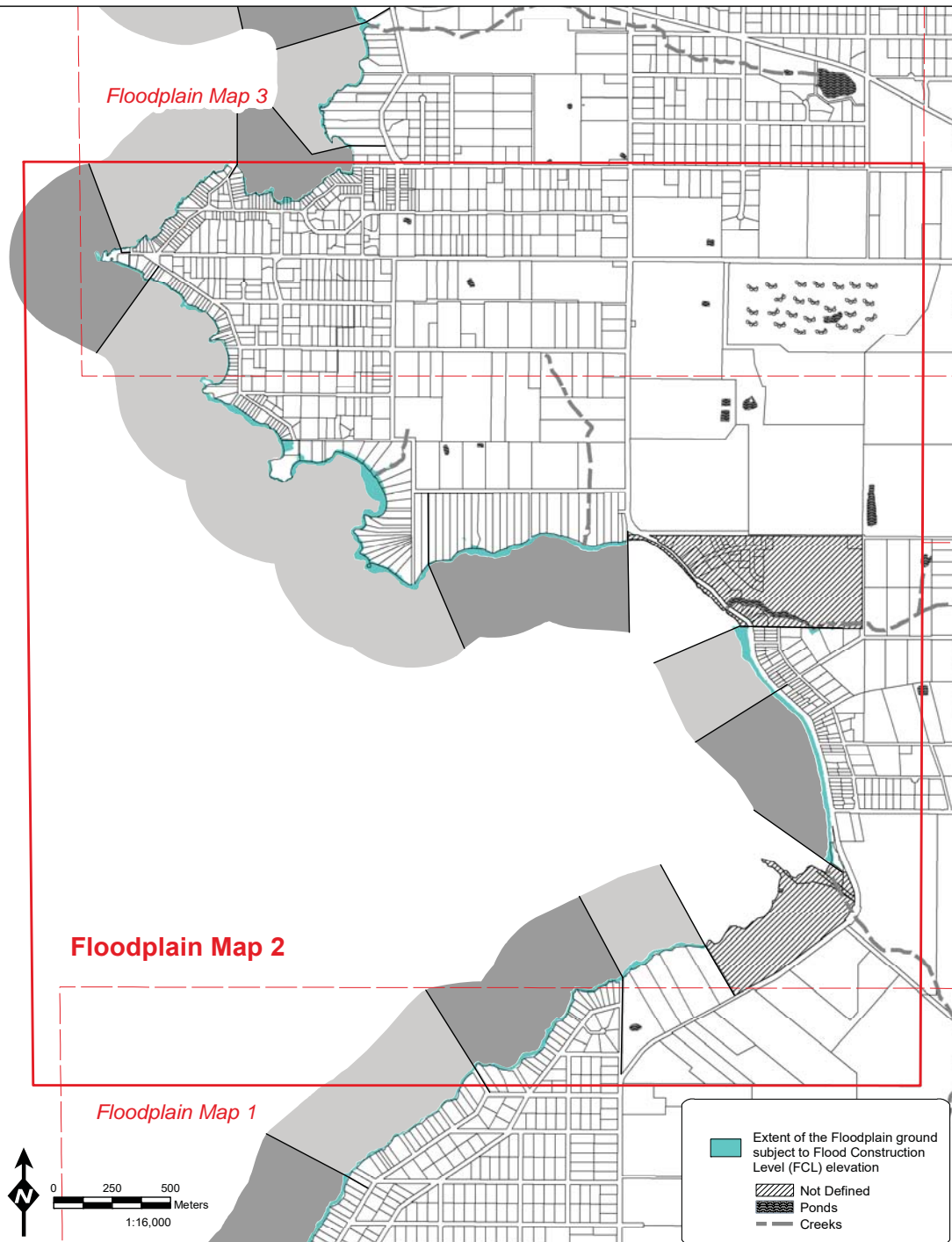
This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 2
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
0.5 m Sea Level Rise



This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 3
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
0.5 m Sea Level Rise

Floodplain Map 3



This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

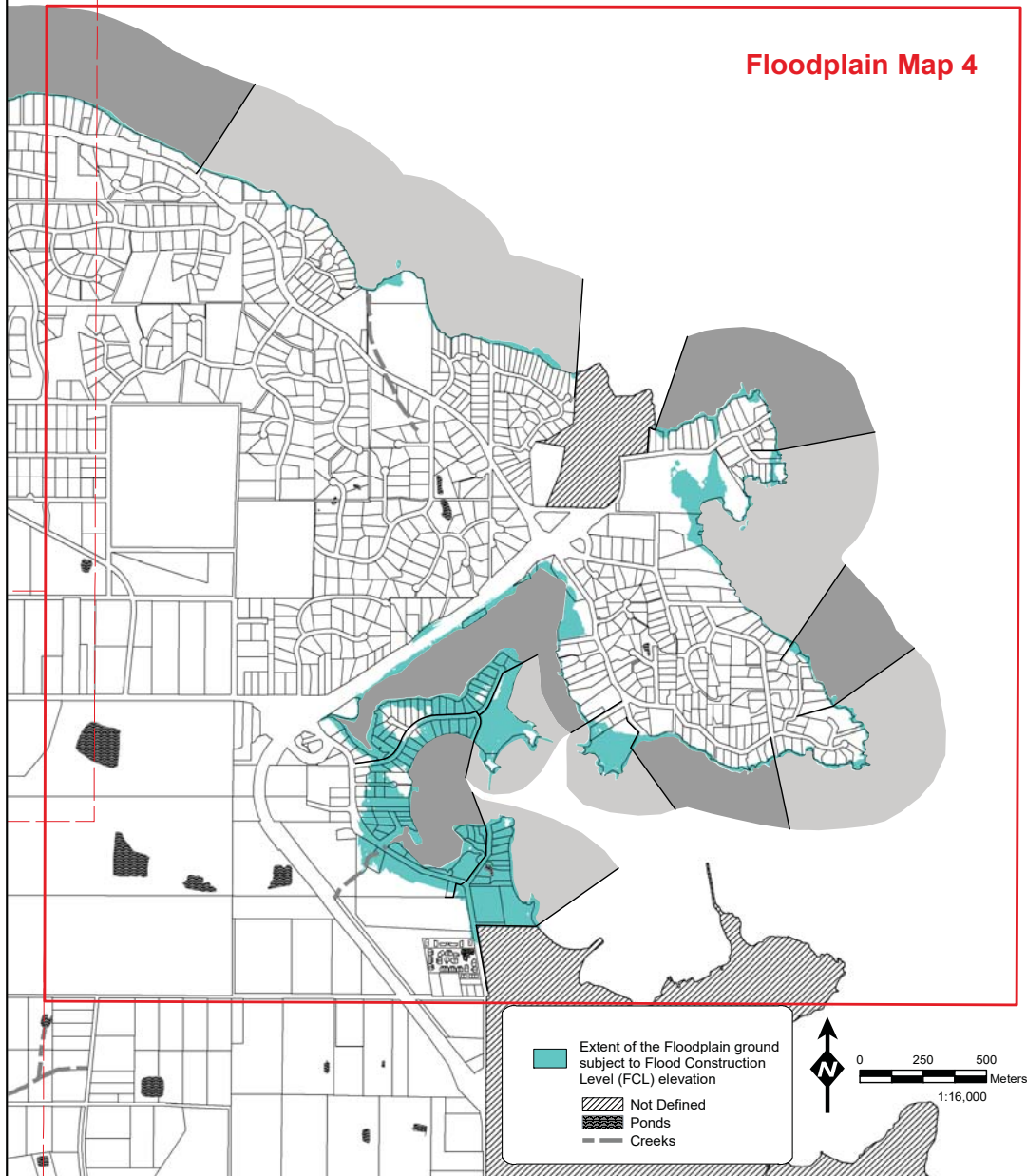
Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 4
 Schedule J - Official Community Plan
 Bylaw 1130 Amendment Bylaw 1442
 0.5 m Sea Level Rise

