

Appendix G

Hillside Development Permit Guidelines

Adapted with Permission from:
City of Vernon and City of Kelowna

By: New Town Planning Services Inc.

HILLSIDE DEVELOPMENT PERMIT GUIDELINES

1.0 GOALS OF HILLSIDE DEVELOPMENT PERMIT (HDP) GUIDELINES

New developments on steep slopes are encouraged to:

- complement the scenic hillside charter of Peachland;
- protect wildlife habitat, corridors and Environmentally Sensitive Areas (ESA1);
- integrate unique or special natural features of the site such as landforms, rock outcroppings, talus slopes, water features, hilltops, and ridgelines;
- avoid unstable or hazardous portions of the site and protect lives and property from hazardous conditions, such as rock falls or storm runoff, erosion, etc.;
- provide safe access for residents, visitors, and service providers;
- support economic and efficient construction and infrastructure maintenance standards.

1.1 HILLSIDE DEVELOPMENT PERMIT AREA

The Local Government Act allows Development Permit Areas to be created for the purposes of:

- a. protecting the natural environment, its ecosystems and biodiversity;
- b. protecting development from hazardous conditions; and
- c. establishing objectives for the form and character of commercial, industrial or multi-family residential development.

Principles and objectives of the guidelines will be applied during subdivision review and approval of developments in accordance with the SDSB # 3843.

1.2 HILLSIDE DEVELOPMENT PERMIT AREA OBJECTIVES

In order to facilitate innovation and flexibility in hillside design, the overarching objectives of the HDP Guidelines serve as the criteria for the review and approval of proposals. The objectives can be separated into four major categories: Site and Subdivision Design, Works and Services, Buildings and Structures and Natural Environment.

SITE AND SUBDIVISION DESIGN

- a. Identify and incorporate significant site features in subdivision and development design. Proposed development layout and the typical building site design must acknowledge these natural features. This is required to:
 - develop an understanding of the environmental and geological conditions of the site prior to any construction to ensure that the most appropriate methods are used to develop the site; and
 - preserve and protect unique natural features.

- b. Undertake subdivision planning and design that respects the existing natural area's terrain, hazardous conditions, and the area's natural character. This is required to:
- enable subdivision planning and design that allows as much ESA1 protection as is possible;
 - direct more development density to the less sensitive and flatter sections of a site, thereby creating clusters of development;
 - direct development to appropriate areas with slopes averaging less than 30%. Where it can be demonstrated that the proposed development will be sensitively integrated with the natural environment and will present no hazards to persons or property. Development may be permitted on land with a natural slope that averages greater than 30%. Natural vegetation should be retained on slopes in order to control potential erosion, land slip and rock falls; and
 - minimize the impact of grading and retain as much of the natural and topographic character of the site so natural vegetation and other features remain undisturbed in order to protect vital ecological values and maintain slope stability.

WORKS AND SERVICES

- c. Implement methods for collection, conveyance, control and treatment of stormwater that mitigates potential impacts and emulates the area's natural water cycle. This is required to:
- limit runoff from new development based on the soil capacity and sensitivity for ground recharge and overland conveyance.
- d. Integrate onsite design that compliments the streetscape design. This is required to:
- ensure works and services are suited to the development proposed and support the streetscape required.
- e. Provide municipal services and utilities on steep slope developments that minimize redundancy and provide cost efficient maintenance and future replacement. This is required to:
- ensure that development on steep slopes does not result in financially unsustainable increases in infrastructure relative to the number of units created; and
 - ensure comprehensive design of water and sewer system based on ultimate land use and topography, both onsite and beyond, regardless of ownership or other imposed boundaries. The service life of proposed infrastructure must be considered when examining the limitations of required works.
- f. Provide safe and functional access to individual properties and homes throughout the year. This is required to:
- ensure driveway access design is incorporated into the overall development design in order to restrict steep driveways that may be unsafe in winter conditions; and
 - ensure lot layout provides for the unique nature of hillsides and onsite parking that does not restrict access to the garage.

BUILDING AND STRUCTURES

- g. Hillside Development Guidelines shall recognize the unique nature of hillsides and govern onsite coverage and setback issues necessary to provide liveable neighbourhoods. A Hillside Development Permit area is required to provide for greater flexibility in determining minimum lot size and locating a building on a steep slope lot. This is required to:
- provide flexible front and side yard setbacks that reduce the amount of cutting and filling required, and support level entry and good street presence; and
 - provide a less “imposing” character on surrounding developments.

NATURAL ENVIRONMENT

- h. Complete an Environmental Development Permit prior to any site works or design being initiated. This is required to:
- ensure development site design and construction protects ESA-1 as much as is practical.
- i. Minimize slope alterations and retain the natural terrain and topography of the site. This is required to:
- minimize disturbance to natural vegetation, maintain ecosystem integrity, and protect natural buffers between development clusters with removals based on an intimate knowledge of the site in accordance with the information required.
- j. Plant vegetation that helps mitigate the impact of development, enhances visual quality and addresses the needs of residents. This is required to:
- ensure the use of indigenous local plants and tree species that can provide food and shelter for local wildlife, cost less to maintain, and are drought tolerant and fire resistant.

