WELCOME TO
THE DISTRICT OF NORTH SAANICH

OCP MARINE POLICY & GUIDELINES RECOMMENDATIONS FOR SEA LEVEL RISE PLANNING & ADAPTATION

WORKSHOP

THURSDAY, JANUARY 26TH 2017

DNS Adaptation Action Plan

Marine Task Force Review (2008)

DNS FCL Studies

Marine Policy Review

Community Consultation

2010 **2012** **2014** **2016** **2018**

2011
Province updates SLR flood management guideline Documents

2013
Property Rights on Waterfront (PROW) association calls for DNS initiative

2014
Capital Regional District (CRD) starts Regional Flood Construction Level (FCL) assessment

2014
Dr Tom Petersen addresses Council on Sea Level Rise
Province updates Council on updating of FHALMG

2017, January 26 Community Consultation

2017 / 2018, Winter
OCP Policy Options approval

Public consultation zoning policies

north saanich

OCP Marine Policy & Guidelines Recommendations For Sea Level Rise Planning & Adaptation

26 Jan 2017

Agenda

Time	Meeting/Workshop Agenda
5:10 pm	**Update on Expected Sea Level Rise**
	Presentation and Update of FCL's: 0.5m, and 1.0m Sea Level Rise
	Questions on FCL Update
	Current Marine Policies Overview *How these policies are influenced by Updated FCL Study Results*
	Questions on Current Marine Policy Overview
6:00 pm	**Break (15 min)**
	DRAFT Marine Related Policy Recommendations & Guidelines *How to start responding to the challenges*
	Application Example: Lands End – North area
	Application Example: Patricia Bay area
	Application Example: Lochside Drive – North area
	Application Example: Tsehum Harbour area
7:20 pm	**General Discussion and Feedback**
	Next Steps
8:00 pm	**Adjourn**

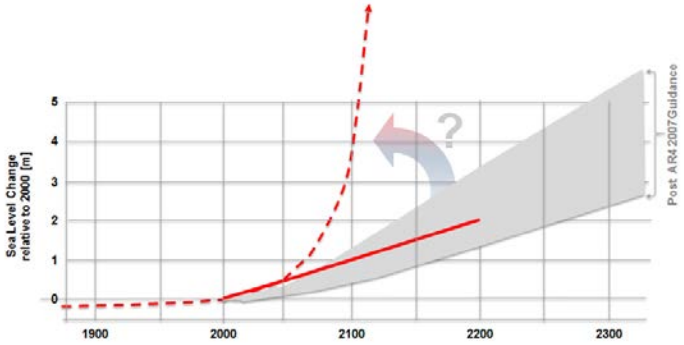
Acknowledgements

Sherry Lim, P. Eng.	Project Engineer, Policy Review
Jessica Wilson, EIT	Project Engineer, FCL Study
Brett Korteling	Mapping Consultant

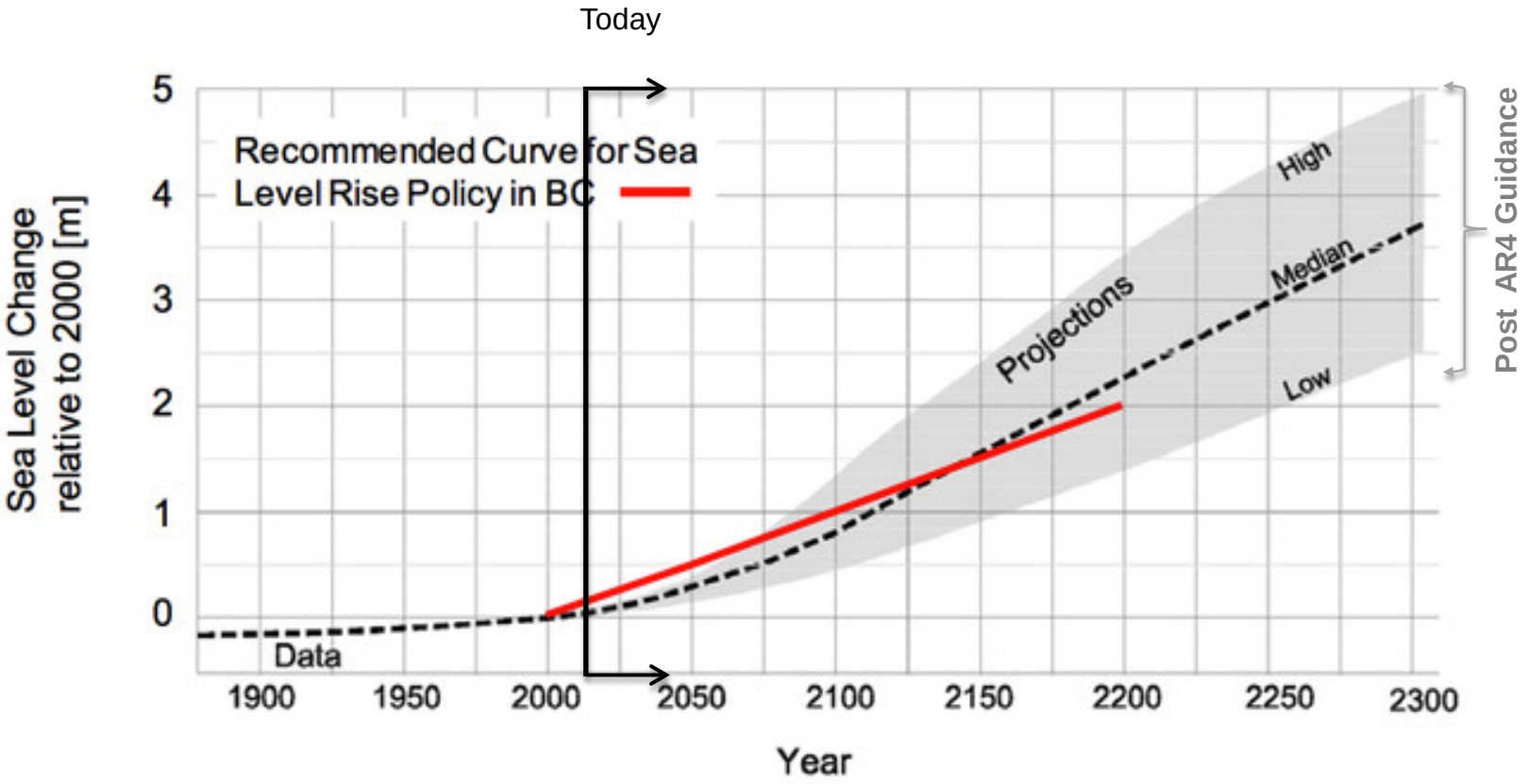
Reviewers from North Saanich

SLR Update

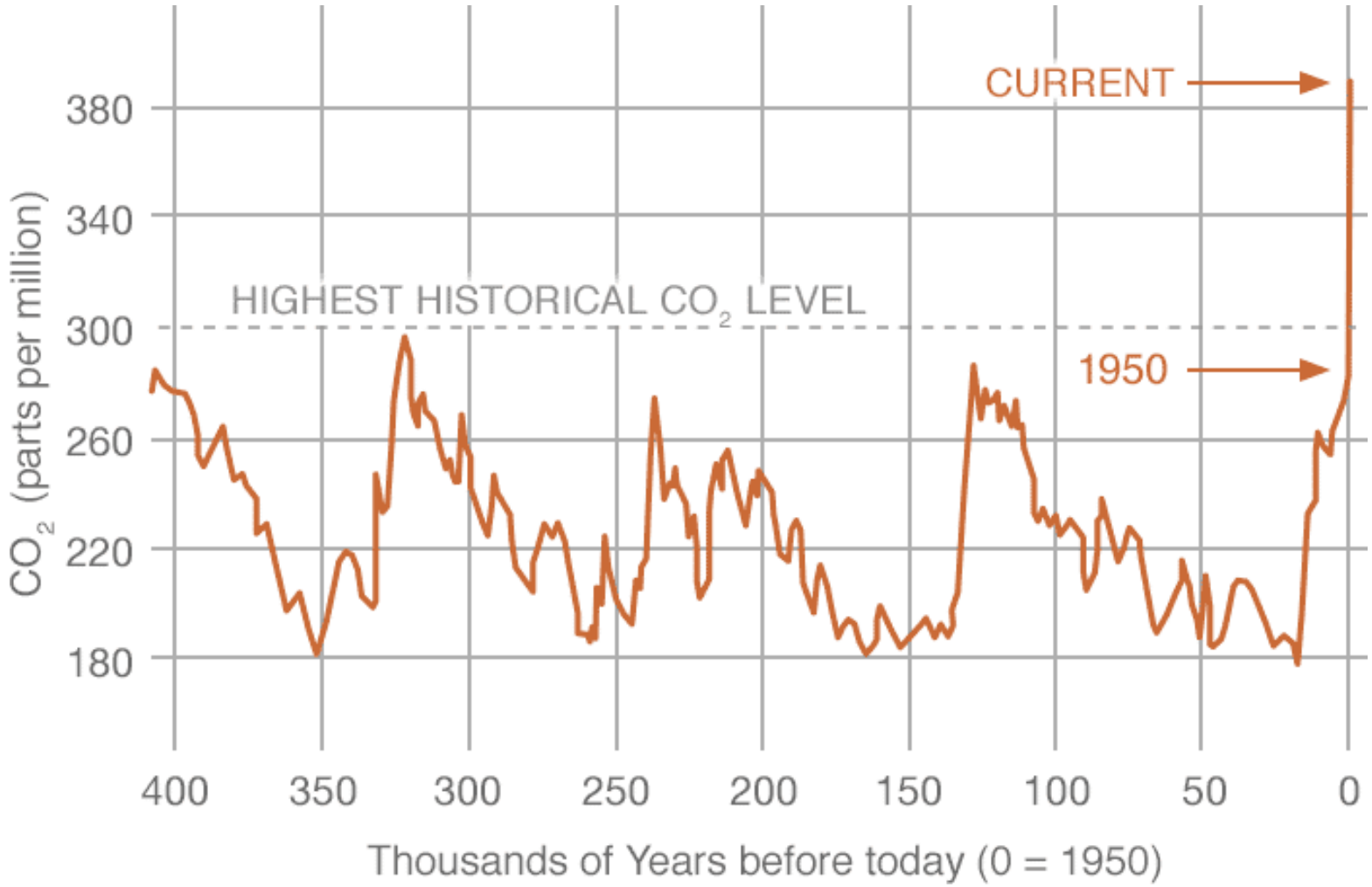
Since June 2016



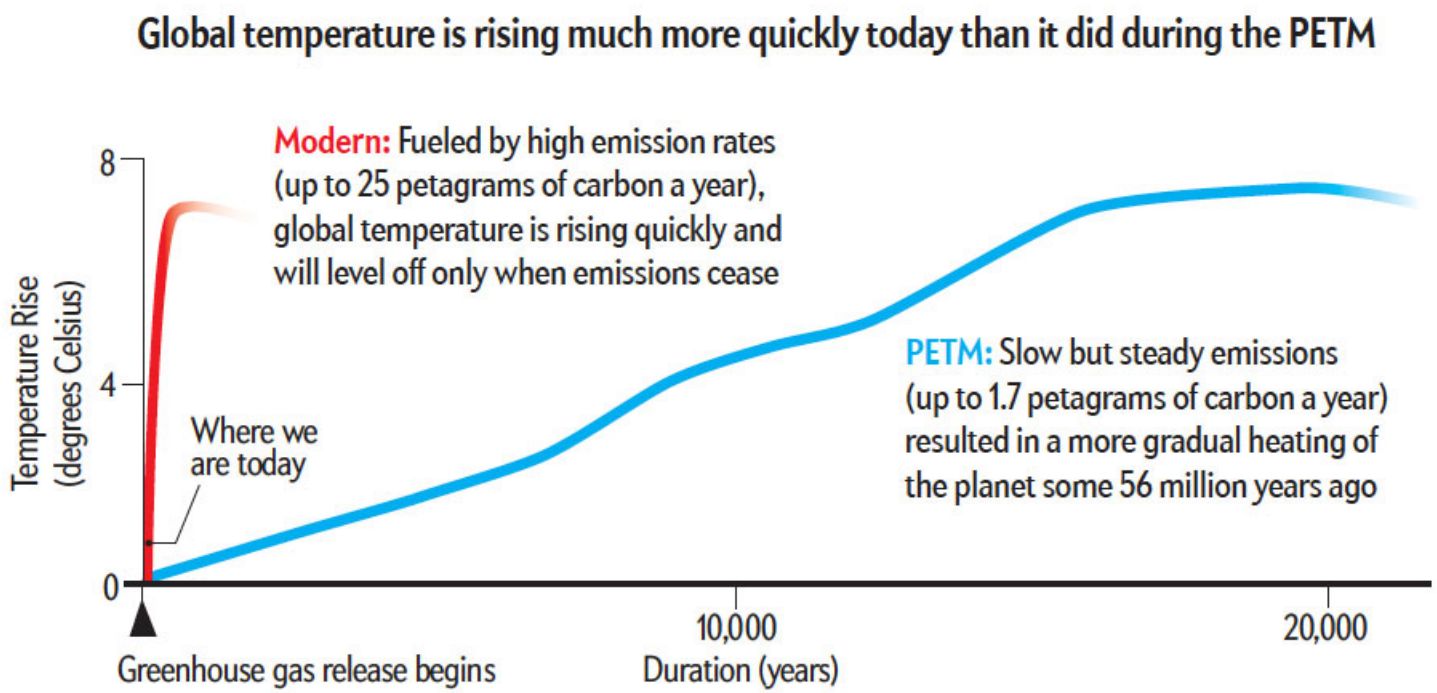
2011 BC Guidance



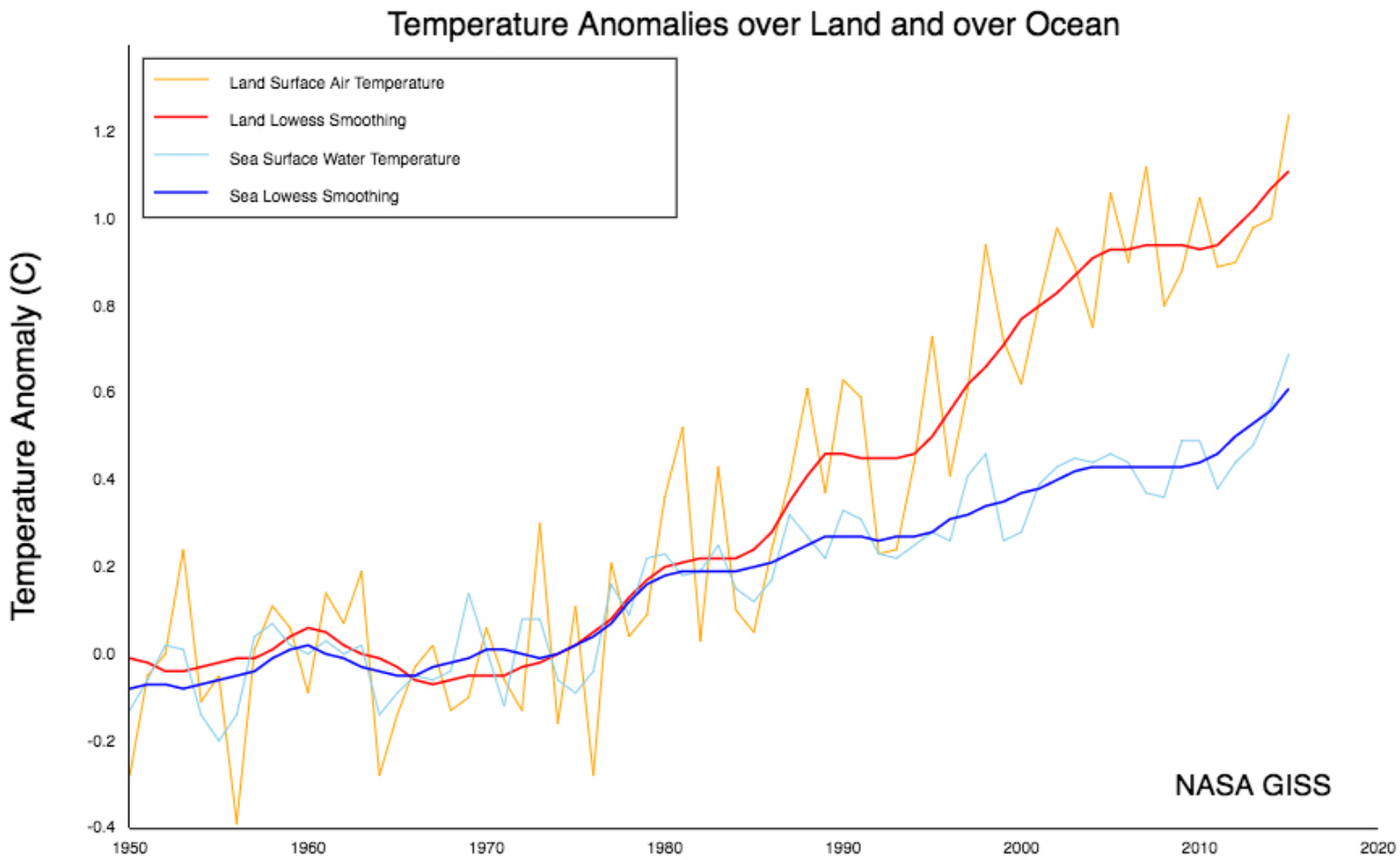
CO_2 Background



CO_2 Record

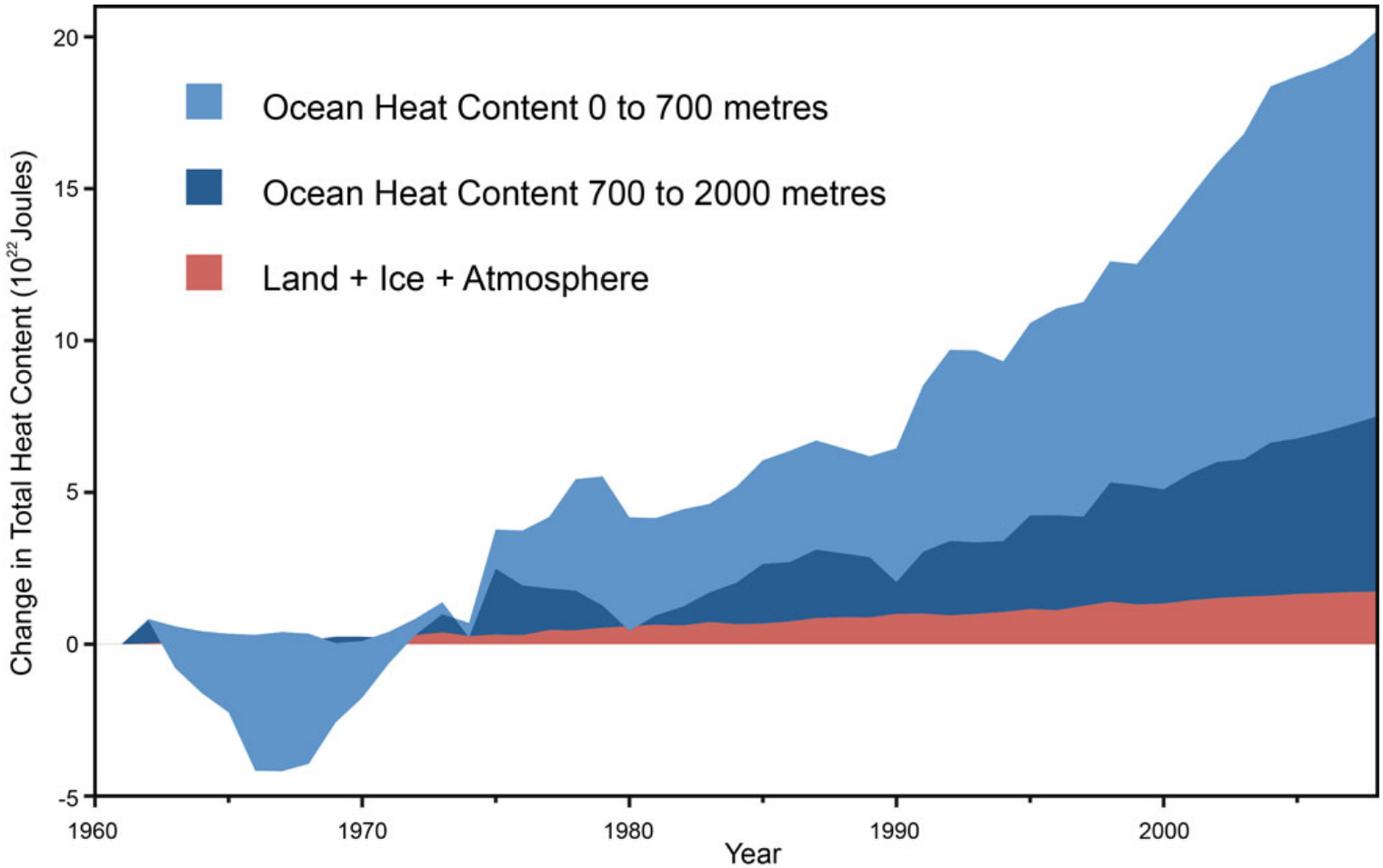

Global temperature is rising much more quickly today than it did during the PETM
Modern: Fueled by high emission rates (up to 25 petagrams of carbon a year), global temperature is rising quickly and will level off only when emissions cease
PETM: Slow but steady emissions (up to 1.7 petagrams of carbon a year) resulted in a more gradual heating of the planet some 56 million years ago
Where we are today
Temperature Rise (degrees Celsius)
8
4
0
Greenhouse gas release begins
10,000
20,000
Duration (years)

Present Temperature Trends



Credit: NASA GISS (October 2016)

