



**STEEP SLOPE  
DEVELOPMENT PERMIT AREA  
GUIDELINES**

**- ATTACHMENT 3 -**

*Last Revised: 2005-JUN-21*

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# 1. INTRODUCTION

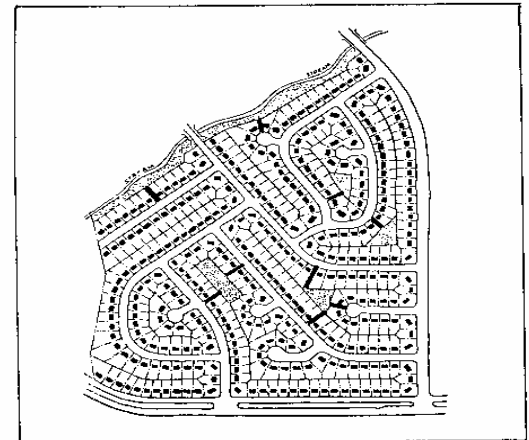
## 1.1 A MANDATE FOR THE GUIDELINES

The City of Nanaimo adopted its Official Community Plan (*Plan Nanaimo*) in 1996. The Plan provides direction for the way the community will grow and how future land use decisions contribute to the achievement of social, economic and environmental goals. A key goal of the Plan is protecting the natural environment in the course of land use and development. This requires environmentally responsible development practices and the integration of natural features into development design.

Plan Nanaimo recognizes that many of the remaining undeveloped lands in the city are on steep slopes and hillsides. These steep slope areas provide spectacular opportunities for home sites, but they also present special challenges in designing development that is safe, economical, and maintains the qualities of hillsides that contribute to Nanaimo's natural beauty. Consequently, the Plan sets out a series of policies dealing with steep sloped lands, one of which is the creation of these Guidelines.

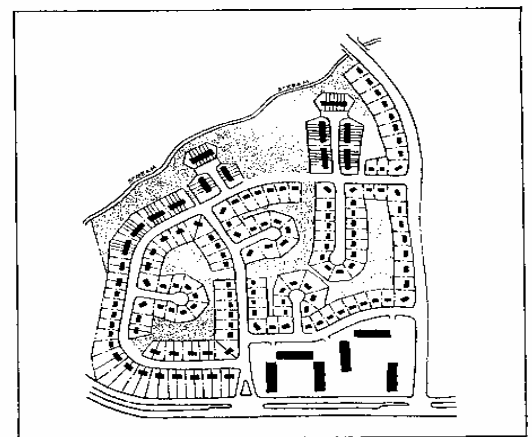
Local governments in the USA have been adopting Hillside/Steep Slope Guidelines and Regulations for many years, as flat and valley bottomlands are fully developed or in some cases protected for agriculture. Hillside environments pose unique problems for construction and maintenance of housing and services. They are prone to natural hazards, they topographically constrain the design of developments and contain many natural features or aesthetic values that may need to be protected. Despite the constraints, they are attractive places to live. However, experience shows us that poor and excessive hillside development can diminish the very views, and natural features that residents value.

One feature of many of these Hillside / Steep Slope Guidelines in the USA has involved the promotion of open space development. Open space development is a "new" form of residential development (to Canada) that can vary significantly from a standard subdivision pattern, and therefore be viewed suspiciously by surrounding residents.



**CLUSTER DEVELOPMENT**

Plats show difference in development under typical lot by-lot zoning (above) and cluster zoning. Both tracts have the same density, but clustering allows for more open space.



**Open Space Development**

Plans show difference in development under typical lot by lot zoning (above) and open space zoning. Both tracts have the same density, but clustering allows for more open space.

They may perceive it as negatively impacting their property values or quality of life in their neighbourhood. It is certainly true that a poorly designed or constructed development can fail to harmonize with its surrounding neighbourhood. Any open space design needs to not only protect natural features and provide natural open space; it must also reflect the character and quality of its setting.

Studies in the United States show that lots within a well designed open space development, as well as neighbouring properties, usually gain increased value as a result of their proximity to permanently protected open space.

The responsibility for the maintenance of open space created by clustering is another potential issue. The open space could be dedicated as City parkland if it fits into the City's overall plan for parks and trails. Dedication for City park should be considered first. Otherwise, smaller open space parcels could be managed by a homeowners association to which everyone is contractually obligated to contribute when they purchase their home. This is fairly common practice in strata-type developments. For larger tracts of open space, the owner may wish to dedicate the land to a land trust or organization that is capable of holding and maintaining lands for conservation purposes.

In earlier developments on slopes around Nanaimo, time has allowed trees and vegetation to re-establish and lend character to the neighbourhood. Today, time is less likely to "green" new subdivisions because lots have generally become smaller while houses and roads have become larger. As development continues up our slopes, it will be difficult under the existing zoning and building requirements to retain some of the unique features in Nanaimo's spectacular natural setting.

A balance is required so that the character of Nanaimo and its hillside environment is not permanently compromised. The balance involves sound site design and techniques to eliminate or avoid hazards to public safety. In some cases it may also involve prohibiting development altogether because of the natural resource value or the concern that an engineered solution may not apply appropriately to a particular steep slope.

These guidelines have been adopted to assist the City and the development community to achieve environmentally sound and livable hillside neighbourhoods. It is the City's intent that proper application of these guidelines will enhance the desirability and marketability of hillside developments, allowing flexibility and innovation in design while recognizing key goals to manage hillside development. While associated with the Steep Slope Development Permit Area, these guidelines will also assist in rezoning, subdivision design, and development variance application preparation and reviews.

## 1.2 GOALS OF STEEP SLOPE DEVELOPMENT

New development on steep slopes should:

- contribute to the hillside character of Nanaimo's residential neighbourhoods in a positive manner;
- protect wildlife habitat and environmentally sensitive areas;
- integrate or protect unique or special natural features of the site such as landforms, rock outcroppings, mature trees and vegetation, drainage courses, hilltops and ridgelines;
- avoid unstable or hazardous portions of the site and protect lives and property from hazardous conditions such as landslides, erosion, etc.
- provide safe access for residents, visitors and service providers;
- maintain the aesthetic and scenic quality of Nanaimo's hillsides;
- be compatible with the natural features, building location and existing open spaces of neighbouring properties;
- respect the existing views, privacy, access to light and safety of neighbouring properties; and
- support economic and efficient construction and maintenance standards.

## 1.3 A STEEP SLOPE DEVELOPMENT AREA

The Provincial *Local Government Act* allows local governments to designate Development Permit Areas (DPA) in Official Community Plans for the purposes identified in Section 919.1(1). It is under Section 919.1(1) that Steep Slope Development Permit Area 25 under Plan Nanaimo (Bylaw 6000) has been created to designate all properties shown in attachment (a) of this guidelines as Steep Slope Development Permit Area 25. The properties that have been placed in the Steep Slope Development Permit Area are properties 0.5 hectares or greater that contain steep slopes (see Section 2).

The Provincial *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;
- c) establishing objectives for the form and character of commercial, industrial or multi-family residential development, and
- d) establishing objectives for the form and character of intensive residential development.

The principles and objectives of the Guidelines will also be applied during subdivision approval of single-family developments in accordance with sections of the Zoning Bylaw.

## 1.4 SPECIAL CONDITIONS OR OBJECTIVES

In order to achieve the general OCP goal to protect the natural environment and, more specifically, provide policy and regulatory direction for environmentally sensitive development on steep slopes, these Guidelines have been implemented in the Steep Slope DPA in Section 8.2.24 and as shown on Schedule B of the OCP.

The following are special conditions and objectives, within which the Steep Slopes Guidelines are applied:

### *SITE AND SUBDIVISION DESIGN*

- a) *to identify significant features as part of a site assessment prior to developing the building site and road design in order to acknowledge and maintain the hillside character and natural features of the site.*
  - develop an understanding of the environmental and geological conditions of the site prior to any construction to ensure that the most appropriate methods and materials are used to develop the site.
  - protect the important ecological and aesthetic values of environmentally significant features, such as wildlife trees and ecologically rare vegetative communities, as well as maintain slope stability, drainage and prevent erosion.
  - Create larger lots or cluster the development in order to avoid disturbances of those ecologically sensitive sites generally identified as Environmentally Sensitive Areas (ESAs) and specifically located during a site assessment prior to site planning.
- b) *to undertake subdivision planning and design that respects the existing natural area's terrain, hazardous conditions, and enhances the natural character of the area.*
  - subdivision planning and design that allows as much untouched native and natural green space as possible on a development site is the most desirable.
  - direct more density on the less sensitive parts of a site through "open space" development.
  - avoid including steeper portions of a site (with 30% or greater slope) in the lot size calculation, or where sufficient land with a slope less than 30% is not available, larger lots may be considered provided there is a building site and access.
- c) *to minimize the impact of grading and retain the natural and topographic character of the site.*
  - the maximum amount of vegetation and other natural features should remain undisturbed so as to protect ecological values, maintain slope stability and provide an aesthetically pleasing viewscape.
- d) *to protect and preserve the scenic characteristics of strategic hillsides as well as to consider opportunities to provide scenic views from a hillside site.*
  - attachment (b) identifies significant ridgelines that are visible throughout the city and need to be protected for public enjoyment and benefit of this visual character.

- in order to maintain the character of a hillside, for residents as well as the neighbouring communities, natural features such as ridgelines, knolls, boulders, cliffs, wildlife trees and stream riparian corridors, should remain.