1.3 DEVELOPMENT APPROVAL INFORMATION

A HDP is required as part of a rezoning application and/or subdivision approval process. The Director of Planning and the Director of Engineering Services can be delegated the authority, at the discretion of Council, to vary the information required on a site-specific basis. The following is a listing of some information that maybe required for inclusion in a Hillside Development Permit:

- general site survey including topographic and land features;
- geotechnical evaluation;
- Environmental Development Permit;
- proposed grading plan;
- tree and vegetation plan;
- drainage management plan;
- erosion control plan; and
- a life cycle analysis of the proposed works including cost estimates for all infrastructure materials and installation.

2.0 CLUSTERING OF DEVELOPMENT

Clustering of development locates groupings of residential units on a portion of a development parcel rather than uniformly covering the entire site with units. Clustering allows for large portions of the original development parcel to be retained in its undisturbed natural state. For this form of development to be financially practical, reduced lot sizes or a greater variety of building forms are necessary to ensure no net loss of units compared to conventional subdivisions. Larger single family residences are to be a part of this but not to the extent of limiting the diversity of housing forms and prices available. To ensure that clustering of units provides the open space desired:

- there is no significant change in the number of units permitted under a conventional zoning; and
- the remaining land is devoted to protected open space.

Clustering of development can provide flexibility by including a variety of housing forms and tenure options such as:

- small and larger lot detached housing (reduced yard setbacks);
- zero-lot line development (the equivalent of duplexes and townhouses but with each unit owned in fee simple);
- multiply family development (e.g., duplex, triplex, four-plex, townhouse apartment); and
- strata development (any of the above where common areas are collectively owned by two or more residents).

2.1 BUILDABLE SITE

Every lot created by subdivision shall have sufficient building area for the use intended. The proposed housing form and engineered platform depth necessary to achieve this is dependent on the existing slope and depth to rock. Development on all slopes must be designed to ensure that the toe of slope of the building platform is retained within each lot created based on geotechnical and structural design limits.

The creation of large, level, front or rear yards is not supported, nor is the creation of uniform lot depths that do not respect the undulating nature of the hillsides. Retaining walls not exceeding 2.4m in height may be used to retain topsoil slopes or provide retention of native undisturbed areas.

2.2 OPEN SPACE

Open space is natural undisturbed area that may be privately owned, jointly owned and managed, or designated as public park. This land is permanently protected from development. Minor disturbances can be made as part of a fire protection area or for modest park amenities such as trails created in keeping with the intent of maintaining the space as natural and undisturbed.

3.0 GUIDELINES

The following guidelines will apply in Hillside Development Permit Areas.

3.1 SITE AND SUBDIVISION DESIGN

Subdivision and site design on steep slopes is expected to respond to the unique characteristics of each site and avoid significant disruption of the natural terrain. Along with respecting the natural hillside, projects must provide a desirable form and character necessary for marketability. For planning new developments on steep slopes, the following principles should be considered:

- clustering development using higher and mixed densities can be more appropriate to protect steeper or more environmentally or geotechnically sensitive parts of the hillside; and
- larger, irregular shaped lot sizes may be considered as a means of utilizing areas where road frontage is limited, provided undisturbed areas are protected on the lot by a covenant on title.

3.1.1 Assessing the Site

Objective: To identify significant features prior to developing the subdivision layout, road, and site building design in order to acknowledge the hillside character and retain natural features of the site.

Guidelines: To ensure the proposed design for development minimizes the overall development footprint on the site. The site assessment for design purposes must look for:

- a. Natural site characteristics that can be incorporated and accentuated in the design in a manner that respects the slope and special features.
- b. Soil and rock characteristics and depths that can enable re-use for construction as well as their stability and natural angle of repose to ensure site safety and limit future erosion.
- c. ESA1 and adjacent areas that can accentuate as part of the development's character and identity.
- d. Locations to cluster development and increase densities that will minimize cuts and fills required.
- e. Interaction of the flora and fauna on a site and means that development can maintain or improve the natural habitat for significant species in the area.
- f. Natural storm water recharge areas, storm water and groundwater routes that can be utilized in the site design.
- g. Stability of the existing soils and ground cover to withstand overland flows; and peak flow rates they can withstand to limit concentrations of water that can cause erosion.
- h. Visibility of a site from a distance can have a significant impact of public perception of the area and impact future sales. Effort spent in avoiding negative visual impacts and mitigating unpreventable visual impacts will decrease the time required for the site to mature and blend into the hillside.

3.1.2 Planning the Development

Objective: To undertake HDP planning and design that respects the existing natural area's terrain, hazardous conditions, and ensures that the form and character of the development enhances the natural settings.

Guidelines: In general, the guidelines support the use of clustering of development and increases in density through mixed zone use. A combination of these two types of development is necessary on steep slopes in order to provide appropriate building sites while retaining natural features and hillside character.

a. Single Family Subdivision Development

A plan for a proposed open space development shall show how it meets the following criteria:

- Higher density, smaller sized lots are encouraged. Where the minimum lot size cannot be achieved on lands with slopes less than 30%, a larger lot size may be considered, provided site disturbance is minimized and a covenant is registered on title that preserves natural areas.
- Each single-family parcel created by subdivision must have a buildable site or pad area, which suits the proposed house size for that zone. Hillside zones setbacks are based on the front and side yard property lines, as access to the site is dependent on the road grading. The pad area must be prepared as part of the site grading and land development such that additional earth moving or blasting is not required to construct the house. The subdivision grading plan must include sections through each lot which clearly show building envelopes, including the top of cut and toe of slope, as well as the top of cut of down slope development.
- Use lot sizes and building setbacks in a flexible manner to protect slopes and natural features from development encroachments.
- Show native slope, depth of topsoil, depth to rock, proposed setbacks, driveway grades and building pads on grading and subdivision development plans.

