North Shore Sea Level Rise Risk Assessment and Adaptive Management Strategy: Summary of Methodology for Coastal Flood Mapping on DNV.org/SeaLevelRise

The North Shore partners (District of North Vancouver, City of North Vancouver, District of West Vancouver, Squamish Nation, Port of Vancouver, and North Shore Emergency Management) retained Kerr Wood Leidal Associates Ltd. (KWL), a consulting engineering firm with expertise in risk assessment and water resource engineering, as technical consultants for the North Shore Sea Level Rise Risk Assessment and Adaptive Management Strategy.

Sea Level Rise Flood Hazard Mapping

The main focus of the hazard analysis for this study was mapping the extents of coastal overland flooding from the combination of tide and storm surge, together typically referred to as the stillwater level.

The mapping shown on the webpage identifies areas of coastal flooding under two future stillwater scenarios if no adaptation measures are undertaken (these are not regulatory floodplain maps):

- 1 m sea level rise during an extreme storm, 0.5% annual probability (200-year return period),
- 2 m sea level rise during an extreme storm, 0.5% annual probability (200-year return period), and
- Sea level rise flood planning area is the simplified extent of 2 m sea level rise during an extreme storm, 0.5% annual probability (200-year return period), with 0.6 m freeboard.

Although Tsleil-Waututh Nation IR#3 is not within the study area, the Nation is conducting a Community Climate Change Resilience Planning Project and has provided mapping data for the same scenarios for information only.

Coastal overland flooding occurs when a combination of tide and storm surge cause ocean water levels to exceed the elevation of the top of the shoreline. Storm surge is a moderately short (i.e. days) rise in water level measured above the tide water level and due to offshore or near-shore storm processes (i.e. pressure changes and wind). Typical return periods used for analysis of storms are 10-year and 200-year events, which can also be expressed as 10% or 0.5% annual exceedance probability (AEP), respectively. A 10-year return period event has a 10% probability of occurring in any given year (does not mean will occur only once every 10 years).

Stillwater levels are the water levels observed during a flood, and are the combination of tide and storm surge determined using a joint coastal water level frequency analysis. These are separate processes and there is no correlation between them. The highest stillwater levels typically occur in winter when storm surge weather events are more likely to occur and when the highest tides of the year also occur (also known as ‘king tides’).

Maximum flood depths were estimated by projecting the peak stillwater surface elevation over a digital elevation model produced from available light detection and ranging (LiDAR) data. The LiDAR data is from the Province of BC (2016), District of West Vancouver (2016) for north of Horseshoe Bay, and District of North Vancouver (2013) for northern portions of Indian Arm. LiDAR data is collected by airplane and processed to remove buildings, tree canopy and other vegetation impacts to produce a ‘bare earth’ interpretation of topography. Both the approach to flood mapping and the LiDAR itself are subject to uncertainty.

The stillwater level does not include wave effects which vary significantly across the North Shore due to shoreline typology and wind/wave exposure characteristics. Stillwater flood mapping is considered a reasonable indicator for larger scale coastal floodplain assessments while wave effects are important for properties located on the shoreline which require more site-specific assessments.

The coastal flood maps in this study do not include potential flood impacts of concurrent riverine and drainage system peaks flows. Nor do the maps reflect any ground subsidence or uplift that may be occurring on the North Shore. The flood maps have been prepared with consideration of relevant provincial and industry guidelines, including the Engineers and Geoscientists BC Professional Practice Guidelines on Flood Mapping in BC (EGBC, 2017), and do not negate the need for site specific assessments. A technical report currently under preparation by KWL will provide additional information and documentation.