## NATURAL ENVIRONMENT

- e) *to minimize slope alterations and retain the natural terrain and topography of the site.*
- minimize disturbance to natural vegetation, thereby maintaining:
    - ecosystem integrity and protecting natural buffers between lots; and
    - slope stability reducing hazardous conditions such as landslides and erosion.
- f) *to identify and protect significant stands of trees and vegetative communities.*
- retaining or removing vegetation should be based on an intimate knowledge of the site in accordance with the information required under Section 1.6.
- g) *to plant vegetation that helps mitigate the impact of development, enhances visual quality and addresses the needs of residents.*
- consider using plants and tree species that are native to the local environment which can help provide food and shelter for local wildlife, cost less to maintain and, in drier locations, be more fire and drought resistant.

## WORKS AND SERVICES

- h) *to implement methods for collection, conveyance, control and treatment of stormwater that will mitigate potential impacts on and downstream of steep slope sites.*
- use the City's Stormwater Management Goals, Objectives and Policies to limit runoff from new development according to the capacity and sensitivity of the downstream watercourse systems.
- i) *to allow flexibility in road layout patterns and road widths that compliment hillside character, and where visual and environmental objectives can be achieved.*
- road patterns developed for "flat land" are not always suitable on sloped land, and flexibility is needed to achieve a sense of neighbourhood while being sympathetic to the terrain.
- j) *to provide safe and functional access to individual properties throughout the year.*
- when planning subdivisions, the following access issues must be considered:
    - driveways with significant elevation difference;
    - short travel distance or tight corners;
    - limited parking capacity;
    - limited visibility on the road;
    - difficult access in winter conditions; and
    - space for residential pick-up and delivery.
- k) *to provide municipal services and utilities on steep slope developments that has the least environmental and visual impact, meets service requirements, and minimizes redundancy, capital costs and ongoing maintenance costs.*



- since development on steep slopes requires additional infrastructure to deal with elevation changes in relation to the servicing lines, a comprehensive design and phasing of infrastructure should be used to reduce costly redundancy or insufficient capacities, and to limit the impact to the natural environment caused by repeated digging and to limit alterations to the landscape.
- comprehensive design of water and sewer systems could be considered as part of, or in response to, neighbourhood plans.

## **BUILDING AND STRUCTURES**

*l) to allow greater flexibility in locating a building on a steep slope lot.*

- provide flexible front and side yard setbacks in the Zoning Bylaw to reduce the amount of cutting and filling required, and support level entry, good street presence, and a less “imposing” character on surrounding developments.

*m) to avoid overheight buildings and minimize the visual impact of new buildings on steep slopes.*

- apply the residential height requirements in the zoning bylaw.

## **1.5 DEVELOPMENT APPROVAL INFORMATION**

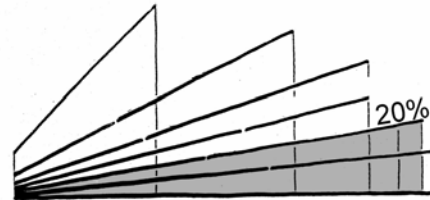
The following information may be required when developing in a Steep Slope DPA as part of a rezoning application and/or subdivision approval process. The Director of Planning has been delegated the authority by Council to vary the information required on a site-specific basis.

- A topographic and land feature survey.
- A general site survey.
- A geotechnical evaluation.
- A grading plan (Section 3.5.5) that indicates a clear feasibility for roads, driveways and building envelop without massive manipulation of the site.
- A tree and vegetation plan.
- A drainage management plan.
- An erosion control plan (Section 3.5.7) that avoids massive manipulation of the site.
- An Environmental Inventory and Assessment (Section 3.5.3) to identify environmentally sensitive areas and features to be protected, and to determine measures to avoid, minimize or mitigate environmental impacts of the proposed development and development activities.
- Adherence to previously established Development Permit Areas.

# 2. DEFINITIONS

## 2.1 SLOPE AND STEEP SLOPES

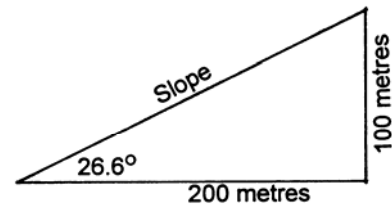
Steep slopes are defined as *lands in their natural state that have a slope angle of 20% or greater for a minimum horizontal distance of 10 metres*. This definition is used to identify all properties 0.5 hectares or greater with a 10% or greater portion of the parent property having sloped land 20% or greater.



*For clarification, land with a slope that is less than 20% for a minimum horizontal distance of 10 metres is not a steep slope under these guidelines.*

There are over 1200 hectares of steep slope lands in Nanaimo comprising 14% of the City's total area and 25% of its undeveloped lands (see attachment (a)). These areas are found primarily in the north end (between Departure Bay and Hammond Bay Roads and along the North Slope), south and east of Westwood Lake, along the Chase River, and in the southern Cinnabar Valley region.

The steepness of slopes can be described in degrees, a ratio, or as a percentage. The accompanying figures describe the measurement of a slope and provide a means of quickly estimating equivalencies between the three scales. Note that it is possible to have a slope greater than 100% or 45° (1:1).



100m in elevation change over a horizontal distance of 200m can be expressed as:

- RATIO    horiz.:vert. = 200:100 = 2:1
- PERCENT    vert./horiz. = 100/200 = 50%
- DEGREES    26.6° (n.b., tan 26.6° = 0.5)

The steepness of slopes does not necessarily correlate with the stability of slopes. Stability also depends on factors such as geologic materials, soils, moisture content and vegetation cover. A proper geotechnical investigation is required for developments on steep slopes. Various studies have found that soil slips, which cause avalanche failures, commonly initiate on slopes greater than 33%; slower moving earth flows occur most often on slopes 30 to 60%. Nevertheless, serious erosion can occur on much shallower slopes. However, it should always be remembered that steeper slopes are less forgiving of construction errors than shallower slopes, and, when steeper slopes do fail, such failures generally have more disastrous consequences.

<b>SLOPE</b>	Ratio		5:1	3:1	2:1	1.5:1	1:1	>1:1	
	Percent	0	20	33	50	67	100	>100	
	Degrees	0	11	18	26	34	45		90

## 2.2 OPEN SPACE DEVELOPMENT

**Open space development** is a design method that locates buildings on part of a development parcel, allowing the remaining land to be retained as open space. Open space development typically allows reduced lot sizes or a greater variety of building forms compared to conventional subdivisions provided: (a) there is no significant increase in the number of lots permitted under a conventional subdivision (in other words, no increase in the overall density on the site); and (b) the remaining land is devoted to permanent open space. Using this concept, the number of lots or units remains virtually the same as in a conventional subdivision, but open space is retained.

Open space development can provide flexibility by involving a variety of housing forms and tenure options:

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

## 2.3 BUILDABLE SITE

Every subdividable lot or tract shall have sufficient building area for the use intended. In determining whether suitable building area exists, the Zoning Bylaw will stipulate the calculations for lot size, building siting and access.

## 2.4 INTENSIVE RESIDENTIAL DEVELOPMENT

**Intensive Residential Development** is defined as small lot single-family subdivisions or multi-family forms as described in the Zoning Bylaw and as defined in Section 2.2. Intensive residential development includes a minimum permanent open space component of 20% of the gross area or greater, depending on negotiated density.

## 2.5 OPEN SPACE

**Open space** is natural areas that are privately owned, jointly owned and managed, or designated as public park, and that is permanently protected from development and other disturbances. Minor disturbances can be made as part of a fire protection area or for modest park amenities created in keeping with the intent of maintaining the space as natural and undisturbed. (See Appendix A.)

# 3. GUIDELINES

The following guidelines will apply to DPA 25 to address special conditions or objectives set out in Section 1.4 above:

## 3.1 SITE AND SUBDIVISION DESIGN

*Subdivision and site design on steep slopes is expected to respond to the unique characteristics of each site, avoiding significant disruption of the natural terrain as much as possible. Along with displaying sensitivity to the natural hillside, projects should be compatible with nearby neighbourhoods.*

*For planning new subdivisions on steep slopes, the following principles should be considered:*

- *The conventional 600 – 700 sq. m. single family lot development is typically the most disruptive housing type on steep slopes.*
- *Open space development (Section 2 – Concepts and Definitions) can be more appropriate to protect steeper or more environmentally or geotechnically sensitive parts of the hillside.*
- *Alternatively, larger lot sizes are required.*

### 3.1.1 Assessing the Site

#### Objective

**To** identify significant features prior to developing the building site and road design in order to acknowledge the hillside character and natural features of the site.



#### Guidelines

The guidelines indicate how the site must be planned to respect slope and special features. Sites identified as DPA 25 must provide information in accordance with section 1.6 and include the following:

- a review that includes a topographic survey (Section 3.5.1) to assess and plan the site in a manner that respects the slope and special features.
- a geotechnical assessment (Section 3.5.2) to identify and avoid hazardous areas, to make the site safe for human use and to maintain environmental quality.
- an environmental assessment (Section 3.5.3) to identify existing ecosystems and special natural and cultural features of a site. Using what nature has provided is both environmentally and economically wise. Emphasizing the existing characteristics of the site can help retain natural resources, allow for efficient construction and maintenance, and can reduce permitting and site development costs.
- adherence to the guidelines associated with any Development Permit Areas affecting a site as designated in the *Official Community Plan* for other purposes is required. A Steep Slope Development Permit applicant may not be required to obtain separate approvals or duplicate assessments provided the intent of all permits are met.