Floodplain Map 4



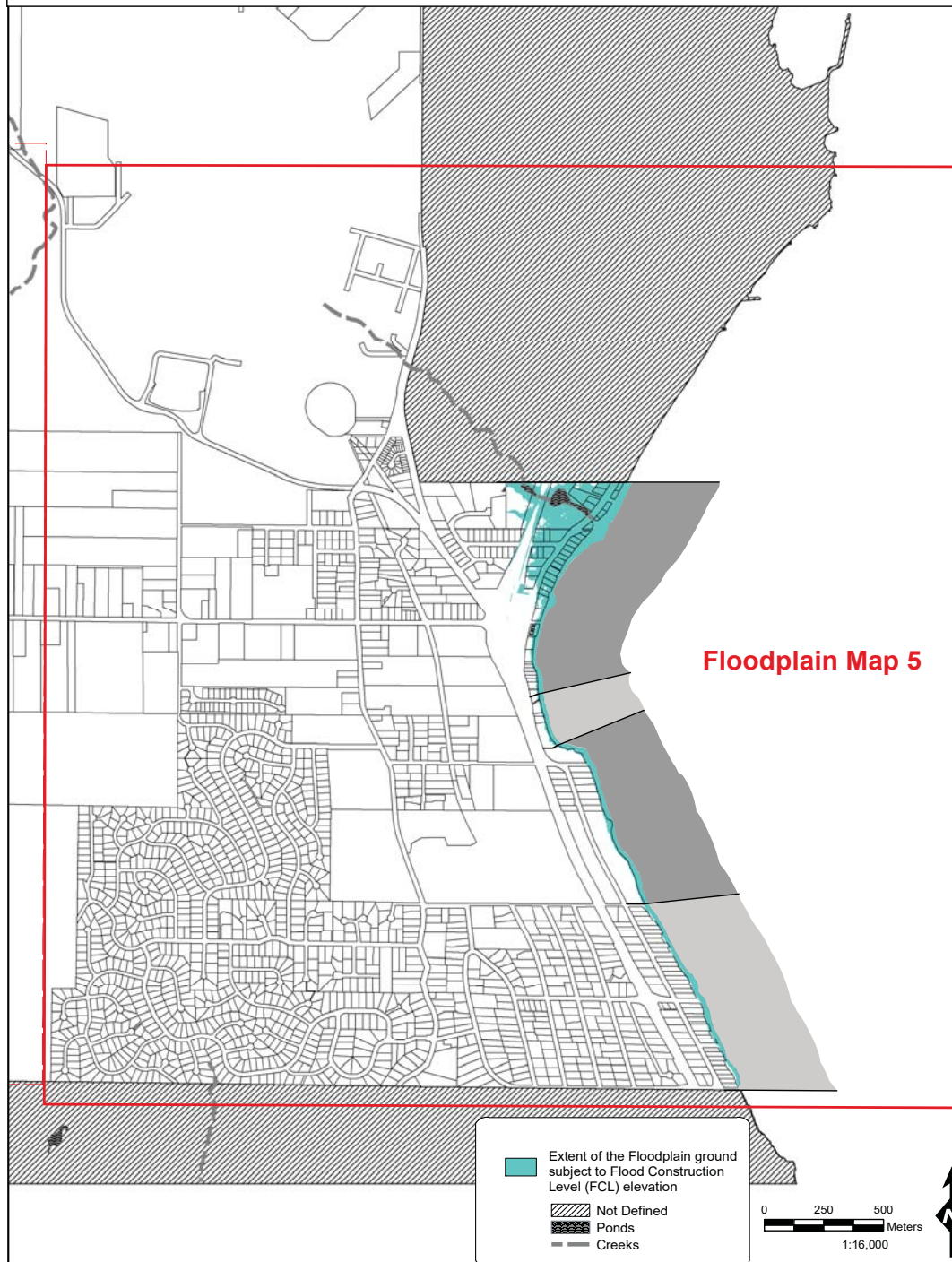
This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
 Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 5
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
0.5 m Sea Level Rise



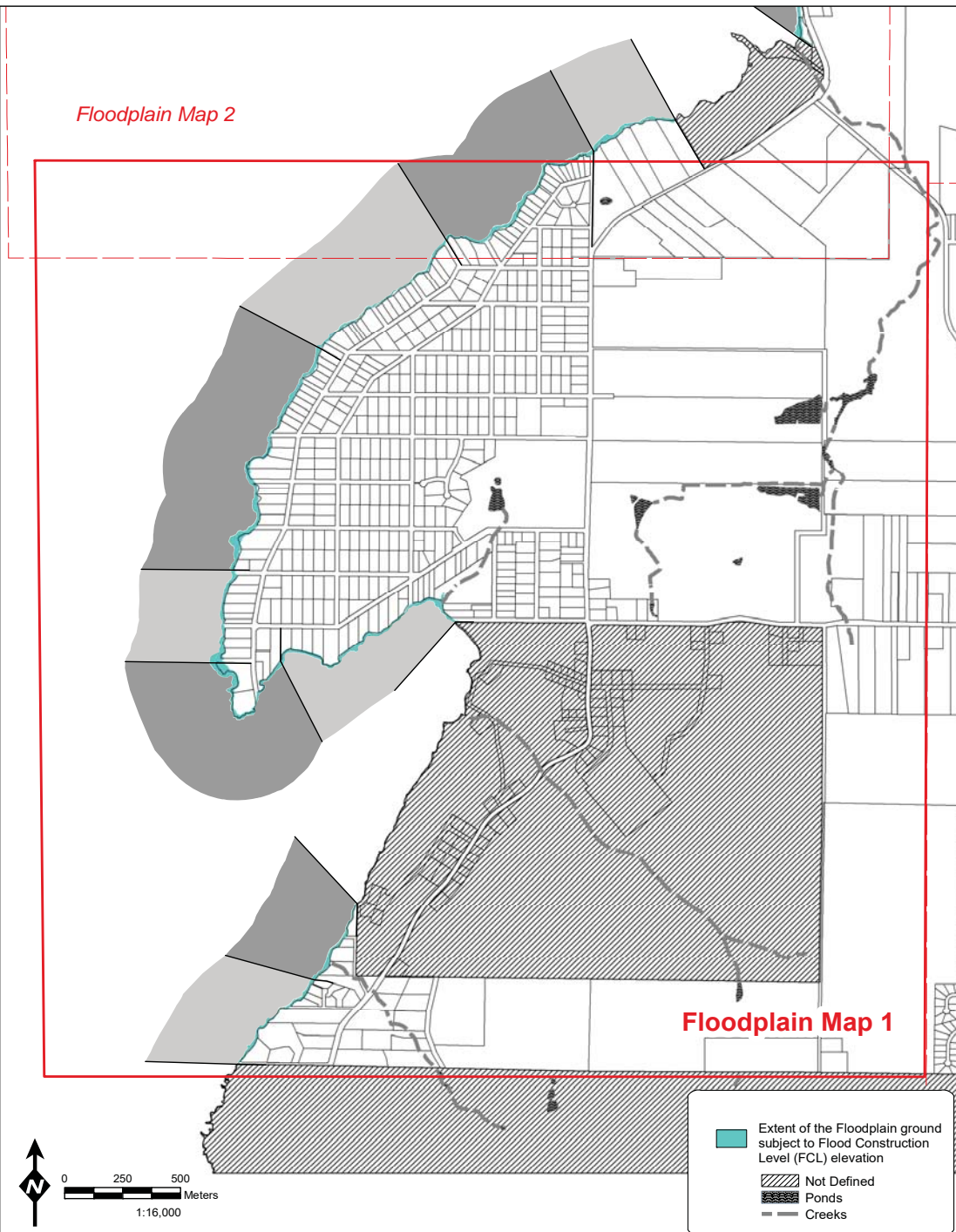
This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 1
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
1 m Sea Level Rise



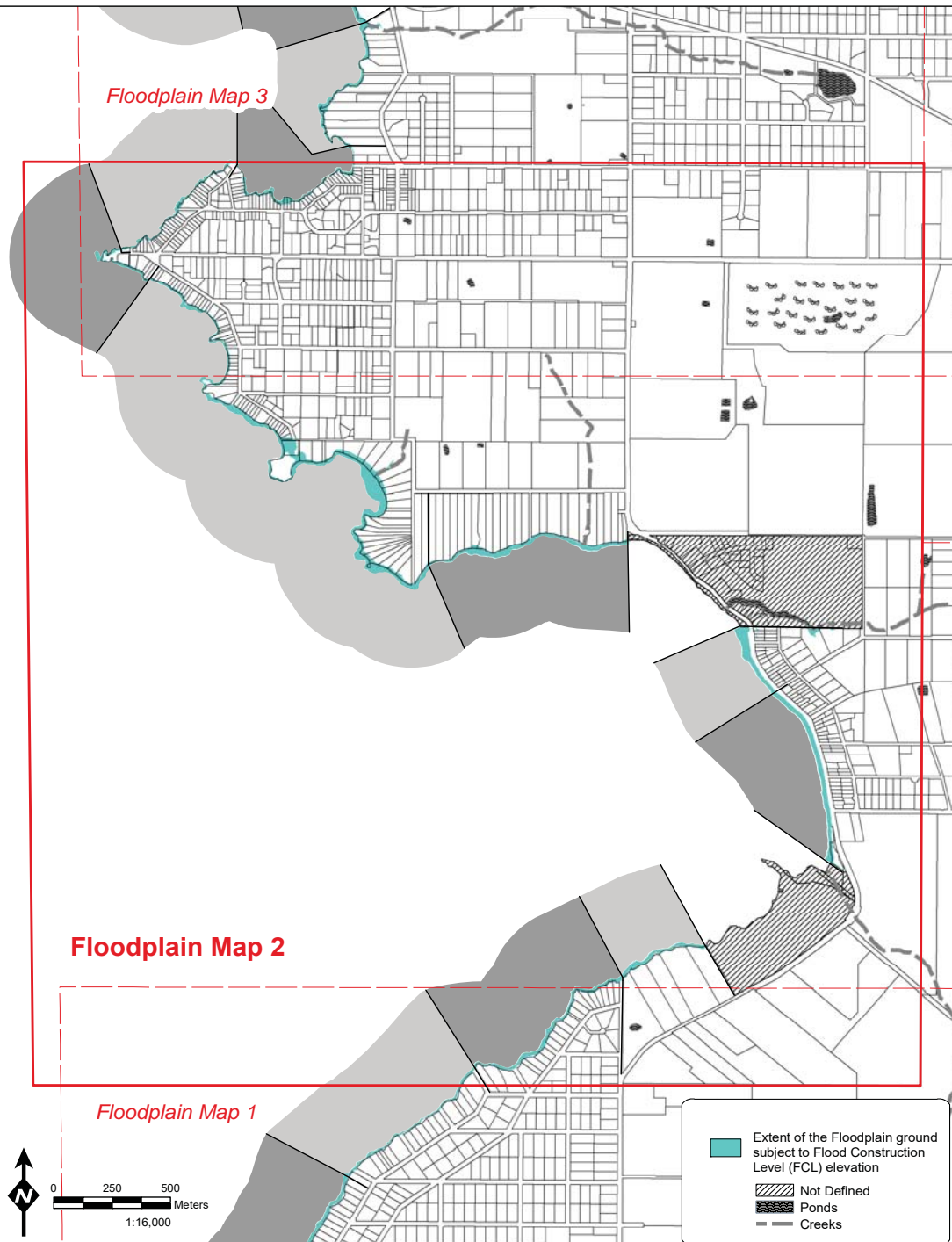
This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 2
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
1 m Sea Level Rise