Air and Ocean Temperatures



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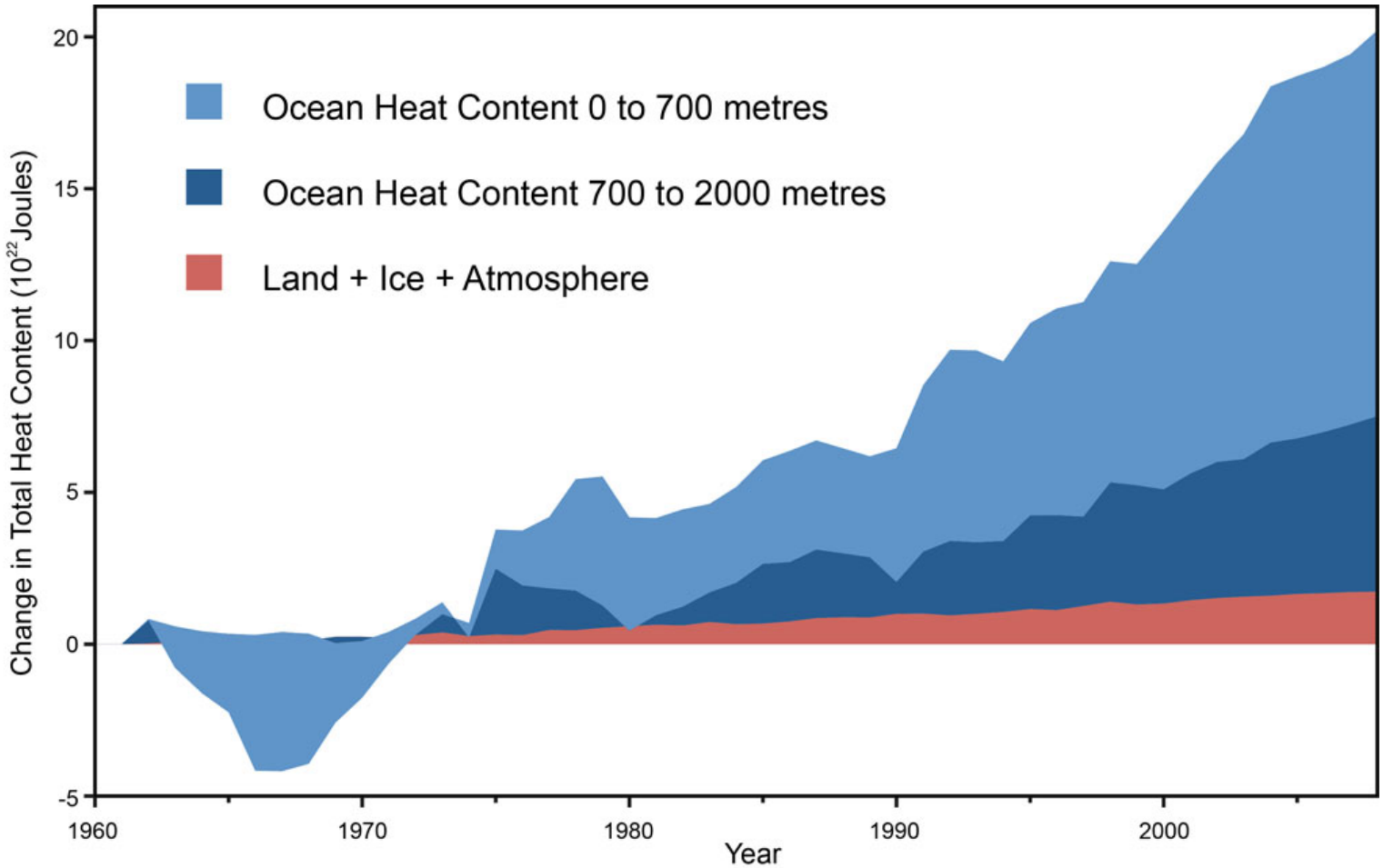


Post 2011

IPCC - AR5:

- SLR - UNEQUIVOCAL
- ACKNOWLEDGED TO BE A LOW ESTIMATE
- BUSINESS AS USUAL RANGES - HIGHER THAN AR4

PALEOCLIMATOLGY:

- LAST TIME ICE SHEETS STARTED TO MELT– SLR ~ 5 m/century (Hansen et al 2016)

ICE SHEET MELTING:

- GREENLAND ICE SHEETS NO LONGER GROUNDED – MELTING UNSTOPPABLE ~ 7 m *(May 2014)*
- W ANTARCTICA ICE SHEETS NO LONGER GROUNDED – MELTING UNSTOPPABLE ~ 6 m *(May and Dec 2014)*
- SOME E ANTARCTICA ICE SHEETS NO LONGER GROUNDED ~ 13 m
- LARSON C ICE SHEET EXPECTED TO BREAK UP SOON (Dec 2016) [ice berg twice size of VI]
- Allows accelerated loss of Antarctic ice sheets

ARCTIC SUMMER ICE COVERAGE:

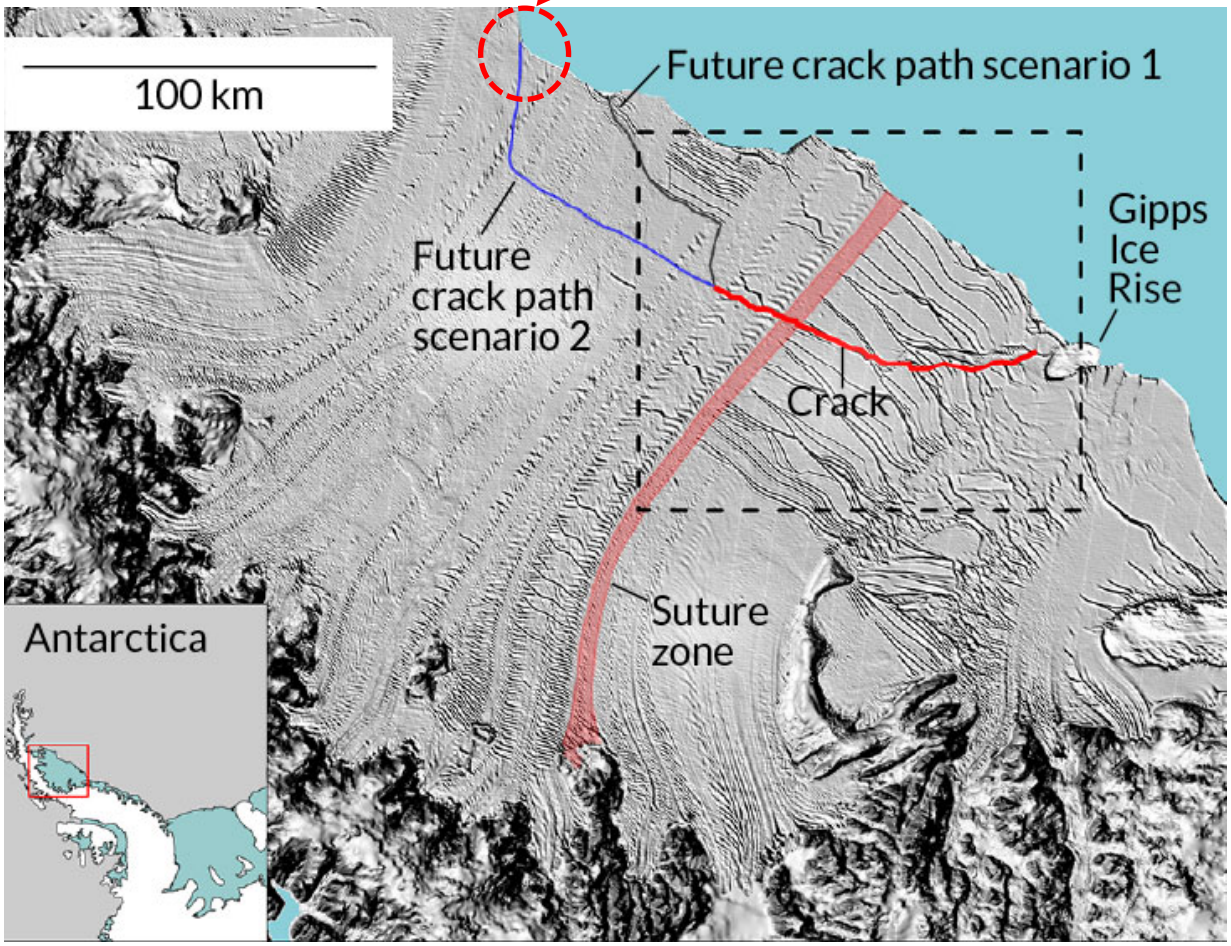
- AR5: 2085
- AREA: DECADE BY DECADE MEASURED TREND – 2010s or 2020s
- VOLUME: US NAVY SUGGESTING SUMMER ICE FREE BY 2016 ±
- SUMMER 2016 COVERAGE 2ND LOWEST (Sept 2016)
- 2017 WINTER COVERAGE VERY LOW (Jan 2017)

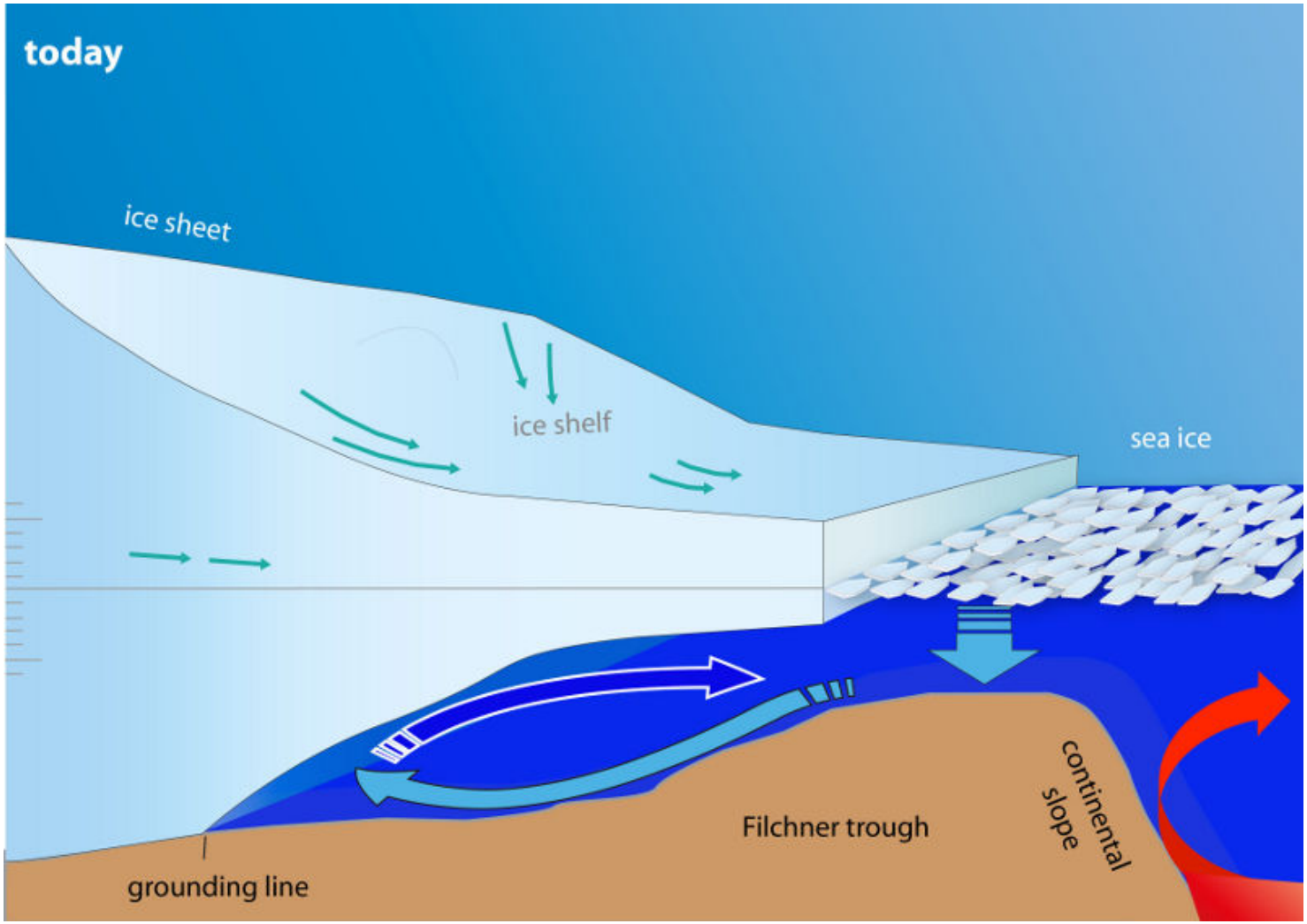
Larsen C Ice Shelf Crack

Credit: NASA Ice Bridge Program Nov 2016

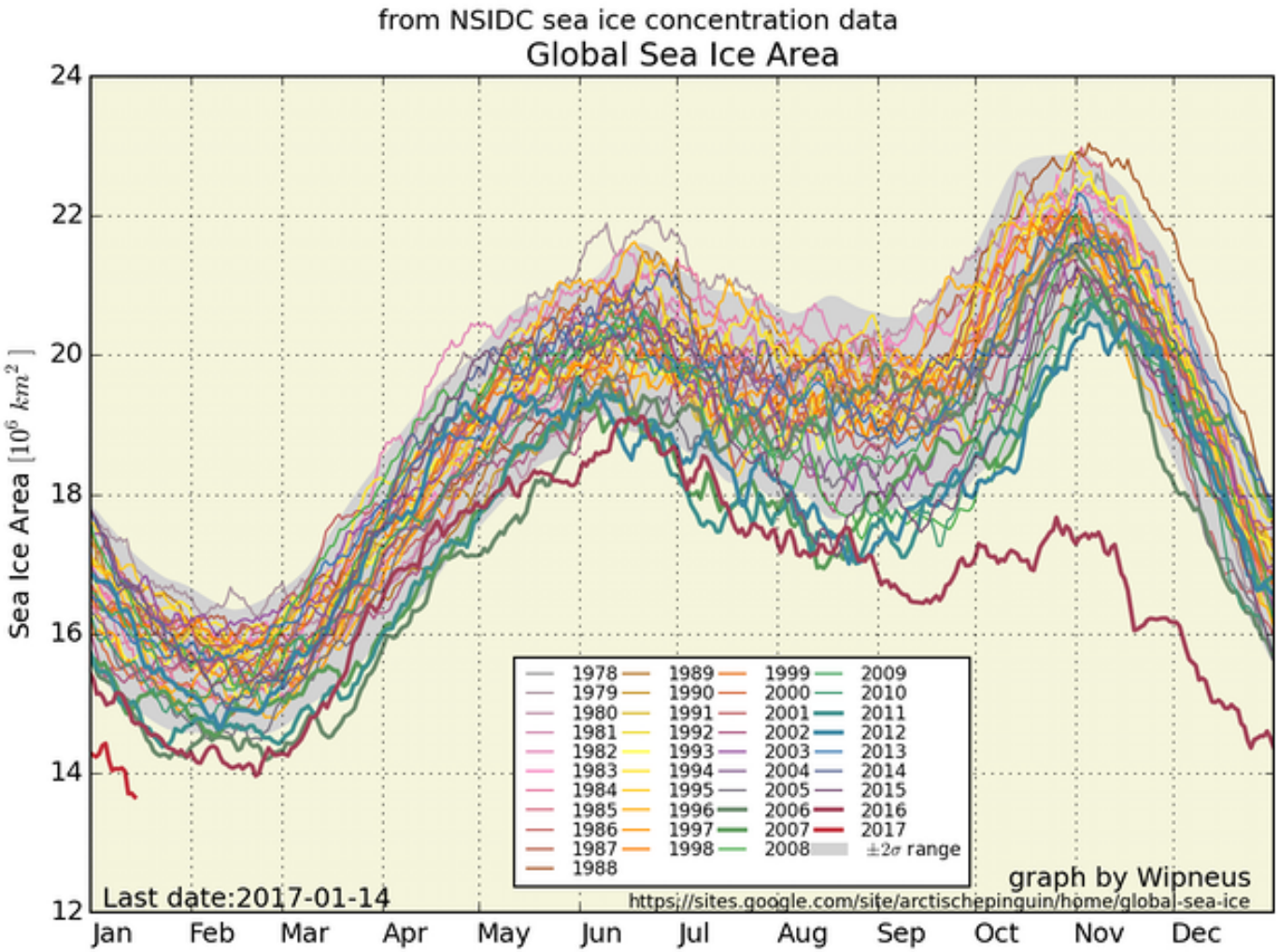
Larsen C Ice Shelf

≈ 20 km remains uncracked (Jan 2017)

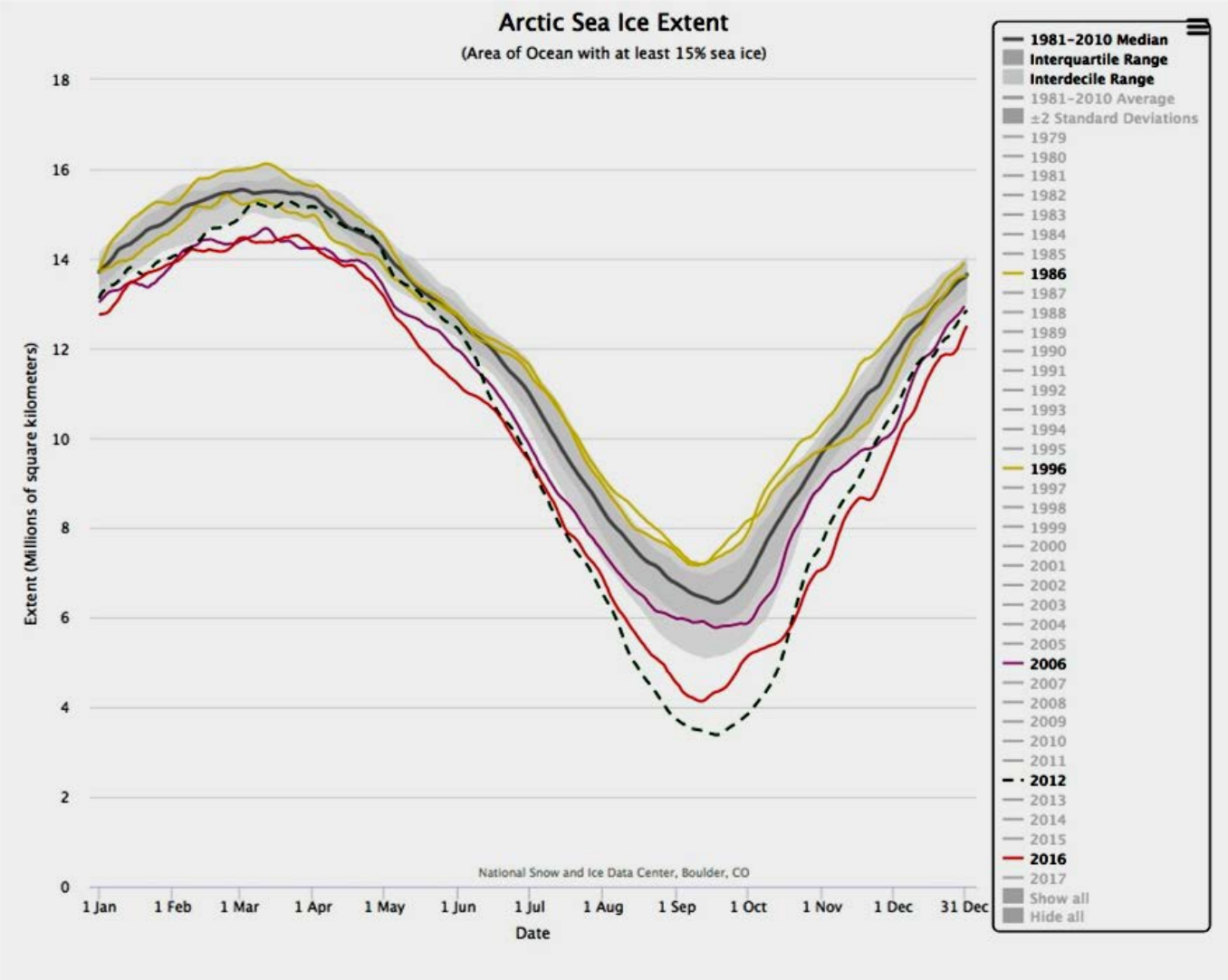



today
ice sheet
ice shelf
sea ice
continental slope
Filchner trough
grounding line