## 3.1.2 Planning the Development

### Objective

**To** undertake subdivision planning and design that respects the existing natural area's terrain, hazardous conditions, and ensure the form and character of the development enhances the natural setting.

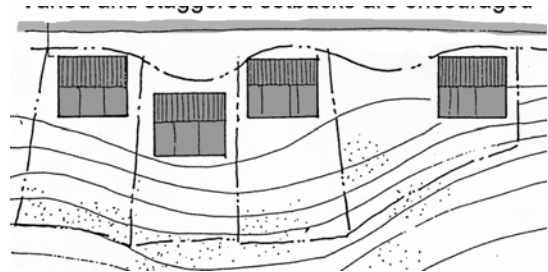
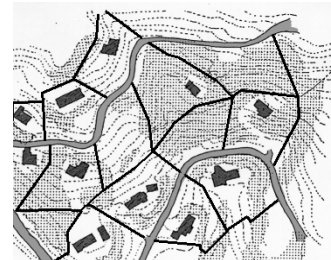


### Guidelines

*In general, the City supports the use of larger single-family lots or open space development or a combination of these two types of development, on steep slopes in order to provide appropriate building sites while retaining natural features and hillside character.*

#### 1. Single-Family Subdivision Development

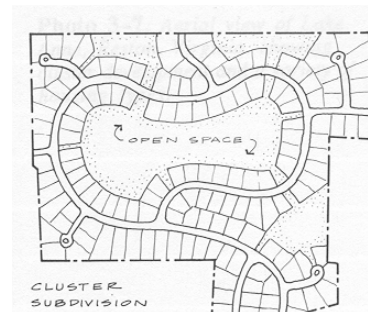
- When calculating lot area within single-family subdivisions, it should be exclusive of any slope of 30% or greater. Where the minimum lot size cannot be achieved on lands with slopes less than 30%, a larger minimum lot size may be considered.
- Each single family parcel created by subdivision must have a buildable site and show a building envelope on the subdivision grading plan.
- Use building setbacks in a flexible manner to protect slopes and natural features from development encroachments (see Section 3.4).
- Show proposed setbacks, driveways and building pads on grading and subdivision development plans.



## 2. Open Space Development

- Open space development should be used as an alternative to a conventional single-family subdivision where one or more of these criteria can be met:

- it reduces site manipulation and preserves more of the natural character of the hillside than a standard single-family subdivision.
- it protects designated Environmentally Sensitive Areas (ESAs) on the property.
- it avoids developing steep or hazardous (eg, erodeable or flood-prone) portions of the property.
- the open space provides a natural corridor through or around the property, or connects to open space in the neighbourhood.
- the open space buffers higher density development from neighbouring single-family development, if applicable.
- the proposed building forms are of a character and quality that fit into and enhance the surrounding neighbourhood.
- the development maintains a visually attractive ridgeline (see guidelines on ridgeline developments).
- installation of infrastructure and provision of public services can be economized.

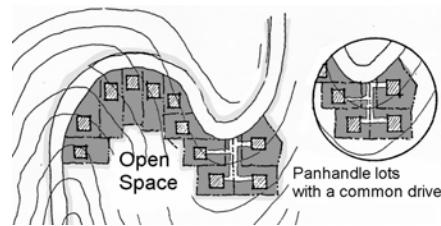


- A plan for a proposed open space development shall show how it meets the above criteria, where applicable.
- In existing residential areas, open space development should be in the form of smaller single-family lots, duplexes, triplexes, quadruplexes, patio homes or small-scale townhouse complexes.
- The amount and distribution 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 form.
- To qualify as open space development on those lots proposing to cluster, a minimum of 20% of the gross site area shall be provided as permanent open space.

- The undeveloped portion of the parcel shall be designated and secured as permanent open space and shall not be further subdivided. Dedication of the Open Space to the Department of Parks, Recreation and Culture for City parkland will be considered as a preferred approach. If parkland is not an option, other options such as a land trust or an organization capable of holding and managing the site should be considered. Smaller tracts could be managed through a strata arrangement.

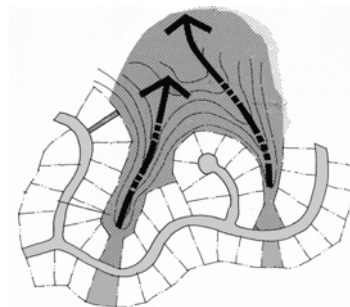
### 3. Roads and Lot Layout

- Straight lines and rectilinear shapes generally do not complement natural hillsides. Lay out roads and lots in a pattern that offers a variety of sizes and configurations that complement the topography and features of the site. See further guidelines regarding roads in Section 3.3.2.
- Use flag or panhandle lots only where they can minimize cut and fill and can provide access to developable areas not readily accessible by public roads. Panhandle accesses shall meet the requirements of the City for servicing and fire protection.



### 4. Trails and Open Space

- Retain open space and corridors between development cells or lots to provide continuous habitat linkages within the site as well as with neighbouring sites.
- Use trails or linear systems to link parts of the hillside community which are not otherwise linked by roads due to topographic constraints. An open space, streetscape and trail system should be developed to provide pedestrian access within the hillside area and to/from key destinations in other parts of the community (eg, schools, commercial or town centres, parks, other trails, etc).
- Avoid extensive slope grading to accommodate parks. Establish “pocket” parks for respite where natural terrain permits, or very minor grading is needed, which could serve as a local amenity as well as protect more of the slope.
- Incorporate significant features such as rock outcrops, streams, cliffs, and stands of trees into the open space/trail system.





### 3.1.3 Earthworks & Grading

#### Objective

**To minimize the impact of grading and retain the natural and topographic character of the site.**

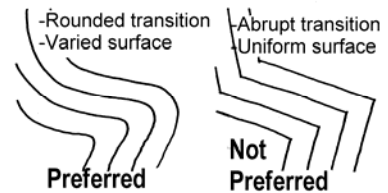


#### Guidelines

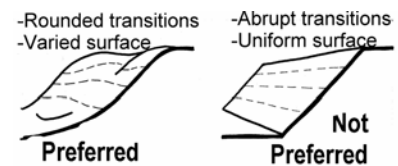
### 1. Grading

In preparation of a grading plan (Section 3.5.5) that indicates clear feasibility for roads and building envelope without massive manipulation of the site, the following must be considered:

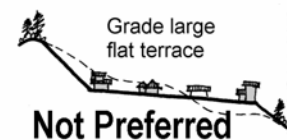
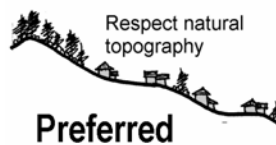
- Avoid grading or alteration of key topographic features (eg, knolls, ridgelines, bedrock outcrops, cliffs, ravines, etc).
- Avoid a manufactured appearance for graded slopes. Avoid sharp cuts and long or wide slopes with a uniform grade.



- Establish contours and gradients that resemble the naturally occurring terrain. Round out slope transitions and blend transitions between lots or adjacent to undisturbed areas.



- Refrain from grading large flat terraces on hillside sites in order to expand developable area or to develop housing or other uses characteristic of flat or gently-sloped sites. Developing smaller terraces (eg, for building pads, lawn areas, patios, stepped retaining walls, etc) is acceptable.



## 2. 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:

- Where the volume of cut exceeds the volume of fill material for a proposed development, do not dispose of it on site in the form of unnecessary filling, berming or side-casting. Where necessary, dispose of excess material at appropriate off-site locations.
- Revegetate exposed slopes as quickly as possible to prevent erosion and slope stability problems.

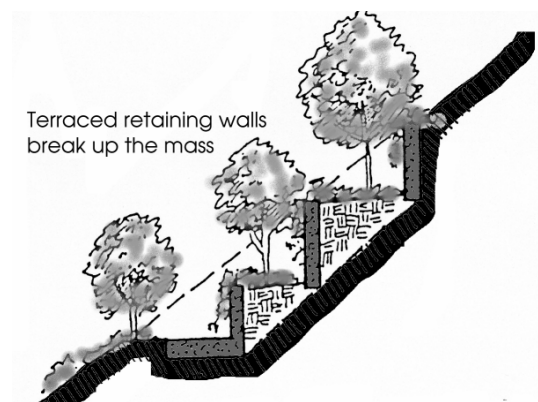
## 3. Earthworks

In preparing an erosion plan (Section 3.5.7), the following must be considered:

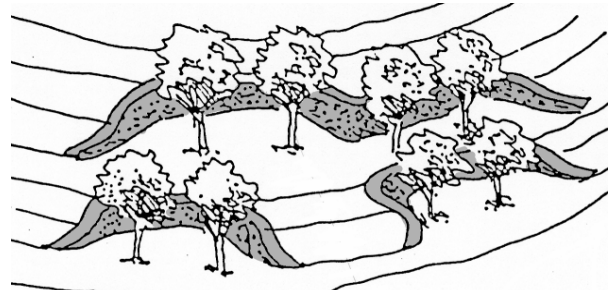
- Avoid potentially hazardous or unstable areas of the site.
- Do not clear more trees and vegetation than is needed to install services for any given phase of the development.
- Do not create deep scars or expose large areas of highly visible sub-soil and parent material of the site.
- Avoid side-casting of material along undeveloped road frontages.
- Avoid the excavations and the placement of fill that result in terrain forms that are not characteristic of the natural topography.

