City of Vernon
Hillside Guidelines 2008

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1. INTRODUCTION

1.1. MANDATE FOR THE GUIDELINES

From its beginnings as a small agricultural and transport centre in the Okanagan valley bottom, the City of Vernon has steadily grown and is now beginning to see demands for development on the hillsides that frame the city. These hillsides not only contribute to the character and beauty of the city, they also contain plant and animal habitats unique to the Okanagan Valley, British Columbia and Canada. These hillsides provide opportunities for spectacular residential development, but this pressure for development presents unique design challenges for the creation of safe, environmentally sensitive neighborhoods that are significantly different than those encountered in the valley bottom. Council has directed staff to provide guidelines to enable a development form which maintains the aesthetic qualities and environmental functionality of hillsides that will contribute, rather than detract from Vernon's character.

In older neighbourhoods in the city, such as East Hill, time has allowed trees and vegetation to re-establish and mature, lending character to the area. Prior to residential development, this area was a grassed slope which was subsequently planted in orchards. For development over the past 20 to 30 years, however, time is less likely to improve the aesthetic character of our city, as newly created lots have generally been smaller while houses have become larger, covering more of the smaller lot area. Demand for unrestricted views from homes also hinders the establishment of significant mature landscaping.

Of key importance to the very character of hillside development is the preservation of undeveloped land which provides natural space, buffering and habitat for native plants and animals. Poorly designed or constructed development will not harmonize with the surroundings to create the necessary components of a complete neighbourhood. Development design for hillsides needs to not only protect natural features and provide natural open space; it must also reflect the character and quality of its setting. Clustering of development and densification of units in lower impact areas can result in similar or greater lot yield than the typical current hillside development pattern. This approach can also significantly reduce development costs.

Hillsides pose unique challenges for the development of residential neighbourhoods. Meeting these challenges requires a shift from traditional methods of servicing, subdivision layout and building form. The growing awareness of the value and frailty of ecosystems in hillside areas has resulted in increased demands to protect these environmentally sensitive areas. Growing awareness of the financial cost to maintain servicing in hillside areas and the social and economic impacts of providing primarily only large lot single family dwelling housing opportunities, has resulted in a demand to re-examine the very nature of hillside development. There are hillside developments which demonstrate how inappropriate land use and servicing can permanently remove localized ecosystems overwhelming and diminishing the very views and natural features which resident's value. As these developments age the costs to maintain infrastructure becomes a burden on the community in general as the tax base created from the low density development is inadequate to cover these costs. Additionally, the dramatic increase in large hillside lot housing prices has far outstripped the ability for the local economy to enable inclusion of these areas as affordable housing options.

The Subdivision and Development Servicing Bylaw #3843 (SDSB), Schedule B, Hillside Standards, were originally adopted to standardize road design requirements and reduce the impact of new roads in hillside areas. Experimentation with these standards has resulted in revisions and refinements meant to address limitations in construction and maintenance practices and improve the livability of the public realm in hillside areas.

The Hillside Guidelines have been created by staff to assist the City and the development community in achieving environmentally sound, attractive and livable hillside neighbourhoods. It is the City's intent that these guidelines will provide a standard of development which results in appropriate residential hillside development, while promoting innovation and flexibility to enhance our unique hillside character. Hillside requirements are intended to enhance the desirability and marketability of hillside developments, while supporting the key goal of managing hillside development. Hillside requirements are necessary for review of all forms of hillside development including building permits, development permits, development variance permits, rezoning and Official Community Plan amendments.

1.2. GOALS OF HILLSIDE DEVELOPMENT

New development on hillsides must:

- complement the scenic hillside character of Vernon by integrating unique or special natural features such as landforms, rock outcroppings, talus slopes, viable existing stands of trees and vegetation, ravines, water features, hilltops and ridgelines;
- minimize the footprint of development during and after construction;
- protect wildlife habitat, corridors and Environmentally Sensitive Areas (ESA);
- avoid unstable or hazardous sites and protect lives and property from hazardous conditions, such as rock falls, storm runoff, erosion, etc.;
- provide safe year round access for residents, visitors and service providers;
- be compatible with adjacent development, open spaces and natural features by respecting existing views, privacy, access to light and safety;
- support innovative, low impact buildings;
- support mixed development densities that provides variety in housing opportunities and affordability; and
- minimize infrastructure maintenance requirements and costs thereby enhancing the financial sustainability of proposed development.

1.3. DEVELOPMENT PERMIT AREA & HILLSIDE DEVELOPMENT

The *Local Government Act* allows Development Permit Areas to be designated as part of the Official Community Plan (OCP) as per section 919.1(1) for one or more of the following purposes:

(a) protection of the natural environment, its ecosystems and biological diversity;

(b) protection of development from hazardous conditions;

(c) protection of farming;

(d) revitalization of an area in which a commercial use is permitted;

(e) establishment of objectives for the form and character of intensive residential development;

(f) establishment of objectives for the form and character of commercial, industrial or multi-family residential development

Specifically the Hillside Guidelines have been created to work with Development Permit Areas 2 and 3, as shown on Schedule A: Development Permit Areas.

The goals and objectives of the Hillside Guidelines will also be applied during development review and approval in all areas of Vernon that meet the criteria for hillsides, as defined in Section 2.1.

1.4. HILLSIDE OBJECTIVES

The Hillside Guidelines regulate design features inside and outside of the public right-of-way area to protect the natural environment by providing policy and regulatory direction for environmentally sensitive development on hillsides. Technology and public acceptance of new methods and styles are never static, therefore strict regulations can become outdated and lose sight of their original intent. In order to facilitate innovation and flexibility in hillside design, the overarching objectives of the SHG serve as the criteria for the review and approval of proposals. A balance is required to ensure that as many objectives as possible are attained while not undermining any one of the goals. The objectives can be separated into four major categories which the Hillside Guidelines address: 1) Site and Subdivision Design, 2) Works and Services, 3) Buildings and Structures, and 4) Natural Environment.

