



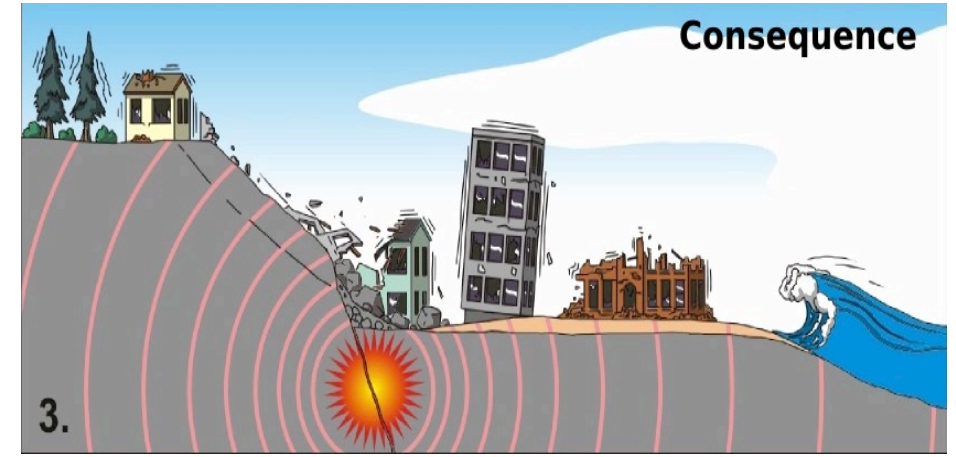
Landslide Risk Assessment 2026 Update

Fiona Dercole, Senior Project Manager Public Safety
June 22, 2026

Agenda

1. Background & Context
2. Risk Assessment Methodology
3. Risk Assessment Findings
4. Recommendations
5. Next Steps
6. Q & A

Coming to terms with risk



DNV Risk Management Framework

(based on CSA ISO 31000)

Risk Communication

- Leadership
- Transparency
- Education
- Shared responsibility

Initiation – Define problem and associated risk issue(s).



Preliminary Analysis – Identify hazards using risk scenarios.



Risk Estimation – Estimate frequency and consequence of risk scenarios.



Risk Evaluation – Compare risks against risk tolerance criteria.



Risk Control – Identify and assess risk control options.



Action / Monitoring – Implement controls and monitor residual risks.

Tolerable vs. Acceptable Risk

Category	Description
Broadly Acceptable	Incremental risks from a hazard are within the range that society accepts and do not require mitigation.
Tolerable	Risk is not negligible, but can be tolerated, given that effort is taken to reduce risk and is kept under review.
Unacceptable	Generally considered unacceptable by society and require mitigation.

ALARP

as low as reasonably practicable

Under the common-law system, risks should be reduced if reasonable opportunities exist.

The cost, time and effort involved in reducing the risk further would be grossly disproportionate to the benefit gained.

Natural hazards task force (2008)

1. Reviewed risk tolerance criteria established in other jurisdictions
2. Developed an understanding of the risks faced in everyday life
3. Hosted community consultations
4. Prepared and presented recommendations for establishing risk tolerance criteria in the DNV



DNV risk tolerance criteria adopted by Council (2009)

Type of Application	Risk of Loss of Life (per annum)		Factor of Safety (static)	
	1:10,000 + ALARP	1:100,000	FOS>1.3	FOS>1.5
Building Permit (<25% increase to gross floor area)	X		X	
Building Permit (>25% increase to gross floor area and/or retaining walls >1.2m)		X		X
Re-zoning		X		X
Sub-division		X		X
New Development		X		X



District of North Vancouver

Landslide Risk Assessment Update

Presented by:

Lauren Hutchinson, M.Sc., P.Eng.
Sophia Zubrycky, M.A.Sc., P.Eng.

Date:

June 22, 2026

January 2005 Berkley Landslide

Where this work started

The 2005 landslide was a catalyst for a better understanding of hazards and more proactive risk management.

The District's leadership set a tone for future work in the following 20 years that has made the DNV a safer and more resilient community.