This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 3
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
1 m Sea Level Rise

Floodplain Map 3



This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

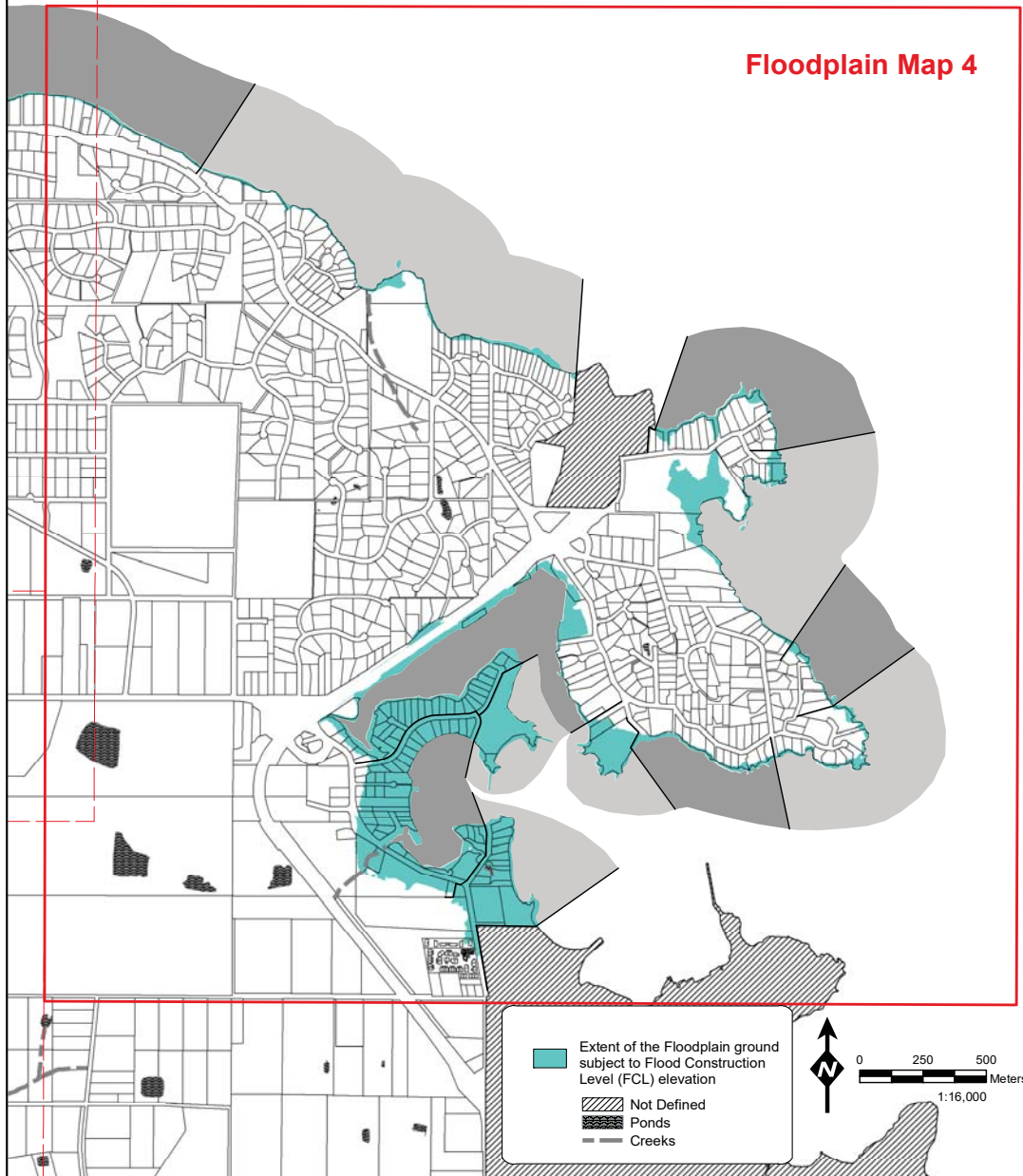
Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 4
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
1 m Sea Level Rise

Floodplain Map 4



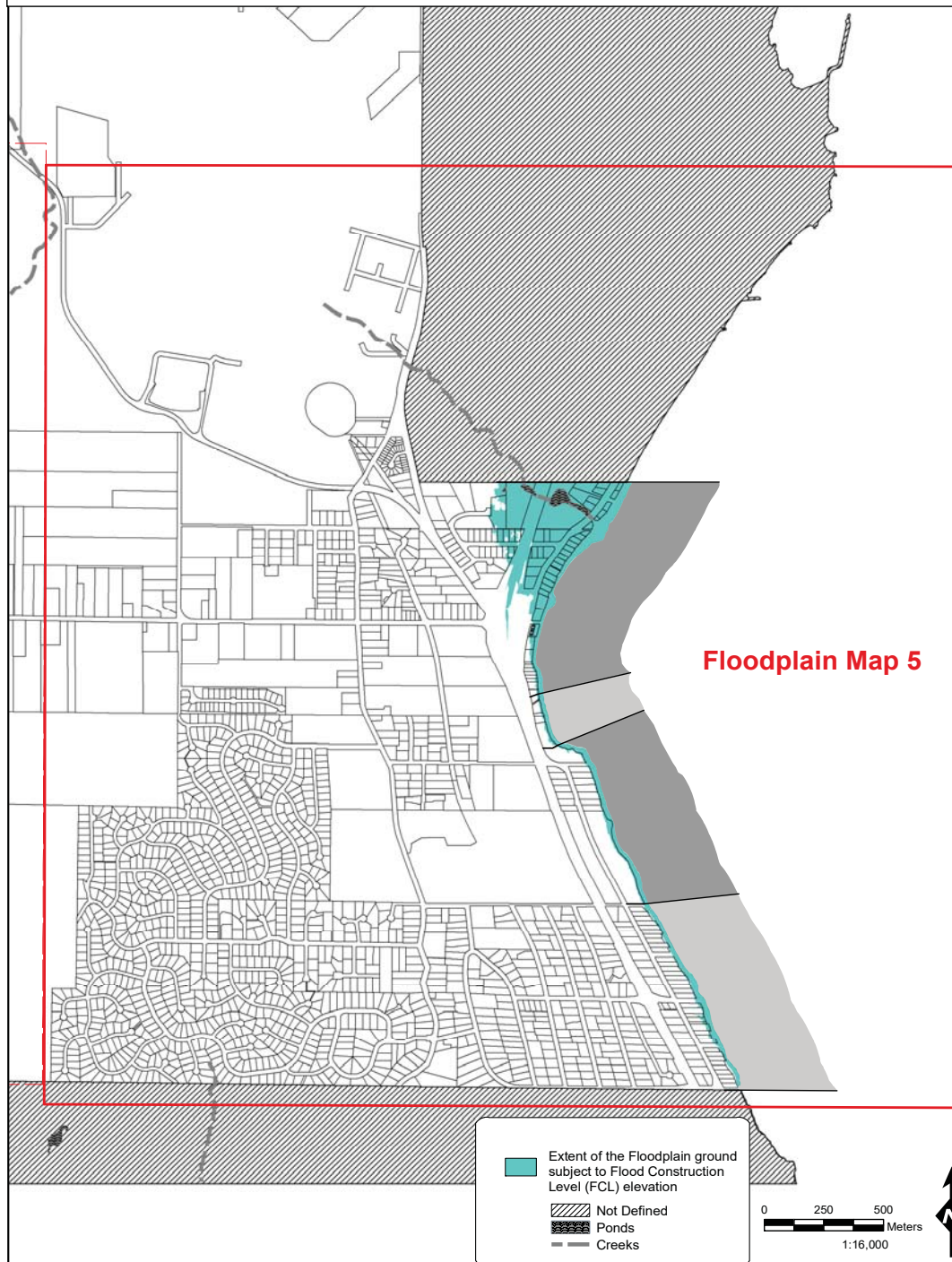
This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018



Floodplain Map 5
Schedule J - Official Community Plan
Bylaw 1130 Amendment Bylaw 1442
1 m Sea Level Rise



This Map shows the extent of the floodplain expected over existing ground in the District of North Saanich.