1) SITE AND SUBDIVISION DESIGN

a. Identify and incorporate significant site features in subdivision and development design. Proposed development layout and the typical building site design must acknowledge these natural features. This is required to:

- develop an understanding of the environmental and geological conditions of the site prior to any construction to ensure that the most appropriate methods are used to develop the site; and
- preserve and protect unique natural features.

b. Undertake subdivision planning and design that respects the existing natural area's terrain and hazardous conditions, while enhancing the area's natural character. This is required to:

- enable subdivision planning and design that allows as much undisturbed native green space as possible on a site;
- direct more development density to the less sensitive and flatter sections of a site, thereby creating clusters of development which avoid ecologically sensitive sites identified as Environmentally Sensitive Areas (ESAs);
- ensure that steeper portions of a site (with an existing slope of 30% or greater) are not included in the developable area calculation; and
- minimize the impact of grading and retain as much of the natural topographic character of the site so natural vegetation and other features remain undisturbed in order to protect ecological values, maintain slope stability and provide aesthetically pleasing viewscapes.

c. Protect and preserve the scenic characteristics of strategic hillsides identified in Schedule C: Ridgelines and Schedule B: Visible Slopes, by considering views toward the development site from the rest of the City as part of the development design criteria. This is required to:

- ensure significant ridgelines visible throughout the city are protected thereby maintaining the natural appearance of skylines for public enjoyment and benefit; and
- maintain the contiguous character of each hillside, with less sprawling uninterrupted development and visibly connected ESA's, open spaces and wildlife corridors.

2) WORKS AND SERVICES

a. Implement methods for collection, conveyance, control and treatment of storm water that mitigates potential impacts and emulates the area's natural water cycle. This is required to:

- limit runoff from new development based on the soil capacity and sensitivity for ground recharge and overland conveyance.

b. Integrate onsite design which compliments the streetscape design required in the SDSB #3843 Hillside Standards. This is required to:

- ensure works and services are suited to the development proposed and support the streetscape required for creation of a people, not vehicle, orientated neighbourhood.

c. Provide municipal services and utilities on hillside developments that minimize redundancy and provide cost efficient maintenance and future replacement. This is required to:

- ensure that development on hillsides does not result in financially unsustainable increases in infrastructure relative to the number of units created, (i.e. single loaded roads or service mains that only cater to market objectives); and
- ensure comprehensive design of water and sewer systems based on ultimate land use and topography. The service life of proposed infrastructure must be considered when examining the limitations of required works. This is required to ensure the scope of initial works is consistent with proposed phasing and does not facilitate installation of works that will have no or minimal use during their service life.
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d. Provide safe and functional access to individual properties and homes throughout the year. This is required to:

- ensure driveway access design is incorporated into the overall development design in order to restrict driveways that may be unsafe in winter conditions; and
- ensure lot layout provides for onsite parking that does not restrict access to the garage and allows space for visitors, service pick-up and delivery.

3) BUILDINGS AND STRUCTURES

a. Hillside zoning recognizes the unique nature of hillsides and governs onsite coverage and setback issues necessary to provide livable neighbourhoods that are not dominated by vehicles or homes. A Hillside zoning district is required to provide for greater flexibility in determining minimum lot size and locating a building on a hillside lot. This is required to:

- provide flexible front and side yard setbacks that reduce the amount of cutting and filling required, and support level entry and good street presence;
- provide a less "imposing" character on surrounding developments; and
- provide opportunities on the newly created lot for the planting of trees that will

eventually mature and contribute towards the long-term aesthetic character of the development as viewed from the rest of the city.

b. Avoid over height buildings and minimize the visual impact of new buildings on hillsides. This is required to:

- ensure building design compliments the zoning height requirements and does not block view corridors from adjacent lots and is based on center lot curb elevation rather than existing ground; and
- decrease grading requirements by increasing ceiling heights of lower/basement levels.

4) NATURAL ENVIRONMENT

a. As part of the Development Permit process, complete requirements as articulated in the Environmental Management Areas Strategy prior to any site works or design being initiated. This is required to:

- ensure development site design and construction protects ESAs by conforming to conditions noted in the DP approval.

b. Minimize slope alterations and retain the natural terrain and topography of the site. This is required to:

- minimize disturbance to natural vegetation, to maintain ecosystem integrity and protect natural buffers between development clusters with removals based on an intimate knowledge of the site in accordance with the information required under Section 3.2.
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c. Identify and protect significant organic and inorganic natural features and wildlife habitat corridors. This is required to:

- ensure that natural features that support unique micro-ecosystems and provide habitat remain undisturbed and linked to other open space features such as ravines, forested areas and water supply.

d. Plant vegetation that helps mitigate the impact of development, enhances visual quality and addresses the needs of residents. This is required to:

- ensure the use of indigenous local plants and tree species which can provide food and shelter for local wildlife, cost less to maintain, are drought tolerant and fire resistant.

2. DEFINITIONS

2.1. HILLSIDES

Hillsides are defined as lands in their natural state that have a slope angle of 12% or greater for a minimum horizontal distance of 10 meters. This definition is used to identify all properties 0.5 hectares or greater with a 10% or greater portion of the property having sloped land 12% or greater. Development of any land in excess of 12% requires road layout design that addresses the impact of that slope on the land and therefore is subject to the Hillside Guidelines.

The steepness of slopes can also be described in degrees; however, for the purpose of land development it is defined as either a percent or a ratio. Figure 1 describes the measurement of a slope and provides a means of quickly estimating equivalencies between the two scales. Note that it is possible to have a slope greater than 100% (1:1).

The steepness of slopes does not necessarily correlate with the stability of slopes. Slope stability depends on factors such as geologic materials, soils, moisture content and vegetation cover. A comprehensive geotechnical investigation is required for developments on hillsides to provide the detailed information necessary to ensure slope stability. 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 and the potential for erosion is greatest in the period between removal or disturbance of vegetation and re-establishment of new vegetation.

