

DPA 5 – Steep Slopes

Location

DPA 5 applies to all lands with a slope of 20% or greater for a minimum horizontal distance of 10 metres. Lands with steep slopes of 20-30% and 30% or greater are shown generally on Map Schedules E1-E3. Site specific field review is required to determine actual extent and location of steep slopes.

DPA 5 applies to all subdivisions and development, except where specifically exempted.

Category

- Protection of the natural environment, its ecosystems and biodiversity.
- Protection of development from hazardous conditions.
- Establishment of objectives for the form and character of intensive residential development.

Justification

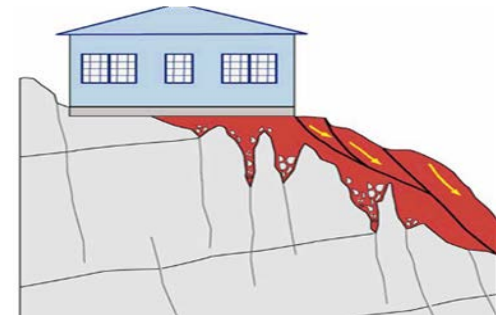
The forested and sloped hillsides are a highly important visual resource, as well as an environmental resource due to extensive tree cover. Some of these sloped areas may provide opportunities for residential development with spectacular views. However, trends toward clear-cutting of the site combined with much larger houses and smaller lots have greatly altered the

natural landscape of some sloped areas. Additional infrastructure such as booster pump stations, reservoirs, pressure reducing valves, sanitary sewer lift stations are commonly needed in steep areas. Financial costs of installing and maintaining services in hillside areas can be significantly higher than in less sloped areas, resulting in higher long-term public costs for this form of development.

Special care is needed to ensure new development is sensitively integrated with the natural contours and landforms of the site, and important habitat/forested areas are protected. This requires a shift away from traditional subdivision layouts, servicing and building forms. Using “conservation design” approaches can significantly reduce the impact and costs of development, while yielding the same number of units as conventional layout. Clustered development using a mix of housing forms and densities is more appropriate in steeply sloped lands than uniform, conventional lots.

Steepness of slopes does not necessarily correlate with stability of slopes, which depends on factors such as geological materials, soils, moisture content and vegetation cover. However, precautions are needed to ensure

development activity or resulting retaining structures do not create hazardous conditions. (See guidelines for DPA 4 hazard designations that may also apply to these steeply sloped lands.)



- ✘ *Avoid building on unstable slopes or placing fill near edge of slope.*

Objectives

- To minimize the impact of development on hillsides and steeply sloped lands.
- To retain the natural features of sloped lands
- To support low impact and innovative development approaches to minimize long-term infrastructure maintenance costs on steeply sloped lands.

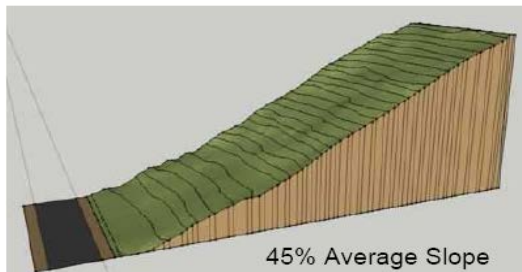
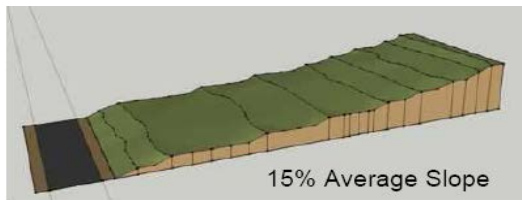
Exemptions

General exemptions for DPA 1-5 apply.

Guidelines

Development Permits issued in DPA 5 will be in accordance with the following:

1. No site disturbance, clearing, building, or other development of land shall take place except in accordance with a development permit or specifically exempted by the District.
2. Land with slopes over 30% is generally not suitable for residential development and development should be avoided. Development may be considered where it can be demonstrated that the proposed development will not create environmental or visual impacts, can be sensitively integrated with the



- * *Slope is calculated by dividing the vertical height by the horizontal distance (rise over run). Many properties have complex slopes requiring detailed analysis*

terrain, and presents no hazards to persons or property.