Details of the Flood Construction Levels in the floodplain are provided in
Bylaw 1439 - Coastal Flood Mitigation Bylaw.

April 20, 2018

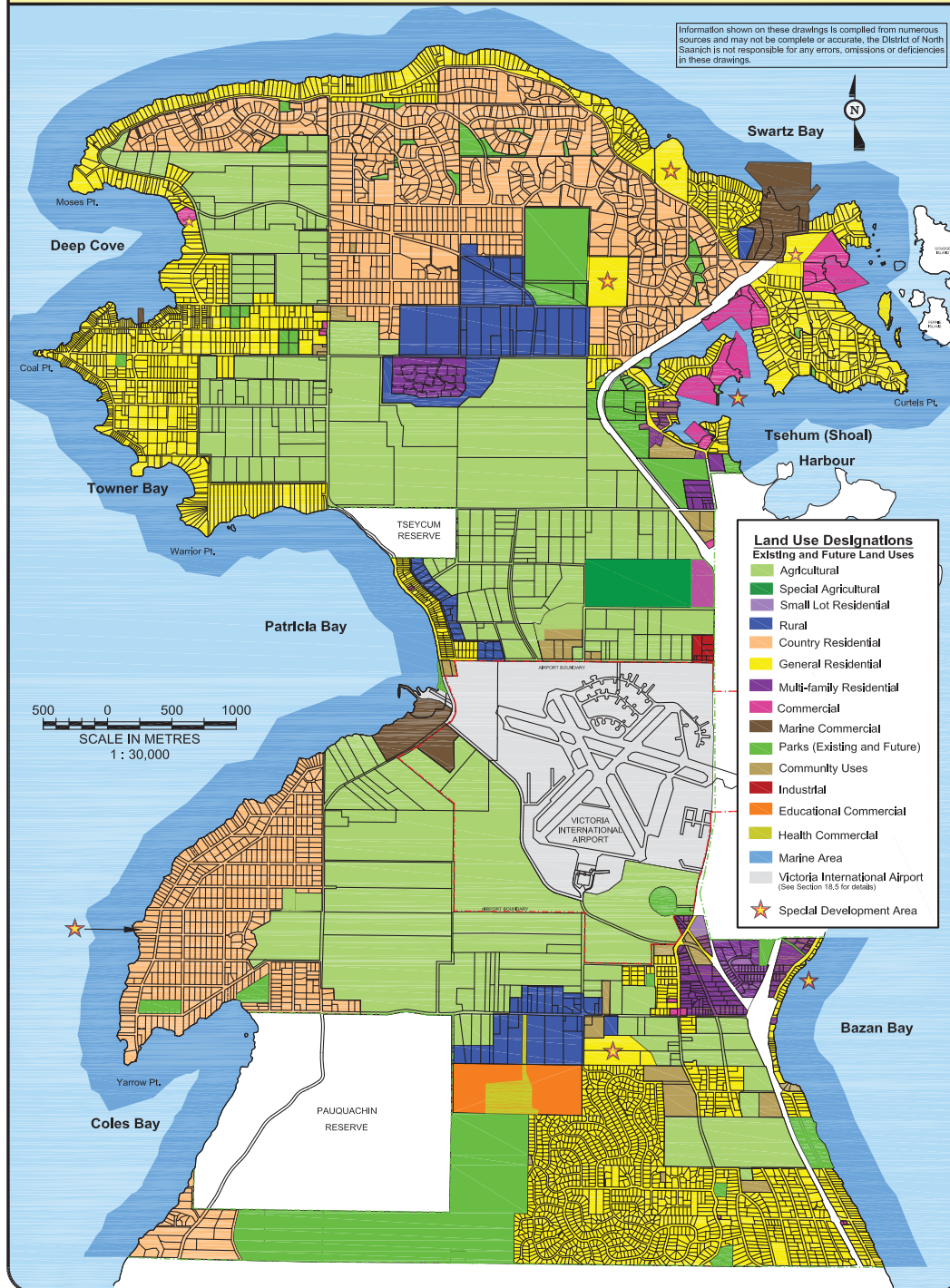
Draft

Schedule B Land Use Designations

District of North Saanich - Official Community Plan

Bylaw: XXXX
Passed & Adopted: XXXXXXXXXX
For: Planning & Community Services
By: Infrastructure Services - GIS
File: OCP Schedule B Bylaw XXXX Map.pdf

Information shown on these drawings is compiled from numerous sources and may not be complete or accurate; the District of North Saanich is not responsible for any errors, omissions or deficiencies in these drawings.



Appendix F

Frequently Asked Questions

District of North Saanich Marine Policy Review

June 2018



Overall Questions

Q1. Why is this Marine Policy Review being undertaken?

Council has directed staff to review the existing Marine related policies in the Official Community Plan Bylaw 1130 (the OCP) to reflect how rising sea levels might affect existing policies.

Q2. Why are these proposed changes being recommended now in the OCP?

The proposed OCP changes reflect a review of how the policies in the OCP will be affected by rising sea levels over the near future and what changes should be made to make it easier to adapt to rising sea levels and increase the resilience of the community in general.

Q3. Why are small changes to the text of existing OCP being suggested?

The suggested changes are related only to the review of those sections of the OCP that are affected or have some effect to building resilience or adopting adaptation measures.

Q4. What is the relationship between the suggested OCP changes and the Flood Construction Level Study Report [*Flood Construction Levels for 0.5 m and 1.0 m Sea Level Rise. Issued 4 January 2017*]

The suggested changes are directly related to the outcome of the FCL Study and the implications to building resilience or adopting adaptation measures.

Q5. What are sea levels doing in the North Saanich area?

Recent reviews of both the satellite measurements of sea level rise in those areas of the Pacific Ocean basin adjacent to the North Saanich area, and the recorded water level data in the Strait of Georgia, suggest sea levels in the North Saanich area are currently rising at an annual rate of between 6 mm/yr and 10 mm/yr. These recent rates are an increase over the historical rates in this area.

The proposed OCP Marine Policy changes, related questions and an explanation of why the proposed change is recommended follows in the rest of this document.

Environmentally Sensitive Areas

OCP Section 3.0

Proposed Change is described in: Chapter 3 of the Marine Policy and Guideline Recommendations report

Q6. Why are changes recommended to the present definition of Environmentally Sensitive Areas (OCP Section 3.1)

Environmentally sensitive areas, such as tidal marshes or beach areas are increasing recognized as providing valuable services by reducing the wave energy at the shoreline behind these features. Conservation or enhancement of these areas will be beneficial to the provision of community resilience or adaptation opportunities, while at the same time preserving their important natural services.

Q7. Why is the Shoal Harbour Migratory Bird Sanctuary being introduced now into the OCP? (OCP Section 3.1)

The Shoal Harbour Migratory Bird Sanctuary is one of the oldest migratory bird sanctuaries in Canada and is located in one of the most vulnerable areas of the District of North Saanich, which is exposed to a coastal flooding hazard. Specifically including it into the OCP recognizes its importance as an Environmentally Sensitive Area and the role it can play in building community resilience or adaptation opportunities in the Tsehum Harbour area.

Q8. What types of modifications in Environmentally Sensitive Areas could assist in building resilience to the effects of Sea Level Rise?

Enhancing the beaches and tidal marshes in these areas can contribute to the absorption of wave energy during coastal flood events, while still providing valuable marine habitat. These types of works will make the adjacent areas of the District of North Saanich less exposed to the risks of flooding during coastal flood events.

Rocky Shores

OCP Section 4.0 Marine Areas | 4.2

Proposed Change is described in: Chapter 3 of the Marine Policy and Guideline Recommendations report

Q9. What type of works would be considered on a rocky shore to limit coastal flood effects?

Along many of the rocky shores of the DNS waterfront, shown in Schedule G of the OCP bylaw, the rocky shoreline is low lying and supports an erodible bluff. As sea levels rise the toe of the bluff will be exposed to erosion by wave action, which could threaten the safety of a building close to the top of the bluff.