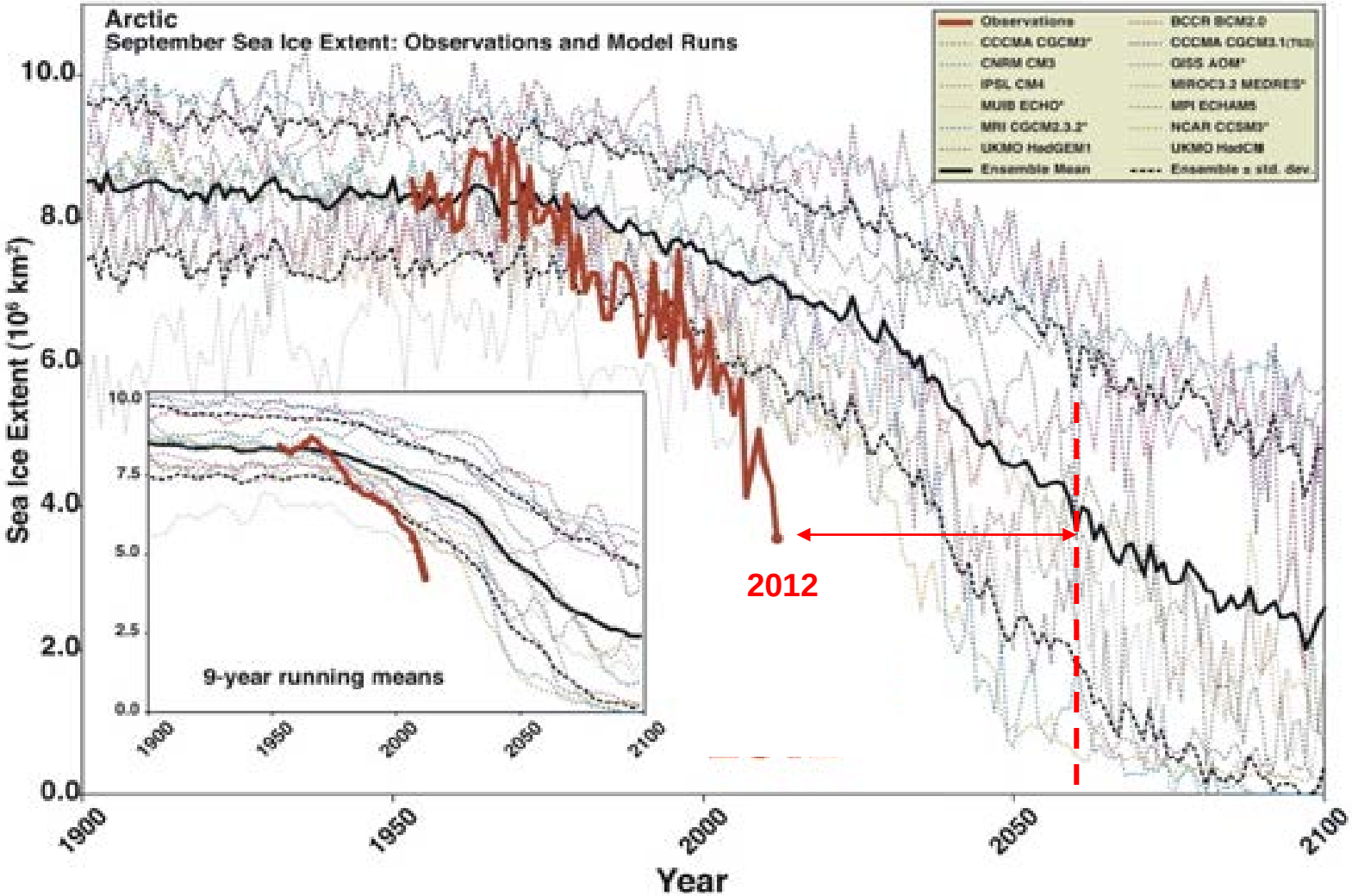
Global Sea Ice coverage



Recent Arctic Ice Cover Extent



Arctic Ice Sheet Melting



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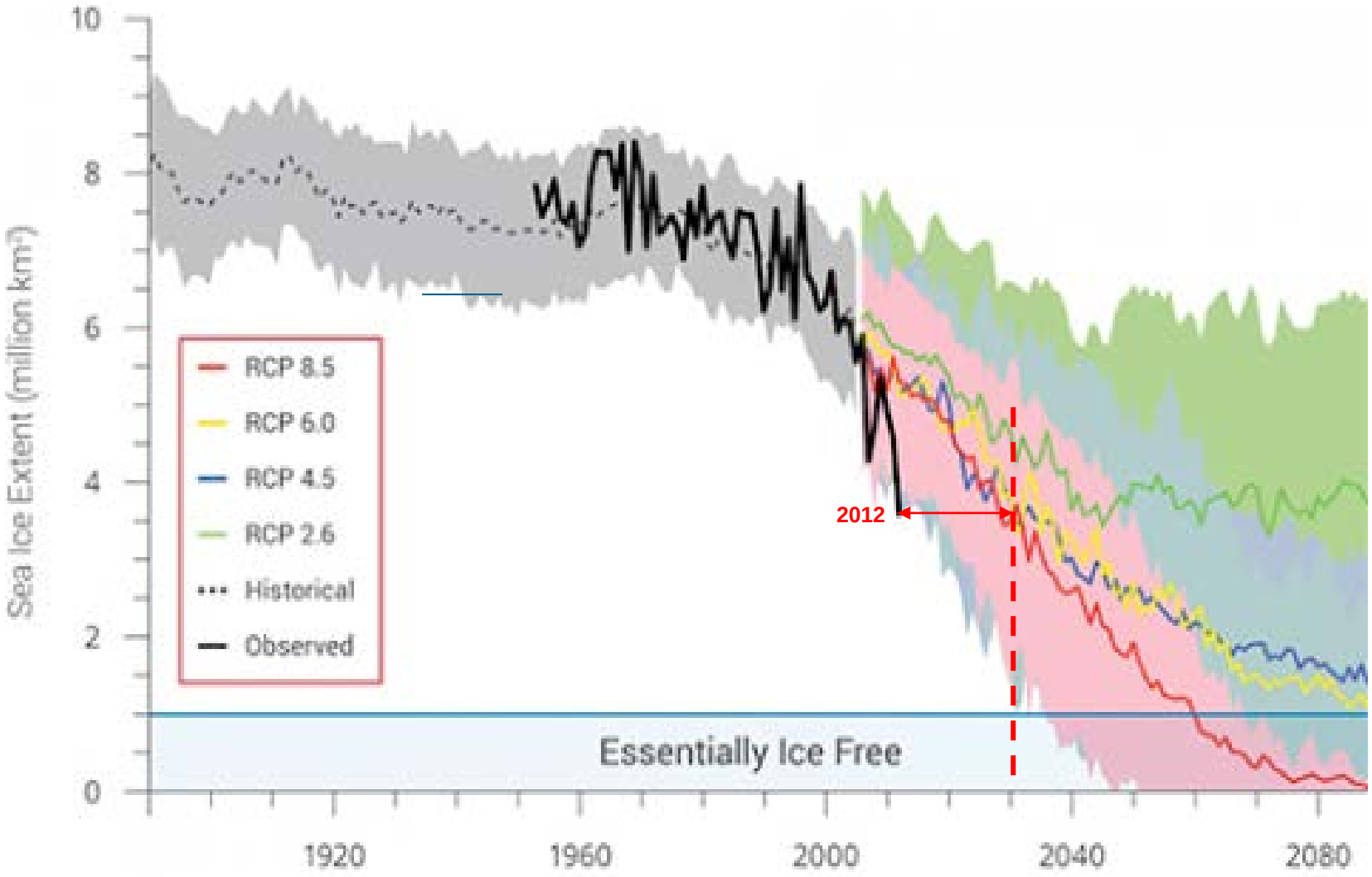

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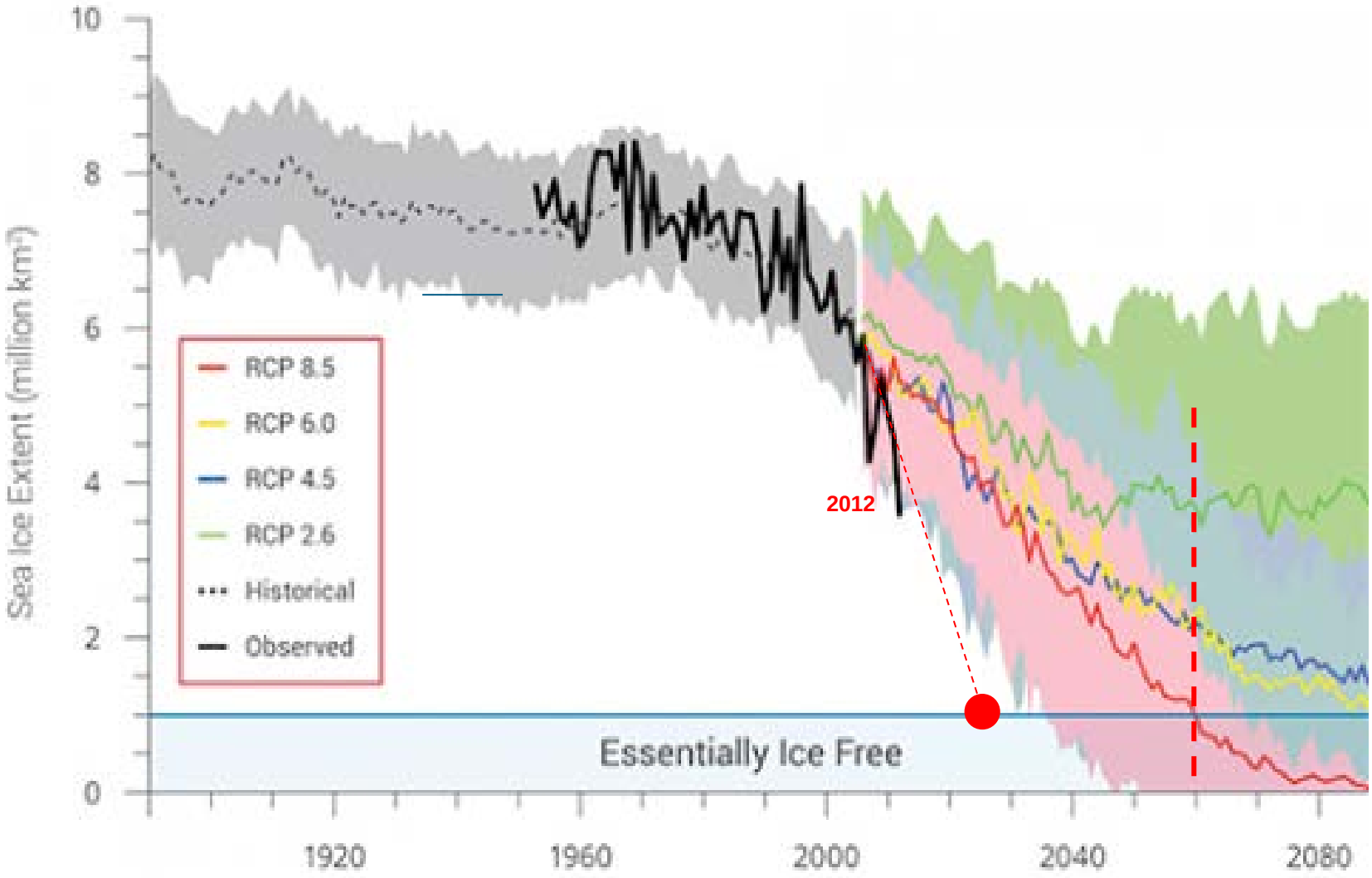


Arctic Warming

-Arctic warming changing and slowing the jet stream

-Upper atmosphere weather systems stalling or progressing more slowly:

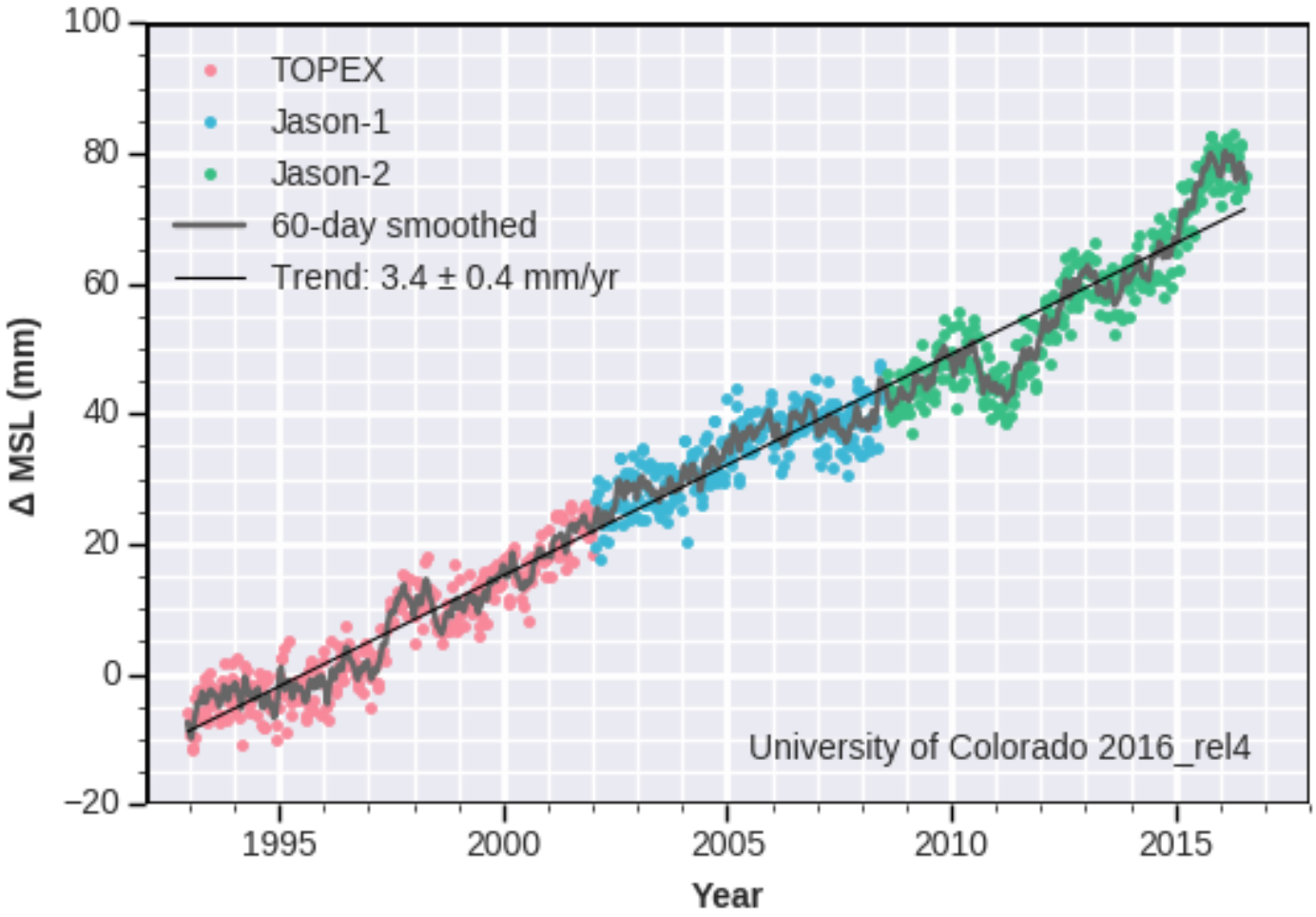
- Prolonged snowy winters in Europe
- Extended drought in SW USA
- Cold snowy winters in E North America
- Recurring easterly moisture laden winds in Prairies (2002, 2005 and 2013)
- Prolonged warm Pacific NW weather

-Increasing occurrence of persistent (stalled) weather:

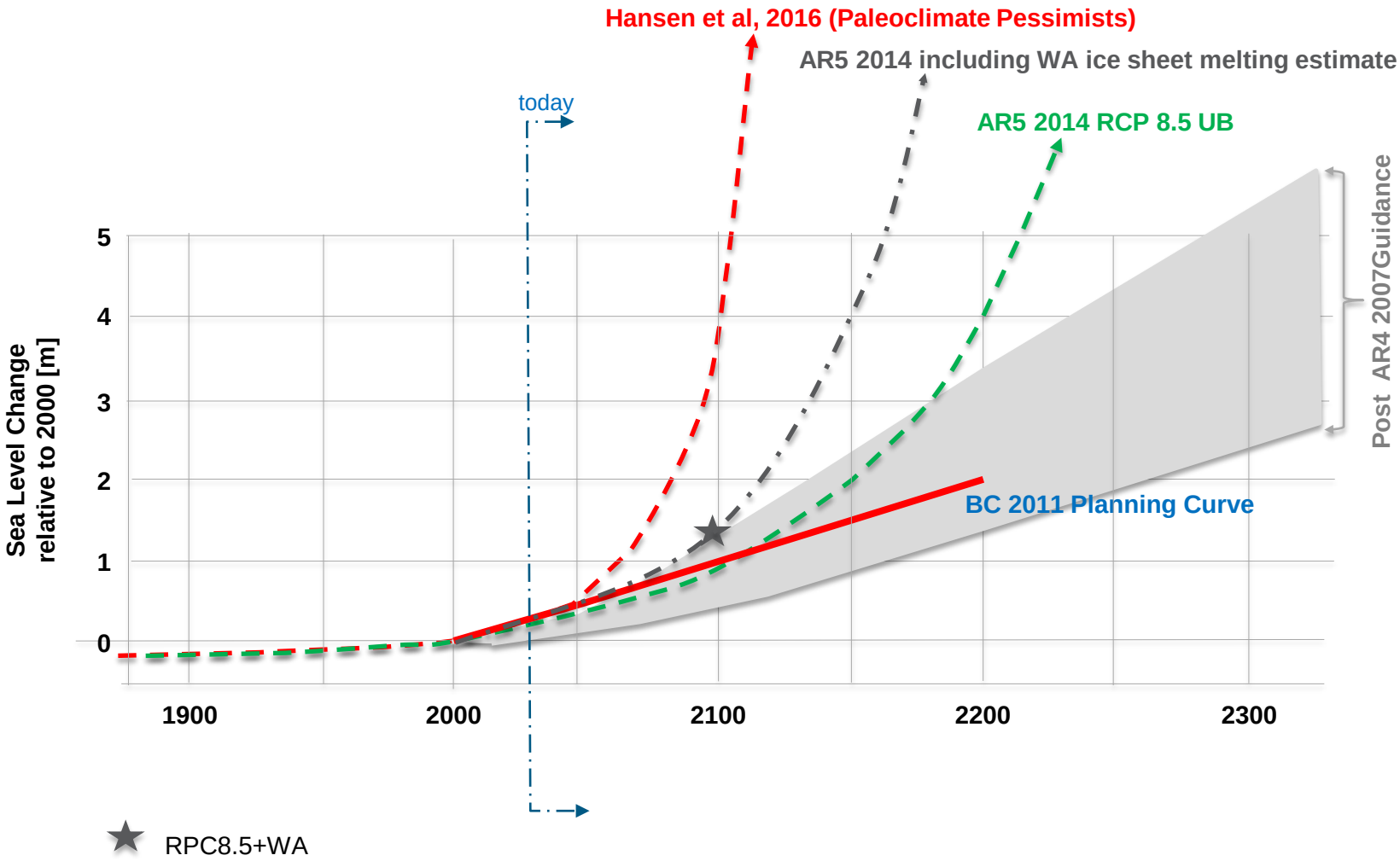
More frontal systems and more storms

Increases the chance of a storm at high tide

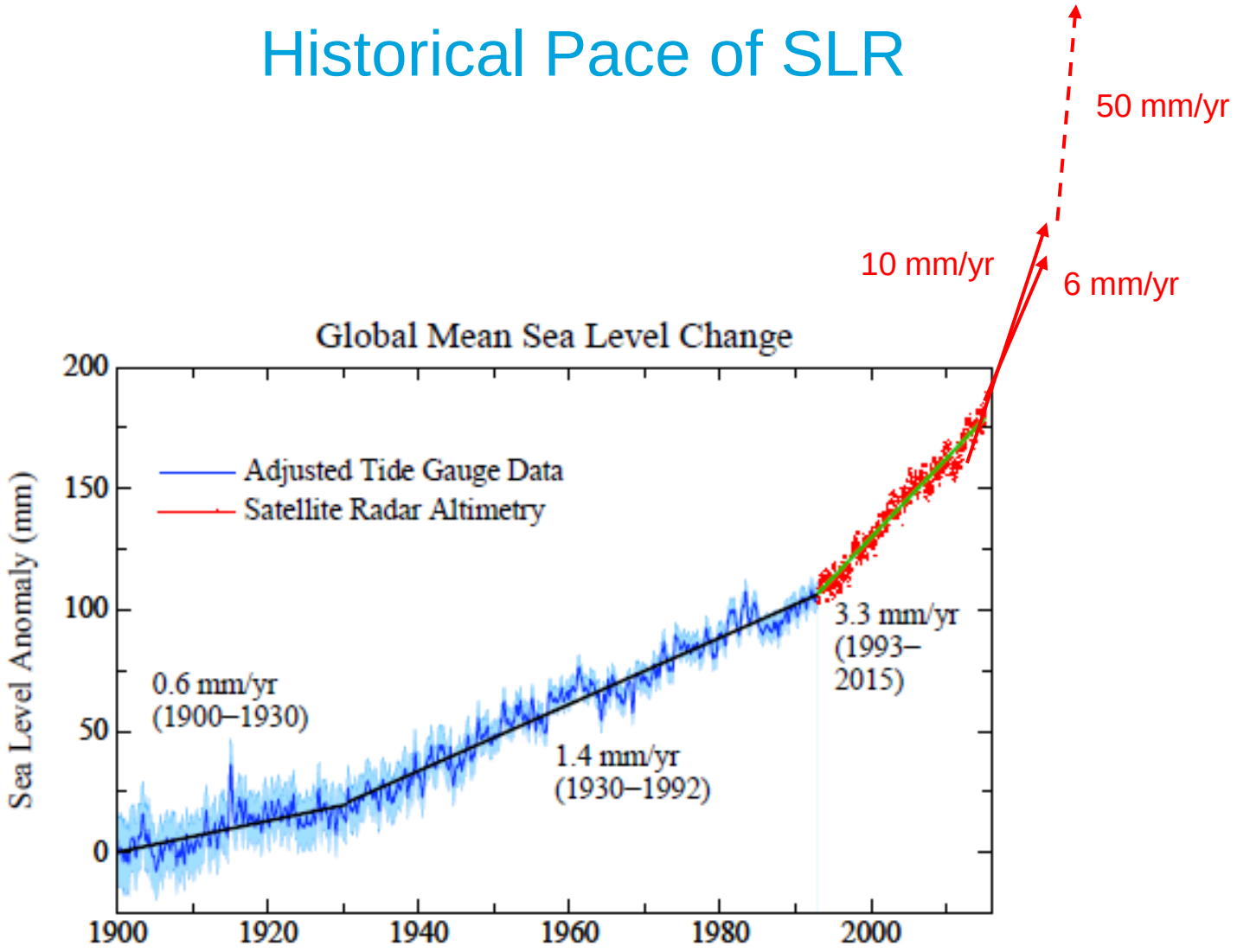
Recent Mean Sea Level Rise



Updated Guidance Summary

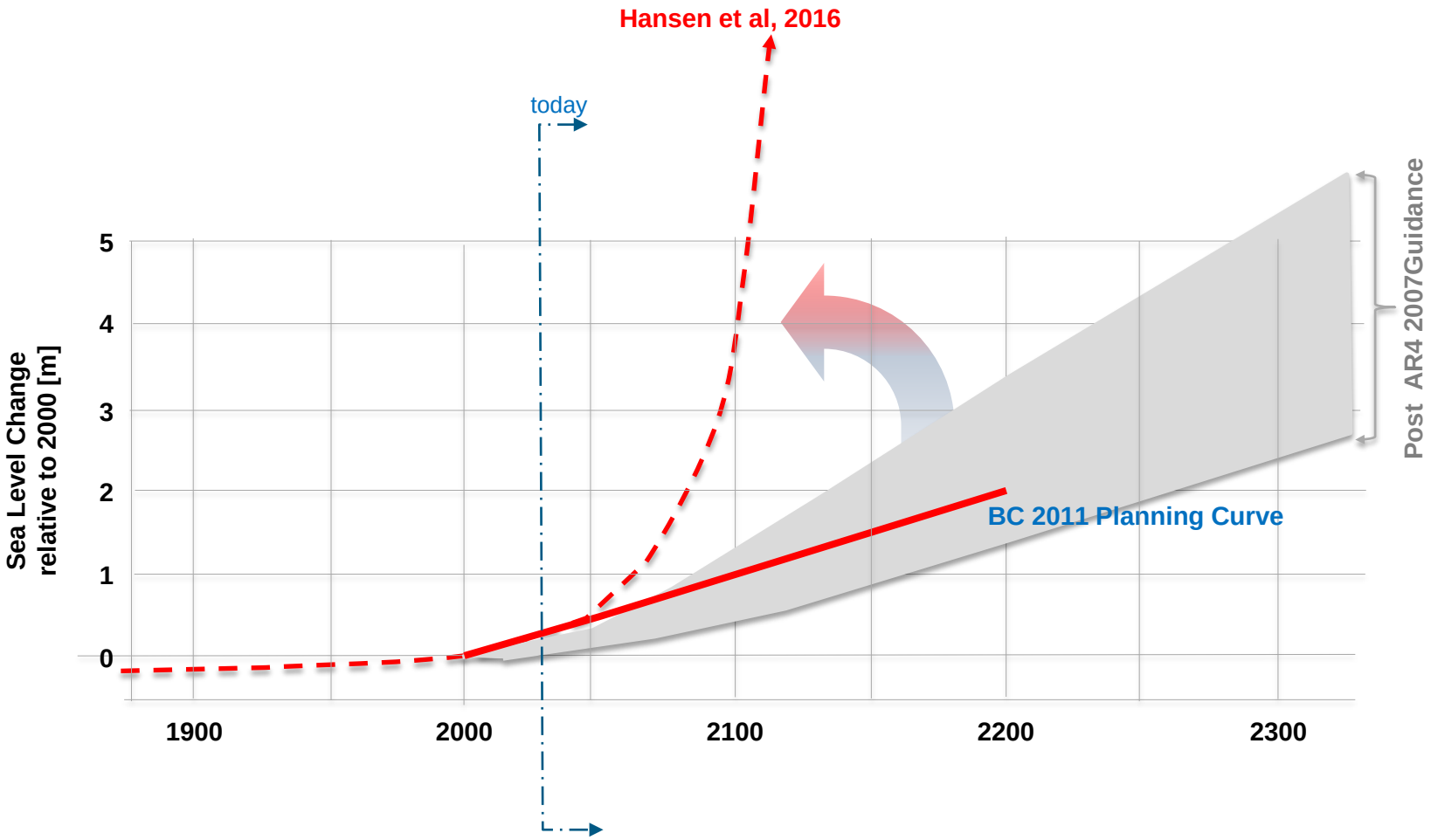


Historical Pace of SLR

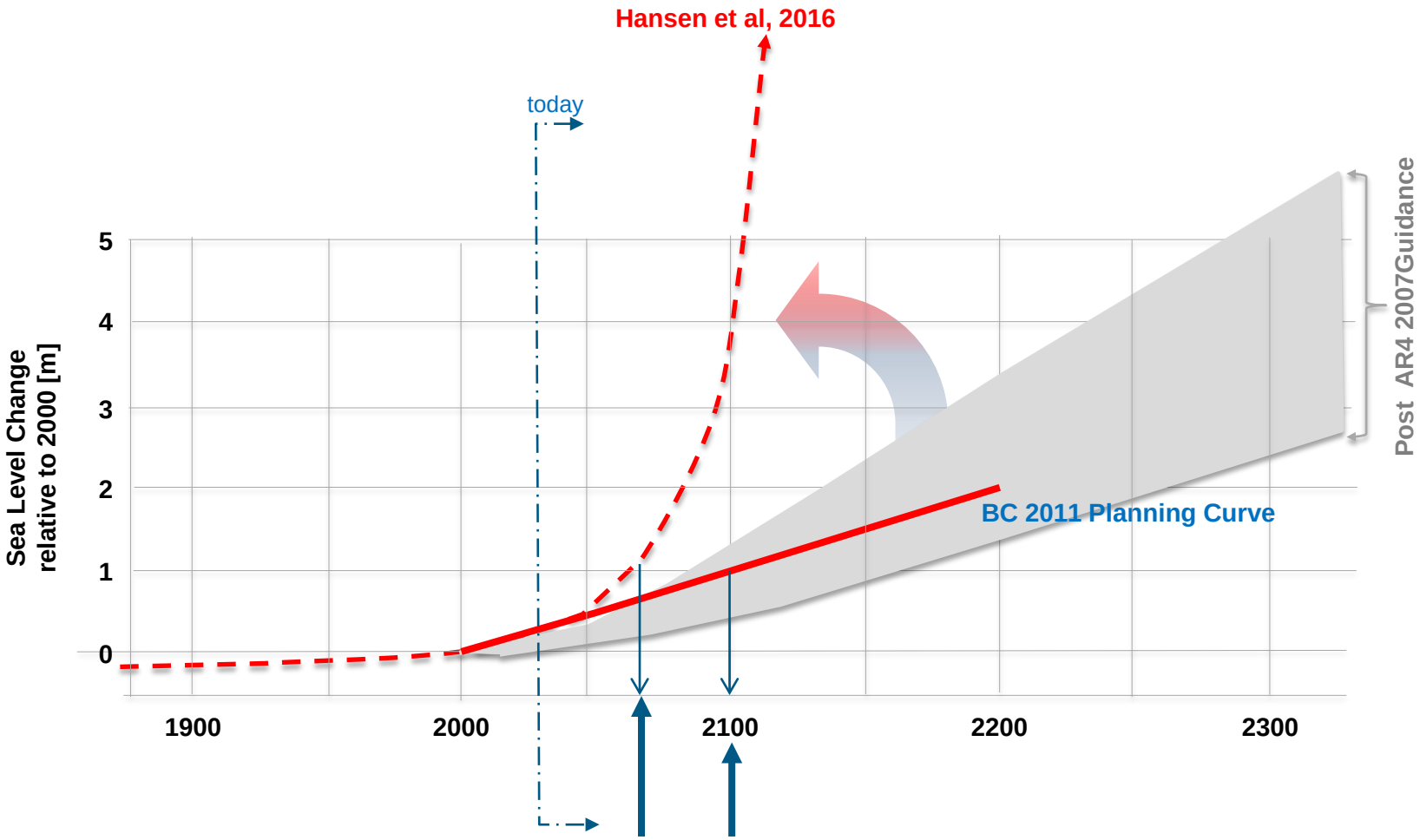


From Hansen et al (2015) – reflecting work by Hay et al (2015)

Guidance 2017

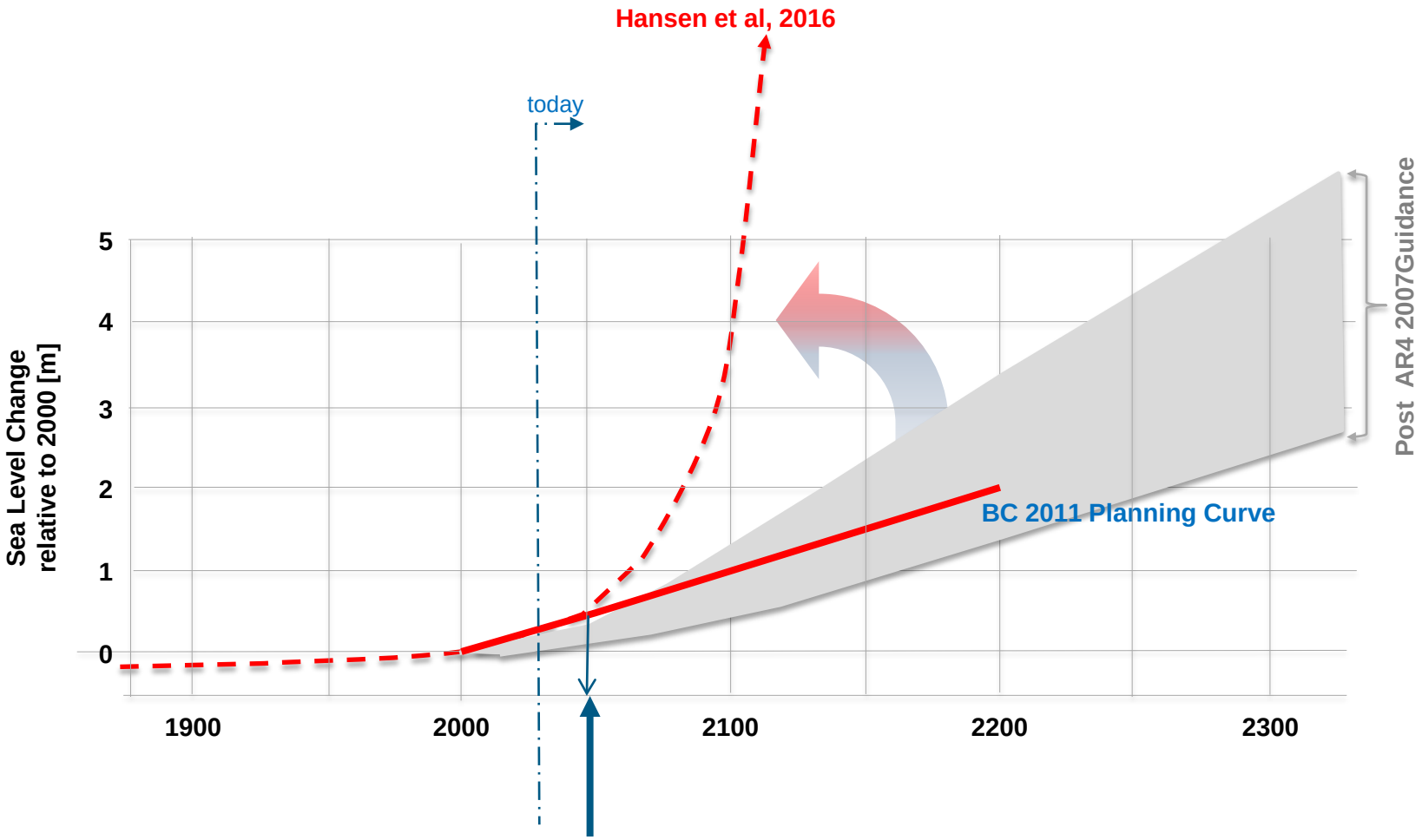


Guidance 2017



1 m of SLR is coming

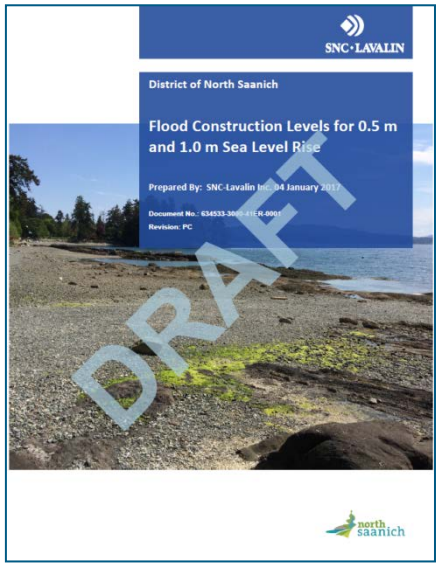
Guidance 2017



0.5 m of SLR is coming

Update on FCLs

Since June 2016



New Work from June 2016

Comments

✓ Improved graphics for clarity of maps

New Work

✓ 0.5 m SLR

→less water depth near shoreline

→same storms

→smaller waves

→less wave runup

→Less overtopping volumes of water

→less flooding

What does Flood Construction Level (FCL) mean

As defined by the BC Ministry of Environment:

- ✓ Applies to Habitable Buildings

- ✓ Minimum elevation for the underside of a wooden floor system
- ✓ Minimum elevation for top of concrete floor slab

FCL does not mean:

- ✓ Ground elevation outside of a habitable building
- ✓ Floor elevations for sheds, garages, gazebos, beach or boat houses (unless habitable)
- ✓ Crest elevations of seawalls, revetments or other shoreline treatments
- ✓ Elevations for any landscaping or infrastructure (driveways)

FCL is useful for:

- ✓ elevations of utilities (furnace, electrical panels, gas)

Flood Construction Level (FCL) Components

- Sea Level Rise
- Tide
- Risk
- Storm Surge
- Wave Effects
- Freeboard Allowance

FCL = SRL + Tide + Storm Surge + Wave Effects + Freeboard Allowance

FCL elevations referenced to geodetic datum (CGVD28)

CGVD28 approximately equal to mean sea level

Flood Construction Level (FCL) Components

- **Sea Level Rise**
- Tide
- Risk
- Storm Surge
- Wave Effects
- Freeboard Allowance

- Ocean Basin considerations
- Regional (BC Coastal waters)
- Tectonic movements (uplift / subsidence
- (1 – 2 mm/yr)
- Becomes insignificant in long run
- Rate of SLR is big uncertainty

- Considering only net 0.5 to 1 m rise

Flood Construction Level (FCL) Components

- Sea Level Rise
- **Tide**
- Risk
- Storm Surge
- Wave Effects
- Freeboard Allowance

Tide Ranges vary slightly around DNS (± 0.1 m)

Using average range at Patricia Bay

Using Higher High Water Large Tide:

- = +1.5 m geodetic datum
- = +3.7 m chart datum (Swartz Bay)
- Several times every two weeks in winter
- Present for 2 – 3 days each time
- 1/20 chance of a winter storm at same time

Flood Construction Level (FCL) Components

- Sea Level Rise
- Tide
- **Risk**
- Storm Surge
- Wave Effects
- Freeboard Allowance

Guidance in Provincial Guideline documents

- Using level of risk consistent with high value developments
- Reflects the risk of a storm occurring at or near high tide
- Consequences of damage are significant for land uses
  - *Residential properties*
  - *Investment in infrastructure (seawalls etc)*
  - *Important utilities (roads, sewers, water supply, electrical supply)*
  - *Environmental consequences from sewerage, fuel, fertilizers, pesticides*
  - *Landfill implications*

Flood Construction Level (FCL) Components

- Sea Level Rise
- Tide
- Risk
- **Storm Surge**
- Wave Effects
- Freeboard Allowance

Storm with a 1/500 chance of occurring

0.2 % chance in any given year

Considered governing types of storms

Components of storm considered:

- Winds
- Waves
- Associated storm surge (mainly generated in the Pacific ocean basin)
- Timing of peak winds and peak storm surge wave
- Governing combinations:
  - Maximum winds – associated surge
  - Maximum surge – associated winds
  - Concomitant waves in each case

Flood Construction Level (FCL) Components

- Sea Level Rise
- Tide
- Risk
- Storm Surge
- **Wave Effects**
- Freeboard Allowance

Extensive modelling of wave propagation into shore:

- Protection provided by Sidney and James Islands
- Protection from islands offshore Canoe Cove
- Influence of headlands/embayments
- Effect of shallow water (reefs, shoals)
- Whitecapping
- Wave breaking
- Intertidal profile and materials
- Shoreline structures

Averaged over 39 reaches around the shoreline of DNS (≈ 1000 m long)

Volumes of water overtopping shoreline based on a threshold of 10 L/m/s

Flood Construction Level (FCL) Components

- Sea Level Rise
- Tide
- Risk
- Storm Surge
- Wave Effects
- **Freeboard Allowance**

Freeboard allowance of 0.6 m used

Default allowance Provincial Guidelines

Allows for:

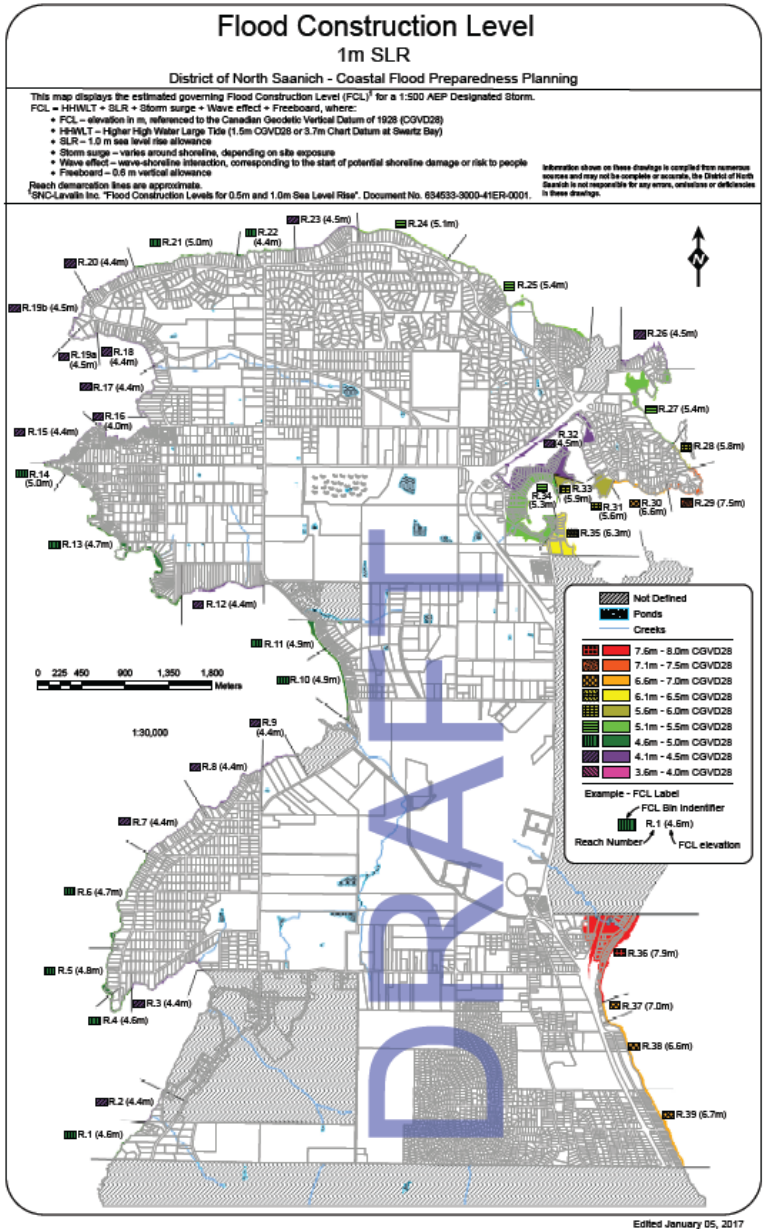
- Uncertainties in storm characteristics
- Uncertainties in waves and wave propagation:
  - Reefs can concentrate wave energy
  - Shallow water and intertidal profile can be steeper → bigger waves
  - Ponding water can sustain wave action
  - Slowly varying aspects to wave action close to shore that can increase wave effects over short durations
- Variations of wave interaction with buildings

FCLs for 1.0 m SLR

Resulted in:

- 25 reaches with lower FCLs than estimated in earlier regional scale CRD study that used a uniform storm and tide combination, a uniform Wave Effect estimate and no specific shoreline resolution
- 14 reaches have higher FCLs

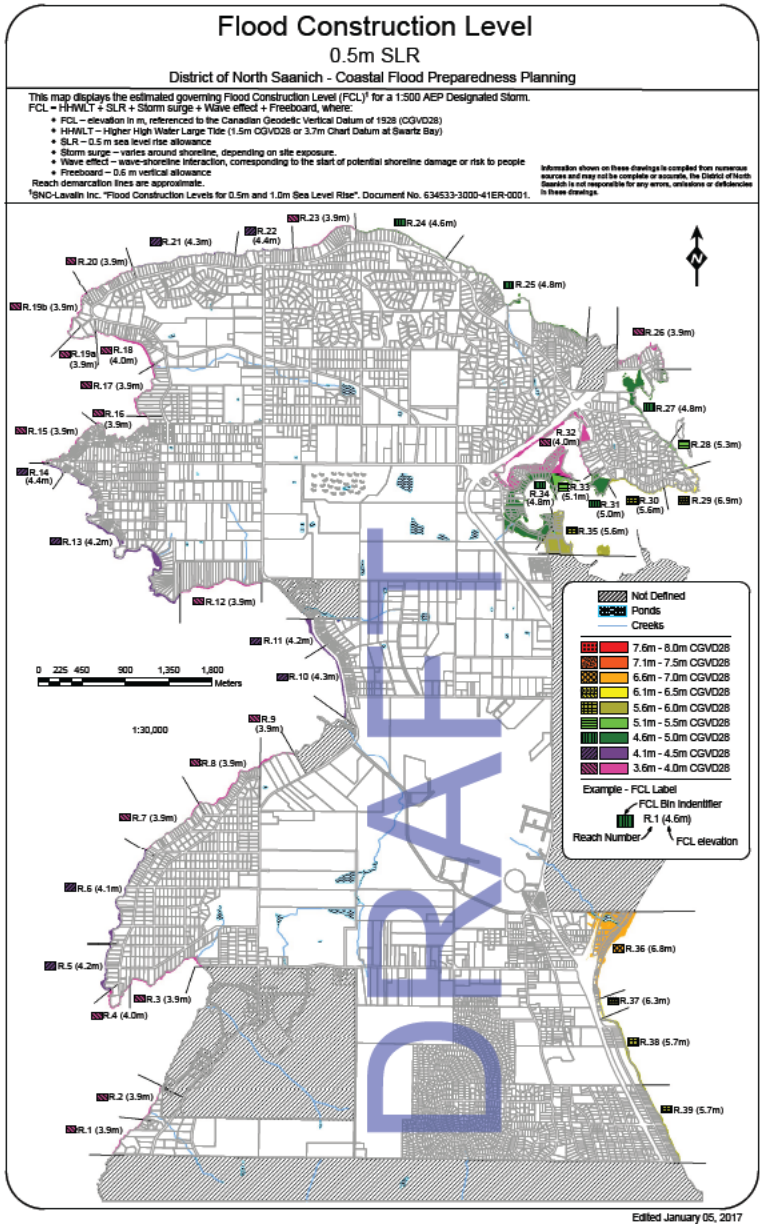
- Risk of minor flooding on 550 lots (less than 15 m from shoreline
- Risk of partial or complete flooding of lot on 163 lots



FCLs for 0.5 m SLR

Reduced SLR resulted in:

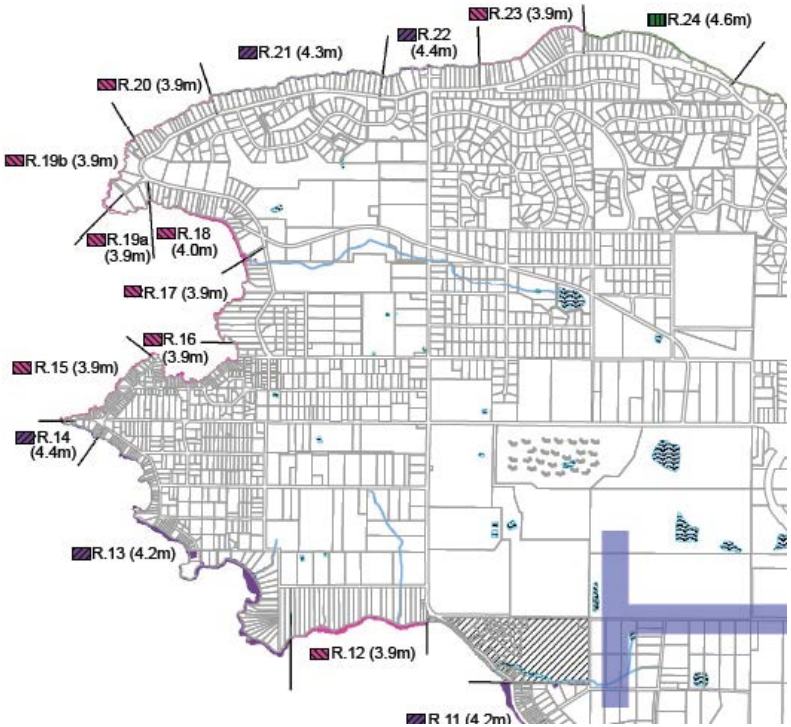
- FCLs that are 0.4 m to 1.1 m lower than for the 1.0 m SLR scenario
- Areas at risk of flooding are less than 15 m from shoreline on 582 lots
- Risk of partial flooding or complete inundation on 131 lots