The undeveloped portion of the parcel shall be designated and secured as protected natural space and shall not be further subdivided.

b. Mixed Single and Multi Family Development

Mixed single and higher density zone development should be used as an alternative to single-family lot subdivision where topography restricts creation of adequately sized single family clusters that will provide sustainable tax base. In addition to the guidelines for Single Family Development the following criteria must be met for Mixed Development:

- Reduction of site manipulation and preservation of more of the natural character of the hillside than a standard single-family subdivision.
- Increase of undeveloped area adjacent to designated Environmentally Sensitive Areas (ESA-1) on the property.
- Increase of the open space provides a natural corridor through or around the property, or connects to other open spaces in the area.
- Use of open space to buffer higher density development from neighbouring single-family development.

- Building forms for higher density development matches that of single family to create a consistent quality that enhances the neighbourhood.
 - Mixed development should be in the form of smaller single-family lots, duplexes, triplexes, four-plexes, patio homes, small-scale townhouse complexes or lower scale apartments.
 - The location and size of open space to be retained, the availability of undeveloped buffers to neighbouring properties, and the nature of surrounding development must be considered when deciding the appropriate mix of building forms. Accesses shall meet the requirements of the Fire Department for fire protection. Access to the proposed building site must be rough graded from the road to the building site as part of lot grading and subdivision development.
- c. Trails and Open Space
- Retain open space and corridors between development cells or lots to provide continuous habitat linkages within the development site, as well as with neighbouring sites.
 - Use trails or linear systems that complement or take the place of typical required streetscape pedestrian facilities, and provide horizontal loops linking cul-de-sacs and open spaces which are not otherwise linked due to topographic or other constraints. An open space, streetscape and trail system shall be developed to provide pedestrian access within the hillside area and to/from key destinations in other parts of the community (i.e. bus stops, parks, other trails, etc).
 - Avoid extensive slope grading to accommodate parks and trails. Create a range of trail types based on natural topography and environmental concerns. Trail ratings and signage-based trail grade and width are required to ensure safe use of the various trails provided.
 - Establish “pocket” parks that direct the public to unique view opportunities or provide respite on trails where natural terrain permits. Trails to pocket parks will be considered as Public Park.
 - Incorporate significant features such as rock outcrops, streams, cliffs, ravines and stands of trees into the open space/trail system ensuring that public safety and the environmental sensitivity of these features are not compromised.

3.1.3 Earthworks & Grading

Objective: To minimize the impact of grading and retain the natural and topographic character of the site as much as is practical.

Guidelines:

- a. Grading
- In preparation of a grading plan that demonstrates the feasibility for roads and building envelope without massive manipulation of the site, the following must be considered:
- Avoid, as much as is practical, grading or alteration of key topographic features (i.e. knolls, ridgelines, talus slopes, bedrock outcrops, cliffs, ravines, etc.).

- Avoid a straight, linear top of slope. Use radii and undulations that resemble pre-development slope conditions. Avoid sharp cuts and long or wide slopes with a uniform grade.
- Round out slope transitions and blend transition between lots or adjacent to undisturbed areas.
- Building pad area depth is dependant on grade and must be created as part of the lot grading such that structural retaining walls or extensive cut and fill are minimized. These building pads are to be set at the design lower floor elevation.

b. Cut and Fill

In designing and developing the site, minimize the total amount of cut and/or fill and its environmental and visual impact by:

- Disposing of excess topsoil onsite by increasing the depth of topsoil fill used.
- Disposing of other excess material at appropriate off-site locations where necessary.
- Re-vegetating exposed slopes as quickly as possible to prevent erosion and slope stability problems, even for temporary topsoil stockpiles.

c. Earthworks

In preparing an erosion plan natural and manmade factors that cause erosion must be considered and erosion minimized by:

- Avoiding potentially hazardous or unstable areas of the site.
- Phasing clearing and removal of trees and vegetation based on imminent development construction phases. Plan site earthworks to coincide with the seasons by having all topsoil and other fine material relocation completed outside of the summer months.
- Not exposing large areas of highly visible sub-soil and parent material of the site.
- Timing the project to take advantage of the late fall, winter, and early spring conditions for topsoil stripping, hauling and placement avoiding this work in the hot, dry, windy summer conditions. Where works are adjacent to or potentially impacting existing development and grading of the site in summer is necessary, temporary irrigation suited to the project size is required.

d. Rock Cut Faces

Where a rock cut is unavoidable as a part of the development design, the following must be considered regarding the resulting exposed rock face:

- Review of the rock by a qualified Geotechnical engineer is required to provide direction for the blasting techniques to be used. The professional must also inspect the rock face upon completion of works and verify the stability of the face and that there is no danger to public safety. For widening of existing roads, or rock cuts less than 2m high TAC manual minimum rock catchment design may be utilized where the rock is competent and failure is not a potential concern.
- Wire mesh, shot-crete and other forms of mechanical stabilization are not permitted and additional blasting will be required to provide a stable rock face rather than permitting these.