## 4. Retaining Walls

- Use retaining walls where they can reduce disturbing the slope to provide useable construction sites.
- Retaining walls should respect the natural character of the site and not be dominating or fortress-like.
- Retaining wall height should generally be limited to 3.0 metres for roads and site works, 1.2 metres for front yards, and 2.4 metres 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 at its base.



- Employ a system of smaller stepped retaining walls over the use 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, landscape the intermediate terraces.



Several small retaining walls can be screened

- If the retaining wall is related to the structural integrity of the building, it will be necessary to address the retaining wall through the building permit process.

### 3.1.4 Visual Quality

#### Objective

**To** protect and preserve the natural character of the hillside as well as to consider opportunities to provide scenic views from a hillside site.



*This or this?*

#### Guidelines

##### 1. Ridgelines

*Certain ridgelines visible from strategic locations contribute significantly to the character of Nanaimo. A ridgeline is the continuous line that demarcates the contrast between the sky and the earth (ie, the natural terrain or top of tree line), and can apply to ridges, knolls and significant topographic transitions. Attachment (b) of these guidelines identifies significant ridgelines that are visible from many parts of the city and need to be protected for visual character.*

- Intensive residential development (see Section 2.4) in the vicinity of ridgelines should be sited so as to retain trees and other vegetation on ridgelines as much as possible, so that the ridgeline is seen predominately as a continuous line of natural terrain or vegetation.
- Where there are gaps or interruptions in the ridgeline caused by site development (eg, buildings, road cuts, utility poles or corridors, site clearing, earthworks, etc) plant trees and vegetation in front of and behind the disturbance to screen and restore a naturally appearing ridgeline.
- Interruptions should occur in several smaller components rather than one continuous interruption.
- Site building envelopes below the ridgeline. Avoid the placement of roads, clear cuts, and large or continuous buildings on or over ridgelines.

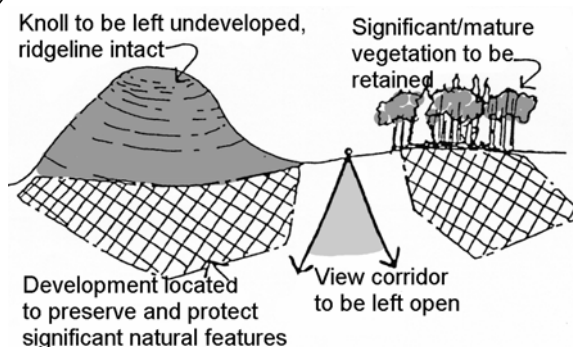


- On any parcel containing a significant ridgeline identified in attachment (b), where interruption of the natural terrain is proposed to exceed 25% of the ridgeline length, within the parcel the siting and form of the development must compensate for this interruption by retaining most of the available slope below or beside the development in its natural state.

## 2. Scenic Features

*Scenic features are components of the site that are visually unique and visible to the site, neighbourhood or community (eg, rock outcrops, cliffs, overhangs, ridgelines, knolls, ravines, gullies, water bodies, water courses, wetlands, etc).*

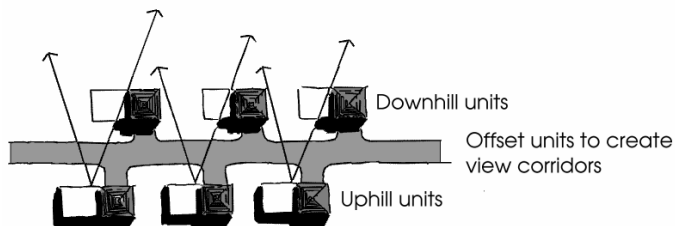
- Development should be sited and designed in a way so as not to alter, disturb or remove significant scenic features of a parcel such as a rock outcrop, cliff, overhang, ridgeline, knoll, ravine, gully, water body, water course or wetland.
- The form, exterior design, and finish of buildings and structures should be complementary to the scenic feature, preferably through the use of muted colours and natural materials.
- Development should be sited so as to minimize the impact on down slope views by interrupting the view of imposing structures seen by the neighbourhood.



## 3. Views From the Site

*Scenic view opportunities from hillsides are recognized as valuable to both hillside residents and the community as a whole. It is important, however, not to compromise the geotechnical or environmental integrity of the slope just to achieve views.*

- Locate buildings to minimize interference with the views of nearby residences. For example, stagger buildings where appropriate to provide views between units that may otherwise limit the field of view.



- Locate buildings and set building heights so that upslope buildings can have views over downslope buildings. If massive grading of the slope is necessary to achieve this concept, it may be necessary to reconfigure the subdivision or layout. The priority is to avoid disruption of the terrain.



- Plan revegetation that will not encroach on views.
- Locate key public open spaces (eg, park, street end, etc) to capitalize on scenic views from the site.

## 3.2 NATURAL ENVIRONMENT

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

### 3.2.1 Environmental Protection

#### Objective

**To** identify and protect significant environmental features and natural systems.



#### Guidelines

- Use the Environmental Inventory and Assessment (Section 3.5.3) to identify environmentally sensitive areas and features to be protected, and to determine measures to avoid, minimize or mitigate environmental impacts of the proposed development and development activities.
- Pay particular attention to sediment and erosion control during and after site development and construction. The City publishes a brochure entitled “Erosion and Sediment Control” to assist landowners and developers in preventing and controlling erosion on their sites. An erosion control plan is required for subdivision and development permit approvals on steep slopes (Section 3.5.7).

## 3.2.2 Vegetation in the Landscape

### Objective

**To identify and protect significant stands of trees and vegetative communities.**



### Guidelines

#### 1. 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 the maintenance of slope stability, drainage and erosion prevention. The decision to retain or remove vegetation should be based on an intimate knowledge of the site.*

- When preparing a land clearing and tree retention/removal plan (Section 3.5.4), apply the following criteria in determining existing vegetation to be retained:

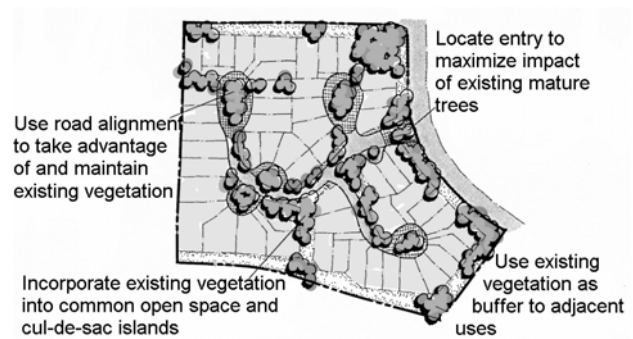
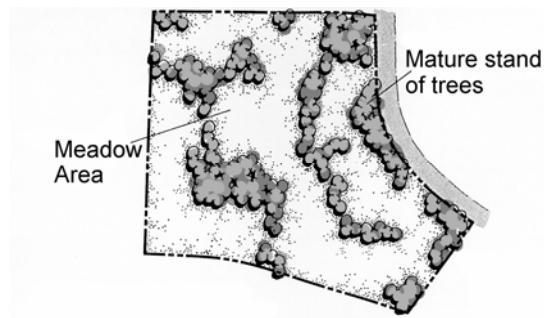
##### RETENTION CRITERIA

- To retain special features and the character of the site
- To retain slope stability
- To prevent erosion
- To keep special or rare trees, plants and plant communities (eg, Garry oak woodlands, manzanita communities, etc)
- To protect habitat values
- To selectively screen development or act as buffers
- To maintain vegetated open spaces

##### REMOVAL CRITERIA

- To accommodate site development/improvements
- To ensure public safety
- To reduce fire hazard

- Use open space development, and varied lot size and configuration, to retain tree stands and other vegetation communities to preserve environmental value (e.g., habitat, biodiversity, heritage trees, etc), 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 building facades, roadways (eg, 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 critical 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.

## 2. Phased Removal

- Phase land clearing to minimize the area exposed to soil loss and erosion at any one time. Phasing may be service related (eg, clear initially only enough to install roads and main service lines), or spatially related (ie, clearing only one portion of the parcel at a time, completing development and revegetation 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 revegetated.
- For areas of the site where vegetation must be removed but no construction will occur, leave soil intact (ie, avoid compaction, excavation, filling, etc) to allow for more successful replanting in these areas.



### 3.2.3 Revegetation & Landscaping

#### Objective

**To** plant vegetation that helps mitigate the impacts of development, enhances visual quality and address the needs of residents.



#### Guidelines

##### 1. 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.*

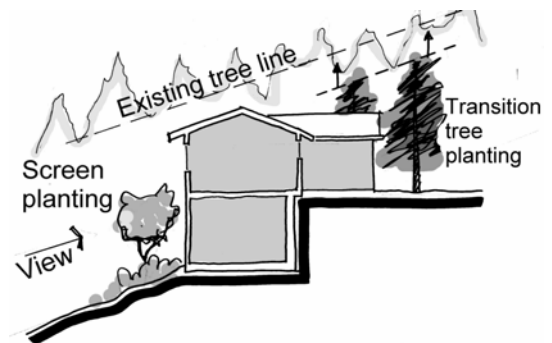
- Restore disturbed areas of the site that are not part of a roadway or formal yard landscaping, to a natural condition as soon as possible after disturbance.
- Employ restoration practices (see sidebar) specifically tailored to address the type and degree of disturbance and the specific conditions of the site.