District Scale Implications

- ✓ Most areas (North and West sides of peninsula) are hardly affected

0.5 m SLR



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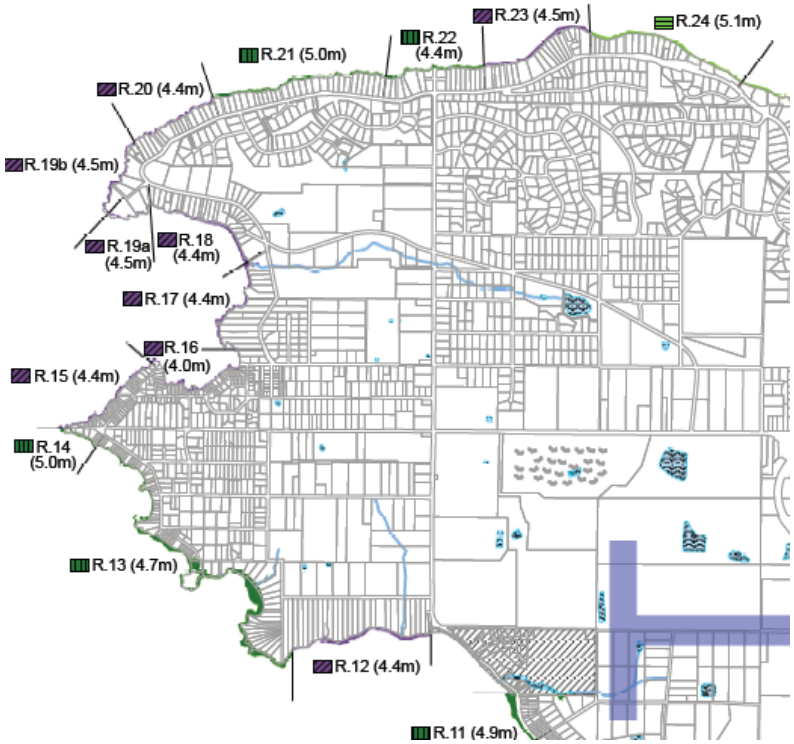
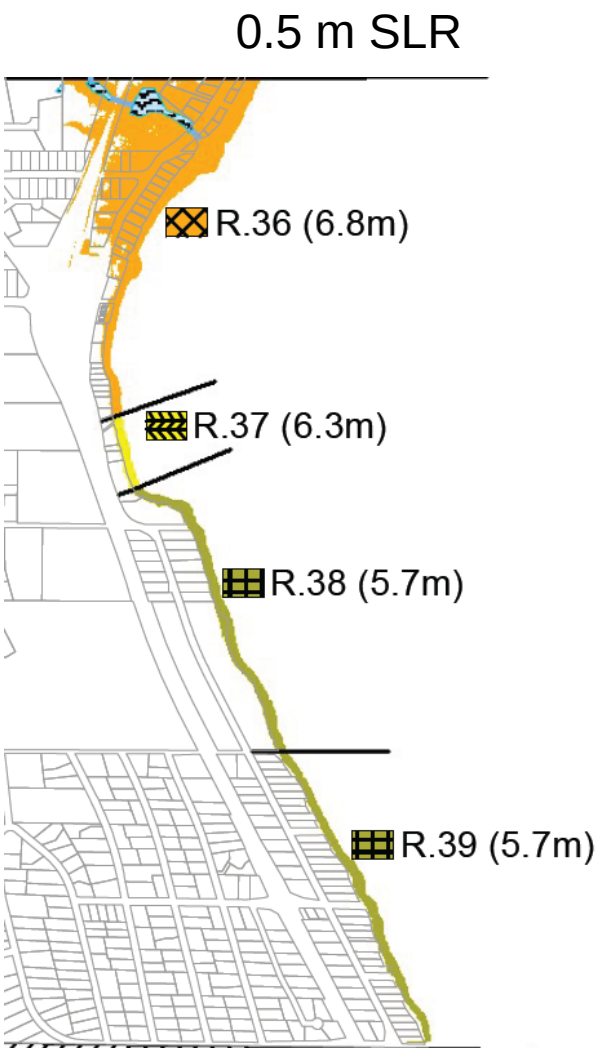
1.0 m SLR



District Scale Implications

- ✓ Most areas (North and West sides of peninsula) are hardly affected
- ✓ East shoreline is the most exposed near Lochside Drive – McTavish Interchange



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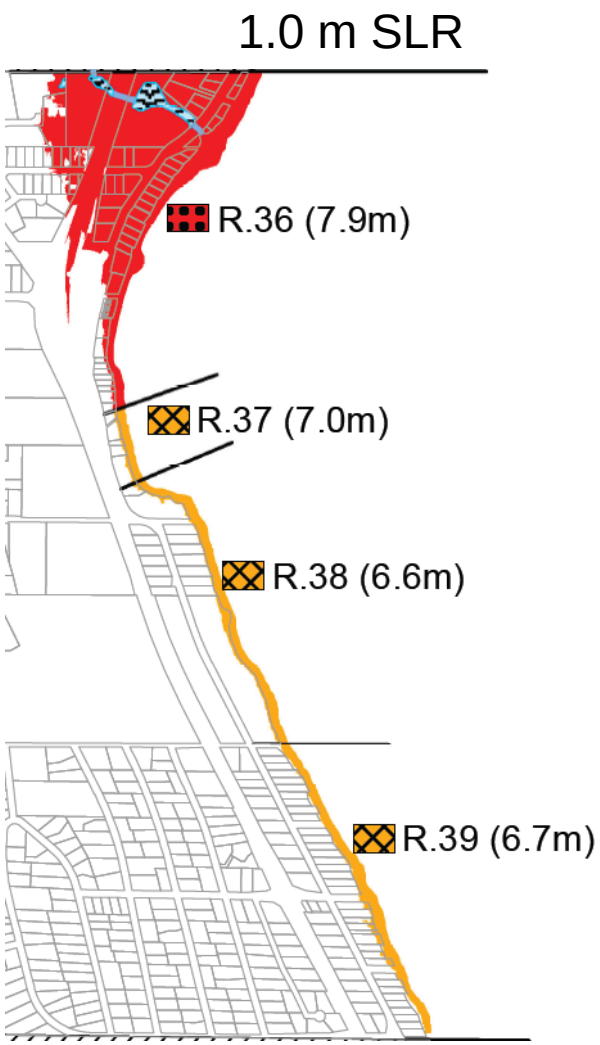
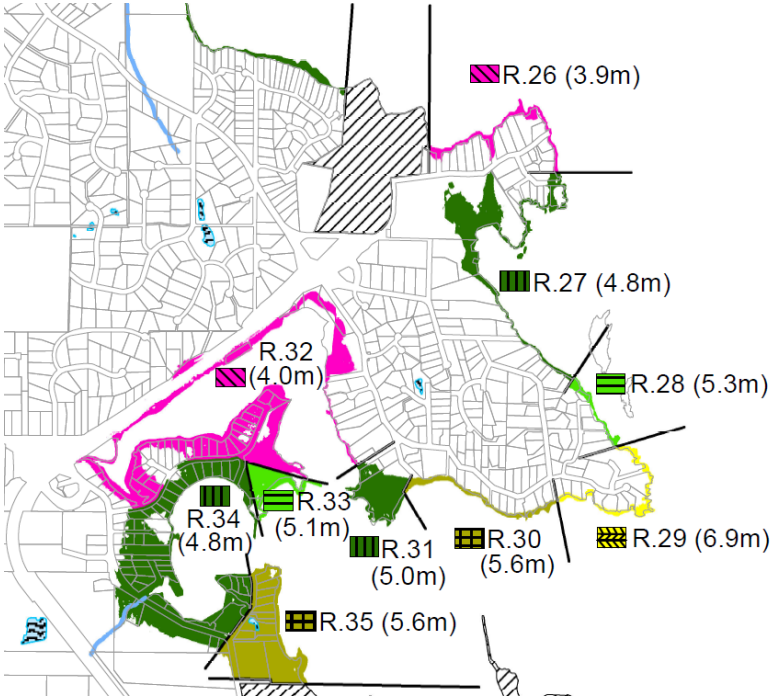


District Scale Implications

- ✓ Most areas (North and West sides of peninsula) are hardly affected
- ✓ East shoreline is the most exposed near Lochside Drive – McTavish Interchange
- ✓ Tsehum Harbour Area has extensive and multiple parcels exposed to direct and indirect risk of flooding

0.5 m SLR



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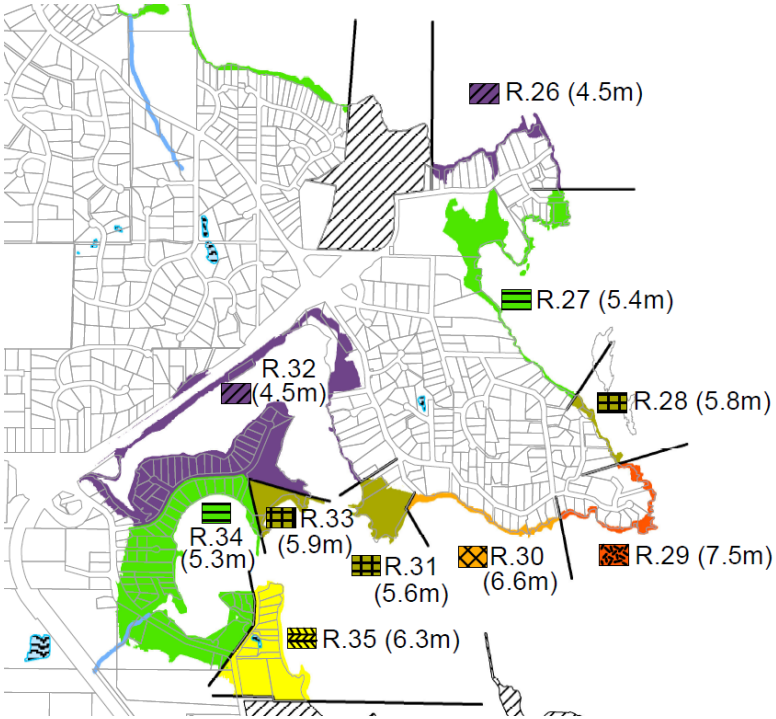

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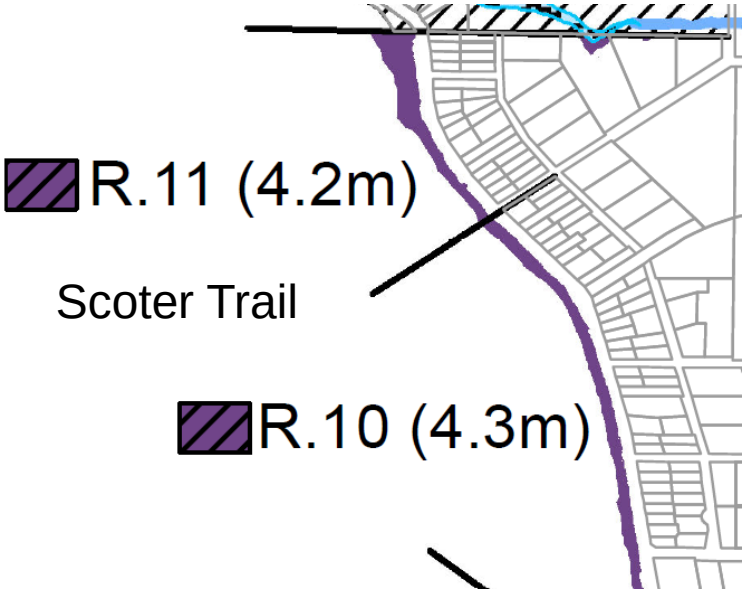
- ✓ Municipal or road infrastructure is exposed to risk in local areas



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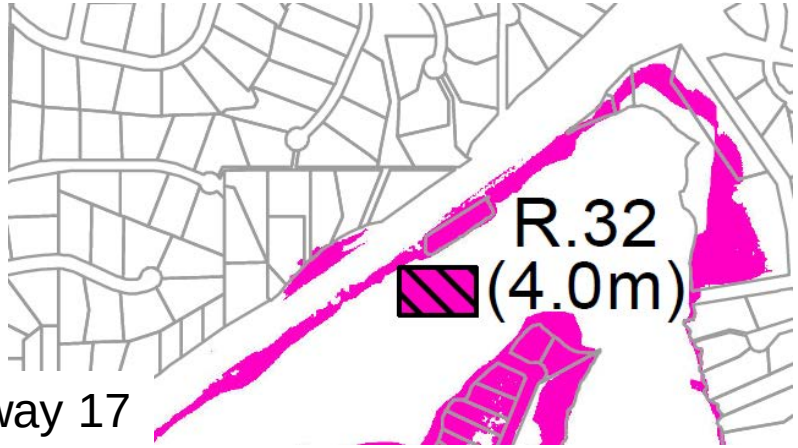

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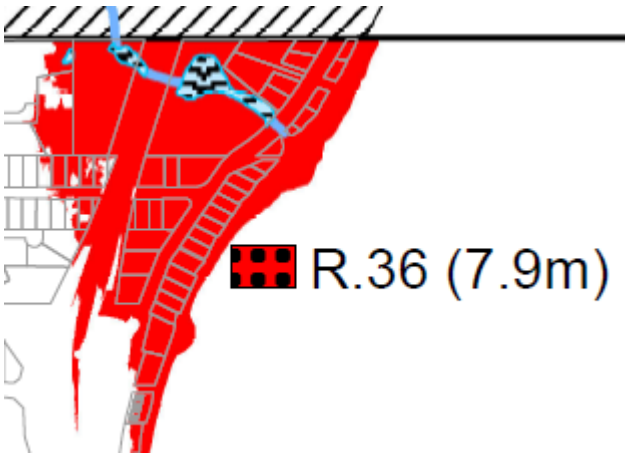


Lochside Drive area

Individual Lot Parcel Scale Implications

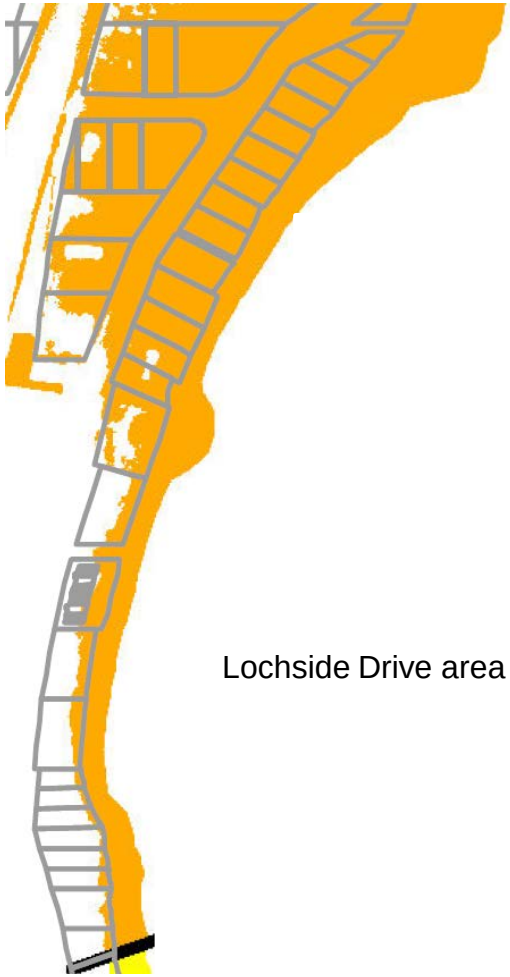
At individual parcel scale, the existing habitable building may be outside of the affected area.

Local parcel details may have significant effect on drainage within the lot

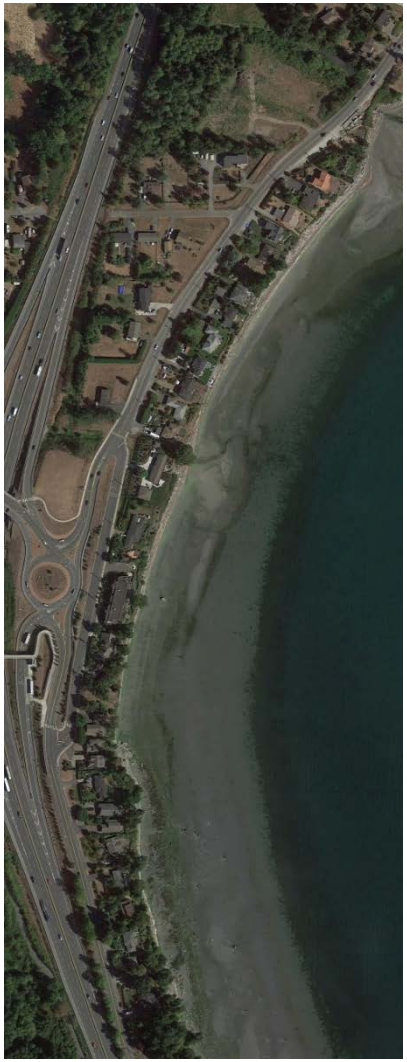
FCL may not be a concern for an existing building.

Work to date is District Scale.

0.5 m SLR



Lochside Drive area



Summary of Affected Properties

Criteria	Number of Lots	
	0.5m SLR	1.0m SLR
Directly Affected Lots		
Parcel is not affected	83	48
FCL elevation encroaches less than 15 m from shoreline	499	502
FCL comes further inland	67	81
Parcel is completely inundated	64	82
Total	**713**	**713**
Indirectly Affected Lots		
Parcel is beside another parcel which is more exposed	17	31
Parcel is adjacent to another parcel completely inundated	37	46
Total	**54**	**77**

Recap of FCL Study Findings

Not much difference between overall total effects for 0.5 m or 1.0 m SLR

There some areas that will get flooded (to some extent) if a severe storm occurs today at high tide

Four general groups of risk exposure:

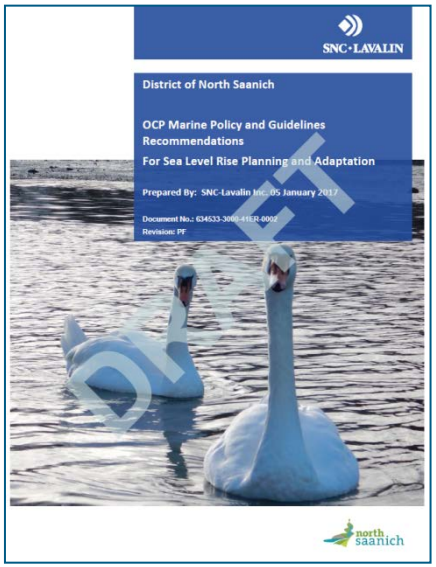
-Tsehum Harbour area has considerable exposure

-Lochside Drive area has some exposure and the highest FCLs

-Large areas of the District only exposed to risk if buildings are close to shoreline (≈ 15 m)

-Two areas have roads exposed to flooding risk

Recent Marine Policies



Timeline

DNS Adaptation Action Plan

2017, January 26
Community Consultation

2017, Spring / Summer
Draft OCP bylaws

Public consultation

2016 - 2017
Vulnerable areas and potential policies identified

2017, Fall
Public Hearing

Draft Zoning policies

2016, September
Community Consultation started (ResilienC)

DNS Marine Policy Review begins

2017 / 2018, Winter
OCP Bylaw approval

Public consultation zoning policies

2016, January
DNS Flood Construction Level (FCL) study begins

2000 | 2005 | 2010 | 2015 | 2020

2004
Province downloads responsibility to local governments

2011
Province updates Flood Management Guideline Documents for Sea Level Rise

2014
Capital Regional District (CRD) starts Regional Flood Construction Level (FCL) assessment

2012 / 2013
Various presentations on the implications of Sea Level Rise on BC shorelines

2014
LiDAR topographic mapping funded by Province

2013
Property Rights on Waterfront (PROW) associations calls for DNS initiative

Recent Marine Policy and Activities

Provincial Level

2004 Standing version of FMALUMG

2011 Provincial Updated Guideline Reports

Ongoing - Draft Updates of Sea related Flood Hazard Area Land Use Management Guidelines

FLOOD HAZARD AREA

LAND USE MANAGEMENT

GUIDELINES

May 2004

Ministry of Water, Land and Air Protection

Province of British Columbia

Ausenco Sandwell

Process Infrastructure

Ports, Marine & Offshore

Project No. 143111
Revision Number 0

BC Ministry of

Climate Change Adap
Dikes and Coastal Fl
Draft Policy Di

27 January 2011

Ausenco Sandwell

Process Infrastructure

Ports, Marine & Offshore

Project No. 143111
Revision Number 0

BC Ministry of Environment

Climate Change Adaption Guidelines for Sea Dikes and Coastal Flood Hazard Land Use

Guidelines for Management of Coastal Flood Hazard Land Use

27 January 2011

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uidelines

BRITISH COLUMBIA

AMENDMENT
(5TH DRAFT – NOV 1, 2016)

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.

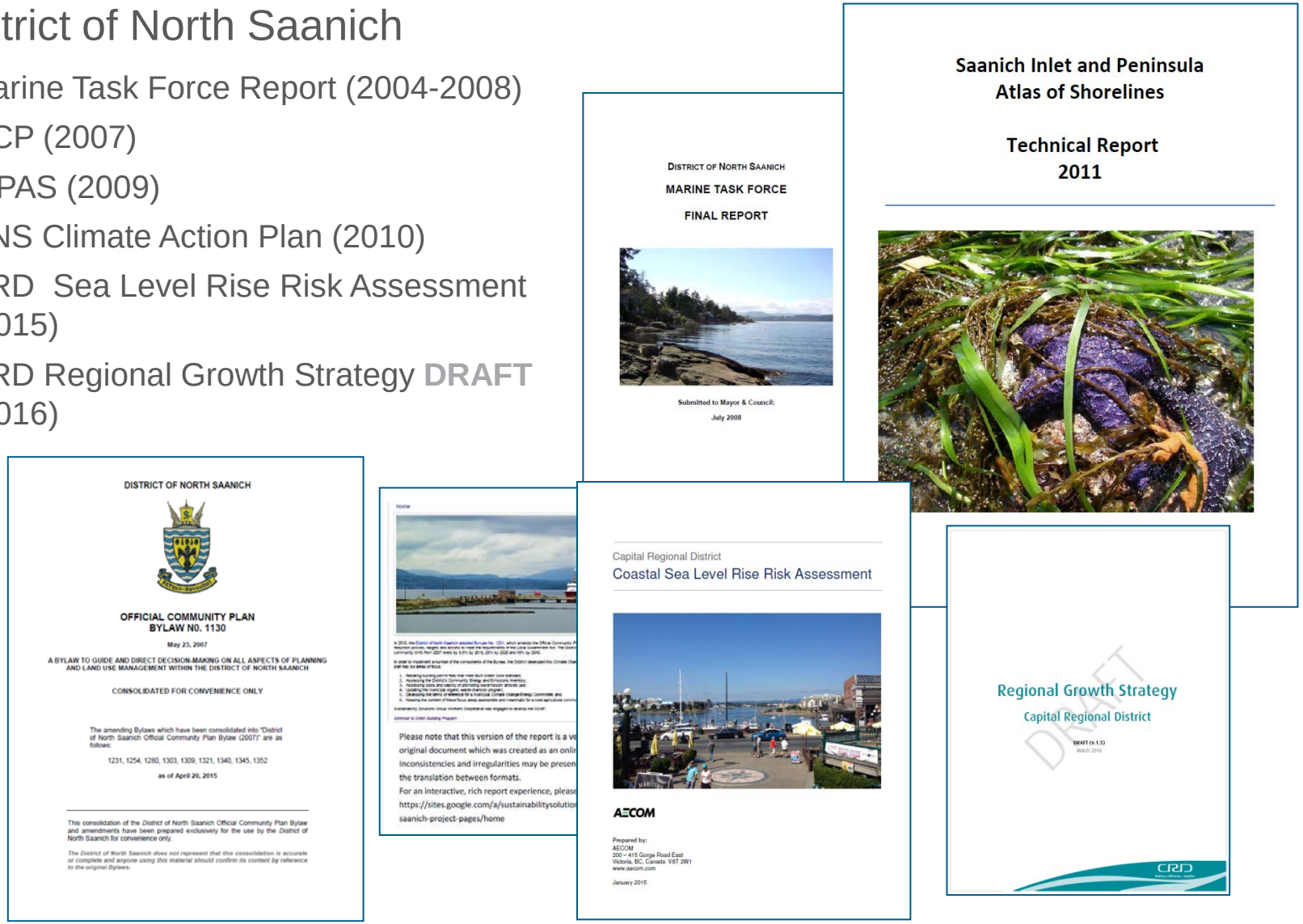
The APEGBC Professional Practice Guidelines describe and provide for use of risk assessment methodologies, however, this Amendment does not consider how risk based approaches might be incorporated into sea level rise area planning, determination of setbacks and FCLs, or long term flood protection strategies. Should local governments, land use managers and approving