2440 Chapman



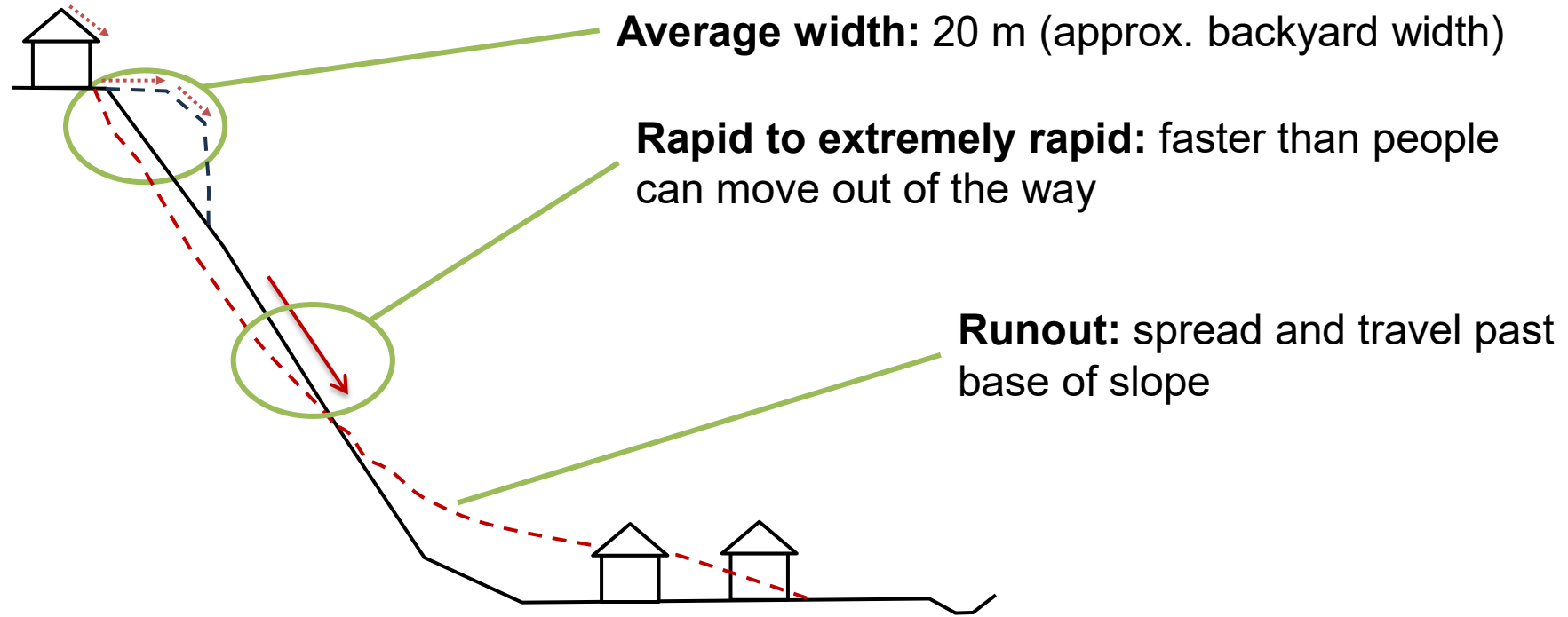
2290 Chapman



Typical DNV escarpment landslides

Development at crest of slope modified slope stability:

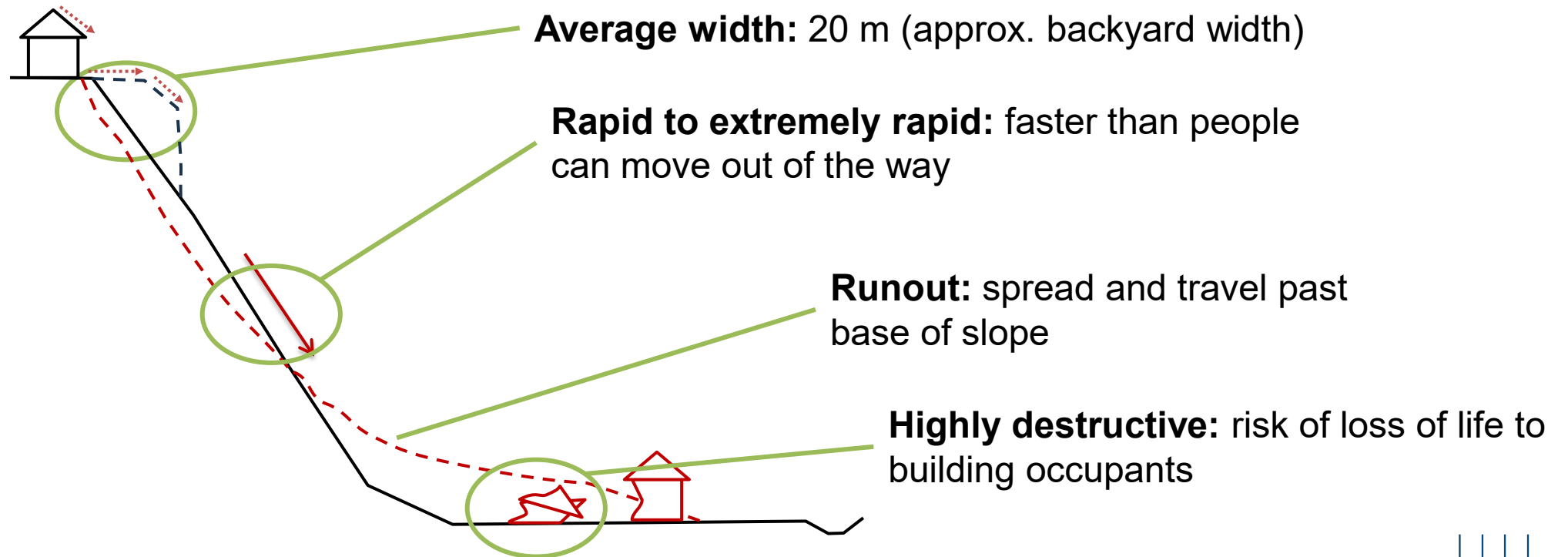
- fill placed to extend building lot and yard resulting in steeper slope than native ground
- water directed onto slope



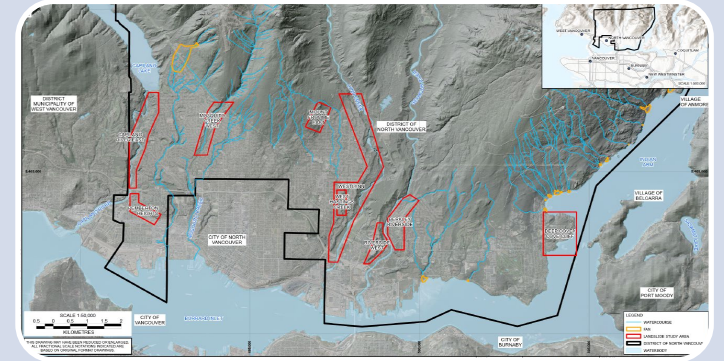
Typical DNV escarpment landslides

Development at crest of slope modified slope stability:

- fill placed to extend building lot and yard resulting in steeper slope than native ground
- water directed onto slope



Following the Berkley Slide, the DNV initiated proactive risk management of natural hazards across the District.



Mitigation measures (fill removal, slope reshaping, surface water drainage management) were implemented on escarpment slopes in partnership with property owners.

DNV formally adopted risk tolerance criteria in 2009 . This work won the prestigious United Nations Sasakawa Award for Disaster Risk Reduction in 2011.

BGC was engaged to estimate risks along priority slopes and known debris-flow hazard areas. The last District-wide summary was in November 2010.