##### **RESTORATION PRACTICES**

- Grade to natural contours
- Stabilize the slope/bank
- Alleviate soil compaction
- Control erosion
- Prepare the soil
- Hydraulic seeding
- Plant trees and shrubs
- Irrigate
- Maintain and follow-up

##### 2. Tree and Plant Replacement

- Replace trees in a manner that helps to restore the natural character of the hillside site. Specifically, plant trees to screen undesirable views and buffer incompatible uses. Arrange trees in natural groupings or clusters rather than in lines or formal arrangements.
- Utilize plant material for site restoration and residential landscaping that is native to the region as much as possible. Where the use of native plant material is not desirable given site or view constraints, select plant material that is similar in appearance, growth habit, colour and texture to native plants, and that will not act as a “weed” in the natural environment (ie, it 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 views of others. Take into account the location, height and “bushy-ness” of tree species planted.
- For restoration or creation of habitat areas (eg, riparian areas, ravines, greenways, etc) use plant species that have value as food or cover for wildlife.
- For dry or south facing slopes, replant with drought and fire-resistant species. Appendix A provides further suggestions for treating vegetation on dry slopes in order to reduce potential fire hazards.

### **3. Irrigation**

- 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.
- Limit over-spray and run-off due to watering.
- Provide automatic shut-off valves for irrigation systems to reduce the risk of accidental erosion in the event that a head or pipe breaks.

## 3.3 WORKS AND SERVICES

*This section of the guidelines addresses various means of designing and siting 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. Reducing cost of development and minimizing maintenance costs are also benefits.*

### 3.3.1 Stormwater Management

#### Objective

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



#### Guidelines

*The City's Stormwater Management Goals, Objectives and Policies limit runoff from new development according to the capacity and sensitivity of the downstream watercourse systems. Attention to these policies is particularly critical on steep slopes due to the potential for significant impacts on downstream drainage.*

#### 1. Drainage Planning

- Plans for all development on steep slopes must indicate how stormwater runoff will be impacted by the development and how those impacts will be mitigated.
- Depending on the size of the development and complexity of the site conditions, a Drainage Management Plan may be required for the entire site and downstream drainage areas. (See Section 3.5.6 for the basic requirements of a Drainage Management Plan.)  
For steep slopes, special attention must be paid to:
  - Hydrological conditions prior to and after development;
  - Protection of natural flow paths, volumes and storage resources;
  - Impacts on trees, vegetation and other environmental features due to changes in drainage patterns;
  - Water quality prior to, during and after development;
  - Sediment and erosion control; and
  - On and off-site drainage impacts (eg, 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 and where visual and environmental objectives can be achieved.



10 m road, sidewalks both sides



8.5 m road, sidewalk one side

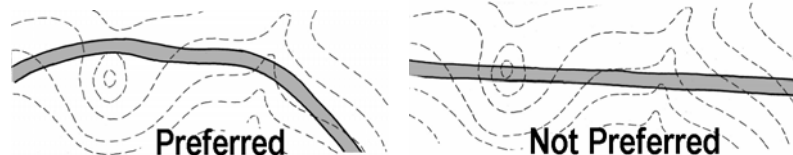
#### Guidelines

### 1. 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 a pattern for lot development. However, the cuts, fills and retaining walls associated with achieving a “flat land” road standard can have a devastating effect. Roads in steep slope areas should help achieve a sense of neighbourhood while being sympathetic to the terrain.

- 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.

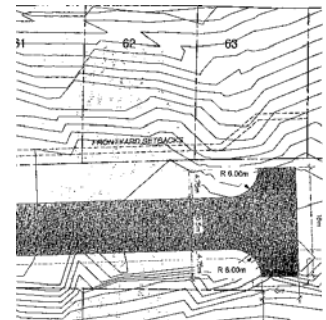
- Align roads to conform to the natural topography. Gentle horizontal and vertical curves are preferable to straight line grid patterns that require significant earthmoving, or create exceptionally steep grades.



### 2. Local Roads

- Local roads (serving houses that front on them) should be kept to a minimum scale and reflect the local resident/pedestrian use.
- Split roads with 1-way access on each portion, 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;

- The pre-development cross-slope on the road right-of-way exceeds 15%;
  - 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 slope 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 six metres and a minimum right-of-way of nine metres, and will not exceed 200 metres in length to the nearest cross-road.
  - Where cul-de-sacs are contemplated, pedestrian connections linking the cul-de-sac to other streets and open spaces should be incorporated.
  - Alternative road-ends (reduced cul-de-sac radii or hammerhead configurations) may be utilized on a site-specific basis where:
    - There is lack of sufficient land for a cul-de-sac 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; and
    - The road end accommodates the turning of service and emergency vehicles.



### 3. Local Road Widths and Cross Sections

*Cross sectional aspects of a road can have a dramatic impact on the area of disturbance caused by construction. For instance, the Subdivision Bylaw requires urban local collector roads to provide parking and sidewalks on both sides of the street. Flexible cross-sectional standards can lessen these impacts.*

- Reduced road widths (eg, from 10 m to 8.5 m) and cross-sectional design standards may be used on steep slopes where:
  - slope disturbance is significantly reduced and/or special features or habitat are protected;
  - parking requirements can be met on-site rather than on the road;
  - public safety is maintained; and
  - access for maintenance and emergency vehicles is assured.
- Similarly, reductions in the required width of rights-of-way may be considered where grading for the full width will significantly impact topography or natural features. See Section 3.4.4 regarding the location of utilities for further guidelines on reducing the width of rights-of-way.

- If access to a particular site by public or municipal service vehicles is considered too challenging or difficult, it may be beneficial to consider a strata development.

#### 4. Sidewalks

- The requirement for sidewalks on both sides of minor collectors and local roads on steep slopes may be reduced to one side where the predevelopment cross-slope on the road right-of-way exceeds 20%. Pedestrian safety must not be compromised by exclusion of the second sidewalk; for example, the road should not be within 0.5 km of a school or other public destination.
- The requirement for sidewalks on local roads may be reduced or eliminated on particularly difficult topography where large lot development generates low traffic volume. Again, pedestrian safety must not be compromised; for example, the road should not be within 0.5 km of a school or other public destination.
- 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.



#### 5. Design Speed and Road Grade

*Conventional design road grades and design speeds require road geometry that may be less able to respond to local topography, and increases the need for significant cut and fill sections. More flexible grades and design speeds may be appropriate in some cases.*

- Design speeds of less than 50 km/h may be considered on local roads or local connectors on steep slopes where this allows roads to be more responsive to topographic conditions and significantly reduces grading requirements.
- The maximum grade on local roads currently allowed under the City's Manual of Engineering Standards and Specifications is 12%. For local roads on steep slopes, grades up to 15% may be permitted for short sections (not exceeding 100 metres in length) if overall impacts are reduced and the natural character of the slope is retained. The "stopping sight distance" at intersections must not be negatively affected. Where future development on adjacent parcels will allow, an alternative, lower grade access into the neighbourhood is encouraged over the long term.

#### 6. Consideration of Alternative Standards

- Where alternatives to the City's existing Engineering Standards and Specifications are being proposed to accommodate steep slope conditions, the City commits to review these alternatives on a priority basis.

### 3.3.3 Property Access

#### Objective

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

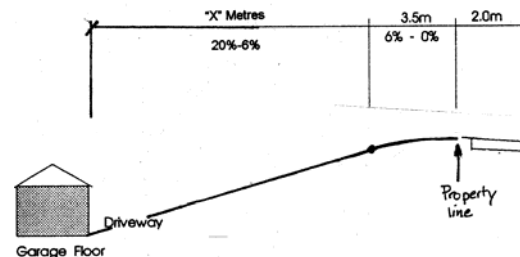


#### Guidelines

### 1. Individual Driveways

On steeply sloping sites, designing and installing driveways presents many challenges, such as: significant elevation difference, short travel distance, or tight corners; limited parking capacity; limited visibility at the road; difficult access in winter conditions; and space for residential pick-up and delivery.

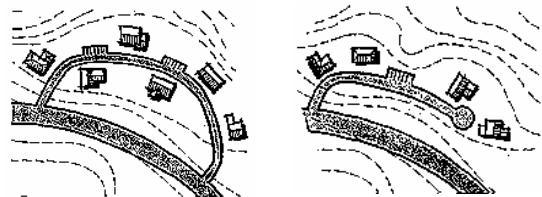
- In general, driveways should have a grade no greater than 20%.
- Where a driveway grade exceeds 20%, there should be two readily accessible off-road parking stalls for the property.
- On downslope parcels, the driveway grade on the first 3.5 m from the property line can be no greater than 7% (see figure).
- Consider the needs of access by emergency vehicles in locating and designing driveways.



### 2. Common Driveways

Common driveways are vehicle access routes shared by two or more lots.

- Common driveways are encouraged when significant site grading can be reduced.
- The grade of a common driveway should not exceed 14%.



- In general, limit in-and-out common driveways to servicing six lots.
- Up to 15 lots may be serviced with a one-way through-access driveway exiting onto a municipal road, depending on site-specific conditions.
- Provide one on-site guest parking spot per dwelling serviced by the common driveway.
- A “reciprocal access and maintenance agreement” among property owners is required for approval of a common driveway. The City is not a party of these agreements.
- The civic addresses of the residences located on a common driveway must be displayed on a sign visible from the street.
- An appropriate location and space must be provided at the street for common garbage and recycling pick-up, and postal delivery. The space must be sufficient to allow a service vehicle to pull over off the street. These provisions must be included in the reciprocal access and maintenance agreement.