Ministry of Forests, Lands, & Natural Resource Operations	Flood Safety Section Resource Stewardship Division Water Management Branch Website: www.env.gov.bc.ca/wsd	Mailing Address: PO Box 9340 Stn Prov Govt Victoria BC V8W 9M1 Telephone: (250) 387-9962	Location: 3rd Floor, 395 Waterfront Crescent Victoria BC V8T 5K7

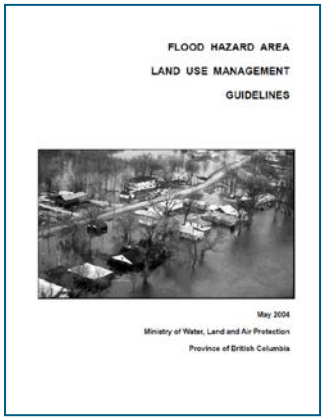
Recent Marine Policy and Reports

District of North Saanich

- Marine Task Force Report (2004-2008)
- OCP (2007)
- SIPAS (2009)
- DNS Climate Action Plan (2010)
- CRD Sea Level Rise Risk Assessment (2015)
- CRD Regional Growth Strategy **DRAFT** (2016)



Timeline



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2000 | 2005 | 2010 | 2015 | 2020

2004
Province downloads responsibility to local governments

2011
Province updates Flood Management Guideline Documents for Sea Level Rise

2014
Capital Regional District

Province reviews and modifies DRAFT FHALUMG (3.5 and 3.6) of 2004 Guideline Document

assessment

2012 / 2013
Various presentations on the implications of Sea Level Rise on BC shorelines

2014
LiDAR topographic mapping funded by Province

2013
Property Rights on Waterfront (PROW) associations calls for DNS initiative

Planning Work

Marine Task Force Report (2004-2008)

- Recognize the marine heritage, economic contributions and interests of residents of DNS
- Deal with and remediate water pollution issues
- Review policies dealing with seawalls

North Saanich Climate Change Action Plan (2010)

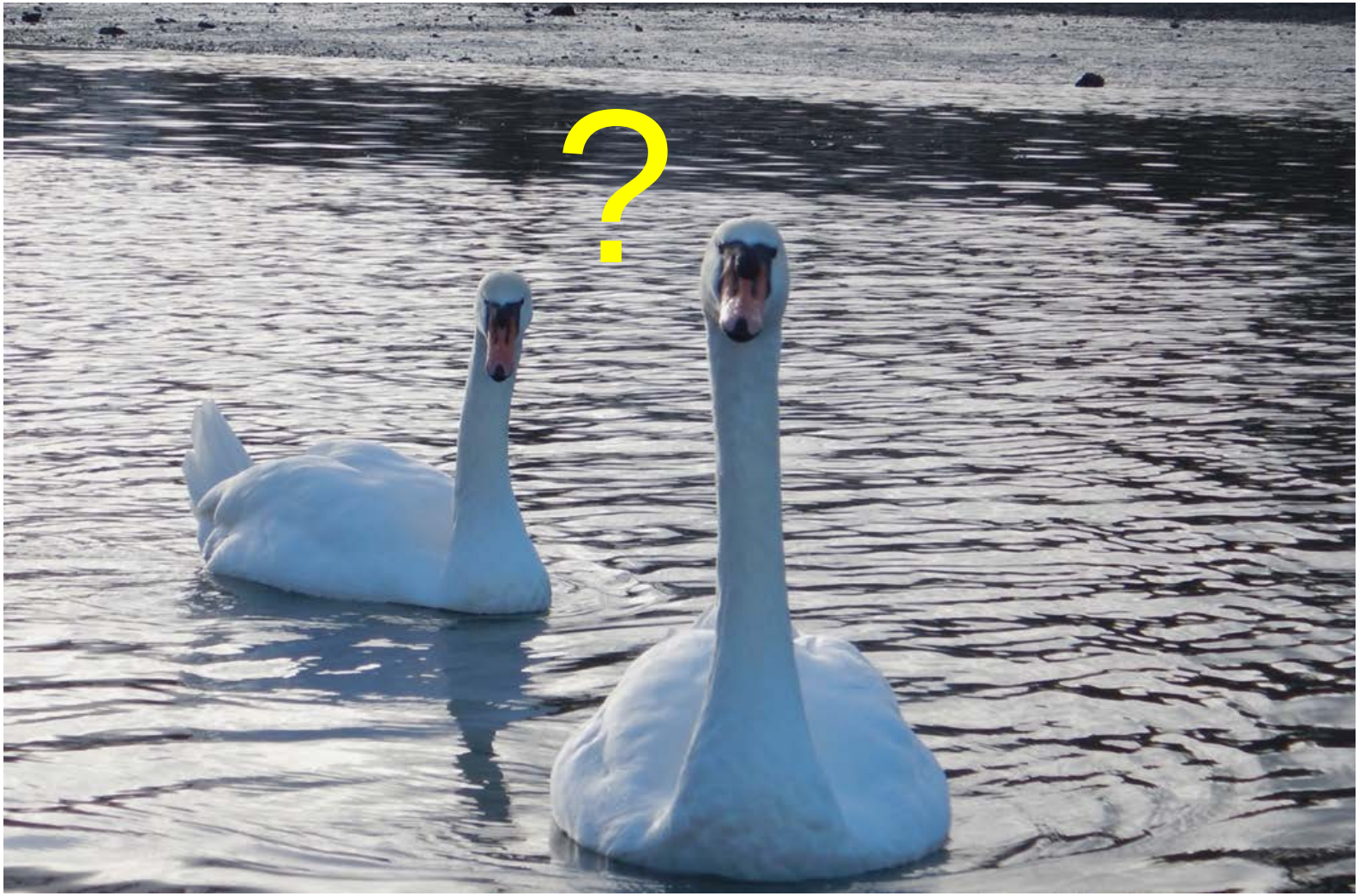
- Develop sustainable building programs in DNS
- Interest in concentration of development in specific areas (not proceeding)

Regional Growth Strategy (DRAFT) (2016)

- Protection of a green/blue belt in Saanich Inlet and the DNS shorelines
- Protection of the ecological integrity of the marine areas
- Concentration of most new growth where it can be served by mass transit
- Protection of areas prone to flooding

OCP (Bylaw # 1130) (2007)

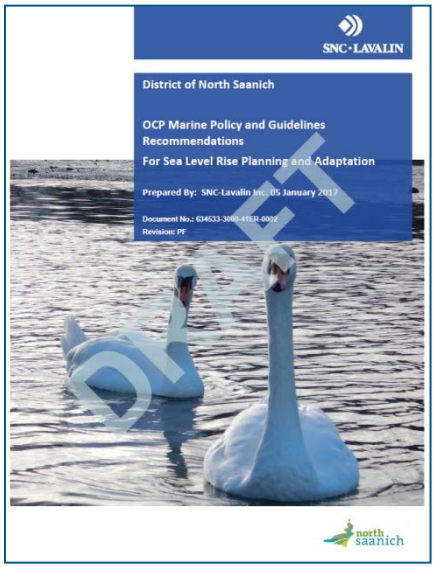
- Update in process



BREAK

Recommended Marine Policy Changes

DRAFT



Recommended Marine Policy Changes (DRAFT)

Changes to OCP Sections

Special Development Areas

Development Permit Areas

Changes to Existing OCP

There are 4 areas of the Existing OCP that should be updated:

- Section 4 – Marine Areas
- Section 6 – Residential Areas
- Section 11- Roads and Servicing
- Section 12 – General Development Policies

All other Sections are either not affected or are still consistent with the findings of the results of the FCL Study.

Note:

Section 3 – Environmentally Sensitive Areas will be affected by sea level rise:

- Sensitive areas will tend to move inland, however, no changes are necessary to the existing policies.

Changes to Section 4 Marine Areas

Recommended changes are primarily to existing wording regarding the identified Shoreline Components. Recommended changes are shown in the report highlighted in **yellow**.

Example:

Rocky Shores	
Policy 4.2.1	
Current Policy	**Evaluation and Explanation of Need for Change**
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.	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. 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.
Recommended Policy	
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, or where works are intended and designed to preserve the shoreline character and limit coastal flood-related effects.	

Changes to Section 11 Roads and Servicing

The FCL Study showed that in some areas of DNS, existing roads and services will be affected by SLR.

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.	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 must follow guidelines and policies required of in Development Permit Areas, one of which includes the draft DPA X. The recommended changes to the existing policy mandates owner/developer to consider the effects of sea level rise through adherence of the draft DPA X.
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 possible sea level rise and the requirements of Development Permit Areas 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 X.
Recommended Policy	
The proposed network of bicycle paths is shown on Schedule D. Developments shall take into consideration possible sea level rise and the requirements of Development Permit Areas 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.	To reduce the potential negative impact on services, it may be necessary to allow for works related to sea level rise adaptation. The recommended amendment to the policy allows for expansion and/or works related to sea level rise adaptation.
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.	

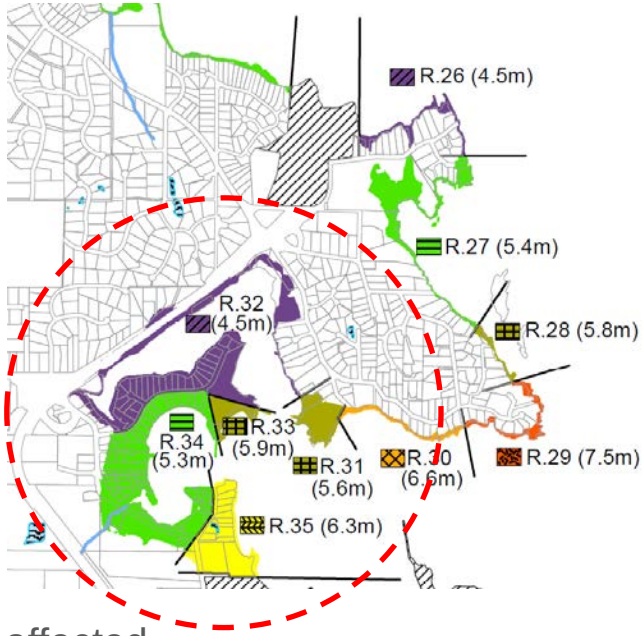
Recommended Marine Policy Changes (DRAFT)

2 Special Development Areas

Special Development Areas - (DRAFT)

Tsehum Harbour Area

- Multiple properties will be affected by sea level rise
- Most shoreline areas are directly exposed
- Low lying shoreline
- Adjacent properties will be affected by neighbours
- Mix of existing and new development
- Mix of residential, commercial and park facilities
- Numerous marine related infrastructure
- Municipal infrastructure (roads, utilities, power) will be affected



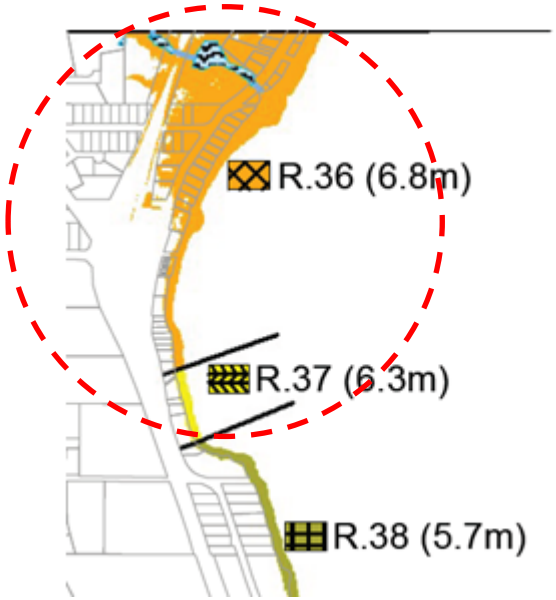
Clear that eventually, special consideration should be given to maintain and continue development of this area of DNS.

This area is presently part of the ResilienCE project currently underway in parallel to this work.

Special Development Areas - (DRAFT)

Lochside Drive – McTavish Interchange Area

- Multiple properties along the shoreline will be affected by sea level rise
- Most exposed land parcels in the District
- Shoreline does not lend itself to piecewise adaptation at the shoreline
- Mainly residential
- Municipal infrastructure (roads, utilities, power) will be affected
- Potential for future development



Clear that eventually, special consideration should be given to maintain and continue development of this area of DNS.

This area is presently part of the ResilienCE project currently underway.

Recommended Marine Policy Changes (DRAFT)

Coastal Flooding Development Permit Area

Development Permit Areas (DPA)(DRAFT)

There are currently 7 DPAs in the OCP

- 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 7 was re-numbered to DPA 6 in the current OCP.
- DPA 8: Intensive Residential Development

These reflect the *Local Government Act* (LGA) in place 1n 2007

Latest LGA (2015) allows for DPA to protect development from hazardous conditions.

Hazard

The ongoing Provincial Climate Change update program clearly recognizes the flooding hazard from expected sea level rise as a hazard.

- Hazard to personnel during storms
- Hazard to First Responders if called out during storm
- Potential damage to buildings and loss of use until repaired or replaced
- Potential release of pollutants (stored fuel, pesticides or fertilizer, sewer spills/blockage, debris washed into environment

- Also implications to land fill capacity for damaged materials

Coastal Flooding Area DPA

Why a new DPA?

Existing DPA's that include areas exposed to flood risk:

- DPA 1
- DPA 4

have specific reasons, that are still valid and should be sustained.

Some aspects of the new DPA are still in a state of flux:

- DPA 1 relates to existing shoreline
- New DPA relates mostly to future development or redevelopment
- Province has still not released final guidance

As both the guidance (provincial) and the understanding of the rate of SLR evolves, the other DPA issues remain constant.

A SLR related flooding issue DPA can be modified/revised as appropriate.

Coastal Flooding Area DPA

Present and Future Basis for Coastal Flood Hazard Management

Present

- 2004 era FCLs (static sea level) are 1.5 m above Natural Boundary
- 2004 era Setbacks (static sea level) are (generally) 15 m from Natural Boundary

Future

- Sea Level will rise and the Natural Boundary will move inland
- Provincial Guideline documents define a rationale procedure for estimating where the Natural Boundary will be in the future.
- This project's work has followed the updated Provincial Guidelines

Natural Boundary - today

(Land Act, Section 1)

Natural Boundary

means 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

In addition, the natural boundary includes the best estimate of the edge of dormant or old side channels and marsh areas. For coastal areas, the natural boundary shall include the natural limit of permanent terrestrial vegetation.

Natural Boundary – field definition

Only a BC Land Surveyor can designate the Natural Boundary

- Done on Subdivision
- Done on the day of the survey
- Done in any season of the year
- Done in calm or stormy weather
- Assessed visually
- Can vary in location and elevation depending on the land parcel and exposure

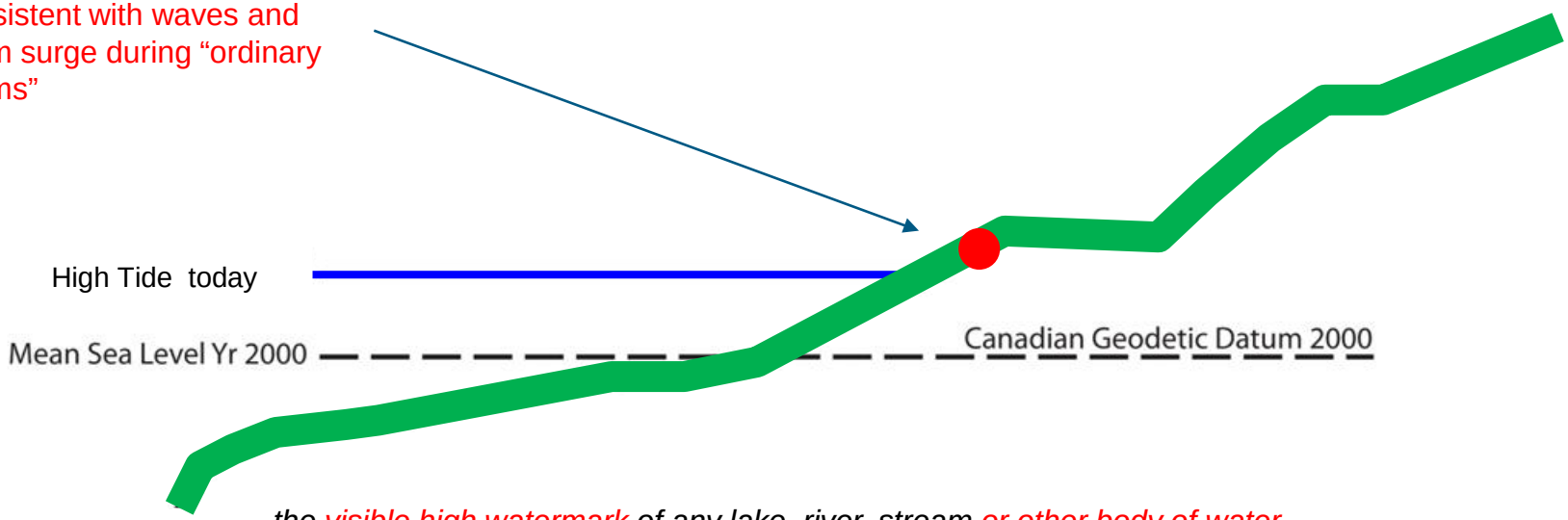
Limited training in:

- Oceanography (…… *visible high watermark .....)*
- Coastal engineering (..... *presence and action of the water .....)*
- Meteorology (..... *so long continued in all ordinary years.....)*
- Geology (..... *a character distinct from that of the banks thereof.....)*
- Biology (……*in respect to vegetation*…..)
- Soil (…..*nature of the soil itself* ……)

Legal Concept with considerable Common Law precedents.

Natural Boundary - today

“mark on the bank”
Consistent with waves and storm surge during “ordinary storms”



..... 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
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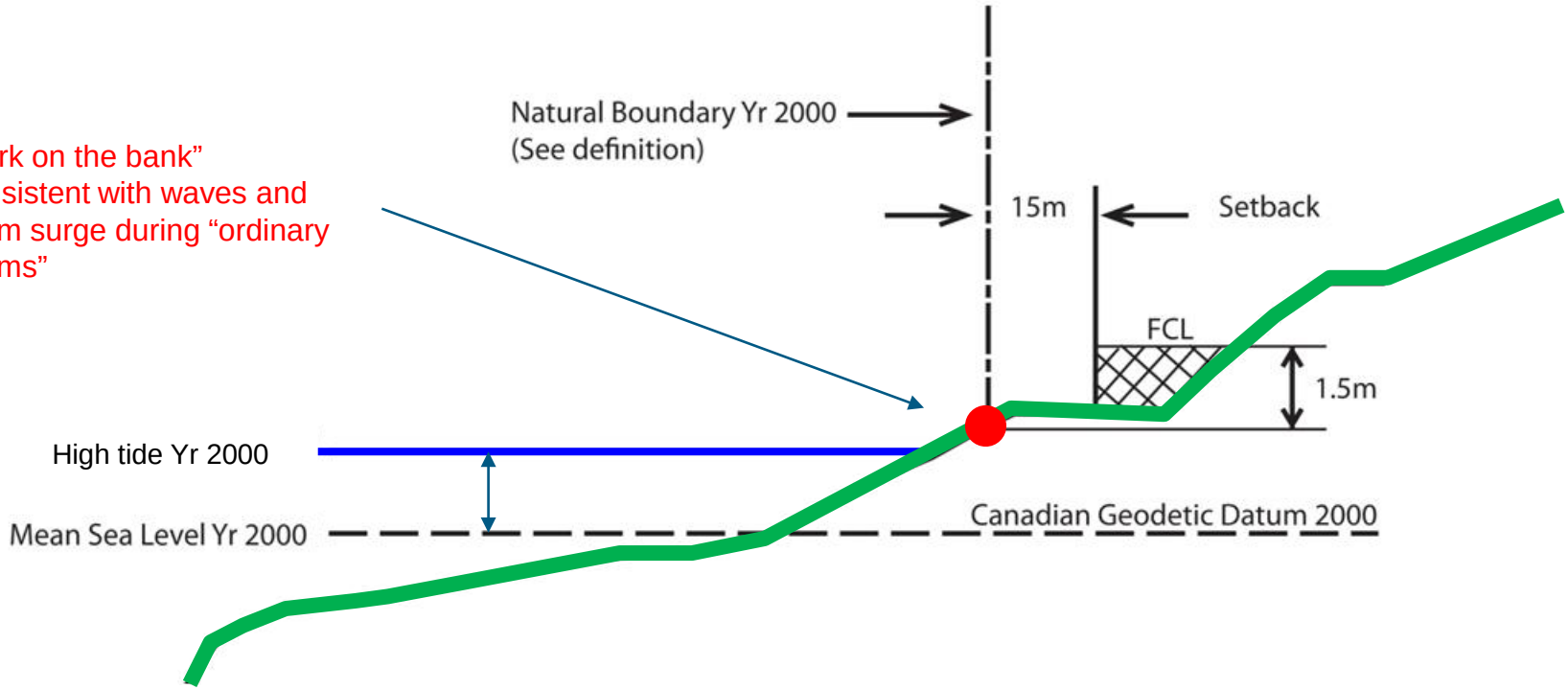