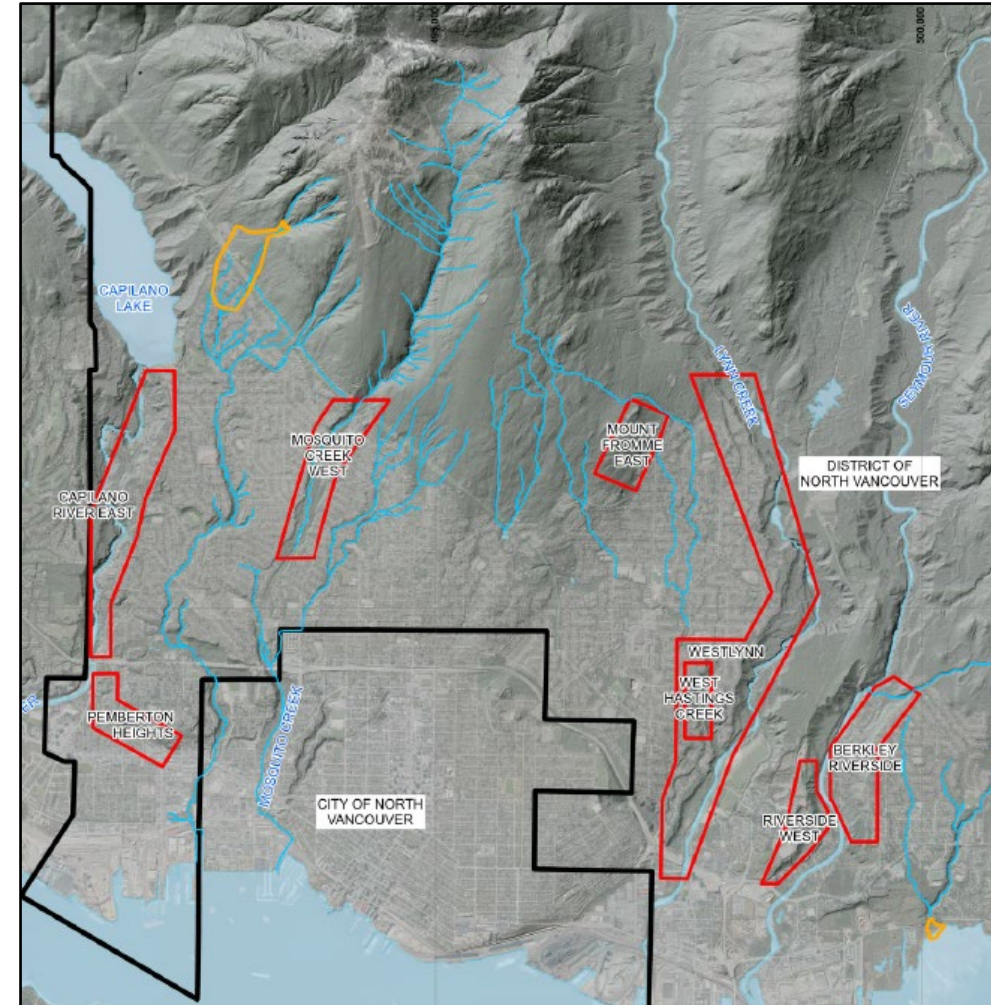
Risk Assessment Update

Objectives:

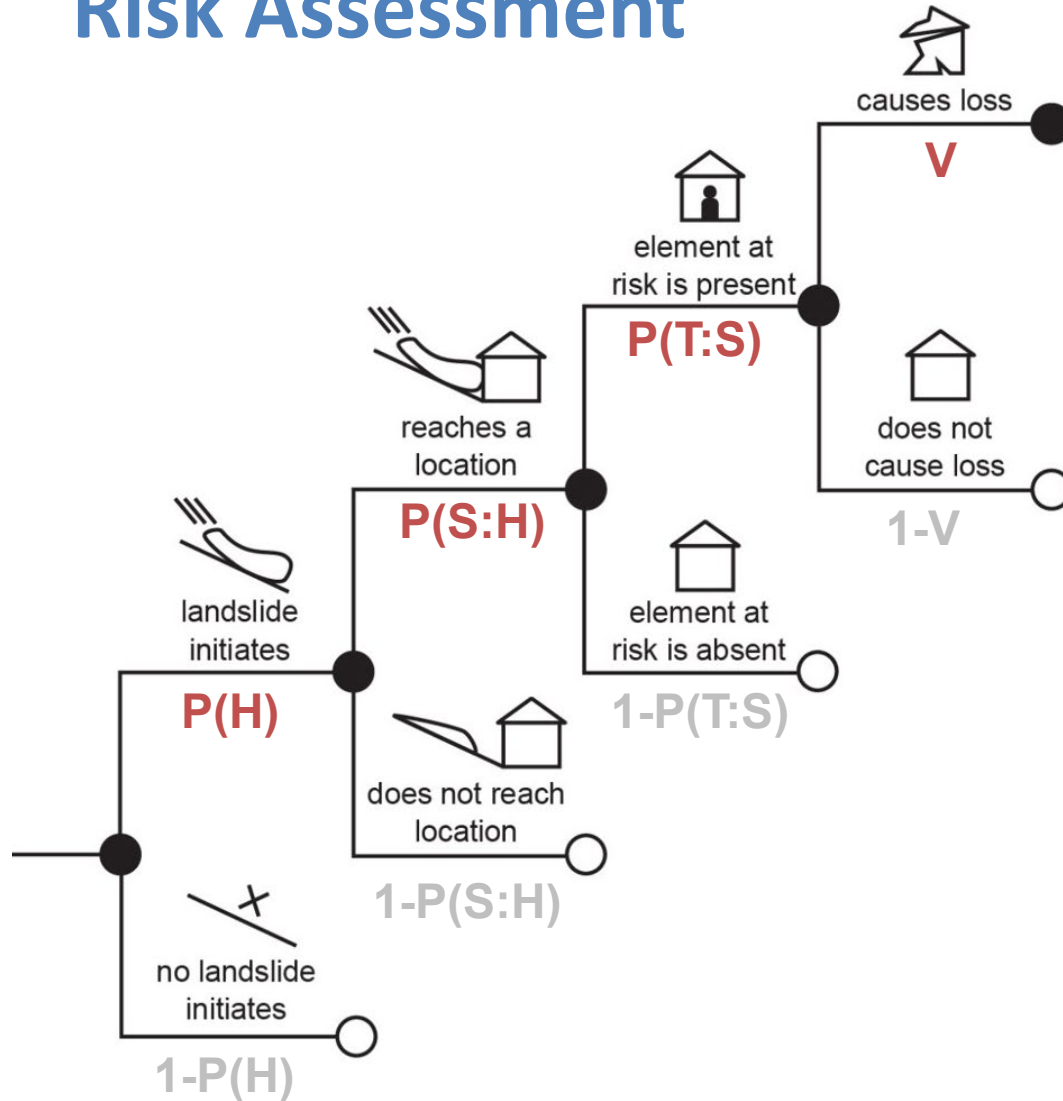
1. Identify landslide hazard areas with potential to pose life-safety risk
2. Update landslide risk estimates
3. Communicate study findings with DNV staff and affected property owners
4. Recommend risk management approaches

District-wide assessment primarily completed as desktop assessment supported by:

- Review of historical records, air photos, lidar data, and slope changes (2013 to 2022) from topography (lidar change detection analysis)
- Field verification and numerical modelling at select sites where the district-wide desktop level risk assessment was near or exceeded the DNV risk tolerance criteria



Risk Assessment



Individual Risk



Average annual probability of death of an individual (**PDI**)

$$\mathbf{PDI} = \mathbf{P(H)} \times \mathbf{P(S:H)} \times \mathbf{P(T:S)} \times \mathbf{V}$$

2026 Update Integrates

- Mitigation works implemented
- Refined landslide runout
- Advances in vulnerability modelling

BGC assessed risk at 124 properties at the crest and 149 properties at the base of escarpment slopes.

