Input	Item	Description	Implications	Considerations to Resolve
Valued Assets	General	Gaps exist in the valued data model in terms of location, attributes, and data formats. Specifically, the layers are based on the best information available at the time of study but are not complete.	Potential gaps in information leading to underestimation of hazard threat (e.g. missing assets), or overestimation of hazard threat (e.g., where assets not located within hazard extents are still captured due to coarse resolution of datasets).	As a starting point for maintaining and updating asset data throughout the RDFFG, identify parties with roles and responsibilities related to compilation and management of valued asset data. In addition to those responsible for 'hard' assets, develop road map to geo-locate values defined through local and Indigenous knowledge.
	Summary - ICI Society Data	Much data about built environment valued assets in BC, including utility networks, is maintained by the Integrated Cadastral Information (ICI) Society. These data represent a valuable source of built environment data for disaster hazard threat and risk assessment. However, the data model requires substantial re-work (e.g. grouping, categorizing) to prepare for hazard threat analysis.	Increased effort and cost to prepare built environment data layers for hazard threat and risk analyses. This increase in effort increases multifold by each risk assessment completed that relies on these data.	In collaboration with ICI Society, review and consider updates to data organization and format to facilitate hazard threat, vulnerability and risk analysis.
	Population	Demographic breakdown of population totals in NRCAN (2022) is based on 2016 Census data (not 2021). Current Census data may under-represent populations with lower rates of response to census data requests, and for occupied areas not represented by Census data (e.g. non-residential. BGC also used two data sources to spatially represent and report population exposure: building footprints attributed with Census (2021) data, and the NRCAN settlement layers (also 2021 Census data). The building footprint layer is more precise for exposure analysis, but contains data gaps in some areas (e.g. Village of McBride).	Demographic breakdown of population exposure is limited to 2016 Census results. Population exposure based on building footprints will be underestimated where gaps in building footprint data exist.	Update hazard exposure analysis (re-run exposure analysis) when updated population data becomes available. Review exposure results based on both Population Total (2021 Census Building Footprint) and Population Total (2021 Census). McBride should ignore the building footprint - sourced population exposure results due to substantial data gaps.
	Built Forms (First Nations Reserves)	Built forms (parcel improvements) are not represented by BC Assessment (BCA) data on reserve lands. NRCAN physical exposure layer provides estimates of building replacement value aggregated at settlement area level of detail, but at lower resolution and without attribution amenable to vulnerability analysis. No data source for actively maintained built form data on FN reserves has been identified in a format amenable to regional scale, parcel or building resolution, hazard threat, vulnerability or risk analysis.	High uncertainty and likely underestimation of built form values on First Nations reserves, with subsequent implication for underestimation of loss due to hazards.	Review programs for the maintenance and distribution of built form geospatial data that can be efficiently accessed at province-wide scale (e.g. do not fragment data access between reserve areas).
	Built Forms (Data format)	BC Assessment data joined to cadastral fabric contains polygons at folio level of detail. For example, a condominium tower with many units (folios) will have many polygons stacked on top of each other. These were assigned a primary actual use and total value for spatial analysis.	More detailed analysis may require folio level of detail, such as to distinguish a retail ground floor from residential upper stories of a building for flood loss estimation.	Consider folio level of detail of spatial analysis for the completion of regional-local stages of assessment, where required to apply appropriate vulnerability criteria.
	Built Forms (Valuation)	Hazard threat analysis uses assessed built form values, which may differ from replacement costs.	Potential underestimation of disaster recovery costs where replacement costs exceed depreciated assessed built form values.	Maintain the use of a regularly updated dataset (BC Assessment); if replacement values are desired, consider BCA data fields as a data source for provincial scale estimation workflows.
	Built Forms (Building Footprints)	Available building footprints data does not characterize building type (built form actual use is derived from BC Assessment Actual Use codes). For example, if multiple footprints exist within a parcel, no attribute exists to distinguish between a main occupied structure and an out-building.	Exposure analysis conservatively considers hazard exposure to any building footprint within a parcel. This may over-estimate exposure if, for example, an unoccupied structure is exposed, but a main buildiing is outside the hazard extent.	For sites advanced to detailed assessment, complete site-specific checks of building footprint data to characterize at an individual building level of detail.
	Built Forms (Valuation)	There are two data sources for valuation -- parcel improvement value based on BC assessment data, which applies to all areas outside of first nations reserves, and Canada lands parcel building values, which is used within the boundaries of first nations reserves. In some cases the summary results may include exposed value from both sources as a result of the resolution of the grid summaries.	Conflicting built form exposure values	a consistent dataset applying to the entire province would eliminate this issue. The reducing the sizer of the 100 x 100 m grid cells may also help to limit the impact of this issue at the expense of more computational time required to generate results.