- Long-term public safety and maintenance must be considered prior to any rock cut, and the blasting design must maximize the rock face integrity at the final cut face location providing a stable rock face.
 - Design for the minimum required rock catchment ditching must also be included and be based on the characteristics of the rock. Catchment ditches must be accessible for regular maintenance.
- e. Retaining Walls
- The use of retaining walls is only permitted where they preserve native undisturbed areas, address unstable native slopes or rock faces, or form part of the development character.
 - Retaining walls should respect the natural character of the site and not present a large uniform wall face that overpowers the site.
 - Walls that span more than one lot must be designed and installed as part of the development.
 - Walls must be structurally competent and their appearances must complement natural rock colour in the development area.
 - Retaining wall height should not exceed 3.0m for roads and site works, 0.5m for front yards, and 2.4m for rear and side yards. Higher walls may be appropriate where they are articulated, have a surface texture/pattern, or where sufficient landscaping is provided to screen the wall.
 - Employ a system of smaller stepped retaining walls instead of a large uniform wall. The height and depth of the wall steps should be consistent with the natural terrain or with the slope above and below the walls. For stepped retaining wall systems, the walls must include irrigation to all terraces. Landscaping of the terraces using mixed hardy native shrubs or trees is required.
 - Retaining walls must be set back from the traveled portion of roads to enable planting of screening landscaping. The setback required is a function of the total wall height, as taller plants will require a large growing area below the wall.

3.2 NATURAL ENVIRONMENT

This section addresses how to minimize the impact of development on the protected natural environment of the site and make residential development more compatible with the hillside environment.

3.2.1 Environmental Protection

Objective: To identify, protect, and enhance, where possible, significant environmental features and natural systems.

Guidelines:

An Environmental Development Permit (EDP) is required to provide the minimal environmental requirements for the site. Development size and adjacent natural features must also be considered to ensure a comprehensive plan that addresses general area issues.

3.2.2 Vegetation in the Landscape

Objective: To identify and protect ESA-1 as much as is practical.

Guidelines:

a. Strategies for Retaining Natural Vegetation

Existing vegetation on steep slopes is important to the ecological and aesthetic values of the site, as well as to maintenance of slope stability, drainage, and erosion prevention. Retention or removal of vegetation must be based on an in depth knowledge of potential impacts of these actions both long and short term.

When preparing a land clearing and tree retention/removal plan apply the following criteria to existing vegetation to determine whether it is to be retained or removed:

RETENTION CRITERIA

- Retains special features and the character of the site
- Retains slope stability
- Prevents erosion
- Comprises of special or rare trees, plants, and plant communities
- Has ESA-1 values
- Selectively screens development or provides buffering
- Located in future open space

REMOVAL CRITERIA

- Accommodate site development/improvements.
- Endangers public safety.
- Constitutes an unacceptable fire hazard.
- Use clustered development and varied lot size and configuration to retain significant ecological communities that preserve environmental value, maintain soil stability, provide a buffer between development cells, and define neighbourhood character.

- Make strategic use of existing vegetation to retain the site's natural character and to break up views of buildings, roadways (e.g. cut and fill slopes) and other site works.
 - The alignments and profiles of roadways and utilities should avoid disruption of significant and unique stands of vegetation and environmentally sensitive areas. Provide sufficient clearance between roads, services and vegetation root zones to ensure viability of the vegetation.
 - On forested slopes, retain trees and tree stands that represent a range of ages, to provide for natural succession and the long-term sustainability of the forest ecosystem.
- b. Phased Removal
- Phase land clearing to minimize the area exposed to dust, mud, soil loss and erosion. Phasing may be service related (e.g. clear initially only enough to install roads and main service lines) or spatially related (i.e. clearing only one portion of the parcel at a time, completing development and re-vegetation to control erosion before starting the next portion).
 - On individual large lots, limit clearing to what is required for services and the building footprint. Any additional clearing should be immediately re-vegetated, watered and seeded until the re-growth is self-sustaining and out-competing weeds.
 - For areas of the site where vegetation must be removed but no construction will occur, leave soil intact (i.e. avoid compaction, excavation, filling, etc) and seed disturbed areas with native plant species to allow for more successful replanting in these areas.

3.2.3 Re-vegetation & Landscaping

Objective: To plant vegetation that helps mitigate the impacts of development, enhances visual quality and addresses the needs of residents.

Guidelines:

a. Site Restoration

Not only do site disturbances (cut and fill, clearing, compacted soil, dump sites, eroded areas, etc.) have short-term impacts but, if not properly treated, these disturbances may have long term negative impacts on personal safety, property and the environment.