Natural Boundary - today

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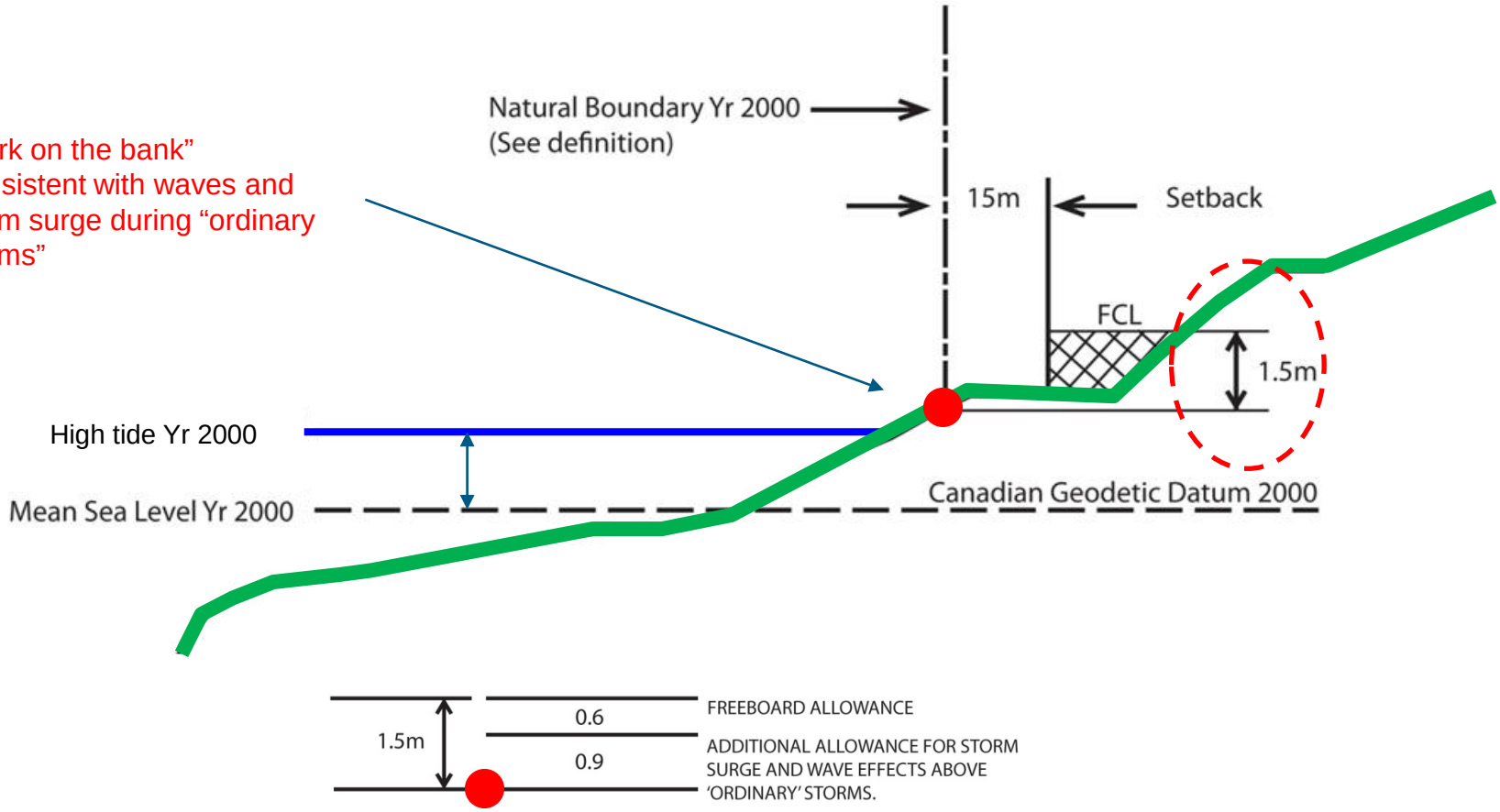
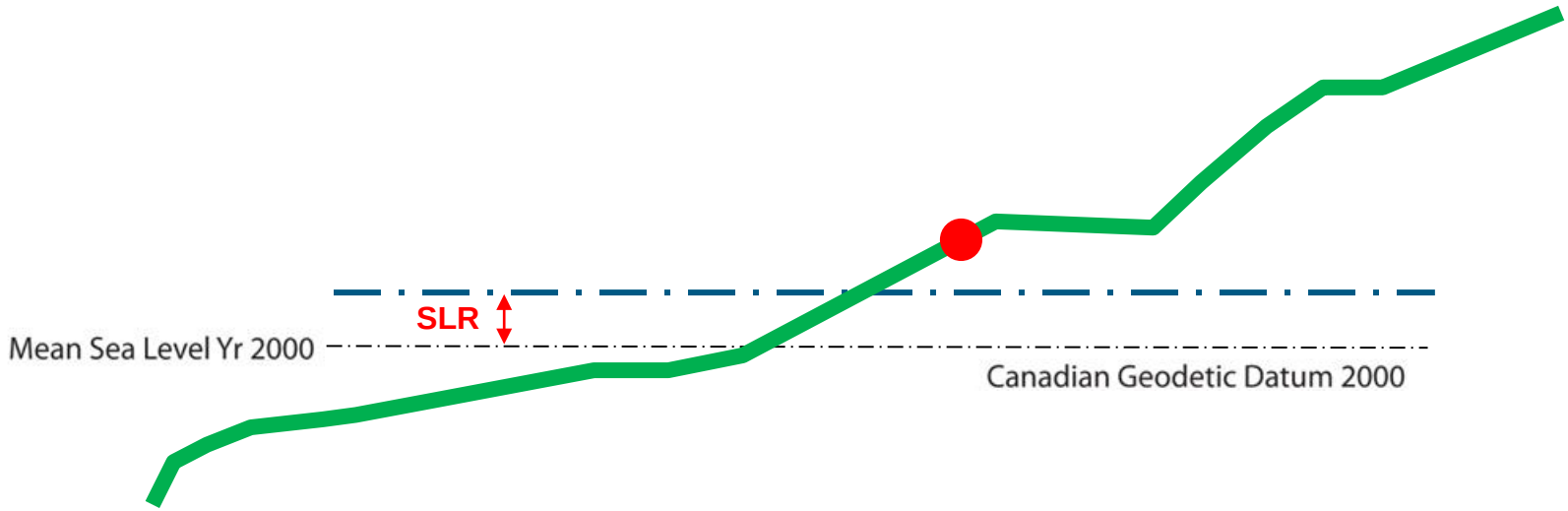
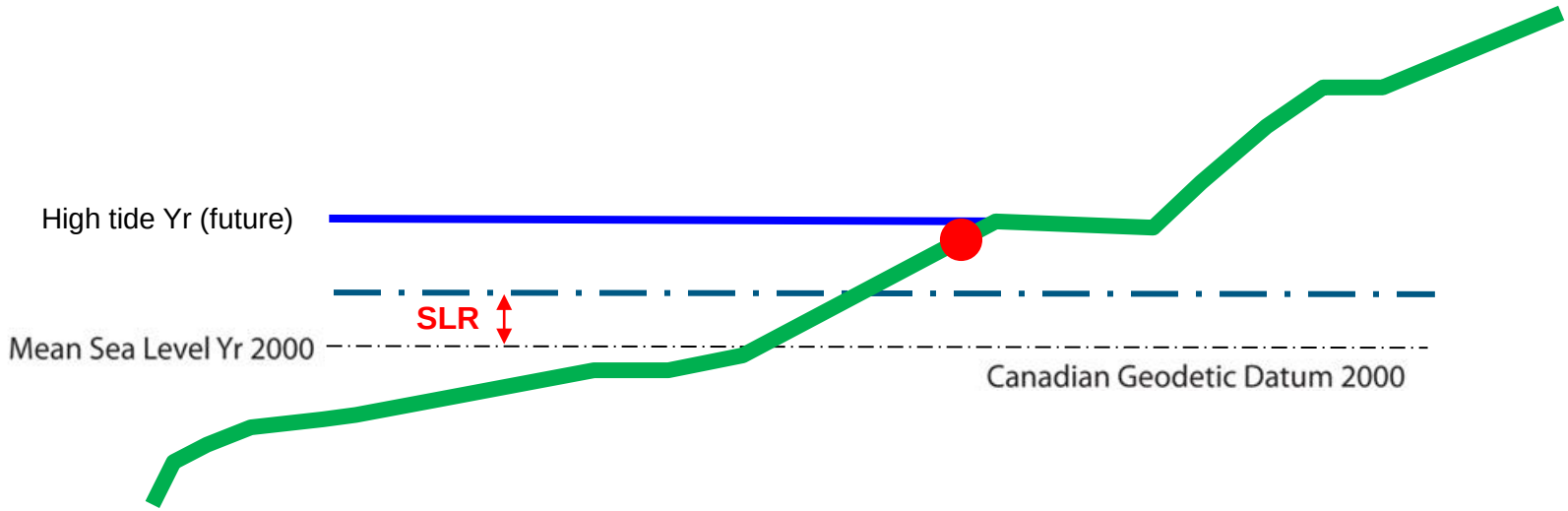


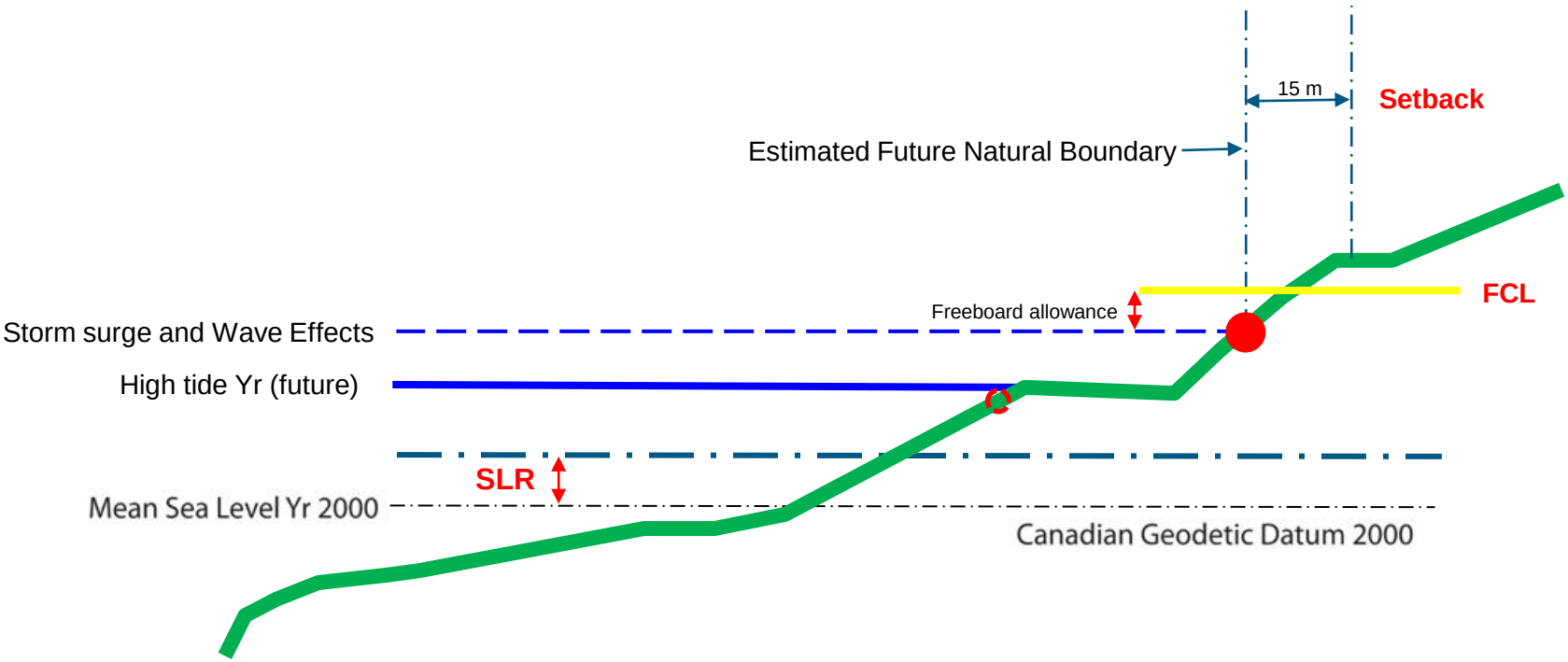
(future) Natural Boundary



(future) Natural Boundary

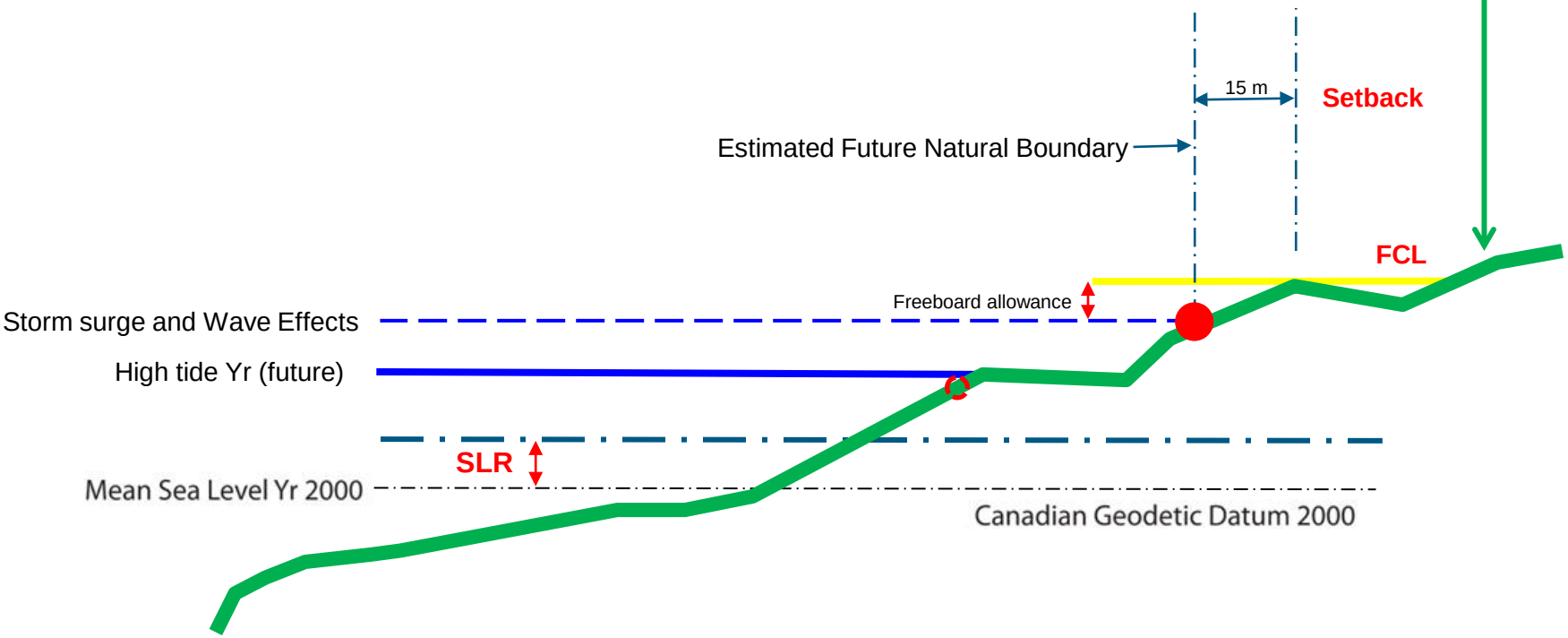


Estimated (rational) Natural Boundary



Estimated (rational) Natural Boundary

Every land parcel will have a different topography at the shoreline



How to deal with the rising sea level?

King Canute demonstrating to his courtiers that not even a King can hold back the sea

credit: Henry of Huntingdon (12th Century) and Alphonse-Marie-Adolphe de Neuville (circa 1860s)

Coastal Flooding Area DPA

The main structure of the Draft DPA is:

- Designation: - applies to parcels exposed to direct or indirect future flooding
- Justification: - authorized by *Local Government Act*
- Objective: - protect developments (habitable buildings) from hazardous conditions and reduce risk to life, property, public safety and related consequences
- Geographic Areas: - as per FCL Study mapping
- Development Type: - considers 4 types/locations of development
- Parcel Category: - considers 6 classes of land parcels
- Flood Construction Level: - defines FCL elevations per development type and parcel category
- Setback: - defines Setbacks for habitable buildings as above
- Guidelines: - outlines reporting and flexibility provisions in DPA
  - Mandatory Report: - required to show how proposed development will conform
  - Flexibility: - provides for a parcel specific modification if desired
  - Adaptation Report: - provides for situations where a parcel is expected to be completely inundated in the future
- Revision: - as sea level rise rate becomes clear in the future allows for revision

Development Types

Development Types

- 1 - New Build or Construction on Undeveloped Lots
- 2 - New Build or Construction on Already Developed Lots
- 3 – Substantial Renovation of Buildings
- 4 – Minor Renovations, Maintenance or Repair of Buildings

What is not included

- **Renovations that do not require a Building Permit**

Land Parcels

Types of Land Parcels

Directly Affected Lots

- 1 – Not at Risk -The FCL elevation does not encroach onto the existing ground of the lot
- 2 – Parcel partially affected < 15 m setback distance
- 3 – Parcel partially flooded > 15 m but not entire lot
- 4 – Parcel completely inundated

Indirectly Affected Lots

- 5 – Parcel adjacent to lot where some flooding is expected
- 6 – Parcel is adjacent to a completely inundated lot

Directly Affected

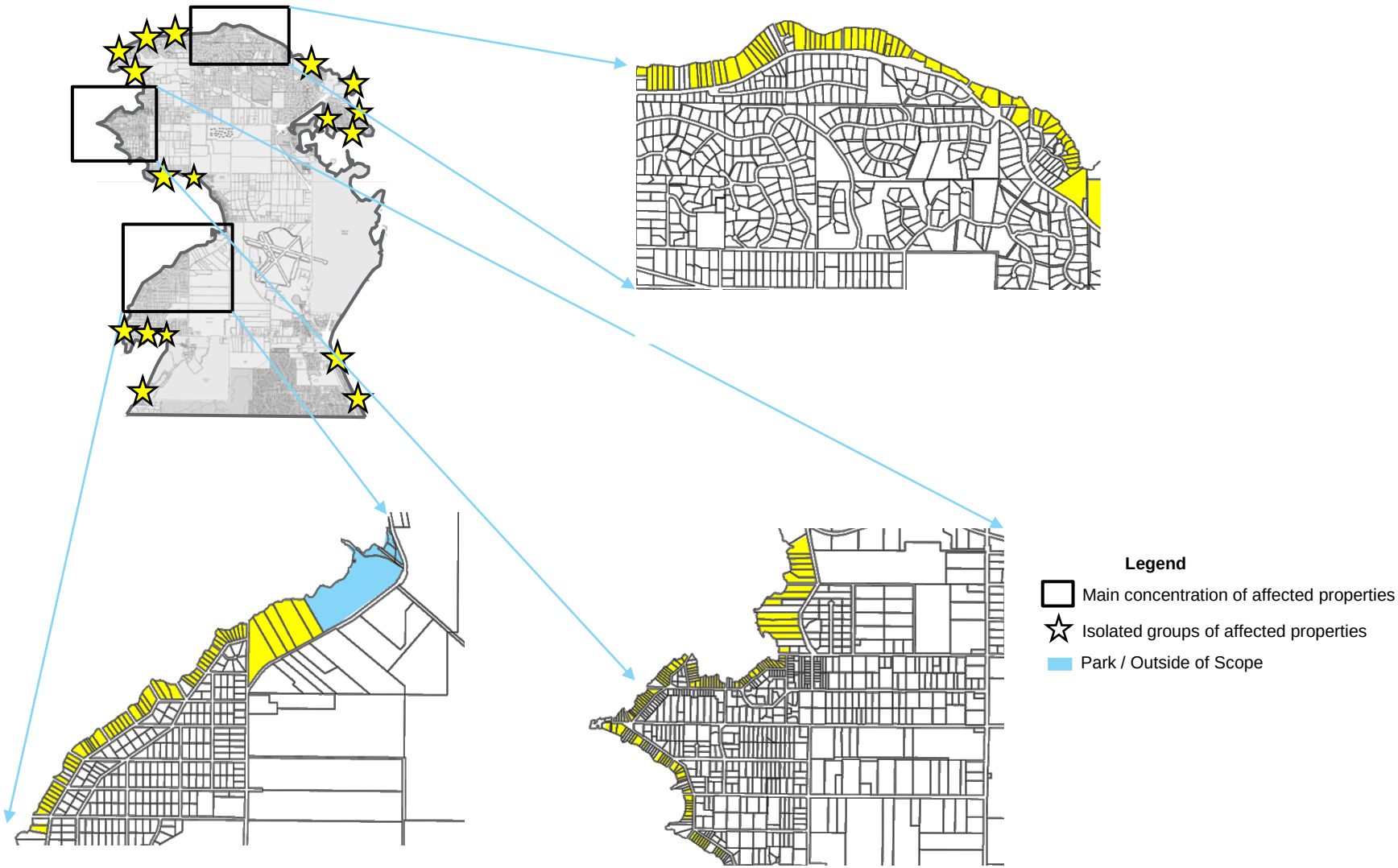
Category 1

(Lot not affected)

Directly Affected

Category 2

(Lot partially affected, <15m)



Directly Affected

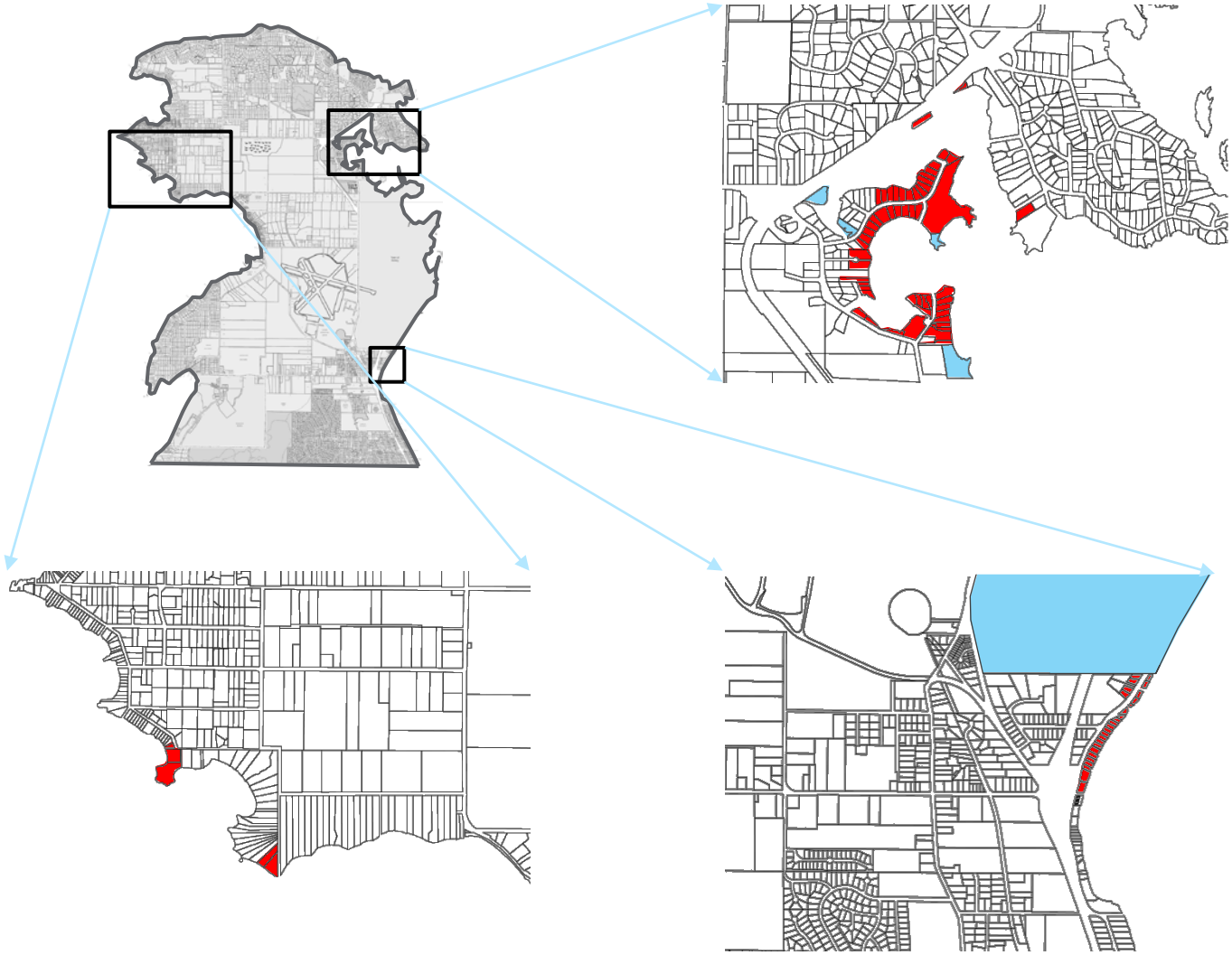
Category 3

Lot partially flooded, >15m)