3. Land with slopes from 20-30% may be suitable for building at lower densities or with special site planning techniques.

Report/Submission requirements

4. Prior to consideration of development or subdivision on lands within DPA 5, reports prepared by a Qualified Professional(s) are required.
5. The report shall provide:
 - (a) An inventory and accurate plan of site features, including tree cover, rock outcroppings, watercourses and assessment of soil types, depths and conditions;
 - (b) Plans showing the location of all existing and proposed buildings and structures, building envelopes, utility services, driveways and other impervious surfaces;
 - (c) A slope analysis, geotechnical assessment, and slope stability plan providing assessment of the potential for landslide, landslip or erosion, detailing how the proposed development is to be designed and constructed to prevent any destabilization or erosion of the slope. This will include plans showing lands with 0-10%, 10-20%, 20-30% and over grades at a 1m contour interval.
- (d) Location and amount of anticipated removal or fill.
- (e) View corridor analysis to determine the visual impact of development. The District may also require a 3D digital terrain model illustrating pre and post-development conditions, illustrating extents of cuts and fills, clearing and building placements;
- (f) A site grading plan including sections through each lot that clearly shows building envelopes, including the top of cut and toe of slope, and the slopes of adjacent uphill and downhill adjacent lots.
- (g) Recommendations on appropriate building envelopes or setbacks in relation to potential slope hazard, with specific recommendations and criteria for design, construction and maintenance.
- (h) Detailed measures to safeguard neighbouring properties and structures arising from the proposed construction or site preparation (including blasting)
- (i) Identify the anticipated effects of septic and drainage systems on slope stability;
- (j) Any geotechnical reports must meet the report guidelines for *Legislated Landslide Assessments for Proposed Residential Development in British Columbia* published by the Association of

Professional Engineers and Geoscientists of British Columbia, March 2006, including submission of Schedule D (Landslide Assessment Assurance Statement) to specify that the land may be safely used for the use intended.

Basic Design Principles

- 6. Design the project to fit the site rather than alter the site to fit the project.
- 7. Development density calculations will be based on the areas of the property excluding land areas with original slopes greater than 30% (see OCP policy 3.7).
- 8. Use conservation design site planning approaches that:
 - (a) Minimize alteration of natural grades.
 - (b) Increase lot sizes as slope increases.
 - (c) Preserve natural features and vegetation and incorporate them into the design of the project.

Example A; however, the lots are arranged in clusters.

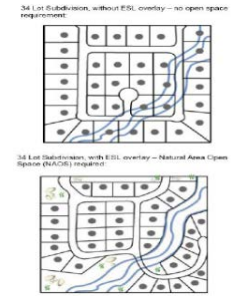


✓ Clustered development preserves nature features while yielding the same number of residential units (Vision Plan)

- (d) Cluster development on less steep portions of the site.
- (e) Reduce footprints of buildings.
- (f) Step buildings to reflect the slope of the site.
- (g) Use variations in lot sizes and subdivision layout to reflect natural site contours.
- (h) Reduce the length of roads.
- (i) Limit the extent of hard surfaced/paved areas.
- (j) Use low impact stormwater management
- (k) Share driveways to reduce paved areas and cut and fill of slopes.

Natural Areas/Vegetation

- 9. Natural slope features including treed ridgelines, hilltops, rock outcrops, drainage courses, mature vegetation and forest stands shall be retained in their natural state and incorporated into the design of the project.
- 10. Preserve native vegetation, with removal only where necessary for the building foundation, septic system, driveway, and landscaping directly adjacent to the house.
- 11. Any trees or vegetation removed shall be replanted in order to prevent potential erosion, landslip or rockfalls, to stabilize slopes and to restore



✓ Subdivision layout should retain natural site features (example on left)

visual quality. Native plant materials and tree species are preferred to restore the natural character and biodiversity of the site.

- 12. A detailed landscape plan prepared by a Qualified Professional shall be submitted and accepted by the District as part of the development permit.

Building Sites

- 13. Building sites should fit with natural slope contours such that structural retaining walls or extensive cut and fill are not required, and so that no blasting or significant soil/rock removal or fill is required to build on the site.
- 14. No fill or excavated materials should be placed near the top of slopes or along drainage channels.
- 15. Every residential lot created by subdivision shall have a safe building envelope located on stable slopes at less than 20% grade.