### 3.3.4 Municipal Services and Utilities

#### Objective

**To** provide municipal services and utilities on steep slope developments that has the least environmental and visual impact, meets service requirements, and minimizes redundancy, capital costs and ongoing maintenance costs.



#### Guidelines

##### 1. Municipal Services

*Development on steep slopes requires additional infrastructure for water systems, including booster pump stations, reservoirs, pressure reducing valves, individual pressure regulators and pipe anchors. Sanitary sewer systems require additional infrastructure such as lift stations and forcemains. If these systems are not comprehensively designed and phased, costly redundancy or insufficient capacities can result.*

*Comprehensive design of water and sewer systems could be accomplished as part of, or in response to, neighbourhood concept plans. This approach eliminates ad hoc expansions, which can result in costly future upgrades as services are extended. Comprehensive planning ensures appropriately sized services and logical phasing and expansion of the systems in a cost-effective manner.*

- All services and utilities will be installed underground.
- Where practical, install more than one service in a common trench to reduce the number of trench excavations and therefore the impacts on the terrain. Where the design profile permits, increase the pipe separation to obtain more than one service in a trench. The works must be constructed in accordance with City and Provincial standards regarding separation of water and sewer lines.
- Design water service valve and meter boxes with flexible offsets to property lines to maintain ease of access and maintenance. Locate boxes where future grading or landscaping of boulevards will not make access difficult.
- Design water system pressure zone boundaries with sufficient range to ensure fire fighting pressures in the highest side of parcels.

## 2. Utilities

*Development of utility service strategies should also be included in the neighbourhood planning process. Any 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. This will allow more flexibility to grade rights-of-way to match existing ground within the road rights-of-way, which will reduce physical impacts and provide easier servicing in steep slope neighbourhoods.
- Where practical, install power, telephone and cablevision in a common trench in accordance with the City's Standards. Installation of these services under sidewalks is encouraged where this can reduce the effective right-of-way required on a steep slope.
- Alternatively, if no sidewalks are installed on the upper side of a road right-of-way, utilities could be installed deeper than standard, allowing the slope to grade upward from the back of the curb within the road right-of-way. Utility service and transformer boxes, which need to be at road grade, would require suitable grading and retaining structures. However, the net effect can significantly decrease earthwork volumes and grading required to install a road into a steep slope.
- Locate access to utility boxes, fire hydrants and other services that require periodic inspection in areas where slopes do not exceed 15% and where they are clearly visible from the road.
- Consider providing hydrants and access behind lots that back onto forested areas where vegetation can be a potential hazard.

## 3.4 BUILDINGS AND STRUCTURES

*This section addresses the height, mass and setbacks of buildings on steep slopes to reduce slope disruption, minimize visual impact and avoid impinging on sight lines from neighbouring lots.*

*Appendix B complements this section by offering suggestions on building design and architecture that complements steep slope settings.*

## 3.4.1 Building Setbacks

### Objective

**To** allow greater flexibility in locating a building on a steep slope lot.



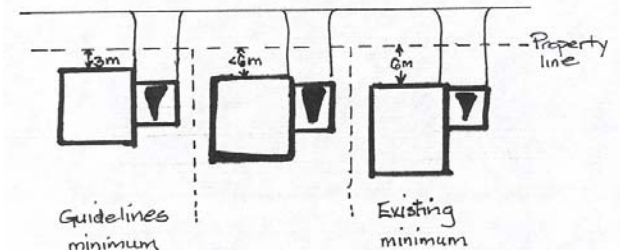
### Guidelines

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.

#### 1. Front Yard

The Zoning Bylaw now requires a minimum 6 m setback from the front property line for most residential zones. 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 m.



## 3.4.2 Building Height and Mass

### Objective

**To** avoid overheight buildings and minimize the visual impact of new buildings on steep slopes.



### Guidelines

#### 1. 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 on properties below.*

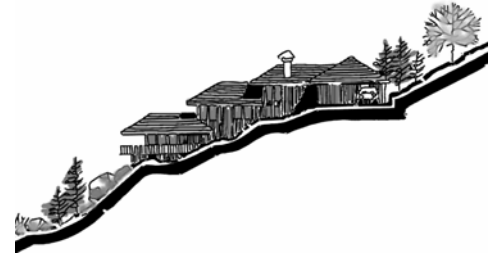
*When dealing with height on steep slopes, the following should be considered:*

- Height of adjacent buildings should be considered and consistency maintained.
- Overall height should be reduced for flat-roof buildings.
- Consider higher building heights in exchange for a steeper roof.
- 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 up hill.
- Consider the use of a reduced front yard setback to resolve issues such as steep driveways.

## 2. 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 below. The Zoning Bylaw stipulates a maximum lot coverage for each residential zone which addresses building mass to some extent. The following provide some additional 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.



- On downhill elevations, avoid the use of single plane walls that exceed one storey. Rather, step upper storeys 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 which reflect the sloped character of the site.



## 3.5 INVENTORY, ASSESSMENT AND PLAN REQUIREMENTS

Refer to Section 1.6 under “Development Approval Information”

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

- *General site survey;*
- *Geotechnical evaluation;*
- *Environmental assessment;*
- *Grading plan;*
- *Tree and vegetation plan;*
- *Drainage management plan; and*
- *Erosion control.*

### 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, rights-of-way;
  - Contours (1.0 metre interval), spot elevations;
  - Natural physical features including swales, knolls, ridgelines, bedrock outcrops, cliffs and slope transitions or break lines;
  - Existing human made features including roads, curbs, sidewalks, above and below ground utilities, trails, buildings, structures, fences and retaining walls;
  - Slope analysis showing slope intervals of 0-10%, >10-20%, >20-30%, >30%. This information should also be shown 20 m beyond the property line;
  - Potential hazards and hazard areas (see “Geotechnical Evaluation” below);
  - Environmental attributes (see “Environmental Assessment” below); and
  - 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 should include:
  - An assessment of existing surface and subsurface conditions;
  - Identification of hazards;
  - Potential impacts of development; and
  - Recommendations for safety, site protection, development and mitigation.
- Use the “Guidelines for Preparation of Geotechnical Reports” in preparing this evaluation.

### 3.5.3 Environmental Assessment

- An environmental assessment is required that consists of the following minimum steps:
  - An inventory of environmental attributes on the site;
  - An evaluation of the impacts of the proposed development on these attributes; and
  - Proposals to avoid, minimize, mitigate or compensate for impacts.
- The environmental inventory should coordinate with the site survey, and be based on available documented data and field investigations of the site. It should include the following information as a minimum:
  - Watercourses (if applicable). Characteristics to be surveyed and mapped include top of bank, wetland or natural boundary (as appropriate), and leave strip boundary as defined in Schedule G of the Zoning Bylaw or Schedule B of the Official Community Plan.
  - Environmentally Sensitive Areas (ESAs), that is, ecosystems that are ecologically important and in danger of disappearing. Known ESA sites are identified in Schedule B of the OCP; however, any sites that meet the description of environmentally sensitive lands provided in the OCP (see accompanying text box) are considered an ESA.



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**ESA's defined in the OCP**

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- Trees, including the location, species and dimensions of significant trees (as defined in the Tree Protection Bylaw) and their drip lines, significant stands of trees.
  - Vegetation associations and their coverage.
  - Existence of rare or endangered plant or animal species or ecosystems (referred to provincially as red- and blue-listed).
- Sensitive, rare or depleted ecosystems and features
  - Productive wildlife or fish habitat
  - Watersheds, streams, wetlands, riparian areas and aquatic habitat
  - Mature and old growth forest
  - Unique or rare woodland communities (e.g., arbutus, Garry oak, manzanita) and wildlife trees
  - Unique or rare herbaceous communities
  - Cliffs, bedrock outcrops, coastal bluffs, points and rocky islets
  - Marine foreshore and nearshore areas
  - Habitat where red- or blue-listed plant or animal species have been identified and confirmed
- 

- An assessment of the environmental attributes of the site, based on the results of the inventory work, is required and should address the following in relation to the proposed development activities:
  - Opportunities and constraints of the environment as they apply to the proposed development;
  - Measures to be taken to avoid impacts on environmental attributes of the site; and
  - Measures to minimize, mitigate or compensate for environmental impacts where they are unavoidable.
- Inventory and assessment work should be conducted and recommendations made by qualified professionals for issues within their area of expertise. Examples of professionals that may be required for some aspect of the environmental assessment include a Registered Professional Biologist, Professional Engineer, Registered Professional Forester or Arborist, Landscape Architect, etc.

### 3.5.4 Land Clearing and Tree Retention/Removal Plan

- A *Tree Management Plan* is required by the City. 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. Details of tree management plans are specified in the *Tree Protection Bylaw*.
- Clearing and tree removal should be phased to avoid creating large expanses of bare slopes, and thereby reduce the potential for erosion, land slumping and dust generation.

### 3.5.5 Grading Plan

- A grading plan is required for development on steep slopes. Using the site survey information regarding topography, physical and natural features, it should indicate:
  - Existing and proposed topography and features in plan view and key site sections;
  - Limit of disturbance or limit of earthworks/grading;
  - Delineation and shading to show cut and fill and cut and fill volumes; and
  - At the request of the City, building envelopes and accesses to individual lots or building sites.