This proposed change would allow appropriately designed protection works at the toe of the bluff on the rocky shoreline.

Q10. How would this be administered by the District of North Saanich?

This will be addressed in the District of North Saanich Zoning Bylaw 1255 review.

Beach Shores - Drift Sector Beaches

OCP 4.0 Marine Areas | 4.2

Proposed Change is described in:

*Chapter 3 of the Marine Policy And
Guideline Recommendations report*

Q11. What is a Drift Sector Beach?

A Drift Sector Beach is a beach that is long enough that there is a source of sediment on the beach, a transport pathway for sediments to move due to waves and currents and an area where the transported sediments can accumulate. The beach shoreline in Bazan Bay is an example of a Drift Sector Beach in the District of North Saanich.

Q12. What type of works could preserve the shoreline character and limit coastal flood related effects?

Examples of works that could preserve the shoreline character and limit coastal flooding on a Drift Sector Beach would include: beach nourishment, removal of bulkheads or seawalls to restore upland sediment supply, installation of low beach sill structures, combined with the supply of beach material to maintain a beach crest berm.

Q13. Does the OCP allow property owners to undertake works below the existing Natural Boundary?

Works below the Natural Boundary would have to be reviewed and approved by both Provincial and Federal approval and permitting agencies. This proposed change to the OCP would provide a basis for District of North Saanich support for an application.

Q14. How would work below the Natural Boundary be administered by the District of North Saanich?

Planning staff will work with property owners to ensure Federal and Provincial regulations and District policies are followed.

Beach Shores - Pocket Beaches

OCP 4.0 Marine Areas | 4.2

Proposed Change is described in: [Chapter 3 of the Marine Policy And Guideline Recommendations report](#)

Q15. What is a Pocket Beach?

A Pocket Beach is a beach that is contained between two bedrock headlands or outcrops that essentially functions as a closed system in terms of the transport of beach sediments by waves or currents.

Q16. What type of works could preserve the shoreline character and limit coastal flood related effects?

Examples of works that could preserve the shoreline character and limit coastal flooding on a Pocket Beach would include: beach nourishment, the provision of beach materials to form a beach crest berm or the removal of bulkheads and seawalls to restore upland sediment supply.

Q17. Does the OCP allow property owners to undertake works below the existing Natural Boundary?

Works below the Natural Boundary would have to be reviewed and approved by both Provincial and Federal approval and permitting agencies. This proposed change to the OCP would provide a basis for District of North Saanich support for an application.

Q18. How would work below the Natural Boundary be administered by the District of North Saanich?

Planning staff will work with property owners to ensure Federal and Provincial regulations and District policies are followed.

Mudflats, Marshes and Delta Shores

OCP 4.0 Marine Areas | 4.2

Proposed Change is described in: [Chapter 3 of the Marine Policy And Guideline Recommendations report](#)

Q19. What are Mudflats, Marshes and Delta Shores?

The sheltered areas of Tsehum Harbour are examples of mudflat and marsh areas in the District of North Saanich. These areas are indicated on Schedule G of the OCP. Delta Shores are located at the mouth of creeks that discharge into the sea and examples can be found at the mouth of Reay Creek and Chalet Creek. These areas are indicated on Schedule G of the OCP.

Q20. What type of works could preserve the shoreline character and limit coastal flood related effects?

Examples of works that could preserve the shoreline character of Mudflats or Marshes would include: restoration of salt marshes, removal or modification of bulkheads or seawalls to minimize wave reflections or the installation of subtidal reefs or berms to reduce erosion of mudflats by waves during storms.

Q21. Does the OCP allow property owners to undertake works below the existing Natural Boundary?

Works below the Natural Boundary would have to be reviewed and approved by both Provincial and Federal approval and permitting agencies. This proposed change to the OCP would provide a basis for District of North Saanich support for an application.

Q22. How would this be administered by the District of North Saanich?

Planning staff will work with property owners to ensure Federal and Provincial regulations and District policies are followed.

Residential Areas - Policy 6.2

OCP 6.0 Residential Areas

Proposed Change is described in: Chapter 3 of the Marine Policy And Guideline Recommendations report

Q23. Why are changes to the sensitive natural areas of a residential development now being allowed?

There are many parcels of land around the shoreline of the District of North Saanich where the parcel is exposed to coastal flooding either directly from the parcel shoreline or indirectly from adjacent land parcels. The proposed changes are intended to allow slope adjustments, in particular, to direct flooding away from existing buildings or from adjacent properties.

Q24. What type of changes to existing slopes will be considered to help reduce the effects of coastal flooding?

Changes in slope that direct coastal flooding towards the shoreline of the property might be considered as appropriate. Changes in utility corridors or driveways that assist in minimizing the effects of coastal flooding might be considered as appropriate.

Roads and Servicing - Policy 11.1 and 11.2 OCP 11.0 Roads and Servicing

Proposed Change is described in: [Chapter 3 of the Marine Policy And Guideline Recommendations report](#)

Q25. Why should Developments consider sea level rise for the placement and construction of roads on Developments?

Roads provide important connections both to and within Developments during flooding events. These connections should continue to be accessible during future coastal flooding events.

Roads and Servicing - Policy 11.3 OCP 11.0 Roads and Servicing

Proposed Change is described in: [Chapter 3 of the Marine Policy And Guideline Recommendations report](#)

Q26. Why should existing services consider sea level rise adaptation measures?

Existing services are presently exposed to the effects of coastal flooding in some locations in the District of North Saanich. This change is intended to make it clear that some expansion outside of the Servicing Area will be considered if the reason is to make those services resilient to the effects of coastal flooding.

General Development Policies

OCP 12.0

Proposed Change is described in:

*Chapter 3 of the Marine Policy And
Guideline Recommendations report*

Q27. Why should General Development Policies consider coastal flooding and incorporate adaptation measures?

These policies are applicable to all land uses in the District of North Saanich and coastal flooding and the adaptation of land use in the District will be an important factor in many aspects of the future development of the District.

Q28. What would be appropriate adaptation measures that might be considered as consistent with these General Policies?

Design and construction of new developments to meet the Flood Construction Levels and setbacks in Bylaw 1439 - Coastal Flood Mitigation Bylaw is an important and effective first step.

Q29. How would these General Development Policies be administered by the District of North Saanich?

These General Policies would become part of a DP application review process if applicable.

Q30. Do these policies apply to existing Developments in the District of North Saanich?

The policies apply to new Developments except when an existing development intends to expand the existing habitable space as described in Bylaw 1439 – Coastal Flood Mitigation Bylaw.

Special Development Areas

OCP Section 13.0

Proposed Change is described in:

Chapter 3 of the Marine Policy And Guideline Recommendations report

Q31. Why are two new Special Development Areas being proposed?

The two proposed areas, Tsehum Harbour area and the Lochside – McTavish area are significantly affected by expected sea level rise effects. Designation as a Special Development Area will allow the future development of these areas to be guided in an innovative manner that can be expected to accommodate sea level rise effects in a manner that benefits the communities in these areas.

Q32. Why should the two new Special Development Areas be created now?

New developments will have a service life that extends well into the time frame when sea level rise related effects will influence the communities. Creation of the Special Development Areas now will allow the development of specific land use policies in these areas that can guide appropriate development.

Q33. What does designation as a Special Development Area imply?

Designation as a Special Development Area will start the beginning of a consultation process for the particular area and that provides the flexibility that best suits the neighbourhood and individual properties in the neighbourhood. Special studies for the specific area will be required.

Q34. How will the Special Development Area be rezoned?

The Special Development areas will be rezoned using a Comprehensive Development Zoning Bylaw upon consideration of each future development application.

Q35. How will the Tsehum Harbour SDA be coordinated with the adjacent areas in the Town of Sidney?

The District of North Saanich will invite the Town of Sidney to participate as a stakeholder in the development of the Tsehum Harbour Special Development Area as will the Shoal Harbour Bird Sanctuary society so that the SDA can be consistent across the municipal boundaries and the existing Shoal Harbour Sanctuary Area

Development Permit Areas

OCP 14.0

NOTE: *The Sea Level Rise Coastal Flood Hazard Area DPA, which was proposed in the Marine Policy And Guideline Recommendations report, since January 2017, has been withdrawn.*

Q36. Why is the proposed DPA no longer recommended?

The - Sea Level Rise Coastal Flood Hazard Area DPA – will be replaced by a Bylaw to Mitigate Coastal Flood Hazards. Development Permit Areas are guidelines for development and are adopted by local governments when there is no specific information and reports from experts are required. The District of North Saanich has acquired specific FCL information through the FCL Study report. This different approach, which is consistent with the Provincial Guidelines – Flood Hazard Area Land Use Management Guideline (FHALUMG), Amended 1 January 2018, is proposed.