Risk Categories



Broadly acceptable: Meets DNV criteria for new development (PDI < 1:100,000)



Tolerable: Meets DNV criteria for existing development (PDI < 1:10,000)



Unacceptable: Exceeds DNV criteria for existing development (PDI > 1:10,000)

DNV Escarpment Properties:

- **Capilano River East**: crest only
- **Pemberton Heights**: crest and base
- **Mosquito Creek West**: crest and base
- **WestLynn**: crest and base
- **West Hastings Creek**: crest only
- **Riverside West**: base only
- **Berkley**: crest and base

Crest of Slopes (124 properties)

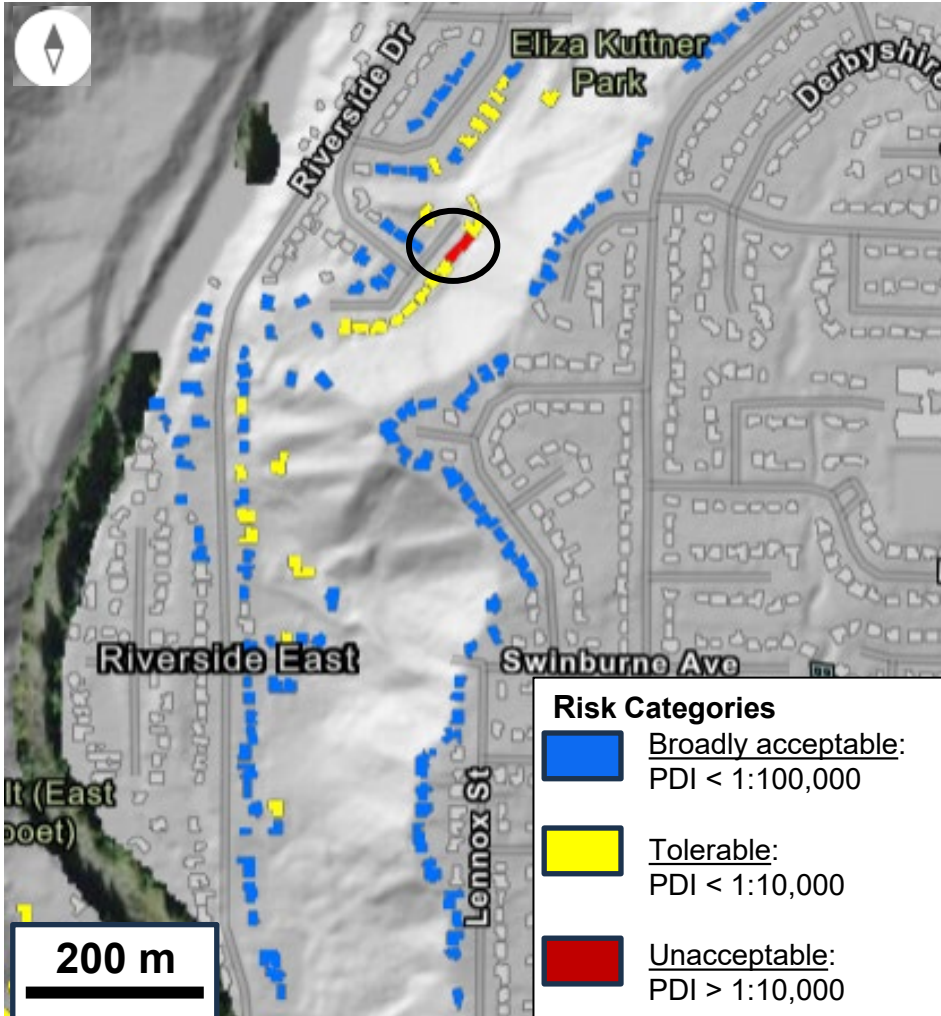
All assessed properties have **broadly acceptable** risk level.

Base of Slopes (149 properties)

All assessed properties have **broadly acceptable** or **tolerable** risk levels, except two properties at Berkley Escarpment with **unacceptable** risk levels.

Overall, estimated risk levels have been reduced in most locations assessed.