In order to maximize the potential for quick and cost effective site restoration the development should:

- Grade to natural contours
- Stabilize the slope/bank
- Alleviate soil compaction
- Control erosion
- Prepare the soil
- Utilize hydraulic seeding for large areas in early spring or winter
- Plant hardy native trees and shrubs in early spring or late fall
- Irrigate until established
- Maintain and follow-up (i.e. weed and replant)
- Restore disturbed areas of the site that are not part of a roadway or formal yard landscaping to a natural condition as soon as possible after disturbance.

- Employ restoration practices specifically tailored to the type and degree of disturbance and the specific condition of the site.
- b. Tree and Plant Replacement
- Replace trees and shrubs in a manner that helps to restore the natural character of the hillside site. Specifically, plant trees to screen undesirable views and buffer mixed uses. Arrange trees in natural groupings or irregular clusters.
 - Utilize hardy low maintenance native plant material for site restoration and residential landscaping as much as possible. Where the use of native plant material is not possible given site or maintenance constraints, select plant material that is similar in appearance, growth habit, colour and texture to native plants that will not out compete native plants, provide habitat for undesirable wildlife, or act as a host for insect pests.
 - Plant shrubs and trees in masses and patterns characteristic of a natural setting and with the intent of encouraging biodiversity.
 - Do not encroach on the views of others. Take into account the location, height and foliage density of tree species planted
 - For restoration or creation of habitat areas (e.g. riparian areas, ravines greenways, etc.) use plant species that have value as food or cover for wildlife.
 - For dry slopes, replant with drought and fire-resistant species.
 - Plant tree and shrub species of significant individual size that they will survive natural predation.
 - Where native species may grow so large as to ultimately block views replanting over time is required to provide a continuous plant cover and still enable removal of mature plants.
- c. Irrigation
- Irrigation is only supported as a means of re-establishing planting and regular irrigation should not be necessary for any plant species proposed on the site, including those on private property. Employ water-conserving principles and practices in the choice of plant material (“xeriscaping”) and in the irrigation design and watering of residential and public landscapes on hillside sites. Temporary drip irrigation systems and hand watering are preferred.
 - Ensure no over-spray or run-off due to watering.

3.3 WORKS AND SERVICES

This section of the guidelines addresses various means of designing and sighting roads and utilities to lessen impacts on steep slopes, while maintaining public and private safety, individual lot access, municipal and emergency access, and other operational needs. Reduction of capital costs to the developer and long-term maintenance and replacement costs for the Municipality are integral to a successful design.

3.3.1 Stormwater Management

Objective: To assess design methods for collection, conveyance, control and treatment of stormwater that will mitigate potential impacts on steep slope sites.

Guidelines: Limit minor storm event offsite flows to pre-development conditions and protect major event flow routes. Attention to these requirements is particularly critical on steep slopes due to the potential for significant impacts on downstream drainage.

a. Drainage Planning

- A section 219 Covenant on title is required to prohibit roof gutters. If, due to Geotechnical constraints of the native soil conditions, storm runoff from roofs must be collected, a covenant is to be registered on title requiring an engineered design, supervised installation, and continued maintenance of an onsite disposal system.
- Plans for all development on steep slopes must indicate current drainage routing for minor and major storm events and indicate how development proposes to alter these patterns. Identify storm recharge areas and maximize onsite ground recharge at all scales from individual lots up to the catchment area. Mitigation is required to address unavoidable changes in stormwater patterns that could result in changes in the viability of native plant habitat, onsite and off.

For steep slopes, special attention must be paid to:

- Hydrological conditions prior to and after development;
- Protection of natural flow paths, volumes and storage resourced;
- Impact on trees, vegetation and other environmental features due to changes in drainage patterns;
- Sediment and erosion control during and after construction until final re-vegetation on all lots is established; and
- On and off-site drainage impacts (e.g. drainage from an upper lot to a lower lot).

3.3.2 Road Design

Objective: To allow flexibility in road layout patterns and road widths that compliment hillside character where visual and environmental objectives can be achieved.

Guidelines:

a. Road Hierarchy and Alignment

Roads are the skeleton of a neighbourhood, providing car, pedestrian and emergency access. They contain many other necessary services (sewer, water, electrical, etc.) and establish the pattern for lot development. Road widths must be kept to a minimum to reduce cuts, fills and retaining walls associated with achieving a "flat land" road standard which can have a devastating visual impact. Major roads must be vehicle orientated and designed to convey vehicle traffic safely and efficiently. Local road design, on the other hand, must be designed to enhance the outdoor living space and not be vehicle dominated. Roads in steep slope areas should help achieve a sense of neighbourhood while respecting the terrain. Double loaded road design is preferred as it minimizes infrastructure requirements per lot created. Where this is not feasible or results in significant cuts and fills, single loading, utilizing laneways between roads to access building sites may be permitted.

- Design roads with a hierarchy characterized by numerous local roads connecting to local collector roads that follow the topography as much as possible.
- Avoid large grid-like streets and major collector roads that do not adapt well to steep slopes.
- Align roads to conform to the natural topography. Gentle horizontal and vertical curves are preferable to straight-line grid patterns that require significant earthmoving, or create exceptionally steep grades.

b. Local Roads

- Local roads should be kept to a minimum scale and reflect the local resident/pedestrian use. Provision of on-street parking is discouraged as it increases the development footprint, reduces the amount of impervious surface, and results in a vehicle dominated streetscape.
- With the use of narrower roads, widened areas for specific purposes must be provided. These can take the form of a widened road, curb to curb, or pullout areas behind the curb. Increased road width areas that must be included in the design and construction are small radius curves, bus stops (transit and schools) and mailbox locations, with at least one parallel stall per box. Locations for bus stops must be confirmed with transit and the school district, however preferred locations are near intersections of major roads in zones of higher density.