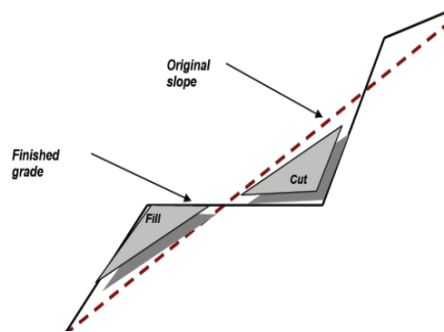
16. Creation of large flat terraces on hillsides in order to expand developable area or create large level front or rear yards is not supported.

17. Where a building or structure is permitted at the top or foot of a steep slope or bluff, the building should be set back a minimum horizontal distance equal to 3.0 times the height of the bluff as measured from the toe of the bluff, or as determined by a Qualified Professional.

Buildings Height and Massing

18. Buildings should have foundations stepped into the hillside so the building integrates with the natural landform. This is particularly important for houses on the uphill side of the street to avoid overly dominant appearance.

19. Roof pitches should be aligned to reflect the natural slope conditions. Long continuous decks, or large



✘ *Minimize the use of cut and fill to create level building sites*

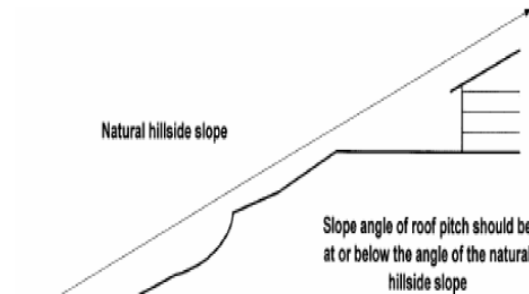
cantilevered decks can be visually overpowering; smaller stepped decks are preferred.

20. Limit building heights to the height of existing tree cover and no higher than natural ridge lines.

21. Development should be sited to retain trees and vegetation along ridgelines.

22. Avoid large unbroken expanses of wall and long building masses. Instead, buildings should have smaller, less massive, articulated appearance to fit with the natural vertical planes in excess of two storeys should be avoided.

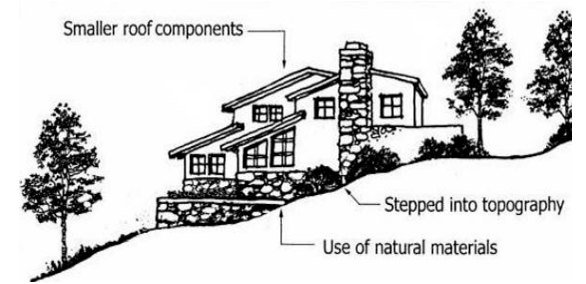
23. Large, monolithic housing forms that are visually prominent on hillsides are not supported. Buildings should be stepped to reflect the topography and sited to reduce visual impacts from other areas.



✔ *Roof pitch should reflect natural hillside slope.*



✘ *Avoid creating flat building areas that require retaining walls.*



✔ *Buildings should be stepped down to reflect natural site contours.*

24. Building materials should reflect the natural setting, and avoid shiny or reflective surfaces.

25. Variation of zoning bylaw standards for building setbacks may be supported in steep areas if necessary to reduce cut and fill, provide improved level entry, reduce driveway grades, to enable off-street parking, or to avoid hazardous slopes or environmentally sensitive areas.

Driveways and Garages

- 26. Shared driveways are encouraged to reduce extent of site grading, provided fire department access is maintained and a reciprocal access agreement among property owners is provided.
- 27. Individual driveway grades should not exceed 20%. The first 3.5m of the driveway should have a grade no greater than 7%.
- 28. The prominence of garages should be minimized using drive-under and/or detached garages, locating garages parallel to the street, or by increasing the setback for upper storeys above the garage.



- ✓ Garage located underneath house reduces visual impact in sloped areas.

Site Grading

- 29. Avoid grading or alteration of key topographic features (i.e. rock outcroppings, ridgelines, cliffs), and avoid grading that results in

landforms that are not characteristic of the natural topography (i.e. linear terraced benches with no undulations or irregularities).