Engineered structural slopes are required in all fill locations where roads, utilities or buildings are being supported. These slopes can be as steep as 100%, or 1:1, depending on materials used and compaction methods. The use of geotextiles as part of a structurally engineered design can further increase the maximum slope attainable. Typical engineered slopes are 67% or 1.5:1. 1.5:1 slopes, though they may be structurally acceptable, are generally too steep to properly retain the minimum depth of topsoil of 150mm necessary to enable re-growth of native plant species. Minimum finished slopes that will consistently retain topsoil are 50% (2:1) or flatter.

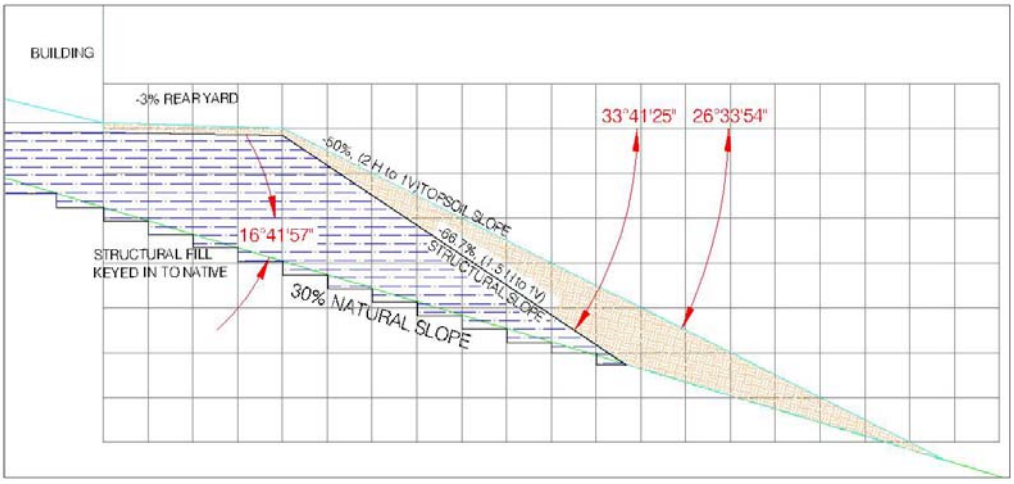


Figure 1: Slopes

Verification of the volume of topsoil required to fill over a structural slope, to a flatter, non-structural final grade is required prior to removal of any topsoil from a site. These engineered slopes must be protected by means of a Section 219 covenant registered on title of each final lot to ensure design slopes are not built on or disturbed without design by a geotechnical engineer that compliments the existing engineered slope design. Any un-engineered alterations of engineered slopes could jeopardize the design integrity of the slope and lead to structural weakening or failure. 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 significant consequences.

2.2. RIDGELINES

A ridgeline is the continuous line that demarcates the contrast between the sky or distant hills and the earth (i.e. the natural terrain or top of tree line), and can apply to ridges, knolls and significant topographic transitions. Depending on the view point the specific ridgeline area varies, therefore use of a single point to identify a ridgeline is not acceptable.

2.3. CLUSTERING OF DEVELOPMENT

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

- zoning density is based on areas of the property verified to have original slopes not exceeding 30%;
- there is no significant change in the number of lots permitted under a conventional subdivision; and

- the remaining land is protected as permanent open space.

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

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

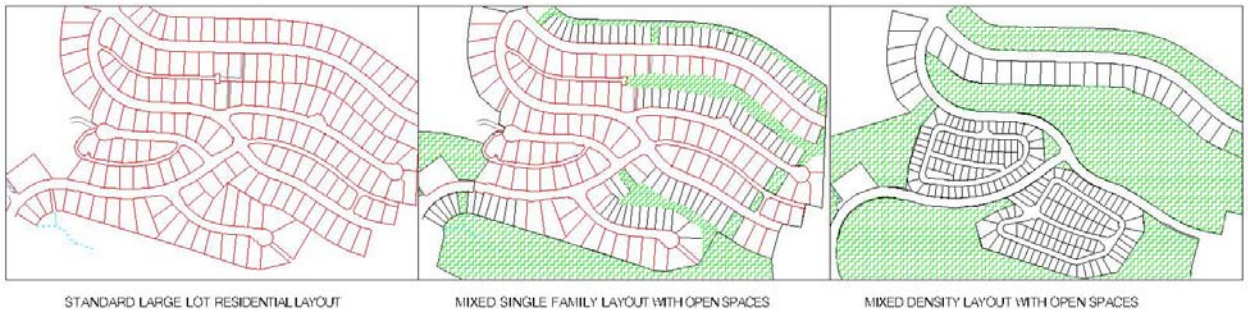


Figure 2: Density Options

2.4 BUILDABLE SITE

Every lot created by subdivision shall have sufficient building area for the use intended. The proposed housing form and engineered platform depth necessary to achieve this is dependent on the existing slope and depth to rock. Development on all slopes must be designed to ensure that the toe of slope of the building platform is retained within each lot created based on geotechnical and structural design limits. A 2:1 slope is required though use of a steeper slope may be permitted if supported by site specific soil conditions which provide for slope stability with at least a 1.5 safety factor and the re-growth of native plant species.

Minimum lot depth in hillsides is therefore typically a function of the slope and only changes in lot width will achieve changes in lot yield. The creation of large, level, front or rear yards is not supported, nor is the creation of uniform lot depths that do not respect the undulating nature of the hillsides. Retaining walls impede movement of native species and should only be used as a last resort. Retaining walls not exceeding 2.4m in height may be used to retain topsoil slopes or provide retention of native undisturbed areas. In determining whether suitable building area exists, the Zoning Bylaw stipulates the calculations for minimum lot size, coverage and typical setbacks.