Directly Affected

Category 4

(Lot completely inundated)



Legend

Main concentration of affected propertie

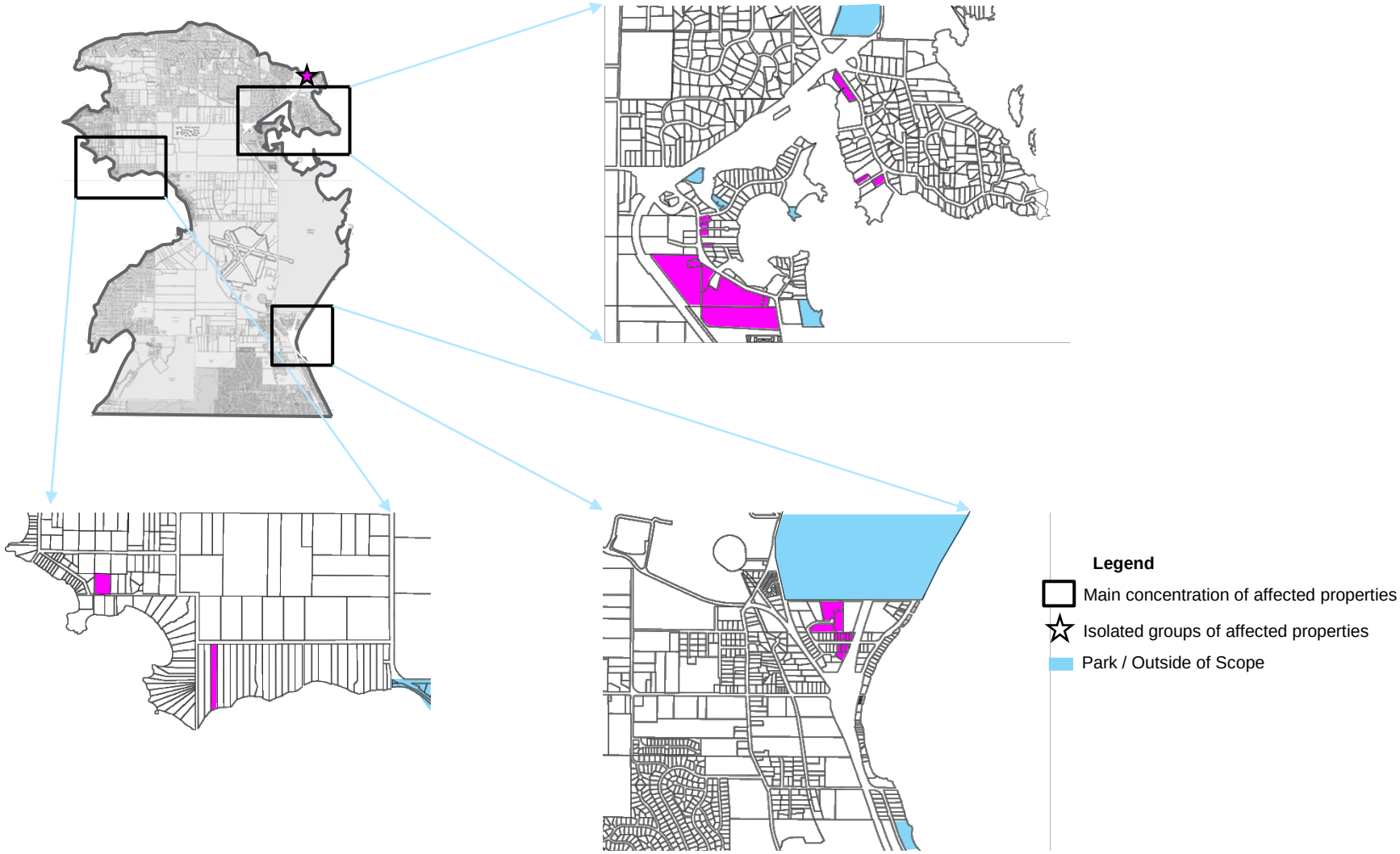
Isolated groups of affected properties

Park / Outside of Scope

Indirectly Affected

Category 5

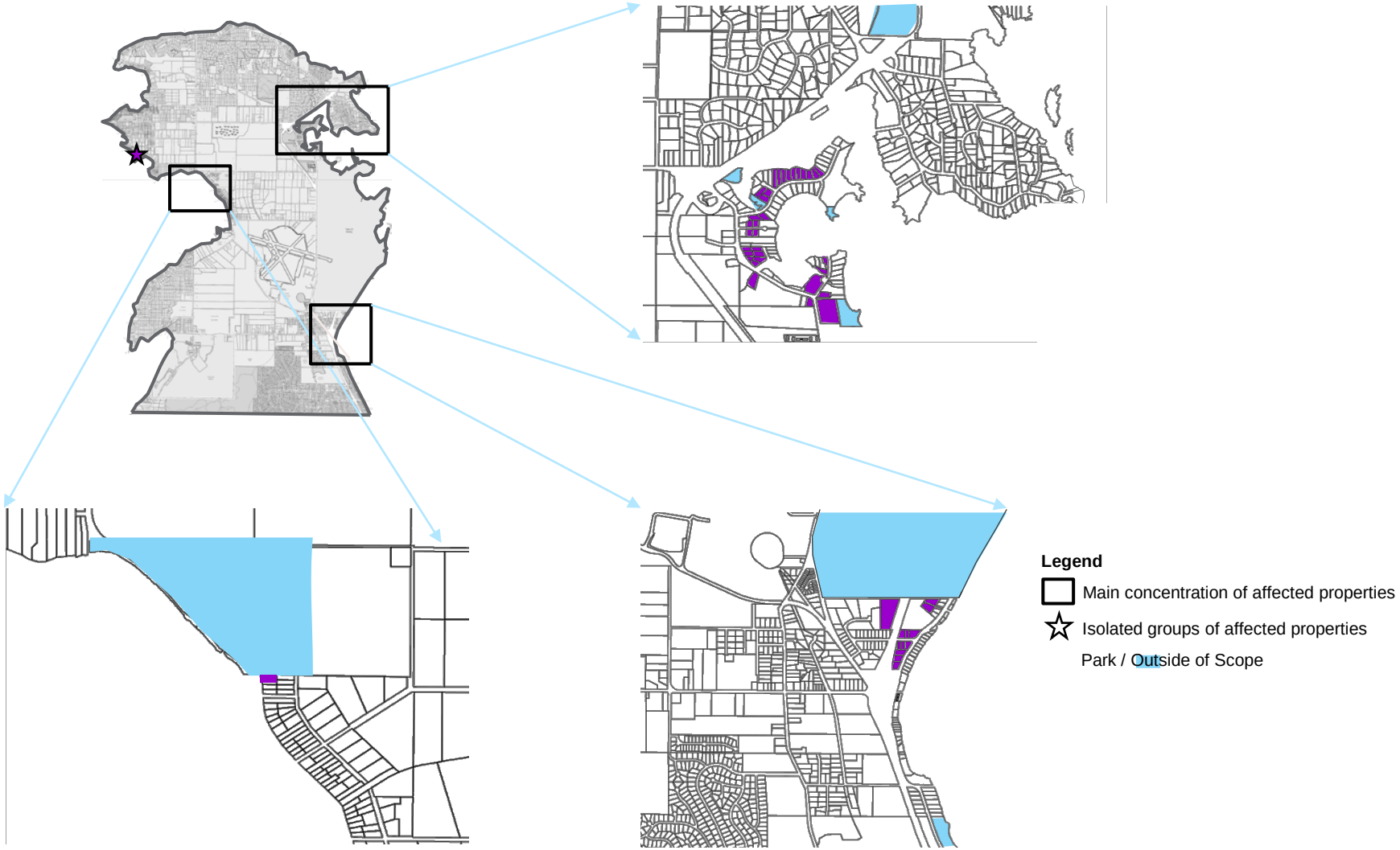
(Adjacent lot has flooding potential)



Indirectly Affected

Category 6

(Adjacent lot completely inundated)



FCLs

Development Type	Land Parcel Category					
	1	2	3	4	5	6
	Directly Affected				Indirectly Affected	
1 New Build/Construction (Undeveloped Land)	NA	NA	1 m SLR	1 m SLR	1 m SLR	1 m SLR
2 New Build/Construction (Developed Land)	NA	NA	1 m SLR	1 m SLR	1 m SLR	1 m SLR
3 Substantial Renovation	NA	1 m SLR	1 m SLR	1 m SLR	1 m SLR	1 m SLR
4 Minor Renovation	NA	0.5 m SLR	0.5 m SLR	0.5 m SLR	0.5 m SLR	0.5 m SLR
NA: Does not apply						

Setbacks

Development Type	Land Parcel Category					
	1	2	3	4	5	6
	Directly Affected				Indirectly Affected	
1 New Build/Construction (Undeveloped Land)	15 m	15 m	15 m	*	15 m	15 m
2 New Build/Construction (Developed Land)	15 m	15 m	15 m	*	15 m	15 m
3 Substantial Renovation	NC	NC	NC	NC	NC	NC
4 Minor Renovation	NC	NC	NC	NC	NC	NC

The indicated setbacks are the minimum. Setbacks where a coastal bluff exists may be greater due to other issues

*: Parcels that will be completely inundated will require an Adaptation Report.

NC: No change to the existing setback.

Exceptions and Flexibility

The Draft DPA includes provision for relaxation and flexibility where parcels may not allow for adaptation or in special circumstances:.

- - sea level rise will occur and is not stoppable within practical limits
- - some parcels may have unique features not captured by the present study
- - it may not be possible to move the building
- - the appropriate response is both individual and site specific
  - Measures are taken to mitigate flooding (safe haven, choice of materials etc)

There is provision for lot specific independent determination of FCL

- Lots may have specific details different from the reach (1000 m) characteristics
  - Large lot with varying exposure and opportunity to mitigate flooding
  - Modification proposed to shoreline treatment (ie: replace seawall with beach)
  - Dry flooding proofing considered (ie.:fill)

Reports

Various reporting options:

Mandatory Report

- ✓ Report prepared showing:
  - ✓ How proposed development conforms with the “default” FCL and Setback guidance.
  - ✓ Describes how proposed development includes measures to safeguard adjacent properties from transferred flooding hazard

Adaptation Report

- ✓ In cases where a relaxation is requested:
  - ✓ Describes the vulnerablity of site to flooding hazard
  - ✓ A risk assessment and risk management plan
  - ✓ Measures taken to increase site resilience

Independent Parcel Specific Report

- ✓ *Applicable to individual lot refinements*
  - ✓ *Required content is in the Draft DPA*

RECAP

Review of Existing Marine Related Policies in the OCP giving consideration of the results and findings of the FCL Study

1] Specific Sections of the Existing OCP that should be amended to allow for adaption options that may be undertaken.

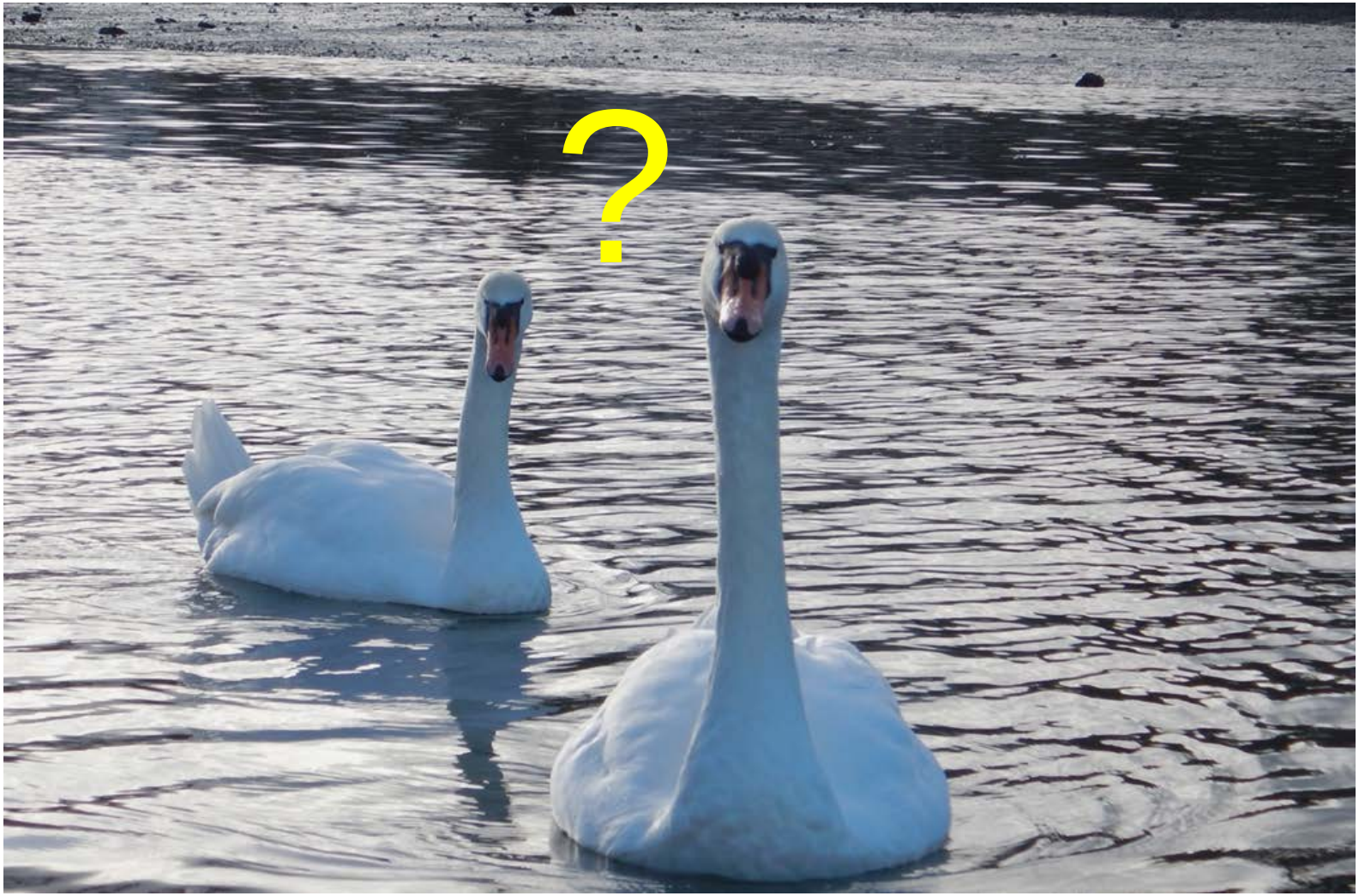
- *Individually addressed in the Marine Policy Review report*

2] Two new Special Development Areas are recommended due to the nature of the expected flooding and the existing developments in the area:

- *Tsehum Harbour Area*
- *Lochside McTavish Road Interchange Area*

3] A new Coastal Flood Hazard Area DPA is proposed

- *Focus the DPA on coastal flood hazard issues and responses*
- *Compatible and not contradictory to existing DPA 1 (Environment) and 4 (Slopes)*
- *Includes flexibility and process for individual lot based refinement of FCL and Setback*



Application Examples

Conceptual Only

Application to High Bank Areas

Non-Erodible Steep Shoreline

Application to High Bank Areas

Erodible Steep Shoreline

Application to High Bank Areas

Seawalls or Steep Revetments

Patricia Bay Area

Lochside Drive – McTavish Interchange

Tsehum Harbour Area

Tsehum Harbour Area

Tsehum Harbour Area

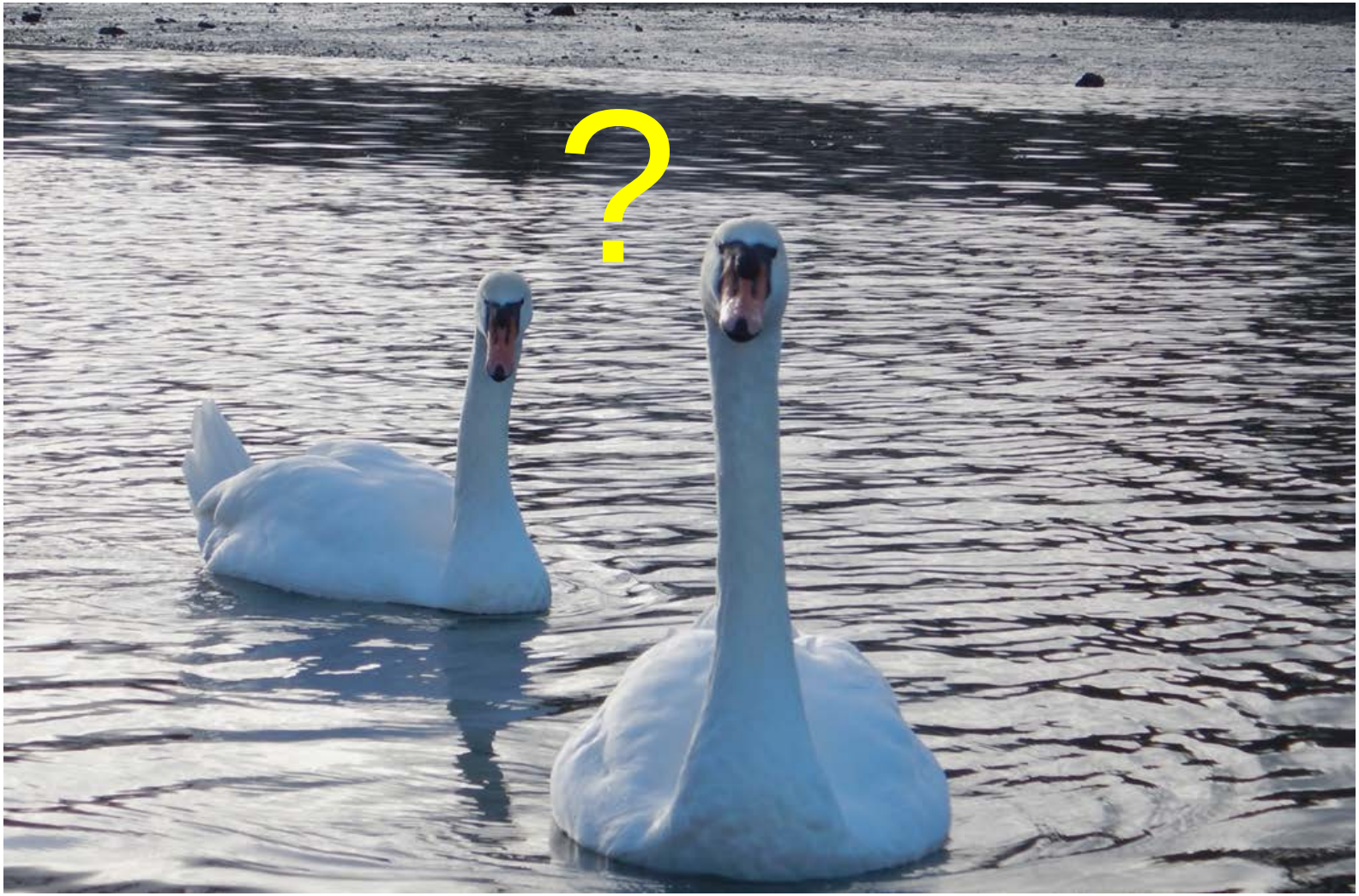
Tsehum Harbour Area

Tsehum Harbour Area

SUMMARY

Province has delegated responsibility for Flood Management to local governments (2004)

- The FCL Study work has shown areas of DNS will be flooded
- These same areas are threatened if a severe storm occurs at high tide
- Existing (2007) OCP policies do not allow some practices are simply just good adaptation strategies
- Proposed policy modifications will allow these strategies in the future
- The intent is to provide guidance and flexibility



Next Steps

Next Steps

:

1. Policy Options
2. Public Consultation
3. Review Bylaws and Marine Task Force Recommendations

What can individuals do?

If concerned:

1. Study the property.
2. Where is the building?
3. Consult with a coastal engineer

- *≈ 50 registered professional coastal engineers currently practicing in British Columbia*

- *Discussions underway with APEGBC regarding more formal identification process and a Professional Practice Guideline for shoreline engineering.*

What is a Coastal Engineer?

Multi – disciplinary branch of Civil Engineering

Requires knowledge of:

-Meteorology

-Oceanography

-Wave and Current interactions with structures

-Marine Environmental processes

-Geology

-Geotechnical Engineering

-Economics

-Planning

-Risk Assessment.

Relatively new branch – first really emerged as an engineering field during WW 2

- Three universities in Canada
- Many universities world wide

What Can a Property Owner Do Now?

Observation, Observation, Document

Establish a known elevation reference on your property

- Make it visible

Take repetitive photographs and video of wave interaction with shoreline features

- Seasonal
- High tides
- Storm conditions – try to capture the angle of approach of waves in particular under many conditions

Document changes to the character (type of sediment, extent of coverage, changes in both) of beaches and toe of cliffs

Define your functional requirements:

- What is your time frame?
- What are the site vulnerabilities?
- What are the tolerable consequences?

Review and consider upland alternatives:

- Divert or control surface water runoff
- Maintain vegetative cover over shoreline area
- Can access to shoreline for small equipment be improved?
- Are there options to move back or up?
- **Talk with neighbours**

To follow developments

For latest information on the melting of ice sheets and glaciers:

- https://nsidc.org/
- http://icebridge.gsfc.nasa.gov/
- http://darksnow.org/

For latest information on measured sea level rise

- http://sealevel.colorado.edu/

For up to date information on new studies, reports and investigations related to climate change and sea levels

- http://climatecrocks.com/

To read the paper by J. Hansen et al (2016):

- http://www.atmos-chem-phys-discuss.net/15/20059/2015/acpd-15-20059-2015.pdf

THANK YOU FOR ATTENDING:

PLEASE COMPLETE THE QUESTIONAIRE BEFORE LEAVING OR DROP OFF OR MAIL BY 6 FEBRUARY 2017

Values that guide us

Our values keep us anchored and on track. They speak to how we run our business, how we express ourselves as a group, and how we engage with our stakeholders and inspire their trust.

Teamwork & excellence

We're innovative, collaborative, competent and visionary.

Customer focus

Our business exists to serve and add long-term value to our customers' organizations.

Strong investor return

We seek to reward our investors' trust by delivering competitive returns.

Health & safety, security and environment

We have a responsibility to protect everyone who comes into contact with our organization.

Ethics & compliance

We're committed to making ethical decisions.

Respect

We consistently demonstrate respect for all our stakeholders.