Split roads, with one-way access may be utilized where:

- Special features or significant natural habitat can be protected.
- The amount of slope disturbance or the amount of cut and fill compared to a standard two-way road is reduced.
- Using a conventional road on very steep sections makes parcel access difficult.
- Through traffic can continue to a conventional road connection, or a turn-around can be provided.
- Intersection clearance is maintained before the split is allowed to occur;
- Signage is provided to warn motorists of changes in the road configuration and to identify the direction of the flow of traffic; and pedestrian safety and emergency access is maintained.

One-way roads may be utilized on a site-specific basis where:

- They will reduce slopes disturbance significantly.

- Through traffic can continue to a conventional road connection; and pedestrian and traffic safety is maintained.
- In these situations, one-way roads will have a minimum pavement width of 4.5 meters and a minimum right-of-way of nine metres, and will not exceed 200 metres in length.
- Where cul-de-sacs are contemplated, pedestrian connections linking the cul-de-sac to other streets and open spaces should be incorporated. Cul-de-sacs over 200m in length are to have an emergency access, where possible.
- A hammerhead turn around, rather than cul-de-sac bulb, may be utilized on a site-specific basis where there is lack of sufficient land for a cul-de-sac bulb or very steep slopes would require excessive cutting and filling.
- The road serves fewer than 16 lots and/or is less than 100 metres in length.

c. Sidewalks

- Sidewalks are to be located on the same side of the road as fronting development however, due to the winding nature of hillside roads, development may not continually front on one side of the road throughout its length. A continuous sidewalk must be maintained on all roads regardless of location of fronting development along the length of the road. The location for the sidewalk must set to maximize its function as a safe pedestrian corridor through the development.
- Sidewalks on both sides of the road may be required for short distances to provide walking linkage between roads and to provide improved sight distances for road crossings.
- The requirement for sidewalks on local cul-de-sac roads may be waived where low traffic volume is generated, provided alternate off street pedestrian facilities exist.
- Curvilinear or meandering sidewalks and pathways may be used where they eliminate long sustained grades. Varying offsets between the road and the sidewalk may also be considered where it will save a significant feature or reduce grading requirements.

d. Design Speed and Road Grade

- Conventional road grade and speed design require road geometry that is less able to respond to local topography and increases the need for significant cut and fill sections. Conventional design has been proven to increase traffic speed thereby requiring traffic calming measures. Flexible grades and radii with resulting lower design speeds are to be integrated into all road design.
- All roads must be designed to minimize traffic speed achievable appropriate for local roads to no more than 50km/hr. Design speeds of less than 50 km/h are appropriate for local roads or local connectors to approve liveability of neighbourhoods and allow a more responsive approach to topographic conditions, significantly reducing grading requirements.
- The design must consider maintenance (snow clearing) and winter safety issues. The design must not compound maximum grades with minimum radius curves. Sight lines and stopping distances are to be maximized in all cases.

- Upright curbs are to be used as much as possible. On the outside of sharp curves with road grades over 8% and directly across from intersections driveway locations for down slope lots must be designed to minimize the potential for accidental egress by road traffic failing to negotiate the curve or stop.

3.3.3 Property Access

Objective: To provide safe and functional access to individual properties throughout the year.

Guidelines:

a. Individual Driveways

- On steeply sloping sites, designing and installing driveways presents many challenges, such as significant elevation change, limited parking capacity, limited visibility at the road, difficult access in winter conditions and space for residential pick-up and delivery.
- In general, driveways shall have an onsite grade no greater than 15%.
- Driveway grades must not compromise cover of buried services to the lot.
- Longer driveways must conform to the Fire Department needs.
- Parking must be provided onsite at an angle or perpendicular to the driveway to enable uninhibited use of the garage.

b. Common Driveways

- Common driveways are vehicle access routes shared by two or more lots and must be designed and built as part of the larger development.
- Common driveways are encouraged when significant site grading can be reduced.
- The design of common driveways must conform to Fire Department needs with grades not exceeding 12%.
- Two-directional-shared, driveways must be limited to no more than six lots and provide adequate width for two-way traffic at the street and at all limited site locations.
- Up to 15 lots may be serviced with a one-way through-access driveway exiting onto a municipal road, depending on site- specific conditions.
- A "reciprocal access and maintenance agreement" among property owners is required for approval of a common driveway.
- An appropriate location and space must be provided at the street for common garbage and recycling pick-up.

3.3.4 Municipal Services and Utilities

Objective: To provide municipal services and utilities on steep slope developments that have the least environmental and visual impact, meet service requirements, and minimize redundancy, capital costs, maintenance and replacement costs.