### 3.5.6 Drainage Management Plan

- A Drainage Management Plan is particularly critical on steep slopes (Section 3.4.1). Developers of steep slope sites should pay close attention to the requirements of the City's Stormwater Management Goals, Objectives and Policies.
- 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. Infiltration is encouraged on a site-by-site basis where appropriate soil and topographic conditions exist, but cannot be used in the calculation of 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.
  - Water quality characteristics of proposed flows. Suggest appropriate methods to deal with any quality concerns.
  - 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; water quality considerations.
  - Impacts of irrigation on short and long term stability of any slopes.
  - Protection of drainage swales (eg, 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.
  - Catch basins. Conventional catch basins often have much lower inlet capacity when located on steeper hillsides. It may be appropriate to recommend alternative types of catch basins for correct foot size hillside conditions.
  - Hydrogeological considerations including maintenance of existing groundwater regimes or attempts to correct known groundwater problems.
  - Energy dissipation into existing water courses, where necessary.
  - Individual lot drainage and siltation control during and after construction, and impacts of overland drainage from one lot to another.

### 3.5.7 Erosion Control Plan

*The City of Nanaimo publishes a brochure entitled Erosion & Sediment Control. It provides information to assist landowners and developers in preventing and controlling erosion.*

- 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.
- Refer to the City’s “Erosion and Sediment Control” brochure in developing an erosion control plan.

## APPENDIX A: Fire Protection for ‘Interface’ Areas

*Areas where wilderness or forested areas meet settled areas are referred to as “interface” areas and can be susceptible to wild fires. Steep slopes can increase the risk to urban development at the interface. The following are some vegetation management measures recommended by the provincial Ministry of Forests for planning development in interface areas. These measures have greater significance for dry or south-facing slopes with a history of fire outbreak.*

Homeowners can create an area of “defensible space” between their house and wild land vegetation. This defensible area should be up to 10 metres in width from the house and be relatively free of highly flammable vegetation that could readily transmit a fire from forest to the house. Plants that are low growing and woody are referred to as “low fuel volume plants” and are ideal replacements for more flammable species growing close to a home.

A group or community defensible space may also be considered by creating a firebreak along a series of properties edging a forest. The firebreak should be from 30 m to 50 m wide depending on the slope. Vegetation is cleared or thinned from this firebreak to leave more fire resistant species, and separate tree crowns enough to reduce the risk of fire moving from one crown to another.

The following table indicates some characteristics of flammable versus fire resistant vegetation. Nursery and landscape professionals are a source of information on species appropriate for your area that may also be fire resistant.

<b><i>Flammable Vegetation</i></b>	<b><i>Fire Resistant Vegetation</i></b>
<ul style="list-style-type: none"> <li>• Areas of largely dead vegetation (forest with disease or insect infestation)</li> </ul>	<ul style="list-style-type: none"> <li>• Little or no accumulation of dead vegetation</li> </ul>
<ul style="list-style-type: none"> <li>• Resinous plants that produce flammable sap or pitch (eg, pine or juniper)</li> </ul>	<ul style="list-style-type: none"> <li>• Non-resinous plants (most other deciduous species)</li> </ul>
<ul style="list-style-type: none"> <li>• Drought intolerant plants (many shallow rooted or wetland species subjected to drought)</li> </ul>	<ul style="list-style-type: none"> <li>• Drought tolerant plants (e.g., deeply rooted plants with thick heavy leaves)</li> </ul>
<ul style="list-style-type: none"> <li>• Trees with lots of lower branches that can “ladder” a ground fire into the crown</li> </ul>	<ul style="list-style-type: none"> <li>• Trees with fewer branches between ground and the canopy.</li> </ul>
<ul style="list-style-type: none"> <li>• High maintenance vegetation (plants that grow or reproduce rapidly such as annual grasses)</li> </ul>	<ul style="list-style-type: none"> <li>• Low maintenance vegetation (slow growing plants that require little care)</li> </ul>
<ul style="list-style-type: none"> <li>• “Flash fuel” vegetation (plants that ignite easily and burn rapidly such as dry grass)</li> </ul>	<ul style="list-style-type: none"> <li>• Plants that require prolonged heating to ignite (those with woody stems and branches)</li> </ul>

For more information on specifics, contact the Subdivision Approving Officer and City of Nanaimo Fire Department.

## APPENDIX B: Suggestions for Building Design on Steep Slopes

*Not all architectural styles or design treatments are appropriate for development on hillsides. Most “plan book” house designs assume flat sites and are inappropriate for sloped sites.*

*The following points are not intended to dictate personal tastes, but rather to suggest ways of harmonizing built structures with hillsides in ways that benefit the owner and the community.*



### House Design

- A building should be designed for the physical and visual context of the site, rather than the ease and availability of planbook houses or the latest trends. Costs for a “custom” house plan may be initially higher, but may save money in the long run in requiring less site manipulation.

### Roof Form and Pitch

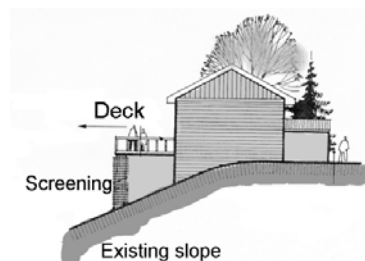
- Roof pitches can be designed to reflect the slope of the natural terrain. Align roof pitches so that the angle of the roof is approximately the same or less than the natural slope.
- Supplementary roof structures (chimneys, vents, skylights, HVAC equipment, satellite dishes, etc.) should be placed with visual considerations in mind, particularly views from other buildings and public open spaces.



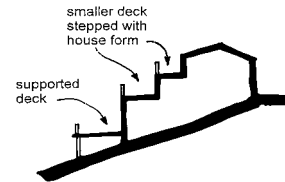
### Decks and Terraces

*Long, continuous decks can have an overpowering visual effect, especially if they are cantilevered or supported by tall poles or columns.*

- Provide outdoor living space that is compatible with both the building and the hillside setting. Use decks and building terraces on the roof areas of lower levels of the building when possible.



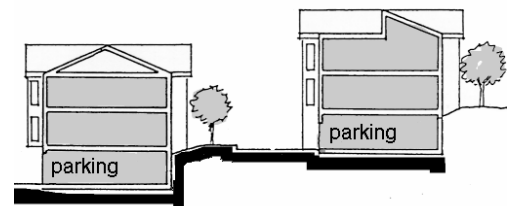
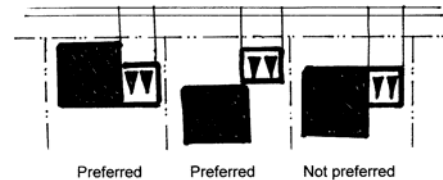
- Limit the size of decks that are cantilevered, overhanging or supported by poles or columns. Create stepped decks or several smaller decks as opposed to one large one.



## Garages

*The mass and location of garages or parking structures can dominate the appearance of the house, and detract from the character of the site. Separating the garage or parking area from a house can sometimes allow the overall design to better step up or down a slope as well as avoid excessively steep driveways.*

- Use detached garages or parking areas where this can reduce impacts on the slope and provide easier, safer vehicle access.
- For attached garage structures, try setting the garages slightly back from the house. Set additional stories above garages back from the front of the garage to help reduce the apparent mass.
- For multi-family forms, put parking under the building. For parking not covered by a building or structure, use arbours, trellises and landscaping to help screen views of parking lots from the street, public open spaces, and significant viewpoints in the community.