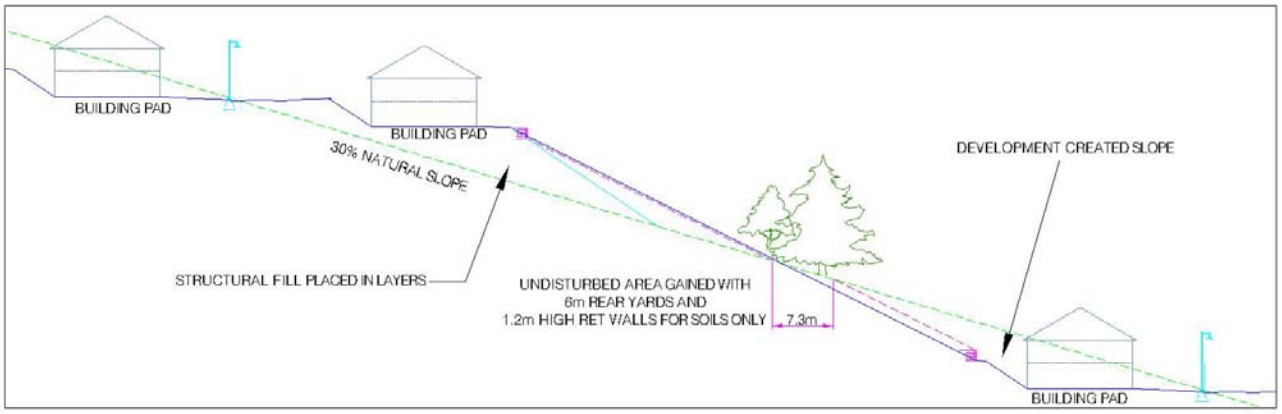


Figure 3: Typical Lot Grading vs. Slope

2.5 OPEN SPACE

Open space is natural undisturbed area dedicated to the City to be held in trust as a natural area. Alternatively, open space could be dedicated as parkland where it compliments GVS's master plan for parks and trails. Smaller open space parcels could be managed by a homeowner's association to which everyone in the adjacent development would be contractually obligated to contribute when they purchase their lot/home. The developer may also dedicate larger tracts of significant open space to a land trust or organization that is capable of holding and maintaining lands for conservation purposes and permanently protects the land from development.

Undeveloped areas resulting from residential development which includes open spaces must not be construed as being the same as contiguous undisturbed open space. The proximity of homes to these open areas can result in conflicts that must be managed to ensure that both residents and nature can co-exist and utilize the open space. Invasive non-native species of plants and animals can also have a devastating impact on open spaces and sensitive ecosystems. Minor localized disturbances can be made to reduce fire hazard potential or for modest park amenities such as trails and view points created in keeping with the intent of maintaining the space as natural and undisturbed (see Appendix A).

2.6 SUSTAINABILITY

Sustainability has three key components: environmental, social and economic. City regulations currently in place address each of these components in isolation. The City's Development Permit, Zoning Bylaw and SDSB #3843 Hillside Guidelines all influence the major components of sustainability for hillside development. The Hillside Guidelines are necessary to ensure coordination between all these regulations in a form that promotes the intent of each and provides clarity and guidance to achieve a truly sustainable development form.

Environmental Components

Hillside development is typically in greenfield or undeveloped areas where any development reduces the amount of natural features and habitat. Most hillside areas have, however, been altered from their original state over time due to grazing and invasive species. Regardless of the current environmental condition, development is highly disruptive and if unplanned, can seriously impact the viability of plant and animal species native to an area.

Grasslands cover the majority of the hillsides in Vernon. Grasslands of the Okanagan Valley have been identified as important and unique habitat for both permanent animal species as well as migratory ones. Even though disruption of grasslands does not appear to be as great of an impact as that in treed areas, the resulting damage to the ecosystem can be the same if not more, for grasslands. For development of hillside areas to be environmentally sustainable, the existing use and connectivity of the open spaces provided must supply an acceptable alternative to existing conditions for all significant species utilizing the area. The City's Environmental Management Areas Strategy addresses these issues, as well as other environmental considerations in hillside areas.

Social Components

Development of hillsides for any other purpose than residential is typically not feasible due to the limited amount of level space required to support commercial or industrial uses. Hillsides also limit the practicality for most residents to rely on non-vehicular forms of transit such as walking or cycling to meet daily commuting needs. High development costs and mono-zoning have resulted in hillsides with no diversity of housing form and little or no affordable housing. For hillside development to be socially sustainable, transit hubs within walking distance from housing clusters must be integrated into the design. Alternate forms of non-vehicular transit must be promoted as part of the design rather than as a secondary function. Development forms and densities that offer a range of housing options while still maintaining consistent, attractive, streetscapes must be provided.

Economic Components

Hillside development typically requires additional infrastructure such as water pump stations, reservoirs, sewer lift stations, deep sewer mains, additional roads, etc. The cost to create infrastructure related to new development is borne by the developer, though this may be assisted where works have been defined as a Development Cost Charge (DCC) project. Maintenance, and indefinite replacement, of all infrastructures is the City's responsibility.

Water and sanitary sewer costs are recovered by direct taxation of those services through utility billing. All other services enjoyed by residents in the City, including street lighting, roads, storm systems, policing, fire protection, etc., must be funded by means of property taxation. Allotment of the City portion of property taxes towards road related infrastructure replacement is determined on a yearly basis by Council. Typically, up to 25% of property taxes may be allocated for road infrastructure maintenance and replacement. For new development to be financially sustainable, it must generate adequate property tax revenue to meet long term

infrastructure maintenance and replacement costs. This may be accomplished by increased density, reduced infrastructure or, where a shortfall exists offsetting of this amount by the developer may be investigated.

In order to ensure that any proposed new development does not unreasonably burden existing development, a life cycle analysis must be provided for all proposed new infrastructure that identifies the long term maintenance and replacement costs to the City. A benefit analysis is required, using current costs and taxation rates, to define the taxation revenue projected from the proposed development. This not only encourages developers to examine cost effective service provision, but also supports mixed densities and re-development.

