

## APPENDIX A: General Terms and Conditions



*Naturally, A Higher Standard*

ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.  
#2 – 2030 Matrix Crescent, Kelowna, BC., V1V 0G5

Tel: 250.491.7337  
[www.ecoscapeltd.com](http://www.ecoscapeltd.com)

## Terms and Conditions

### General

This agreement shall be binding on the Client and Ecoscape Environmental Consultants Ltd. (Ecoscape) unless the Client provides written notice to Ecoscape within five (5) business days from the date of issuance it rejects any part of this agreement. Ecoscape, may at its sole discretion and at any stage engage sub consultants to perform all or any part of the Services.

### Scope of Work

The scope of work for services has been agreed upon in the proposal and within the Letter of Agency.

### Compensation and Payment Terms

Charges for the Services rendered will be made in accordance with Ecoscape's Schedule of Fees and Disbursements in effect from time to time as the Services are rendered. All Charges will be payable in Canadian Dollars. Invoices will be due and payable by the Client within thirty (30) days of the date of the invoice without hold back. Interest on overdue accounts is 12% per annum.

### Termination

Either party may terminate this engagement without cause upon thirty (30) days' notice in writing. On termination by either party under this paragraph, the Client shall forthwith pay Ecoscape its Charges for the Services performed, including all expenses and other charges incurred by Ecoscape for this Project. If either party breaches this engagement, the non-defaulting party may terminate this engagement after giving seven (7) days' notice to remedy the breach. On termination by Ecoscape under this paragraph, the Client shall forthwith pay to Ecoscape its Charges for the Services performed to the date of termination, including all fees and charges for this Project. On termination by either party, Ecoscape will cancel any application processes that have been initiated with relevant agencies regardless of the status of the application. Reliance on any reports, files, or other information provided by Ecoscape to the client or relevant agencies (Municipal, First Nations, Provincial, or Federal), either under separate Contract or under the terms of our Agency representing the client, cannot be transferred to any other party, including relevant Provincial Agencies, without our express written agreement.

### Professional Standards

In the performance of professional services, Ecoscape will use the degree of care and skill ordinarily exercised, conforming to recognized standards, and upholding professional ethics founded upon integrity, competence, and a responsibility to provide sound management and conservation of biological resources and legislated requirements at all levels of government. Ecoscape reserves the right to report occurrences of rare and endangered species resulting from inventories and incidental observations to the Conservation Data Centre or relevant Municipal, Provincial, or Federal authority. The client shall be responsible for presenting any and all information necessary for Ecoscape to undertake and adhere to professional standards. Ecoscape is not responsible and will bear no liability, whatsoever, for failure to provide or disclose any information, relevant to an application process, the subject property, Client, or otherwise. Further, Ecoscape reserves the right to determine whether information is relevant, and through signature on this agreement, the Client agrees that all relevant information pertaining to the Client, Property, Application Process, or otherwise has been disclosed and provided to Ecoscape in writing. The Client acknowledges that Ecoscape may be required by law to disclose information to regulatory agencies and hereby consents to such disclosure of information provided to relevant regulatory agencies, unless agreed to in writing.

### Environmental, Site Information and Disclosure

The client agrees to fully cooperate with Ecoscape with respect to the provision of all available information on the past, present, and proposed conditions of the site. The Client acknowledges that in order for Ecoscape to properly provide the professional service, Ecoscape is relying upon full disclosure and accuracy of this information. The Client acknowledges that Ecoscape will be required to provide any information requested to relevant agencies as required, and the Client must notify Ecoscape in writing of any information that is considered confidential. Ecoscape will not be responsible or liable for providing requested information to a relevant Municipal, Provincial, or Federal authority that the Client fails to notify Ecoscape in writing is confidential or for the viewing of Ecoscape only. Ecoscape's field investigations and recommendations will not address or evaluate pollution of aquatic resources, water, soil or groundwater unless we are specifically retained to provide such services. Ecoscape will co-operate with the Client's consultant(s) and any relevant regulatory Agencies, whether Municipal, Provincial, during the investigations as required, but reserves the right to amend scope to include such services if required.