- 30. Finished slopes of all cuts and fills shall not exceed three-to-one (3:1), unless the applicant can demonstrate that steeper slopes can be stabilized and maintained adequately.
- 31. Exposed slopes should be replanted as quickly as possible to prevent erosion and slope instability. Topsoil should be retained or replaced to cover all cut and fill slopes to a depth not less than 150mm.
- 32. Excess topsoil and rock materials from excavations should be used onsite.
- 33. Plans shall provide details of proposed erosion controls during construction, and measures to mitigate erosion on steep slopes in the finished development.



- ✗ Avoid large scale site clearing

Retaining Walls

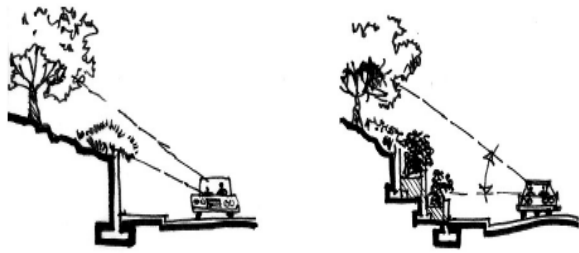
- 34. The use of retaining walls on hillsides is discouraged; large retaining walls do not respect the undulating nature of hillsides and should not be used except where no other alternative exists.
- 35. Where necessary, retaining walls should respect the natural characteristics of the site and should not present a large uniform wall face that overpowers the site. A series of smaller stepped walls is preferred over a large uniform wall.



- ✓ Buildings below ridge lines and natural materials integrate with surroundings.



- ✗ Large retaining walls overwhelm the site, disrupt views and alter the natural topography.
- ✗ Large retaining walls overwhelm the site, disrupt views and alter the natural contours.



Not Preferred

Preferred

- ✓ *Retaining walls adjacent to roads should allow room for landscaping; terraced walls are preferable to large single walls.*

- 36. "Living walls" or bioengineered retaining structures will be considered as an alternative to hard surfaced retaining walls.
- 37. Landscaped terraces created behind retaining walls shall be of sufficient width to allow planting and maintenance of plant materials.
- 38. Retaining walls must be setback from utilities and from traveled portion of the road to enable planting of landscape screening.
- 39. Walls must be structurally competent and their appearance must complement natural rock colours and appearance. Concrete block retaining walls are not considered appropriate.
- 40. As a general guide, retaining walls should not exceed 3.0m height on main roads or 1.2 m for individual properties.

Road design

- 41. Roads in steep areas should
 - (a) reflect the natural topography. Straight grid roads are not compatible with steep areas.
 - (b) be located on natural benches and stable soils.
 - (c) be kept to the minimum width and length possible to minimize the area of disturbance. Alternative layouts should be used to reduce construction.
 - (d) avoid alteration of natural drainage patterns
 - (e) provide adequate surface drainage.

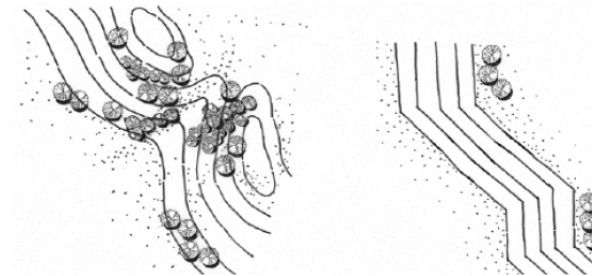


- ✓ *Natural materials and new planting can protect steep slopes without large retaining structures.*

- 42. Reduced design speeds may be considered where appropriate to reduce road widths.
- 43. Long sustained grades should be avoided. A series of small gentle horizontal and vertical curves are preferable.
- 44. With the use of narrower local roads, widened areas for transit and school bus stops, mail boxes, visitor parking, garbage pickup etc. must be pre-designed.

Stormwater Management

- 45. Divert water around and away from unstable slopes, yard and structures in a controlled manner. Avoid saturation of slopes and discharge concentrated water toward storm drains or street gutters.