3.0 GUIDELINES

The following guidelines will apply to hillside development to address the objectives set out in Section 1.4:

3.1 SITE AND SUBDIVISION DESIGN

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

- large estate lots are the most disruptive housing type on hillsides due to the large setback and lot width that results in low yield per linear meter of road. Hillside-specific zoning is intended to restrict the use of excessively large lots for very limited, site specific, locations;
- clustering development using higher and mixed densities (Section 2 – Definitions) to protect steep slopes or environmentally or geotechnically sensitive parts of the hillside; and
- larger, irregular shaped lot sizes may be considered as a means of utilizing areas where road frontage is limited, provided undisturbed areas are protected on the lot by a Section 219 Restrictive covenant registered against the title.

3.1.a Assessing the Site

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

Sites proposed for development in hillside areas as defined in Section 2.1 requesting to use the SDSB #3843 Schedule B, Hillside Standards must provide information in accordance with Section 1.5 & Section 3.5. The proposed design for development must minimize the overall development footprint on the site. The site assessment for design purposes must look for:

a. Natural site characteristics that can be incorporated and accentuated in the design in a manner that respects the hillside and special features.
b. Soil and rock characteristics that can enable re-use for construction as well as their depths, stability and natural angle of repose to ensure site safety and limit of future erosion.
c. ESA and adjacent areas that can be accentuated as part of the development's character and identity. Emphasizing the existing characteristics of a site and retaining natural resources, will allow for cost efficient construction and maintenance, and can reduce permitting and approval times.
d. Locations to cluster development and increase densities that will minimize servicing costs, cuts and fills;
e. Interaction of the flora and fauna on a site focusing on opportunities for development to maintain or improve the natural habitat for significant species in the area.
f. Natural storm water recharge areas, storm water and groundwater routes that can be integrated as part of the site design.
g. Ability of the existing soils and ground cover to withstand overland flows and peak flow rates and limit concentrations of water that can cause erosion. Eliminating the potential for erosion is much more cost effective than cleaning up after it has occurred.
h. Visibility of a site from a distance can have a significant impact on public perception of the area and impact future sales. Effort spent in avoiding negative visual impacts and mitigating unpreventable visual impacts will decrease the time required for the site to mature and blend into the hillside rather than become an unsightly ongoing scar on the community.

3.1.b Planning the Development

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

The City supports the use of clustered development and varying densities in order to provide appropriate building sites while retaining natural features and hillside character. It is recognized that some sites will lend themselves to single family detached forms only. As such, guidelines for both single family only and clustered development options are provided.

For single family detached development, a plan for a proposed hillside development shall show how it meets the following criteria:

a. When calculating development area and lot yield for single family subdivisions, the maximum development potential for any property must exclude all predevelopment lot areas with a slope of 30% or greater. Higher density, smaller sized lots are encouraged. However, where smaller lot sizes cannot be achieved on lands with slopes less than 30%, a larger lot size may be considered, provided site disturbance is minimized and a covenant is registered on title preserving natural open space areas within the lots.
b. Use lot sizes and building setbacks in a flexible manner to protect slopes and natural features from development encroachments (see Section 3.4).
c. Show native slope, depth of topsoil, depth to rock, proposed setbacks, driveway grades and building pads on grading and subdivision development plans.
d. Clustering of development should strive to provide a minimum of 20% of the gross developable site area (area less than 30% slope), as permanent open space.
e. Each single family parcel created by subdivision must have a buildable site or pad area which suits the proposed house size for that zone. Zoning setbacks are based on the front and side yard property lines. Access to the building site and therefore building height is dependant on the adjacent road grade. The pad area must be prepared as part of the site grading and land development. Building pad depth permitted is a function of the steepness of the existing native slope, lot depth and resulting depth to the proposed toe of slope. The location of the proposed toe of slope must take other area grading activities into consideration and ensure at least a 3m separation from any top of cut down slope. The subdivision grading plan must include sections through each lot which clearly show building envelopes, including the top of cut and toe of slope, as well as the top of cut of down slope development.
f. The undeveloped portion of the parcel shall be designated and secured by registration of a no-build covenant on title as permanent open space and shall not be further subdivided. Dedication of the open space to the City or GVS for natural space or parkland is the preferred approach. If neither of these is viable, other options such as a land trust or an organization capable of holding and managing the site must be established. Smaller tracts may be managed through a homeowner's association established through covenant registered on title of lots as a condition of development approval.