General Exemptions for a Development Permit

OCP 14.0 Development Permit Areas |

Proposed Change is described in:

Chapter 3 of the Marine Policy And Guideline Recommendations report

Q37. Why are small additions to commercial and industrial buildings and garden sheds and tool sheds no longer eligible for exemptions to a DPA

Small additions to commercial and industrial buildings and garden sheds and tools sheds should not be located in a floodplain because they often contain materials (fuel, fertilizer, paint, plastics, etc) that, in the event of a flood, can contaminate the soil or, due to runoff, the ocean.

Q38. Why should changes in the height of an existing building, even when it is within the existing footprint, give consideration to the implications of future FCL requirements?

Only if a change in height of an existing building, is occurring in connection with an increase in habitable space in excess of 25%, is the building subject to the proposed Bylaw 1439 - Coastal Flood Mitigation Bylaw.

Q39. Why should small structures (less than or equal to 10 m²) be setback so they are inland of the future estimated natural boundary?

These types of small structures should be setback 15 m from the future estimated natural boundary to ensure they are not exposed to a growing risk of coastal flooding. The method for defining the future estimated natural boundary is provided in the proposed Bylaw 1439 - Coastal Flood Mitigation Bylaw.

Q40. What is the future estimated natural boundary?

The future estimated natural boundary is the location to which it is expected the natural boundary will migrate as sea levels rise to a specific level. The method for determining the location of the future estimated natural boundary is provided in the proposed Bylaw 1439 - Coastal Flood Mitigation Bylaw.

Q41. Why should coastal flood-related mitigation measures be eligible for an exemption to a DPA as an emergency work?

As sea levels rise, existing developments will become more exposed to a coastal flooding hazard and it may be necessary to undertake emergency measures to prevent flooding. This change will make emergency measures undertaken for this purpose similar to measures allowed to remove trees where they are an immediate danger or hazard. Emergency measures do not require a development permit.

Q42. Why should the construction of a single family residential dwelling in DPA 8 be subject to the proposed Coastal Flood Mitigation Bylaw?

This development permit area addresses the appearance of intensive residential development rather than the protection of development from the coastal flooding hazard.

Coastal Flood Mitigation Bylaw

NEW

The Proposed Bylaw is outlined in:

*Chapter 4 of the Marine Policy And
Guideline Recommendations report*

Q43. Why introduce a new "Coastal Flood Mitigation Bylaw"?

Section 524 of the "Local Government Act" confers authority to local governments to "designate land as a floodplain" when those lands are exposed to a flood hazard. The provincial government Flood Hazard Area Land Use Management Guidelines (FHALUMG, Section 3.5.4) suggests that land areas exposed to coastal flood hazards, where potential flood levels will be increased by sea level rise, should be designated as a floodplain to reduce the potential for injury and property damage caused by coastal flooding. If the land is so designated, a local government specifies flood construction levels and setbacks to address the coastal flood hazard including the effect of sea level rise. The FCL Study Report has enabled the District to specify these development standards with a high level of precision for various sectors of the marine shoreline.

Q44. When does the Bylaw come into effect?

The proposed Bylaw is not retroactive. It would come into effect for new developments and building replacements and major additions should it be enacted by Council.

End of document

DISTRICT OF NORTH SAANICH

BYLAW 1442

OCP MARINE PLANNING

BYLAW 1439

COASTAL FLOODING MITIGATION BYLAW

June 25, 2018

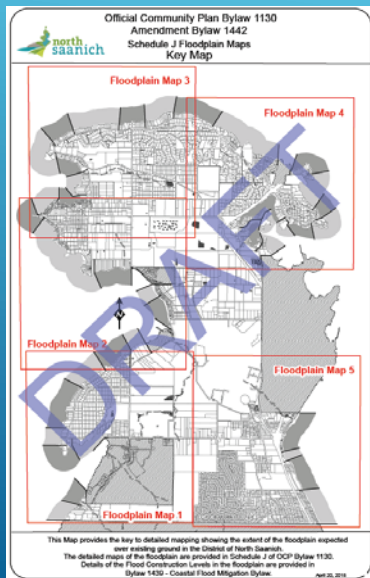


OVERVIEW

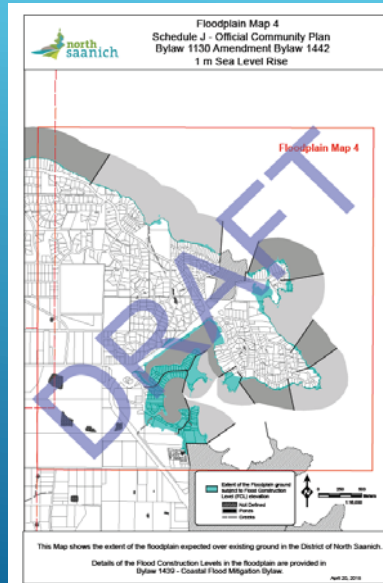
MARINE POLICY REVIEW (Ongoing)

- ▶ The ongoing review of marine policies for OCP Planning recommends several modifications to the OCP:
 - ▶ Wording changes to allow future adaptation measures for sea level rise to be consistent with the updated OCP
 - ▶ Recommendations for two new Special Development Areas
 - ▶ Definition of a Coastal Floodplain (Schedule J) in proposed Bylaw 1442.
- ▶ The Coastal Floodplains in Schedule J were prepared according to the Provincial Guidelines and consider future sea level rises of 0.5 m and 1.0 m.
- ▶ The maps in Schedule J show how the extent of the floodplain varies around the District of North Saanich

Bylaw 1442 OCP Marine Planning Examples of Schedule J Floodplain maps Key Map



Floodplain Map

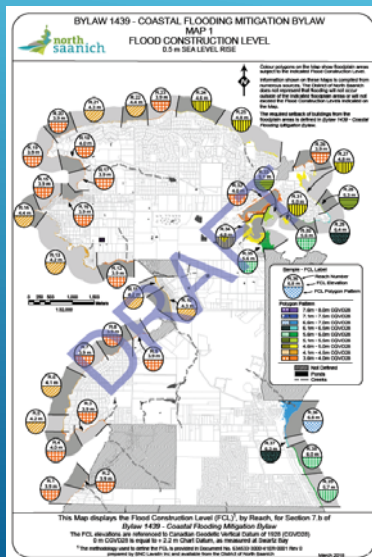


Bylaw 1439 Coastal Flooding Mitigation Maps

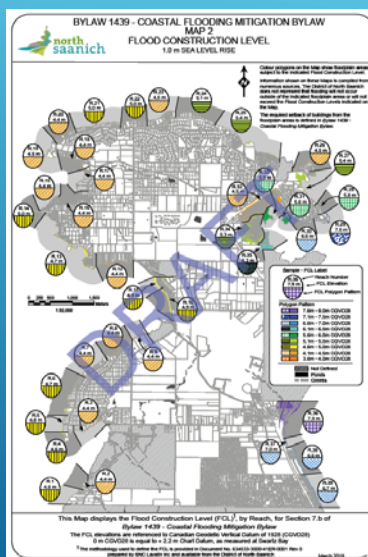
- ▶ These maps reflect all of the studies and consultation completed since the beginning of FCL studies in 2016.
- ▶ The maps define the exposure to waves and storm surge on 39 reaches of the District of North Saanich shoreline.
- ▶ Consider 0.5 m and 1.0 m of sea level rise.
- ▶ Evaluation methodology consistent with recent FHALUMG amendment by the Provincial Government.
- ▶ The maps employ an often used “egg” format to convey the reach by reach FCLs that is easily read by all readers.

Flood Construction Level maps

Map 1 - 0.5 m SLR



Map 2 - 1.0 m SLR



Application of Bylaw 1439 Coastal Flooding Mitigation

- ▶ Once the floodplain is designated:
 - ▶ Map 1 applies to additions to existing buildings exceeding 25 % of existing habitable floor area and for which a building permit is required by the Building Bylaw
 - ▶ Map 2 applies to **new** principal buildings
- ▶ Bylaw 1439 will only apply to buildings in the designated floodplain
 - ▶ Contains the implications to:
 - ▶ 131 – 163 of the 713 waterfront lots partially or completely inundated.
 - ▶ Would only apply in other waterfront lots if future redevelopment occurred very close to the shoreline
 - ▶ This is considered to be unlikely

Examples of Application

- ▶ Three examples:
 - ▶ Property in the Tsehum Harbour Area to be completely re-developed
 - ▶ Property in Lochside-McTavish area to add an addition of 20 per cent existing area
 - ▶ Property on Madrona Drive to be completely re-built.
- ▶ Working Assumptions:
 - ▶ Bylaw 1442 is in effect – Floodplains established
 - ▶ Bylaw 1439 is in effect – FCLs defined