	Critical Facilities	Critical facilities were identified using a rules-based approach (BC Assessment Actual Use Descriptions), spatially represented by a point at the centroid of a given parcel. Given the source of data, facilities critical for reasons related to cultural importance are not included.	Local communities may have facilities critical for function in an emergency that are not identified at the scale of assessment, or that would not be identifiable without local knowledge (e.g. a parking lot containing emergency response resources).	Develop a plan to update and regularly maintain a critical facility inventory based on additional local knowledge of facilities critical for function during an emergency.
	Businesses	Total Annual Revenue data is based on uncertain categorical estimates within commercial data sources. Revenue cited for a given business location is not necessarily related to business activities at that location.	Uncertainly related to business disruption given hazard impact.	
	Environmental Values	Environmental values considered in the assessment (Old Growth Management Areas, Parks and Protected Areas, Fisheries Information Summary System (FISS) locations, and Species and Ecosystems at Risk) have very different vulnerabilities to hazard compared to the built environment.	Hazard thresholds selected for spatial hazard threat analysis are generalized for regional scale application. While spatial relations between hazards and ecosystems will inform subsequent steps of regional assessment, the term "threat" should be used with caution (is not comparable to built environment assets).	Consider additional hazard scenarios and threshold criteria in subsequent stages of assessment tailored more specifically to vulnerabilities within natural ecosystems.
	Linear facilities (road, rail, utilities)	Analysing hazard exposure for linear facilities is highly location-specific and may include mechanisms of damage not well represented by spatial intersection of hazard extent with an asset centerline.	Over-estimation of hazard threat for some hazard types that include a span (e.g. communication or electrical line) between tower locations located to either side of a hazard extent (e.g. flood area). Uncertain estimate of hazard threat for assets requiring distinct approaches for threat analysis (e.g. buried pipelines).	Many linear infrastructure operators in BC operate long-term asset and risk management programs maintained by consultants. Consider engagement with infrastructure operators and their consultants to identify opportunities to share resources, knowledge and tools, to advance shared risk management objectives.
	Municipal assets	Gaps exist for utilities and other asset data that is exclusively managed at a municipal level and not present within provincially compiled sources (ICI Society).	Underestimation of hazard threat for municipally managed assets not present within the database.	Consider municipally managed asset data sources for subsequent steps of local scale assessment

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	Riverine Flooding Tier 1 - Floodplain Identification	Tier 1 floodplain mapping is not of sufficient resolution to consider effects of structural flood mitigation (e.g., dikes). Mapping is limited to watersheds with at least 10 km^2 drainage area.	Under- or overestimation of credible riverine flood threat to valued assets. Watercourses less than 10 km^2 are not included, and may be subject to steep creek hazards (e.g. debris floods and debris flows) not included in hazard threat analysis.	With appropriate subject matter expertise, build on the hazard exposure analysis methods developed by this project with higher resolution flood hazard mapping where available, including additional scenarios and consideration of additional parameters of risk (vulnerability).
	Riverine Flooding Tier 2 - Flood Hazard Mapping	The models have not been calibrated due to limited local data. Modelling results are based on assumed parameters.	Lack of calibration may result in under- or over-estimation of flood hazard level.	After flood hazard events, allocate effort to collect time-sensitive information that is important for future model calibration, such as evidence for high-water marks.
		The models underestimate channel conveyance capacity.	Channel capacity that is larger than shown by the available digital elevation model may result in over-estimation of water levels and extents.	Collect river bathymetry and incorporate in the hydraulic models developed as part of this project.
		BGC developed the models based on current conditions; however, natural processes and human activities could alter the configuration of the study area in the future, potentially affecting the validity of the results.	Mapping results will become out of date as conditions change.	Develop a plan to refine existing mapping as conditions change. Reduce costs by treating hazard mapping as an asset that requires periodic maintenance to avoid becoming so out of date that it requires wholesale replacement.
		The numerical model assumes a fixed bed, excluding the effects of erosion and avulsion, which limits its ability to simulate geomorphological changes.	Lack of ability to consider hazard characteristics affected by a changing river bed, such as through bank erosion or channel avulsion.	Develop a plan to incorporate geomorphic mapping. As with bathymetry, reduce costs by treating additional assessment as part of a plan to refine hazard information (build on previous work).
		Climate change projections are subject to uncertainties due to variability among climate models, future emissions scenarios, and the representation of hydrological processes at regional scales.	Under- or overestimation of credible riverine flood threat to valued assets, as hazard changes in a changing climate.	Develop a plan to revisit climate change assumptions as part of a broader plan to maintain the currency of flood hazard information (along with bathymetry, geomorphology).