*Naturally, A Higher Standard*

ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.  
#2 – 2030 Matrix Crescent, Kelowna, BC., V1V 0G5

Tel: 250.491.7337  
[www.ecoscapeltd.com](http://www.ecoscapeltd.com)

#### Limitation of Liability

Ecoscape shall not be responsible or liable for:

1. the failure of a contractor, retained by the Client, to perform the work required in the Project in accordance with the applicable contract documents or recommendations made in reports or in the field by Ecoscape;
2. the design of or defects in equipment supplied or provided by the Client for incorporation into the Project including any relevant construction drawings or designs, or information provided by any other third party such as a designer or consultant;
3. any Project decisions made by the Client without the advice of Ecoscape or contrary to or inconsistent with Ecoscape's advice;
4. any consequential loss, injury or damages suffered by the Client, including but not limited to loss of use, earnings and business interruption;
5. the unauthorized distribution of any confidential document or report prepared by or on behalf of Ecoscape for the exclusive use of the Client.

The total amount of all claims the Client may have against Ecoscape under this engagement, including but not limited to claims for negligence, negligent misrepresentation and breach of contract, shall be strictly limited to \$5,000.00. Only if specifically agreed to in writing by Ecoscape would this be revised to a specific amount of professional liability insurance Ecoscape may have available at the time such claims are made. In the event that Ecoscape is not carrying professional liability insurance at the time of a claim, the total amount payable would be \$0 under either circumstance.

No claim may be brought against Ecoscape in contract or tort more than two (2) years after the Services were completed or terminated under this engagement.

#### Personal Liability

For the purposes of the limitation of liability provisions contained in the Agreement of the parties herein, the Client expressly agrees that it has entered into this Agreement with Ecoscape, both on its own behalf and or acting as an agent on behalf of another party, its employees and/or principals. The Client expressly agrees that Ecoscape's employees and principals shall have no personal liability to the Client in respect of a claim, whether in contract, tort and/or any other cause of action in law. Accordingly, the Client expressly agrees that it will bring no proceedings and take no action in any court of law against any of Ecoscape's employees or principals in their personal capacity.

#### Third Party Liability

Any reports or information provided by Ecoscape as an agent was prepared by Ecoscape for the account of the Client. The material in it reflects the judgment and opinion of Ecoscape in light of the information available or provided to Ecoscape at the time of preparation. Any use of reports or information provided by Ecoscape to the Client cannot be provided to another party without our expressed, written permission. Any use or reliance upon reports or information provided Ecoscape, for which reliance has not been provided by Ecoscape, is the responsibility of the third party using or relying upon that information and Ecoscape cannot be held responsible or liable for any decisions to be made based on it. Ecoscape accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report or information provided to regulatory authorities in carrying out these services. This report may not be used or relied upon by any other person unless that person is specifically named by us as a beneficiary of the Report. The Client agrees to maintain the confidentiality of the Report and reasonably protect the report from distribution to any other person.

#### Documents

All of the documents or information prepared by Ecoscape or on behalf of Ecoscape in connection with the Project are instruments of service for the execution of the Project. Ecoscape retains the property and copyright in these documents, whether the Project is executed or not. These documents may not be used on any other project without the expressed prior written agreement of Ecoscape.

#### Field Services





*Naturally, A Higher Standard*

ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.  
#2 – 2030 Matrix Crescent, Kelowna, BC., V1V 0G5

Tel: 250.491.7337  
[www.ecoscapeltd.com](http://www.ecoscapeltd.com)

Where applicable, field services recommended for the Project are the minimum necessary, in the sole discretion of Ecoscape, to carry out in general conformity with the intent of the Services. Field investigations may identify additional field requirements that are required to be undertaken prior to completion of this agreement. Ecoscape will not proceed with additional field works without the express written consent of the Client. If Ecoscape recommends additional field visits and the Client advises these works are not to be undertaken, Ecoscape will be required to prepare written documentation addressing field data collection limitations.

#### Dispute Resolution

If requested in writing by either the Client or Ecoscape, the Client and Ecoscape shall attempt to resolve any dispute between them arising out of or in connection with this Agreement by entering into structured non-binding negotiations with the assistance of a mediator on a without prejudice basis. The mediator shall be appointed through agreement by all parties. If a dispute cannot be settled within a period of thirty (30) calendar days with the mediator, the dispute shall be referred to and finally resolved by an arbitrator appointed by agreement of all of the parties.