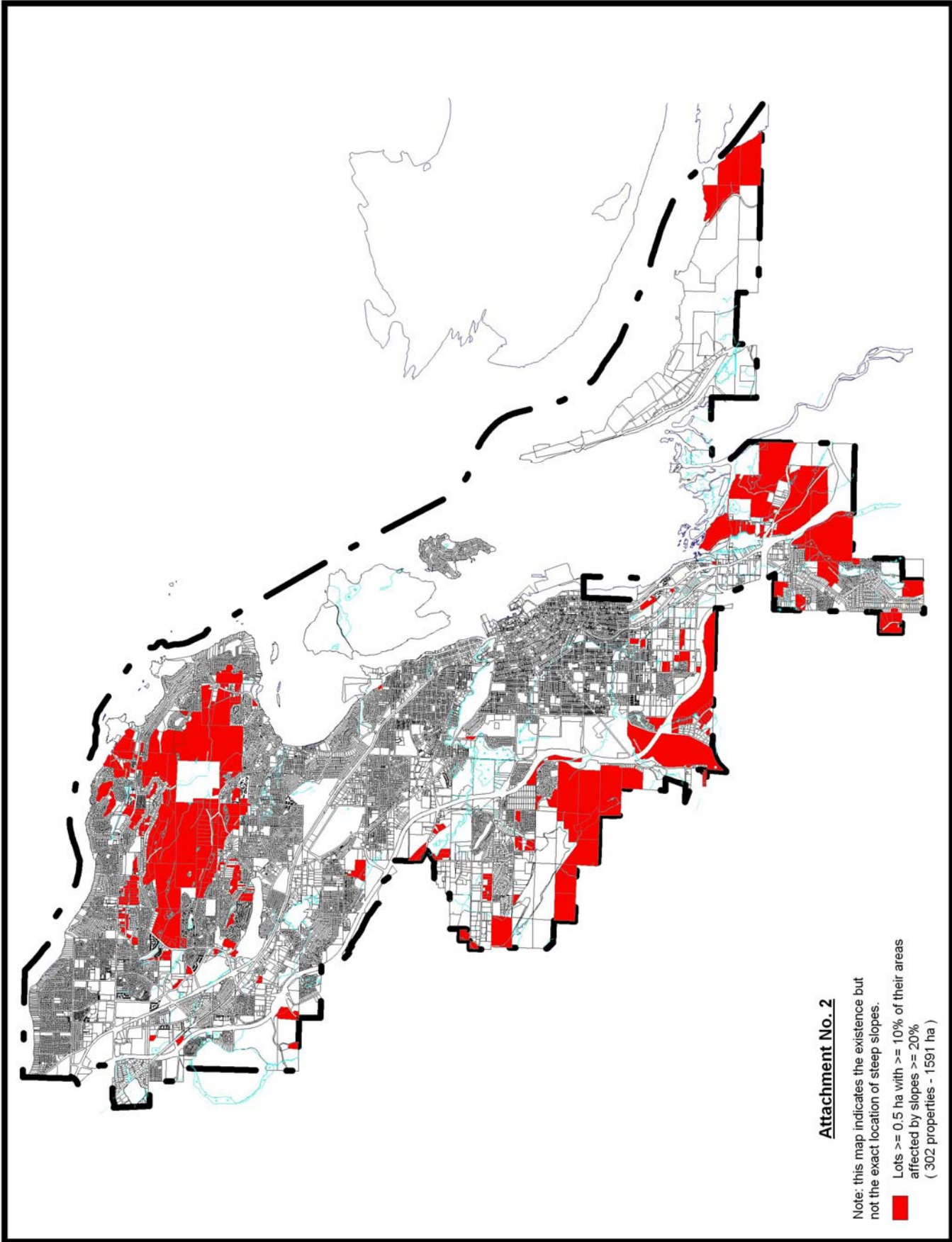
## Building Materials

- Materials, colours and textures that reflect the natural setting and landscape of the hillside setting allows a house to blend with its surroundings. Avoid smooth, shiny, reflective surfaces or bright colours for building walls that clash with the slope.

## Fencing

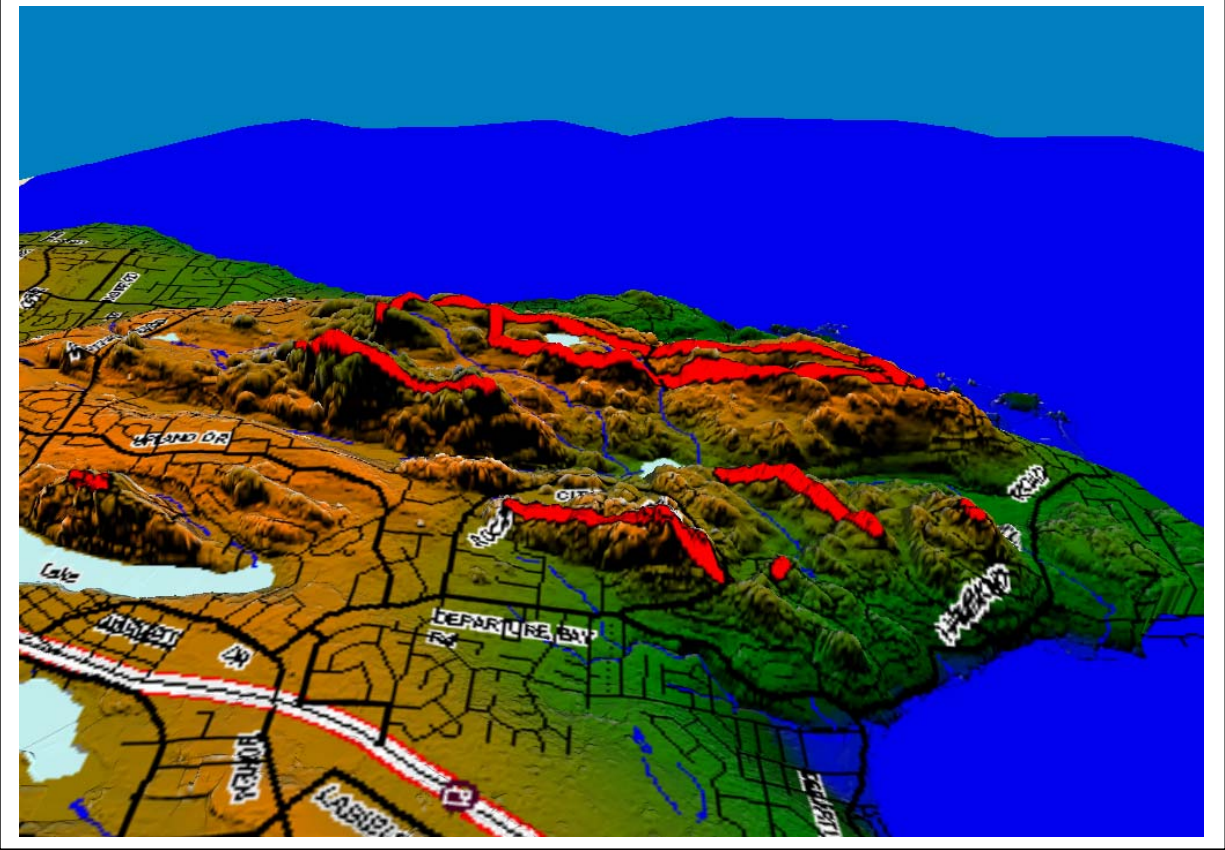
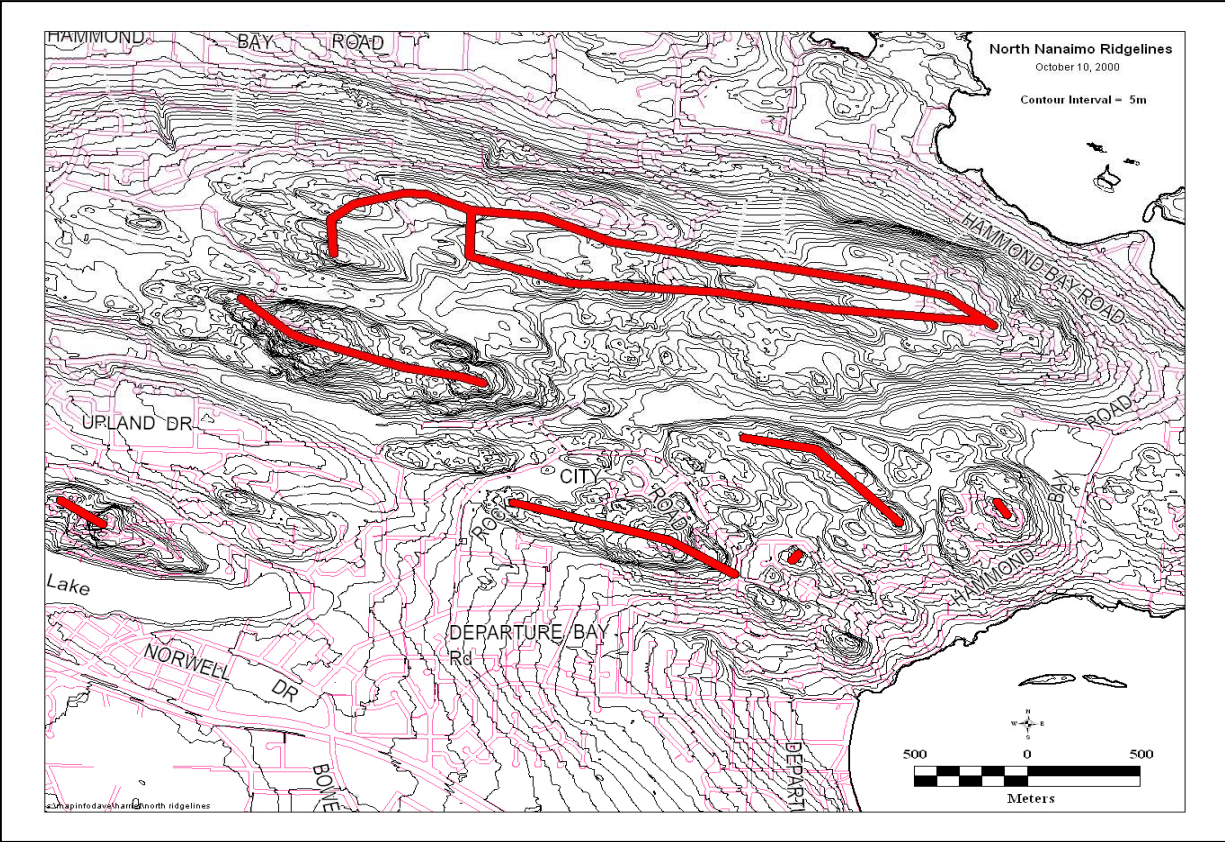
- For dry or south facing slopes, re-plants with drought and fire-resistant species. Appendix A provides further suggestions for treating vegetation on dry slopes

Attachment a: STEEP SLOPES IN NANAIMO



Attachment b: SIGNIFICANT RIDGELINES IN NANAIMO

NORTH





Attachment b: SIGNIFICANT RIDGELINES IN NANAIMO (continued)

SOUTH