	Riverine Flooding	Tier 2 flood hazard maps were developed for select areas. The models were not calibrated due to limited local data and are representative of the terrain at the time of lidar acquistion.	Uncertainty of flood inundation extents. Modelling does not consider changes in the bed condition (degradation or aggradation of the channel bed).	Consider converting Tier 2 mapping areas to detailed floodplain mapping studies (Tier 3) to develop regulatory maps for high hazard areas.
	Landslide Inventory	BGC's hazard inventory is limited to identifying points placed at the initiation of landslide landforms. The accuracy of the landslide inventory depends, in part, on the resolution of the available terrain data. Lidar DEMs provide 1 m or better resolution. The landslide inventory is not exhaustive and has greater uncertainty in areas without lidar coverage.	More detailed assessment is anticipated to identify landslide locations not contained in the current inventory.	Update the landslide inventory as new events occur or when updated studies become available.
		Mapped landslide points do not provide information about their size, current level of activity (i.e., are they moving or have they not moved in decades/centuries/millennia), or the impact zone (runout extent) of past or future events. Landslide inventories also do not provide a comprehensive characterization of the location and probability of future landslide event.	The existence of a landslide indicates previous slope movement but does not necessarily imply current slope movement. Landslide point locations cannot indicate areas susceptible to first-time failure (e.g. where no landslide landform yet exists).	Use the landslide point inventory as a starting point for further hazard characterization as part of more detailed study.
	Landslide Susceptibility	Landslide susceptibility map is based on a model derived from approxiately 700 landslides. The model provides an estimate of landslide susceptibility based on various terrain perameters, which are static (e.g. slope angle, relief, surficial geology). The model is,therefore, also static and does not reflect changing conditions. Moreover, landslide susceptibility is measured as a spatial probability that a given location is within an existing earth landslide and does not provide any indication of activity level or temporal frequency. The model is also limited by the resolution of data inputs.	The landslide susceptibility map is a useful tool for understanding relative spatial distribution of landslide hazards and identifying areas of interest for further assessment. It does not replace more detailed landslide hazard characterization based on higher resolution information that may be available for certain sites.	Conduct further work to validate and improve the landslide susceptibility model--specifically include higher resolution surficial geology data as an input if such data becomes available. Combine landslide susceptibility with regional-scale InSAR analysis to identify areas of high susceptibility which have shown recent movement.
	Landslide Areas of Interest	Landslide areas of interest are intended to identify areas with credible potential for potential landslide initiation. Assessing landslide runout or landslide-affected areas within a setback behind the crest of escarpments was outside the scope of work.	Landslide hazard beyond the base or behind the crest of slopes may exist that was not mapped.	Conduct further work to characterize landslide hazard at the crest and base of escarpment slopes (e.g. in Prince George).
	Alluvial Fan Inventory	BGC's hazard inventory is limited to alluvial fans and is focused on settled areas. Alluvial fans exist in remote undeveloped areas that were not mapped. The presence of a fan indicates past geohazard occurrence, but the lack of a fan on a steep creek does not necessarily rule out the potential for future geohazard occurrence. The fan boundary approximates the extent of sediment deposition since the beginning of fan formation . Geohazards can potentially extend beyond the fan boundary due to localized flooding, where the fan is truncated by a lake or river, in young landscapes where fans are actively forming (e.g., recently deglaciated areas), or where large landslides (e.g., rock avalanches) trigger steep creek events larger than any previously occurring.	The fan inventory completed in this study should not be considered exhaustive. The potential for steep creek geohazards to extend beyond the limit of some mapped fan boundaries cannot be ruled out.	Update steep creek hazard information as new events occur or when updated studies become available.
		The accuracy of fan boundaries depend, in part, on the resolution of the available terrain data. Where available, lidar DEMs provide 1 m or better resolution, compared to 20+ m in areas without lidar. Mapped geohazard boundaries, even where lidar coverage is available, are approximate. The minimum geohazard area that was mapped with the available information is about 20 ha.	Local variations in terrain conditions over areas of 1 to 3 ha, or over distances of less than about 200 m, may not be visible. Future site investigations could alter the extents of the geohazards mapped by BGC. Because greater uncertainty exists when mapping alluvial fan boundareas in areas without lidar coverage, fan boundaries in these areas should be used with caution when making policy, regulatory, and risk management decisions.	In areas without lidar, update steep creek fan boundaries and characteristics once lidar data becomes available.
	Climate change (all hazards)	Quantitative consideration of climate change was limited to Tier 2 flood hazard mapping (via (via adjustments to projected 200-year flows)	Uncertainty of hazard exposure with ongoing climate change.	Consider climate change effects on remaining hazard types as part of more detailed assessment. Update results on a regular basis to maintain currency in a changing climate.