EXAMPLE 1

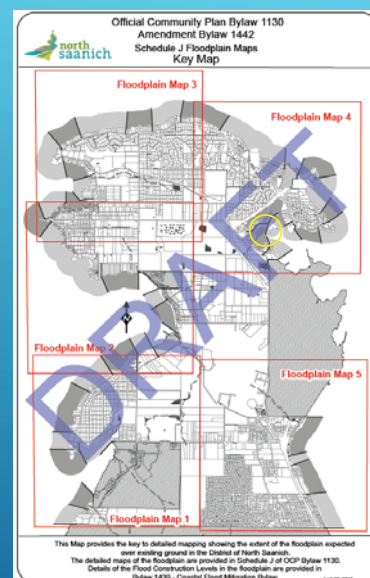
Example 1

- ▶ Property in the Tsehum Harbour Area to be completely re-developed
- ▶ New house under design
- ▶ Existing house to be demolished
- ▶ Check if house is in Floodplain
 - ▶ Floodplain maps



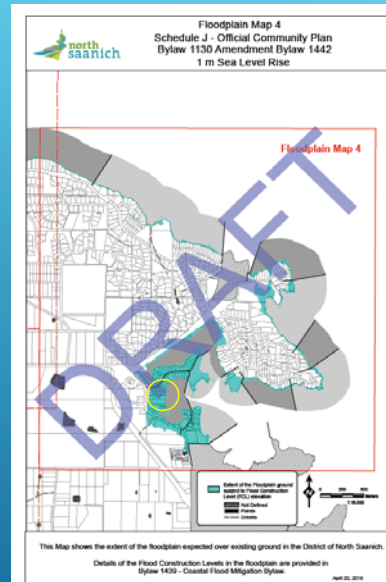
Example 1

- ▶ Property in the Tsehum Harbour Area to be completely re-developed
- ▶ New house under design
- ▶ Existing house to be demolished
- ▶ Check if house is in Floodplain
 - ▶ Floodplain maps – Map 4 on Key Map



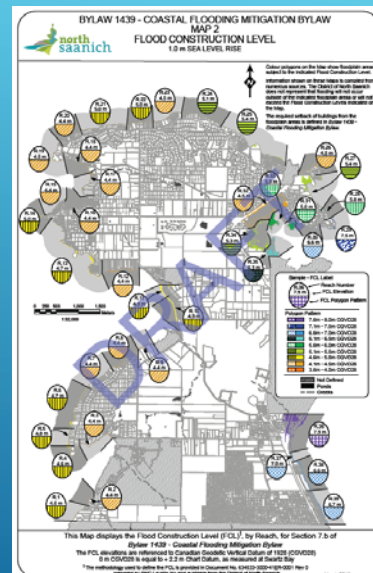
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- ▶ Check if house is in Floodplain
 - ▶ Floodplain maps – Map 4 on Key Map
 - ▶ Map 4 shows property is in the floodplain
- ▶ Find FCL in Bylaw 1439



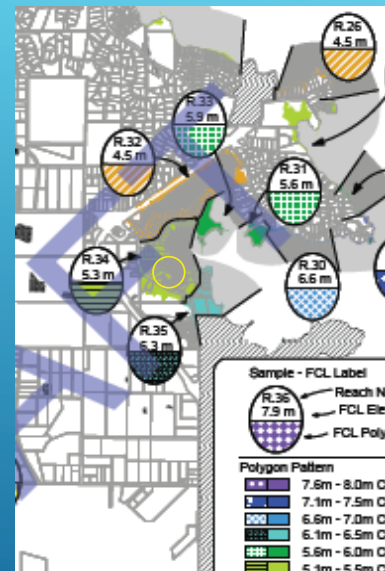
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- ▶ Property in the Tsehum Harbour Area to be completely re-developed
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 - ▶ Map 4 shows property is in the floodplain
- ▶ Find FCL in Bylaw 1439
 - ▶ A complete re-development uses Map 2 in Bylaw 1439



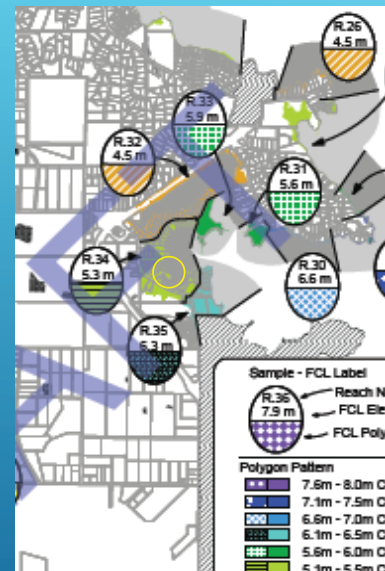
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 - ▶ New house under design
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- ▶ Check if house is in Floodplain
 - ▶ Floodplain maps – Map 4 on Key Map
 - ▶ Map 4 shows property is in the floodplain
- ▶ Find FCL in Bylaw 1439
 - ▶ A complete re-development uses Map 2 in Bylaw 1439
 - ▶ Property is in Reach 34 (R.34)
 - ▶ FCL is 5.3 m (CVGD28)



Example 1

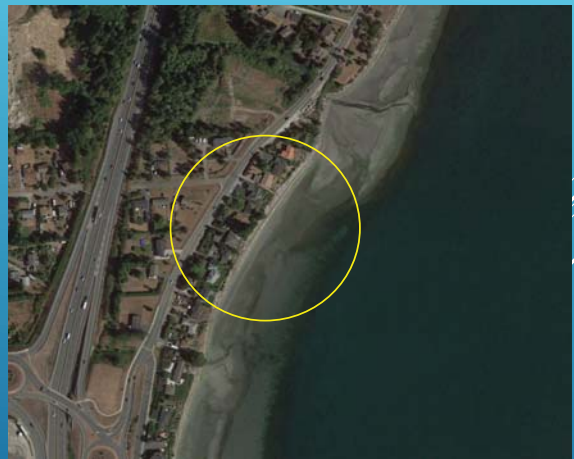
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 - ▶ Existing house to be demolished
 - ▶ New house under design
- ▶ Check if house is in Floodplain
 - ▶ Floodplain maps – Map 4 on Key Map
 - ▶ Map 4 shows property is in the floodplain
- ▶ Find FCL in Bylaw 1439
 - ▶ A complete re-development uses Map 2 in Bylaw 1439
 - ▶ Property is in Reach 34 (R.34)
 - ▶ FCL is 5.3 m (CVGD28)
 - ▶ Approximately 1.8 m above existing ground



EXAMPLE 2

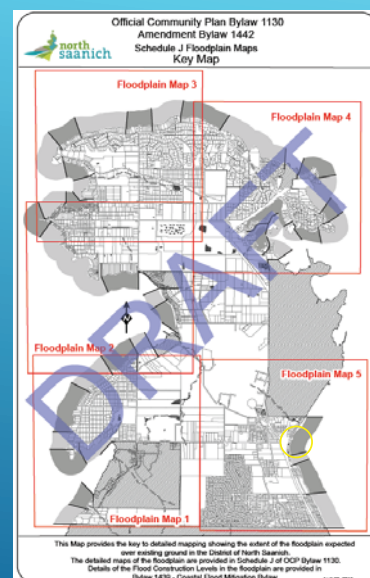
Example 2

- ▶ Property in the Lochside McTavish Area to expand floor plan by 20%
- ▶ Existing house remains same
- ▶ Addition is on the front of the house
- ▶ Check if house is in Floodplain
 - ▶ Floodplain maps



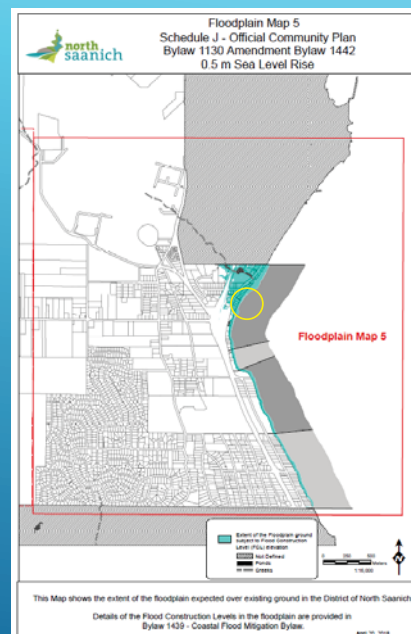
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- ▶ Property in the Lochside McTavish Area to expand floorplan by 20%
- ▶ Existing house remains same
- ▶ Addition is on the front of the house
- ▶ Check if house is in Floodplain
 - ▶ Floodplain maps

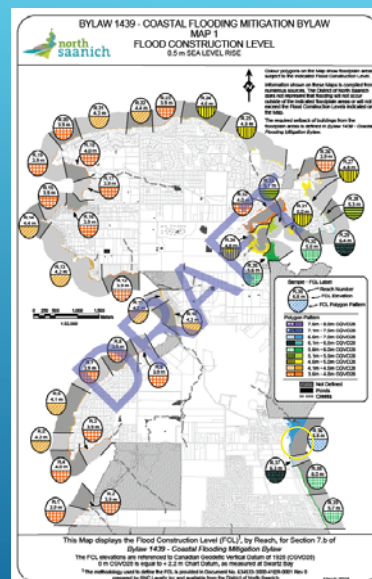


Example 2

- ▶ Property in the Lochside McTavish Area to expand floor plan by 20%
- ▶ Existing house remains same
- ▶ Addition is on the front of the house
- ▶ Check if house is in Floodplain
 - ▶ Floodplain maps – Map 5 on Key Map
 - ▶ Map 5 shows property is in the floodplain
- ▶ Find FCL in Bylaw 1439