At the Berkley Escarpment, two properties have unacceptable risk



Field observations of yard debris and saturated fill at escarpment crests



Recommendations for Landslide Risk Management

Property Owners

Manage stormwater on property. Connect drainage downpipes to stormwater system, where practical. Utilize alternate management systems approved by Municipal Engineer that direct stormwater away from slopes, where not practical. Maintain stormwater drainage system.

Manage fill and yard waste. Refrain from placing at or near crest of slope. Use municipal green waste collection service.

Monitor condition of retaining walls and swimming pools, retain qualified professionals (QP) to assess and repair as needed. For modification or construction of retaining walls, engage QP and submit as-built documentation to DNV

DNV

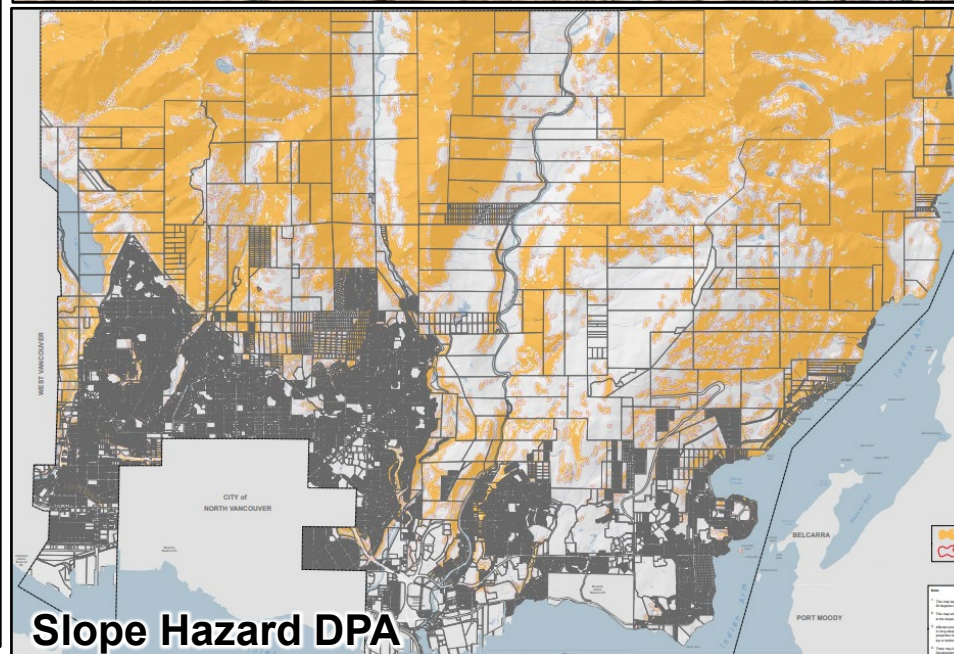
Develop monitoring program for slope conditions including regular lidar collection and change detection analysis

Continue to implement Slope Hazard DPA to manage risk to new development and redevelopment

Update risk assessment at individual properties as conditions change sufficiently to adjust risk level and District-wide approximately every 10 years

Provide information and education to residents on how to reduce landslide risk near steep slopes

Twenty years of landslide risk management leading to a safer, more resilient DNV – and the work continues



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Risk tolerance



Next Steps

1. Continue to provide information about hazards and risks
 - Updated information on dnv.org and nsem.ca
 - Report publicly available on geoweb.dnv.org/properties/
 - Letters to property owners
 - Seasonal preparedness messaging
2. Review the possibility of additional monitoring programs and related costs for Council's future consideration
3. Incorporate changes to Slope Hazard DPA into future OCP updates

Closing

This presentation required a number of complex issues to be reduced to general concepts in a series of concise bullet points, photographs, and/or diagrams. The content of this presentation is not intended for design decisions or construction. This presentation is for general informational purposes only. BGC Engineering Inc.'s report(s) may contain more specific details concerning the issues identified in this presentation. Please consult BGC for further clarification if you have any questions or concerns.

Prepared by:

Lauren Hutchinson, M.Sc., P.Eng.

Client:

District of North Vancouver

Reviewed by:

Sophia Zubrycky, M.A.Sc., P.Eng.

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