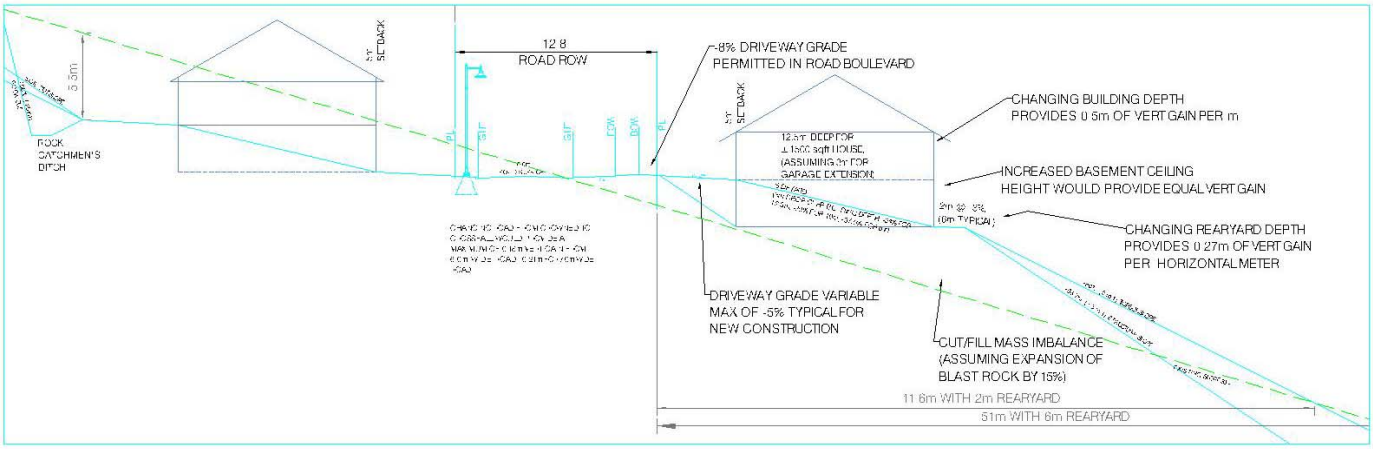


Figure 4: Onsite Grading Issues

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

a. Reduction of site manipulation and preservation of more of the natural character of the hillside than a standard single-family subdivision.
b. Increase of undeveloped buffer area adjacent to designated Environmentally Sensitive Areas (ESAs) on the property.
c. Increase of the open space provides a natural corridor through or around the property, or connects to other open spaces in the area.
d. Use of open space to buffer higher density development from neighbouring single family development.
e. The character of building forms for higher density development matches that of single family to create a consistent theme and quality that enhances the neighbourhood.
f. Mixed development should be in the form of smaller single-family lots, duplexes, triplexes, four-plexes, patio homes or small-scale townhouse complexes. Where appropriate site specific higher density development that is set back from the view perspectives and blends into the natural topography may be permitted.
g. The location and size of open space to be retained, the availability of undeveloped buffers to neighbouring properties and the nature of surrounding development must be considered when deciding the appropriate mix of building forms.

With regard to roads and lot layout, the following criteria should be considered:

a. Straight lines and rectilinear shapes do not complement natural hillsides. Design roads and lots in a pattern that offers a variety of lot sizes and configurations that complement the topography and features of the site. See further guidelines regarding roads in Section 3.3.b.
b. Use panhandle lots to minimize cut and fill and provide access to buildable areas that are too high or low to be directly accessed from the road. Mixed development must incorporate the panhandle access to higher density development to screen the housing mass from the single family roadscape. Panhandle accesses shall meet the requirements of the Fire Department for fire protection. Access to the proposed building site must be rough graded from the road to the building site as part of lot grading and subdivision development.

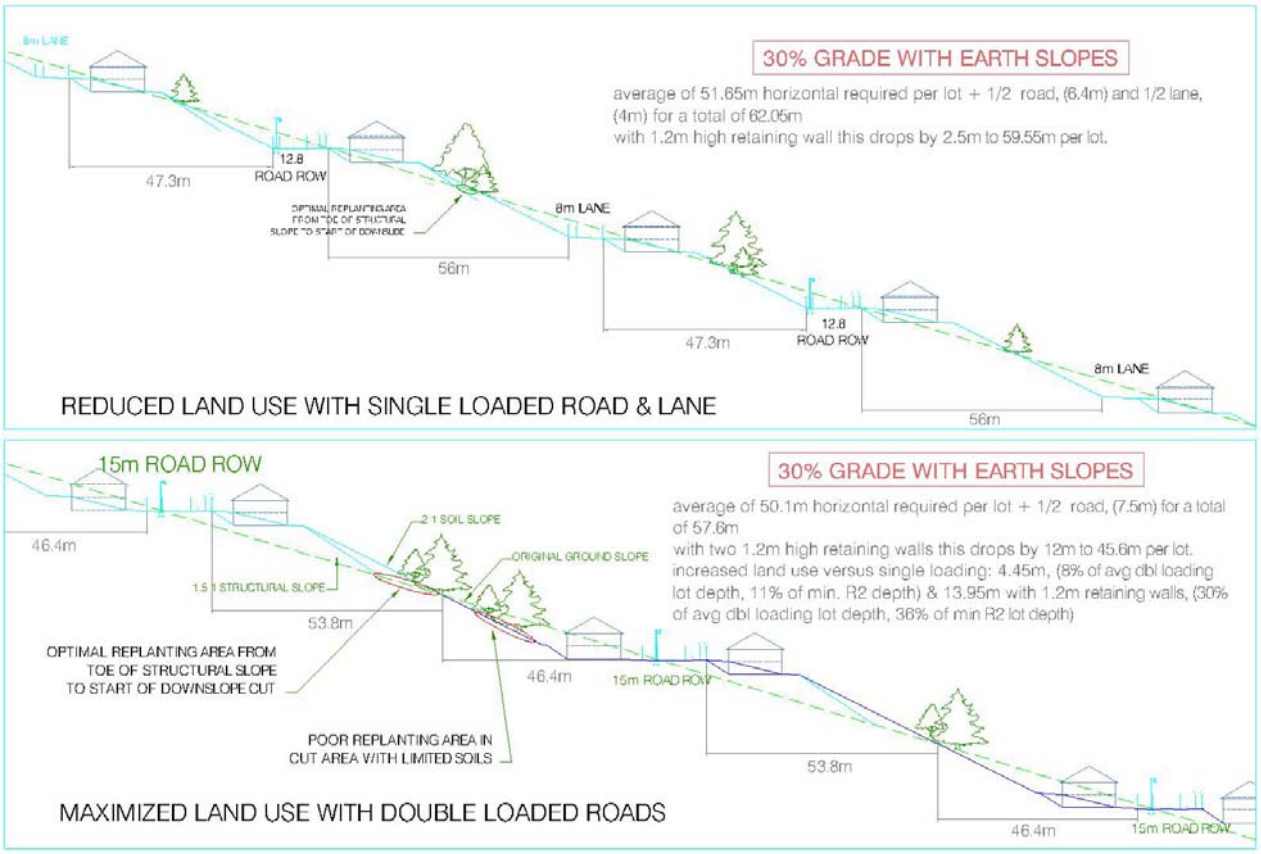


Figure 5: Land Use, Single & Double Loaded Roads

With regard to trails and open space, the following criteria should be considered:

a. Retain open space and corridors between development cells or lots to provide continuous viable habitat linkages within the development site, as well as with neighbouring sites.
b. Use trails or linear systems that complement or take the place of typical required streetscape pedestrian facilities and provide horizontal loops linking cul-de-sacs and open spaces which are not otherwise linked due to topographic or other constraints. An open space, streetscape and trail system shall be developed to provide pedestrian access within the hillside area and to/from key destinations in other parts of the community (e.g. schools, bus stops, parks, other trails, etc).
c. Avoid extensive slope grading to accommodate parks and trails. Create a range of trail types based on natural topography and environmental concerns. Trail ratings and signage indicating the trail grade and width are required to ensure safe use of the various trails is provided. Establish “pocket” parks that direct the public to unique view opportunities or provide respite on trails where natural terrain permits.
d. Incorporate significant features such as rock outcrops, streams, cliffs, ravines and stands of trees into the open space/trail system ensuring that public safety and the environmental sensitivity of these features are not compromised.