#### Agreement

This agreement is binding and will ensure to the benefit of the Client and Ecoscape. These conditions form a part of the proposal, with the same effect as if set forth therein. Verbal and email approvals to proceed with work outlined above are subject to the same conditions as this contract.



## APPENDIX B: Figures

## APPENDIX C: Legend for Terrain Mapping

Texture (Attribute Table Headings: TTEX\_XX and STTEX\_XX)

|   |                   |  |
|---|-------------------|--|
| c | clay              | < 2 µm   |
| z | silt              | 2 - 62.5 µm  |
| s | sand              | 62.5 µm - 2 mm   |
| p | pebbles           | 2 - 64 mm; rounded particles   |
| k | cobbles           | 64 - 256 mm; rounded particles                                       |
| b | boulders          | > 256 mm; rounded particles  |
| a | blocks            | > 256 mm; angular particles  |
| d | mixed fragments   | subrounded and subangular particles of all sizes                     |
| x | angular fragments | mixture of rubble (r) and blocks (a)                                 |
| g | gravel            | mixture of pebbles (p), cobbles (k), boulders (b) and up to 20% sand |
| r | rubble            | angular particles < 64 mm  |
| m | mud               | mixture of sand (s) and silt (z)                                     |
| y | -                 | shells or shell fragments  |
| e | fibric            | well preserved fibre; 40% fibre identified after rubbing             |
| u | mesic             | intermediate decomposition between fibric and humic                  |
| h | humic             | decomposed organic material; 10% fibre identified after rubbing.     |

*Surficial Material* (Attribute Table Headings: SURFM\_X and SSURFM\_X)

|    |                            |  |
|----|----------------------------|--|
| A  | Anthropogenic materials    | Artificial materials and materials modified by human actions such that their original physical appearance and properties have been drastically altered.  |
| C  | Colluvium                  | Products of gravitational slope movements; materials derived from local bedrock and major deposits derived from drift; includes talus and landslide deposits. Includes up to 20% bedrock.  |
| D  | Weathered bedrock          | Bedrock modified <i>in situ</i> by mechanical and chemical weathering.   |
| E  | Eolian sediments           | Sand and silt transported and deposited by wind; includes loess.   |
| F  | Fluvial sediments          | Sands and gravels transported and deposited by streams and rivers; floodplains, terraces and alluvial fans.  |
| FA | "Active" fluvial sediments | Active deposition zone on modern floodplains and fans; active channel zone. Where "A" is entered in SURFM_QX or SSURFM_QX  |
| FG | Glaciofluvial sediments    | Sands and gravels transported and deposited by meltwater streams; includes kames, eskers and outwash plains.   |
| L  | Lacustrine sediments       | Fine sand, silt and clay deposited in lakes.   |
| LG | Glaciolacustrine sediments | Fine sand, silt and clay deposited in ice-dammed lakes.  |
| M  | Till                       | Material deposited by glaciers without modification by flowing water. Typically consists of a mixture of pebbles, cobbles and boulders in a matrix of sand, silt and clay; diamicton. Includes up to 20% bedrock and/or colluvium. |
| N  | Non-classified             | Non-classified, for example, lake  |
| O  | Organic materials          | Material resulting from the accumulation of decaying vegetative matter; includes peat and organic soils.   |
| R  | Bedrock                    | Outcrops and bedrock within a few centimetres of the surface. Includes up to 20% colluvium.  |
| U  | Undifferentiated materials | Different surficial materials in such close proximity that they cannot be separated at the scale of the mapping.   |



*Surface Expression* (Attribute Table Headings: SURF\_XXX and SSURFM\_XXX)

|   |                        |   |
|---|------------------------|---|
| a | moderate slope(s)      | predominantly planar slopes; 15-26° (28 - 49%)  |
| b | blanket                | material >1-2 m thick with topography derived from underlying bedrock (which may not be mapped) or surficial material   |
| c | cone                   | a fan-shaped surface that is a sector of a cone; slopes 15° (27%) and steeper   |
| d | depression             | enclosed depressions  |
| f | fan                    | a fan-shaped surface that is a sector of a cone; slopes 3-15° (5-27%)   |
| h | hummocky               | steep-sided hillocks and hollows; many slopes 15° (27%) and steeper   |
| j | gentle slope(s)        | predominantly planar slopes; 4-15° (6 - 27%)  |
| k | moderately steep slope | predominantly planar slopes; 26-35° (50 - 70%)  |
| m | rolling topography     | linear rises and depressions; < 15° (27%)   |
| p | plain                  | 0-3° (0-5%)   |
| r | ridges                 | linear rises and depressions with many slopes 15° and steeper   |
| s | steep slope(s)         | slopes steeper than 35° (> 70%)   |
| t | terrace(s)             | stepped topography and benchlands   |
| u | undulating topography  | hillocks and hollows; slopes predominantly <15°   |
| v | veneer                 | material <1-2 m thick with topography derived from underlying bedrock (may not be mapped) or surficial materials; may include outcrops of underlying material |
| w | mantle                 | surficial material of variable thickness  |
| x | thin veneer            | a subset of v (veneer), where there is a dominance of surficial materials about 10-25 centimetres thick   |