Guidelines:

a. Municipal Services

Development on steep slopes requires additional infrastructure for water systems, including booster pump stations, reservoirs, pressure reducing valves and pipe anchors. Sanitary sewer systems can also require additional costly infrastructure such as lift stations and forcemains. Comprehensive design of water and sewer systems is required for all development to ensure adequate system capacities with no redundancy. This process is typically undertaken as part of the neighbourhood servicing preplan. Comprehensive preplanning ensures appropriately sized services and logical phasing and expansion of the system in a cost-effective manner. General servicing requirements vary from "flat land" methods by ensuring that:

- Where practical, the offset between sewer mains is reduced from 3m to 1.5m, and services are installed in a common trench to reduce the number of trench excavations.
- Depth of mains is kept to a minimum, especially in narrow roads. Provision of gravity service to basement elevation of low side lots must not influence system design, however all main floor elevations should have gravity service. Any mains not located within a finished road must include provision of a 4.0m wide all-weather surfaced road with a grade not in excess of 25% that permits access to all manholes valves etc. A Section 219 Covenant must be registered on the title of all low side lots indicating the requirement for pumping from basement elevations.
- If steep connecting sewer mains are required outside the road areas where it is not practical to provide maintenance access, fused HDPE pipe with no manholes may be permitted provided there is no service off these sections of main.
- Locate access to curb stops, fire hydrants and other services that require periodic inspection in areas where slopes do not exceed 25%, or utilize precast retaining structures to provide the required adjacent working space. If not clearly visible from the road signage is required.
- Provide emergency vehicle access to open spaces and locate fire hydrants to enable wild fire suppression from these locations.
- Water service curb stop offset may be varied to maintain ease of access and maintenance. Locate these where future grading or landscaping of boulevards will not make access difficult.

b. Shallow Utilities

Development of utility strategies must also be included in the neighbourhood preplanning process. Major infrastructure requirements such as new transmission lines, telephone switching facilities, primary gas mains or pumping stations should be identified and located early.

- Design roads and road rights-of-way to allow flexible offsets for utility trenches and other facilities such as transformers (i.e. provide additional spot "cut out" road dedication at transformer locations to facilitate counter poise installation). This will allow more flexibility to grade right-of-ways, which will reduce physical impacts and provide easier servicing in steep slope neighbourhoods.
- Where permitted, install conduit for telephone and cablevision in a common trench with minimal offset to hydro conduit. Bundle the conduit and stagger vault locations to reduce the width required for each utility.

Installation on these services under sidewalks is permitted where this reduces the effective right-of-way required.

- For utility installation on the high side of the road where no sidewalk is present, conduit may be installed based on final grading over the works with the surface grading upward from the back of the curb within the road right-of-way. Utility service and transformer boxes, which need to be accessible, would require suitable grading and retaining structures.

3.4 BUILDING AND STRUCTURES

This section works in conjunction with the HDP Guidelines to address the height, mass and setbacks of buildings on hillsides to reduce slope disruption, minimize visual impact, and avoid impinging on sight lines from neighbouring lots.

3.4.1 Building Setbacks

Objective: To allow greater flexibility in locating a building on a steep slope lot and reduce the visual massing effect of houses.

Guidelines: Providing some leeway in front and side yard setbacks prescribed under the Zoning Bylaw can help to reduce the amount of cutting or filling required, and better support level entry and presence of the house to the street.

a. Front Yard

On steep slopes, allowing a lesser setback may reduce the need for cut/fill for driveways, create more street presence, and provide a more level entry.

- Where demonstrated that it will reduce excessive cut/fill, help to avoid hazardous slopes or sensitive areas, and enhance the neighbourhood, a front yard setback can be reduced to 3.0m.
- Side yard setbacks for HDP areas are to be a minimum of 4.0m in total with 1.5m minimum on the side. If there is a '0' lot line, then 2.5m is to be the single side yard.

b. Rear Yard

Rear yard setbacks are defined in the Zoning Bylaw however, due to placement of structural fill required to create downhill building pads and rear yards there is a requirement to protect the structural slope by means of a covenant registered on title of all lots. Uphill lots also require a covenant to protect the top of cut provided during site development so as to not undermine uphill development or native slopes on protected land in excess of 30% slope.

3.4.2 Building Height and Mass

Objective: To avoid over height buildings and minimize the visual impact of new buildings on steep slopes.

Guidelines

a. Height of Single-Family, Duplex and Triplex Dwellings

The Zoning Bylaw regulates the maximum height and mass of houses in most residential zones. Determining building height on steep slopes has frequently resulted in two problems:

- a. house entries that are well below the road grade; or
- b. three-storey walls on the downhill side that create an overbearing presence when viewed from offsite.

When dealing with height on steep slopes, the following should be considered:

- Height of adjacent buildings should be considered and consistency maintained.
- Limit the perimeter walls to approximately 2.5 stories. This is required to limit the impact of downslope facades on neighbours. Any additional wall height should be set back in order to have the house step uphill..
- Consider the use of a reduced front yard setback to resolve issues such as steep driveways.

b. Building Mass

“Mass” refers to the perceived prominence of a building on a hillside in relation to the site, other buildings, the street, or views from offsite. The following provide some guidance for steep slopes.

- Respond to the natural slope of the hillside by using a stepped foundation and setting the building into the hillside to help integrate it with the natural landform where practical.
- On downhill elevation, avoid the use of single plane walls that exceed two storeys. Rather, step upper storey back from the level below.
- Avoid large, unbroken expanses of wall and long building masses. Rather, design buildings with smaller or less massive building components that reflect the sloped character of the site.