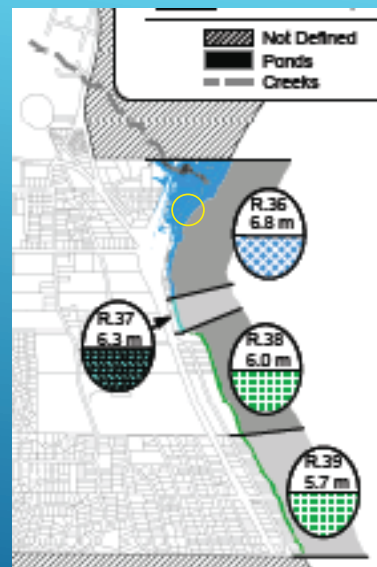


- ▶ Property in the Lochside McTavish Area to expand floor plan by 20%
- ▶ Existing house remains same
- ▶ Addition is on the front of the house
- ▶ Check if house is in Floodplain
 - ▶ Floodplain maps – Map 1 on Key Map
 - ▶ Map 1 shows property is in the floodplain
- ▶ Find FCL in Bylaw 1439



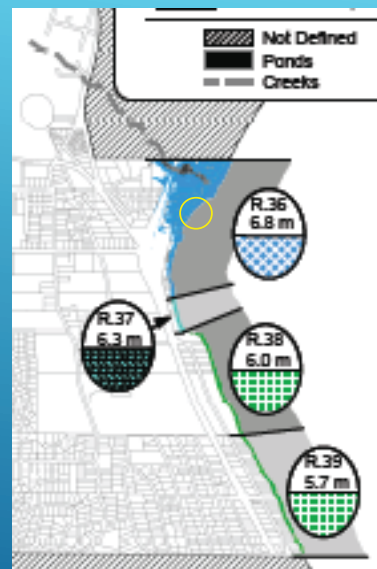
Example 2

- ▶ Property in the Lochside McTavish Area to expand floor plan by 20%
- ▶ Existing house remains same
- ▶ Addition is on the front of the house
- ▶ Check if house is in Floodplain
 - ▶ Floodplain maps – Map 1 on Key Map
 - ▶ Map 1 shows property is in the floodplain
- ▶ Find FCL in Bylaw 1439
 - ▶ Property is in Reach 36 (R.36)
 - ▶ FCL is 6.8 m (CVGD28)
 - ▶



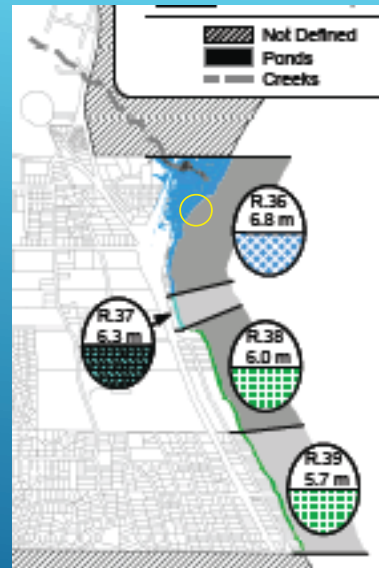
Example 2

- ▶ Property in the Lochside McTavish Area to expand floor plan by 20%
- ▶ Existing house remains same
- ▶ Addition is on the front of the house
- ▶ Check if house is in Floodplain
 - ▶ Floodplain maps – Map 1 on Key Map
 - ▶ Map 1 shows property is in the floodplain
- ▶ Find FCL in Bylaw 1439
 - ▶ Property is in Reach 36 (R.36)
 - ▶ FCL is 6.8 m (CVGD28)
 - ▶ Approximately 1.3 m above existing ground



Example 2

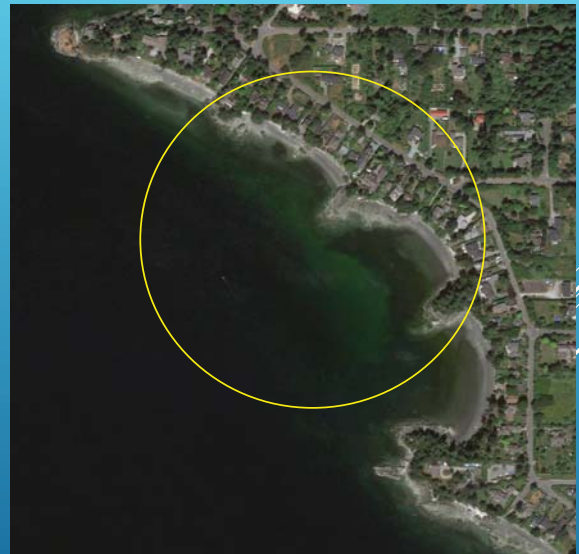
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- ▶ Check if house is in Floodplain
 - ▶ Floodplain maps – Map 1 on Key Map
 - ▶ Map 1 shows property is in the floodplain
- ▶ Find FCL in Bylaw 1439
 - ▶ Property is in Reach 36 (R.36)
 - ▶ FCL is 6.8 m (CVGD28)
 - ▶ Approximately 1.3 m above existing ground
 - ▶ Addition can proceed at existing habitable floor level



EXAMPLE 3

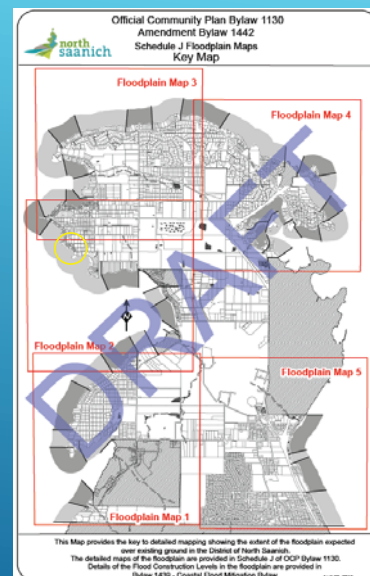
Example 3

- ▶ Property in the Madrona Drive area to completely rebuilt
- ▶ Existing house to be demolished
- ▶ New house under design
- ▶ Check if house is in Floodplain
 - ▶ Floodplain maps



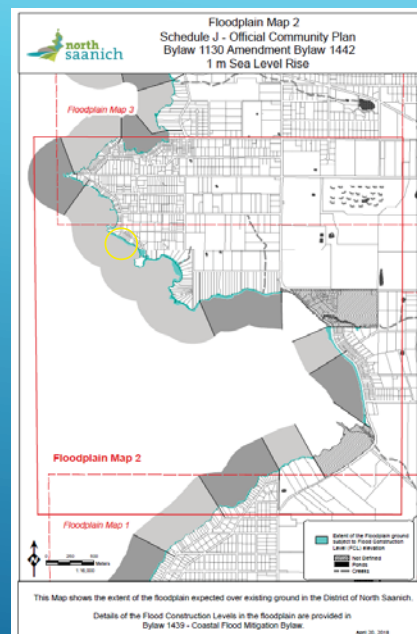
Example 3

- ▶ Property in the Madrona Drive area to completely rebuilt
- ▶ Existing house to be demolished
- ▶ New house under design
- ▶ Check if house is in Floodplain
 - ▶ Floodplain map 2 (or 3) applies



Example 3

- ▶ Property in the Madrona Drive area to completely rebuilt
- ▶ Existing house to be demolished
- ▶ New house under design
- ▶ Check if house is in Floodplain
 - ▶ Floodplain map 2 applies
 - ▶ Map 2 shows existing house is not in the floodplain
 - ▶ Assumption is that new house will still be at top of cliff in this area



Example 3

- ▶ Property in the Madrona Drive area to completely rebuilt
- ▶ Existing house to be demolished
- ▶ New house under design
- ▶ Check if house is in Floodplain
 - ▶ Floodplain map 2 applies
 - ▶ Map 2 shows the floodplain is at foot of cliff
 - ▶ Assumption is that any new house will still be at top of cliff in this area
 - ▶ Bylaw 1439 does not affect building envelope



QUESTIONS

NEXT STEPS

1. Bylaw 1442 OCP Marine Policy – 1st & 2nd Readings
2. Bylaw 1439 Coastal Flooding Mitigation Bylaw – 1st, 2nd, 3rd Readings
3. Notice of Public Hearing Bylaw 1442 OCP Marine (July 2018)
4. Technical Study and Public Engagement for Tsehum Harbour SDA (Summer – Winter, 2018)
5. Marine Policy Planning – Zoning Bylaw Draft Changes (Winter 2018)