*Geomorphological Processes* (Attribute Table Headings: GEOP\_X)

|   |                            |  |
|---|----------------------------|--|
| E | Glacial meltwater channels | Areas crossed by meltwater channels that are too small or too numerous to map individually.                    |
| F | Failing                    | Slope experiencing slow mass movement, such as sliding or slumping   |
| H | Kettled                    | Depressions due to the melting of buried glacier ice.  |
| G | Ground disturbance         | Anthropogenic excavations where the remaining exposed surface has remained undisturbed and is <i>in situ</i> . |
| L | Surface seepage            | Zones of active seepage often found along the base of slope positions.   |
| P | Piping                     | Sub-surface erosion and removal of surficial materials by flowing water to create subsurface tubular channels. |
| R | Rapid mass movement        | Slope or parts of slope affected by processes such as debris flows, debris slides and avalanches, and rockfall |
| V | Gullying                   | Slope affected by gully erosion.   |

*Geomorphological Process Subclass (Attribute Table Headings: GEOP\_SCMXX)*

|     |                                       |
|-----|---------------------------------------|
| -^F | slow mass movement - initiation zone  |
| -Fe | earthflow                             |
| -Fk | tension cracks                        |
| -Fm | slump in bedrock                      |
| -Fg | rock creep                            |
| -Fu | slump in surficial material           |
| -Fp | lateral spread (sackung)              |
| -Fx | slump-earthflow                       |
| -R  | rapid mass movement                   |
| -^R | rapid mass movement - initiation zone |
| -Rb | rock fall                             |
| -Rd | debris flow                           |
| -Rs | debris slide                          |
| -Rr | rock slide                            |
| -Ru | slump in surficial material           |

*Soil Drainage Class* (Attribute Table Headings: DRAIN\_X)

|  |                         |  |
|--|-------------------------|--|
| x  | Very rapidly drained    | Water is removed from the soil very rapidly in relation to supply  |
| r  | rapidly drained         | water is removed from the soil rapidly in relation to supply   |
| w  | well drained            | water is removed from the soil readily but not rapidly   |
| m  | moderately well drained | water is removed from the soil somewhat slowly in relation to supply   |
| i  | imperfectly drained     | water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season         |
| p  | poorly drained          | water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soil is not frozen       |
| v  | very poorly drained     | water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time the soil is not frozen |
| <p>Where two drainage classes are shown:</p> <p>-if the symbols are separated by a comma, e.g., "w,i", then no intermediate classes are present.</p> <p>-if the symbols are separated by a dash, e.g., "w-i", then all intermediate classes are present.</p> |                         |  |

## APPENDIX D: Description of Surficial Materials

## ANTHROPOGENIC (A)

Anthropogenic materials are deposits that are sufficiently reworked or redistributed by human activities that their original character is lost. Examples include gravel pits and fill used for roads and other construction.

## COLLUVIUM (C)

Colluvium has accumulated during post-glacial times as a result of gravity-induced slope movement, for example, rock fall and soil creep. The physical characteristics of colluvium are closely related to its source and mode of accumulation. Four processes generally create colluvial deposits; (1) rockfall from bedrock bluffs, (2) soil creep in weathered bedrock, (3) mass movement processes in surficial materials (debris flows and debris slides), and (4) rockslides, rock slumps and earthflows.

Rockfall from bedrock bluffs typically forms talus slopes (Ck). Talus is loosely packed rubble or blocks with little interstitial silt and sand near the surface and is rapidly drained.