- ✗ *Roads and site grading should follow natural contours (left), not create unnatural linear patterns (right).*

- 46. Best management practices for stormwater should be used for all steep slope areas, in order to retain the natural drainage conditions and reduce impacts to sloped areas:



✓ *Alternative road and pedestrian designs may be needed in steep areas. Meandering sidewalks or paths may be used where they eliminate steep grades or protect natural site features. Varying offsets between the road and sidewalk may be considered.*

- (a) Identify and protect natural drainage flows.
- (b) Maintain predevelopment hydrology through site design, building and landscape design techniques that infiltrate, filter, store, evaporate and detain stormwater close to its source;
- (c) Provide stormwater recharge areas and maximize onsite groundwater recharge in stable areas. This may include retention or detention ponds, constructed wetlands, sand filters, parking areas designed with bioretention features, infiltration ditches to return stormwater to water table.

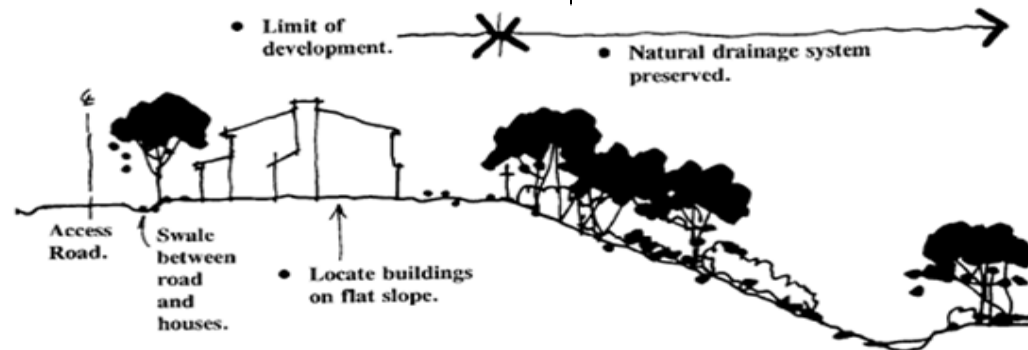
- (d) Minimize impervious surfaces to reduce stormwater runoff and to prevent excessive runoff and erosion.
- (e) Limiting vegetation clearing and soil disturbance;
- (f) Use existing or new vegetation to slow runoff and help stormwater infiltrate the soil (i.e. filter strips and grass swales);
- (g) Divert downspouts away from driveway surfaces and into retention areas/rain gardens or rain barrels/dry wells to capture, store and infiltrate stormwater on-site.
- (h) Assess and mitigate any potential drainage impacts on downhill properties.
- (i) Provide sediment and erosion control during and after construction until final revegetation on all lots is established.

Parks and Trails

- 47.** Small pocket parks with viewpoints and trail connections may be the preferred form of park development in hillside areas where conventional, flat parkland is not available.
- 48.** Development applications must provide details of pedestrian access through the area. Trails or linear greenways may be used where site constraints limit the viability of conventional sidewalks or shared roadway pedestrian use.

Fire Hazard

- 49.** Subdivisions directly adjacent to forested areas may be required to prepare a fire interface hazard assessment. Recommendations of that plan may be incorporated into the development permit, including fire resistant building materials, removal of risky vegetation/fuel, replanting with appropriate vegetation and building sprinklers.



✓ *Preserve natural drainage courses to reduce stormwater flows*

Covenants

50. The District may require a S.219 covenant to protect any environmentally sensitive or visually important natural areas, to protect any structural fill or engineered slopes.

Permit Conditions

51. A Development permit issued for lands in DPA 5 may:

- (a) Specify areas of land that must remain free of development, except in accordance with any conditions contained in the permit;
- (b) Specify natural features or areas to be preserved, protected, restored or enhanced in accordance with the permit;
- (c) Limit impervious surfaces;
- (d) Require construction of works or other protection measures, including planting or retaining vegetation or trees, in order to control drainage, control erosion or to protect steep slopes, rockforms or other natural features on the site or adjacent properties;
- (e) Require in any area that contains unstable soil that no septic system, drainage or water systems be constructed;

- (f) Establish conditions and requirements that vary the permitted use and density of land that may be subject to hazard, but only as they relate to health, safety or protection of property from damage.
- (g) Impose conditions on the sequence and timing of construction;
- (h) Require monitoring and reporting during and post-construction;
- (i) Require security to ensure completion of landscaping or other works required to address damage to the natural environment or unsafe conditions.

52. Lands in DPA 5 may also be within DPA 4 (Rocky Beach, Escarpment, and Rockfall Hazards) and guidelines for all DPA's apply.