3.5 INVENTORY, ASSESSMENT AND PLAN REQUIREMENTS

Refer to Section 1.5 Development Approval Information.

This section brings together all the inventory, assessment and planning requirements to support these Guidelines.

3.5.1 Site Survey

A topographic and feature survey of the site is required prior to site planning or design and should include the following minimum information:

- Property lines, easements, right-of-way: contours at 1.0 metre intervals, spot elevations;
- Natural physical features including swales, knolls, ridgelines, bedrock, outcrops, cliffs and slope transitions or break lines;
- Existing manmade features including roads, curbs, sidewalks, above and below ground utilities, trails, buildings, structures, fences and retaining walls;
- Slope analysis showing slope intervals of 0-20%, 21-30%, 31-40%. This information is required to be provided for an area at least 20m beyond the development site;
- Potential hazards and hazard areas;

- Environmental attributes identified in the ESA-1.
- Archaeological and historic resources.

3.5.2 Geotechnical Evaluation

Undertake a Geotechnical survey and evaluation of all or portions of the site, prior to site planning or design. The survey must include:

- Assessment of existing surface and subsurface conditions including soil depths, groundwater levels, potential storm water recharges areas, (including their recharge rates), native soil slope stability and depth to rock;
- Verification of the suitability of onsite soils and rock for re-use in development construction, including optimum moisture content and the maximum angle of repose for all onsite materials;
- Identification of hazards;
- Potential impacts of development; and
- Recommendations for safety, site protection, development and mitigation.

3.5.3 Grading Plan

A grading plan is required for development on steep slopes. This plan integrates site survey topographic information, geotechnical analysis of the site, physical and natural features. The plan must indicate:

- Existing and proposed topography and features in plan view and key site sections;
- Native undisturbed areas and the limits of disturbance and earthworks/grading;
- Cut and fill contour information at a maximum of 1.0m intervals showing maximum depths of all cut and fill proposed;
- Retaining wall locations complete with base wall elevation(s) and top of wall elevation(s); and
- Building site envelopes including accesses to individual building sites.

3.5.4 Tree and Vegetation Plan

A Tree Management Plan is required. It shall illustrate existing stands of trees and understory vegetation to be retained and those to be removed. It shall also include specifications that describe how retention measures are to be implemented and maintained. The plan must also include proposed replanting of trees and other vegetation required to enhance and re-establish disturbed and natural areas.

- Clearing and tree removal must be phased for lands 5 hectares in size and over to avoid creating large expanses of bare slopes, thereby reducing the potential for all forms of soil erosion.

3.5.5 Drainage Management Plan

A Drainage Management Plan is particularly critical on steep slopes. Inventory requirements for a Drainage Management Plan on a steep slope site are:

- Definition of the existing drainage system, including identification of the drainage basin to which the site contributes, existing minor and major flow routes and volumes, and connections to existing drainage infrastructure.

- Hydrogeological investigation including groundwater conditions, recharge/discharge characteristics, and general flow.
- Geotechnical assessment. Based on existing information of soil characteristics, provide an opinion on the potential for ground infiltration, for the purpose of groundwater recharge, as a drainage mechanism. Infiltrations are encouraged on a site-by-site basis where appropriate soil and topographic conditions exist, but cannot be used in the calculation of major storm event detention volumes or drainage conduit sizes.
- Review of hydrometeorological data. If the site includes different hydrometeorological conditions than those established for the City, it may be necessary to adjust storm types or intensity distribution relationships.
- Identification of catchment areas, flow routes, drainage capacities, flood plain issues, quality and hydraulic constraints, erosion potential, and any specific environmental issues.

The Drainage Management Plan should make specific recommendations regarding:

- Stormwater routing using piped systems and/or open systems. Note that piped collection reduces groundwater infiltration and riparian base flows, and eliminates natural filtering processes that occur in ditches, swales or through natural percolation to the ground.
- Stormwater controls for infiltration or groundwater recharge, if appropriate or required, via ditch/swale seepage systems, infiltration galleries, or basins; detention or retention vs. direct discharge; and water quality considerations.
- Impacts of irrigation on short and long term stability of any slopes.
- Protection of drainage swales (e.g. covenant, rights of way).
- Proposed roof and footing drains for individual lots, on-site treatment or connections to storm sewers, appropriate means of controlling short or long-term erosion if on-site.
- Side inlet catch basins with rollover or upright grates are mandatory. Grate type is dependant on curbing at that location.
- Hydrogeological considerations including maintenance of existing groundwater regimes.
- Energy dissipation into existing ravines at source and down slope where re-concentration or erosion may occur.
- Individual lot drainage and siltation control during and after construction, and impacts of overland drainage from one lot to another.
- Provision of settlement areas that are readily accessible for maintenance.

3.5.6 Erosion Control Plan

An erosion control plan is required for subdivision and development permit approvals on steep slopes.

- The erosion control plan should be prepared by a qualified Registered Professional Engineer or erosion control expert. The plan should identify the potential for erosion and sedimentation, and describe the measures to be taken to minimize that potential before, during, and after site development.