Colluvial veneers (Cv) and blankets (Cb) develop where weathered bedrock or surficial materials has been loosened and moved downslope by gravitational processes such as soil creep. It is loosely packed and usually rapidly drained. Colluvial veneers and very thin veneers are most common on upper, moderately steep and steep gradient slopes and as discontinuous, very thin veneers on bedrock-controlled terrain in the watershed. The matrix texture of the colluvium reflects the bedrock or surficial materials it is derived from.

Colluvial fans (Cf) and cones (Cc) form at the base of steep gullies due to deposition by debris flows (-Rd). These deposits are generally compact, and sorting may range from poorly sorted to well sorted. The deposit may or may not be matrix supported, and the matrix is usually sand.

Deep-seated slumps and earthflows in bedrock and surficial materials result in hummocky, irregular colluvial deposits (Chu). Rock slumps contain blocks and rubble with little or no interstitial silt and sand.

## WEATHERED BEDROCK (D)

Weathered bedrock has been modified in situ by mechanical and chemical weathering. In the assessment area, weathered bedrock is found as a discontinuous very thin veneer (Dx) overlying gently sloping or undulating bedrock outcrops. It typically contains a high proportion of angular coarse fragments with varying amounts of interstitial silty sand. It is non-cohesive and rapidly to very rapidly drained.

## FLUVIAL MATERIALS (F)

Streams have deposited fluvial gravels in post-glacial time. These sediments are loose, non-cohesive and highly porous and permeable. Associated landforms, such as floodplains (Fp, FAp) and parts of fans that are close to stream-level, have high water tables and are moderately to imperfectly drained. Floodplains are subject to periodic inundation during high flows. Fluvial terraces (Ft) stand above present-day creek-levels, are relatively well drained and dry.

## GLACIOFLUVIAL MATERIALS (FG)

Glaciofluvial materials were deposited by glacial meltwater streams near the end of the most recent glaciation. Sands and gravels accumulated along ice margins and on top of melting ice (FGu) (ice contact deposits), and downstream of glaciers (FGp) (outwash plains). Where outwash streams flowed onto flat ground, fans (FGf) were formed. Where outwash streams drained into former lakes, deltas (FGf and FGp) were created. Post-glacial streams have incised into some outwash plains and fans transforming them into terraces (FGt) and scarps (FGk).

Glaciofluvial materials consist of sand and gravel with small quantities of finer material and are potential sources of aggregate. Sorting and bedding characteristics are variable depending on the mode and site of deposition. Gravels range from unsorted to well-sorted and bedding can range from absent to well-defined. Glaciofluvial deposits are loose (uncompacted) and clasts tend to be more subrounded than subangular. Ice-contact deposits may have distorted bedding, slump structures and faults as a result of settling and collapse due to the melting of supporting ice. Ice contact deposits may also contain lenses of fine-textured glaciolacustrine sediments and coarse-textured ablation till. Beds in raised deltas are inclined up to 40% and indicate the frontal slopes of depositional landforms.

## LACUSTRINE MATERIALS (L)

Lacustrine materials were deposited from standing bodies of water. Fine sand, silt, or clay that have been suspended in the water settle to the lake bed creating sediments that are commonly stratified and fine textured. These sediments may be exposed when the lake is drained.

## GLACIOLACUSTRINE MATERIALS (LG)

Glaciolacustrine materials have been deposited in glacial or ice-dammed lakes that were present during and shortly after glaciation. Glaciolacustrine materials generally consist of well to moderately well stratified fine sand, silt and/or clay with occasional lenses of till or glaciofluvial material. Glaciolacustrine materials are generally only slowly permeable, and so the presence of even a thin layer of this material is sufficient to cause impeded drainage, perched water tables, and surface seepage. These conditions may promote instability in some situations. These fine-textured materials are also susceptible to surface erosion by running water.

## TILL (M)

Till is deposited directly by glacier ice and usually exists as a veneer (Mv), blanket (Mb), or mantle of variable thickness (Mw) over the underlying bedrock surface. It typically consists of a fine-grained matrix (particles <2 mm) that surrounds and supports clasts (particles >2 mm) of a variety of sizes, shapes and rock types. Till characteristics, such as texture (particle sizes) and consolidation (or bulk density), vary according to specific processes of deposition by glacier ice (e.g., subglacial vs. supraglacial tills). These deposits can be highly variable and gradations in texture and consolidation can vary over short distances. Over the last 12,000 years, the upper half metre to one metre of these deposits have been weathered by pedogenic processes creating loose, permeable soils. The lower slopes are typically Brunisols and the upper slopes are generally Podzols.

Basal till (subglacial till) is deposited at the base of a glacier creating highly consolidated material. As a result, basal till has a relatively low permeability and commonly acts like an impermeable layer. It tends to be the strongest of all surficial materials. Ablation till has melted-out in situ from stagnant ice and is unconsolidated.

## ORGANIC MATERIALS (O)

Organic materials form where decaying plant material accumulates in poorly or very poorly drained areas. Organic materials typically fill depressions in impermeable materials, such as, till and bedrock.

## BEDROCK (R)

Bedrock is mapped where it outcrops at the surface. Polygons mapped with thin or very thin material (Cv, Dx, Mv, Mx), may also have a small proportion of bedrock outcrops.

## UNDIFFERENTIATED MATERIAL (U)

This material type is used to describe material that is too complex to be represented by the usual terrain symbols. Undifferentiated material is a layered sequence of surficial materials that have been exposed on an erosional slope. There is usually a sequence of three or more layers.



## APPENDIX E: Description of Geomorphological Processes

#### GULLY EROSION (-V)

Gullies are small ravines with V-shaped cross sections that can form in either glacial drift or bedrock. Gully erosion has been mapped in two kinds of terrain: (i) slopes with several parallel shallow gullies in drift materials (dissected slope) and (ii) single gullies where streams have exploited joints in bedrock or have cut down into thick drift. Gullied terrain is an indicator of either former or active erosion, and the symbol serves to identify material that is potentially subject to erosion or mass movement (e.g., Uk-V). Gully sideslopes and steep headwalls are common sites of slope failures and are classed as potential unstable (Class P) where there is no evidence of instability and unstable (Class U) where there is evidence of instability or where there is a high likelihood of landslide initiation following development.

#### CHANNELED BY MELTWATER (-E)

Meltwater channels form alongside, beneath, or in front of a glacier or ice sheet. Glacial meltwater channels are typically sinuous in plan, flat-floored, and steep-sided in cross-section. The floors of the meltwater channel may contain glaciofluvial sediments, indicative of the water flow that once took place here.

#### GROUND DISTURBANCE (-G)

Ground disturbance refers to anthropogenic excavations where the remaining exposed surface has remained undisturbed and is *in situ*; for example, the cutslopes in gravel pits, housing developments, and road cuts.

#### KETTLED (-H)

Kettled topography consists of hummocky undulating terrain, which developed when blocks of glacial ice buried by or surrounded by glaciofluvial gravels and ablation till melted.

#### ABUNDANT SEEPAGE (-L)

Seepage is mapped where relatively wet soils are widespread in a polygon. This commonly occurs where soils are on slowly permeable materials such as till, where thin surficial materials overlie bedrock, and on lower slopes where shallow subsurface water is received from a relatively large catchment area further upslope. They may also occur where groundwater is concentrated at the surface by a physical conduit such as a geological fault.

#### ROCK FALL (-R<sup>b</sup>), DEBRIS SLIDES (-R<sup>s</sup>) and DEBRIS FLOWS (-R<sup>d</sup>)

Rapid mass movement refers to downslope movement by falling, rolling or sliding of debris derived from surficial material and/or bedrock. Where a hat symbol (^) is used with a mass movement process (e.g., -R<sup>s</sup>), slope failure has initiated within the polygon. Mass movement symbols without the double prime symbol (e.g., -R<sup>b</sup>) indicate a polygon that contains the transport or deposition zone of rapid mass movement. Transportation zones are generally not recognized

as areas where landslides initiate; they may contribute additional volume of transported material to a failure. Transport and deposition zones represent hazardous areas downslope of slides or rockfall.

Debris flows (-Rd) initiate in steep gullies and debris slides (-Rs) initiate on steep hillsides. They occur when a mass of surficial material slides rapidly downslope often as a result of the loss of soil strength due to high pore water pressure. Debris slides (non-channelized movement of debris) and debris flows (channelized movement of debris) are initiated on steep slopes where material slides along a shear plane. The shear plane often coincides with the boundary between more permeable and less permeable material (e.g. between weathered and unweathered material or between surficial material and bedrock). Debris flows and debris slides are triggered by heavy rain, water from snow melt, and/or rain on snow events, and result from loss of soil strength due to high pore water pressure. During wet conditions, slides are also triggered by wind stress on trees, tree throw, impact of falling rocks from up slope, and vibrations due to earthquakes or human activity. In logged areas, debris slides that occur several years after tree removal can be due to the loss of soil strength that results from root decay. Diverted drainage from roads commonly trigger failure of sidecast material and may initiate landslides some distance downslope. A debris flow may move downslope for several hundred metres or more before it is arrested by gentler terrain or by de-watering, or it may enter a trunk stream. Debris flows are effective agents of erosion, commonly increasing the volume of material as it progresses downslope. Debris slides and debris flows are significant potential sources of stream sediment and a hazard to activities or structures (roads, culverts) located in runout zones.

#### ROCKFALL (-R<sup>b</sup>)

Rockfall (-Rb, -R<sup>b</sup>) occurs when either a single block or a mass of bedrock falls, bounces and rolls downslope. In the assessment area, rockfall from local outcrops creates talus slopes, colluvial veneers and blankets.

#### SLUMP IN SURFICIAL MATERIAL (-F<sup>u</sup>, -R<sup>u</sup>)

Slow mass movement refers to slope failures where movement occurs slowly or where the displaced material moves only a short distance downslope. The hat symbol (^) indicates the initiation zone of slow mass movement, and when the hat symbol is absent from the geomorphological symbol, this indicates the runout and deposition zone.

Slumps in surficial materials (-Fu) consist of deep-seated, rotational failures along a zone of weakness within thick deposits. Slumping in fine-grained sediments, such as, glaciolacustrine materials are common. Where the slump occurred rapidly the symbol (-Ru) was used.

### SLUMP IN BEDROCK (-F<sup>m</sup>)

A slump in bedrock refers to a rotational slump where portions of the slide mass remain internally cohesive. Rotational slumps develop due to failure along vertical joints and horizontal weak layers.

### TENSION CRACKS (-F<sup>k</sup>) AND LATERAL SPREAD (-F<sup>p</sup>)

Tension cracks are open fissures and lateral spread (sackung) in bedrock that appear as structural lineations (trough oriented roughly parallel to the contour). These deep-seated features are commonly located near ridge tops. They indicate slow slope spreading, and may be the precursor to potentially catastrophic slope failure.

### EARTHFLOW (-F<sup>e</sup>) AND SLUMP-EARTHFLOW (F<sup>x</sup>)

A mass of earth moved by flowing and is bounded by a shear plane. The material usually contains greater than 50% clay content and are slow moving. A slump-earthflow (-F<sub>x</sub>) is a combined slump (upper part) and earthflow (lower part).

## APPENDIX F: 2021 Update of the Central Okanagan SEI Project Team

# 2021 Update of Central Okanagan SEI

## Stakeholder Working Group

Regional District of Central Okanagan: Jing Niu, Brittany Nichols, Todd Cashin, Dave Orlando, Karen Kahtava  
City of Kelowna: Tracy Guidi, Jennifer Miles, Cheryl Trent, Kevin Stehle, Danielle Noble-Brandt, Dean Strachan, Chris Ray  
District of Lake Country: Jared Kassel, Brian Zurek, Mark Laudon  
Okanagan Indian Band: Patrick Riley, Sherry Louis  
District of Peachland: Darin Schaal, Sheri Sweet  
Westbank First Nation: Graeme Dimmick, Kary Fell  
City of West Kelowna: Cam Graham, Brent Magnan  
Province of BC: Jamie Leathem, Deepa Filatow, Jackie Churchill, Kristi Iverson, Michael Ryan, Robyn Reudink  
Okanagan Conservation Collaborative Program: Scott Boswell

## Technical Advisory Committee

Planning & Landuse: Tracy Guidi, Jennifer Miles, Jing Niu  
SEI and Provincial Methodology and Data Standards: Deepa Filatow, Jackie Churchill, Kristi Iverson, Michael Ryan

## Consulting Team

### **Ecoscape Environmental Consultants Ltd.**

Mary Ann Olson-Russello, Kyle Hawes, Dan Austin, Shane Pedersen, Fabian Cid Yanez, Luke Crevier

### **Polar Geoscience Ltd.**

Polly Uunila