3.1.c Earthworks & Grading

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

Site grading is not permitted during the nesting period of any species utilizing the site. The Development Permit must confirm the specific nesting period for species native to a site including reptiles. In preparation of a grading plan (Section 3.5.d) that demonstrates the feasibility of road and building envelope creation without excessive manipulation of the site, the following must be considered:

a. Avoid grading or alteration of key topographic features (e.g., knolls, ridgelines, talus slopes, bedrock outcrops, cliffs, ravines, etc).
b. Avoid a straight, linear top of slope. Use radii and undulations that resemble pre-development slope conditions. Avoid sharp cuts and long or wide slopes with a uniform grade.
c. Round out slope transitions and blend transitions between lots or adjacent undeveloped areas.
d. Building pad areas must be created as part of lot grading such that structural retaining walls or extensive cut and fill are not required. These building pads are to be set at or near the design lower floor elevation such that no blasting or significant material removal or infill is required to build on the site. Large high density or commercial development sites are to provide grading from the road to the setback with the remainder of lot grading to be completed as part of building construction. Blasting of the buildable area to at least the services elevation is required to minimize disturbance from future infill development.
e. Creation of 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 is not permitted. Development of smaller terraces for building pads and minimal rear yard areas is acceptable provided the toe of the structural slope is located within the lot. Special care is to be taken to retain as much native slope and vegetation at the edge of required grading works.

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

a. Disposing excess topsoil onsite by increasing the depth of topsoil fill used. Dispose of other excess material at appropriate off-site locations where necessary. Ensure enough topsoil is retained to cover all cut and fill slopes to a depth of no less than 150mm.
b. Re-vegetating exposed slopes as quickly as possible to prevent erosion and slope stability problems, even for temporary topsoil stockpiles.

In preparing an erosion control plan, Section 3.5.g or grading plan, Section 3.5.d, natural and manmade factors that cause erosion must be considered and erosion minimized by:

a. Avoiding potentially hazardous or unstable areas of the site.
b. Not exposing large areas of highly visible sub-soil and parent material of the site.

c. Phasing clearing and removal of trees and vegetation based on imminent development construction phases. Plan site earthworks to coincide with the seasons by having all topsoil and other fine material relocation completed outside of the summer months.
d. Where works are adjacent to or potentially impacting existing development and grading of the site in summer is necessary, temporary irrigation suited to the project size is required.
e. Avoiding grading that results in terrain forms that are not characteristic of the natural topography (i.e. flat, linear terraced benches with no undulations or irregularities).

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

a. Review of the rock by a qualified geotechnical engineer is required to provide direction for the blasting techniques to be used. The professional must also inspect the rock face upon completion of works and verify the stability of the face and that there is no danger to public safety. For widening of existing roads, or rock cuts less than 2m high the minimum rock catchment design defined by the Transportation Association of Canada may be utilized where the rock is competent and failure is not a concern.
b. Wire mesh, shot-crete and other forms of mechanical stabilization provide an unsightly unnatural appearance and are not permitted. Additional blasting or rock bolting using colour matching powder coated washers may be required to provide a stable rock face.
c. Long term public safety and maintenance must be considered prior to any rock cut and the blasting design must maximize the rock face integrity at the final cut face location providing a stable rock face.
d. Design for the minimum required rock catchment ditching must also be included and be based on the characteristics of the rock. Catchment ditches must be accessible for regular maintenance with large machinery.
e. Previously required long-range maintenance estimates included in the life cycle analysis must include rock face maintenance, scaling and clean up of the rock catchment ditching.

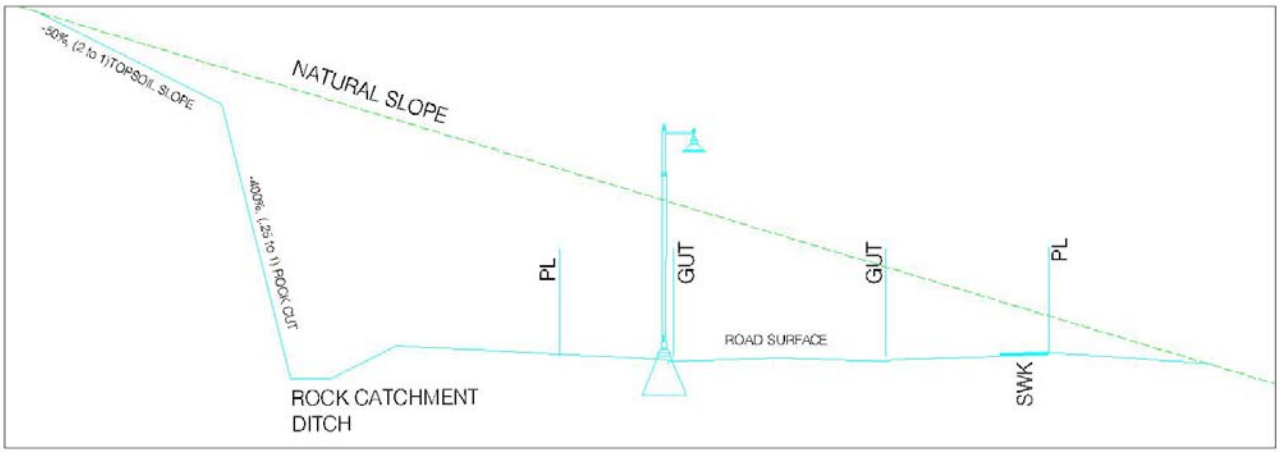


Figure 6: Rock Cuts and Catchment

The use of retaining walls is not encouraged. These are only supported where they preserve native undisturbed areas, address unstable native slopes or rock faces, or form part of the neighbourhood character. Where provided, the following criteria should be considered in their design:

a. Retaining walls should respect the natural character of the site and not present a large uniform wall face that overpowers the site and disrupts animal movements.
b. Walls that span more than one lot must be designed and installed as part of the subdivision development.
c. Walls must be structurally competent and their appearance must complement natural rock colours in the development area.
d. Retaining wall height should not exceed 3.0 m for roads and site specific works, 1.2 m for yards. Higher walls may be appropriate where they are articulated, have a surface texture/pattern, or where sufficient landscaping is provided to screen the wall.
e. Employ a system of smaller stepped retaining walls instead of a large uniform wall. The height and depth of the wall steps should be consistent with the natural terrain or with the slope above and below the walls. For stepped retaining wall systems, the walls must be designed to permit landscaping of the terraces that will screen the wall, including irrigation to all terraces. Landscaping of the terraces using mixed hardy native shrubs or trees is required. Width of each terrace proposed must be sufficient to enable the landscaping required and permit access for maintenance.
f. Retaining walls must be set back from utilities and the traveled portion of roads to enable planting of screening landscaping. The setback required is a function of the total wall height as taller plants will require a larger growing area below the wall.
g. All retaining walls over 1.2 m tall require a building permit to ensure all professional documentation has been undertaken and provided to the City. Final acceptance and approval of the development for issuance of house building permits includes completion and acceptance of all retaining wall building permit requirements. Sites developing over a period of years containing multiple walls may construct all walls utilizing a single permit per each year of construction.

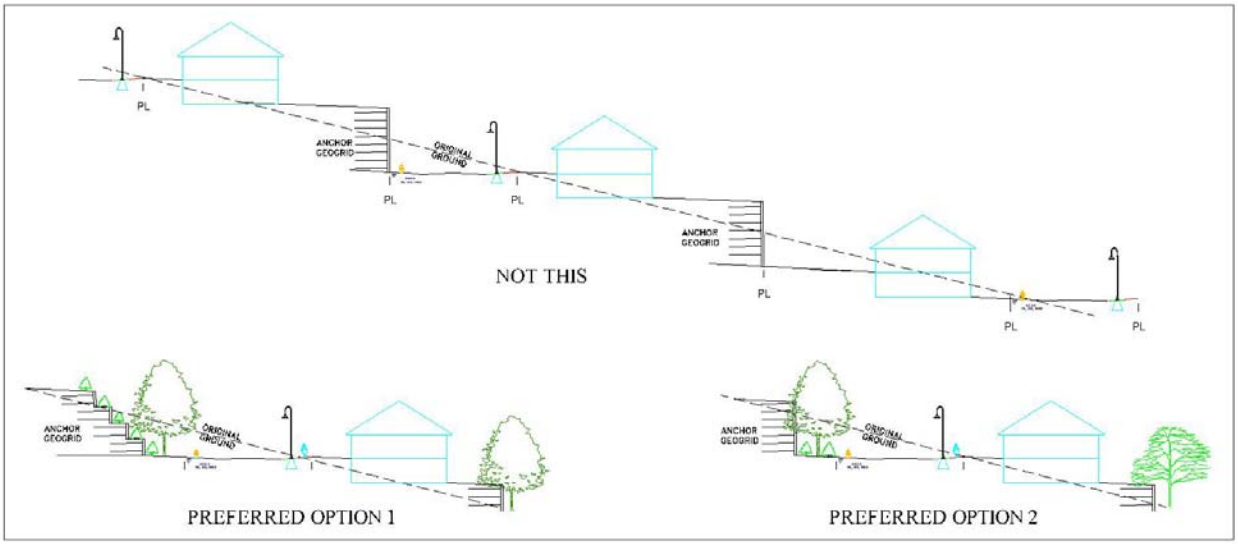


Figure 7: Retaining Walls

Where blasting is required for road works, utility installation or site grading, the applicant is requested to provide copies of any pre-blast surveys conducted. Signs are to be posted indicating proposed blasting times. Large rock cuts or blasting in areas where stability of adjacent rock is a concern require design in coordination with a geotechnical engineer specializing in rock stability. The site must also be reviewed to ensure existing reptile hibernacula will not be disturbed. Methods used must conform to provincial regulations and:

- Minimize excessive or over blast;
- Minimize vibration impacts on adjacent properties; and
- Utilize control methods that ensure maximum stability of the final face.

3.1.d 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.

Schedule C**:** Ridgelines specifies the minimum ridgelines that must be protected. In addition, the following criteria apply:

a. In addition to Schedule C, at least three different view sites must be provided to establish specific ridgeline areas for each development. Additional sites must include views from the main access route to the development.
b. Hillside development (see Section 2.2) in the vicinity of ridgelines must be sited so as to retain trees and other vegetation on and adjacent to ridgelines, so that the ridgeline is seen as a continuous line of natural terrain or vegetation.
c. Development areas must be sited lower than the ridgeline so that the roof line does not protrude into the ridgeline. Avoid placement of roads, cuts and large or continuous buildings near or over ridgelines.
d. Where gaps or interruptions in the ridgeline are unavoidable due to road network requirements, plant trees and vegetation in front of and behind the disturbance to screen and restore a naturally appearing ridgeline. For grassland areas where native trees are limited or nonexistent clusters of viable native trees must be established to provide screening.
e. Multiple small interruptions may be permitted as an alternative to a continuous interruption, provided each can be justified and screened.
f. Development on ridgelines or the top of knolls is not supported and these areas must be integrated as open spaces.

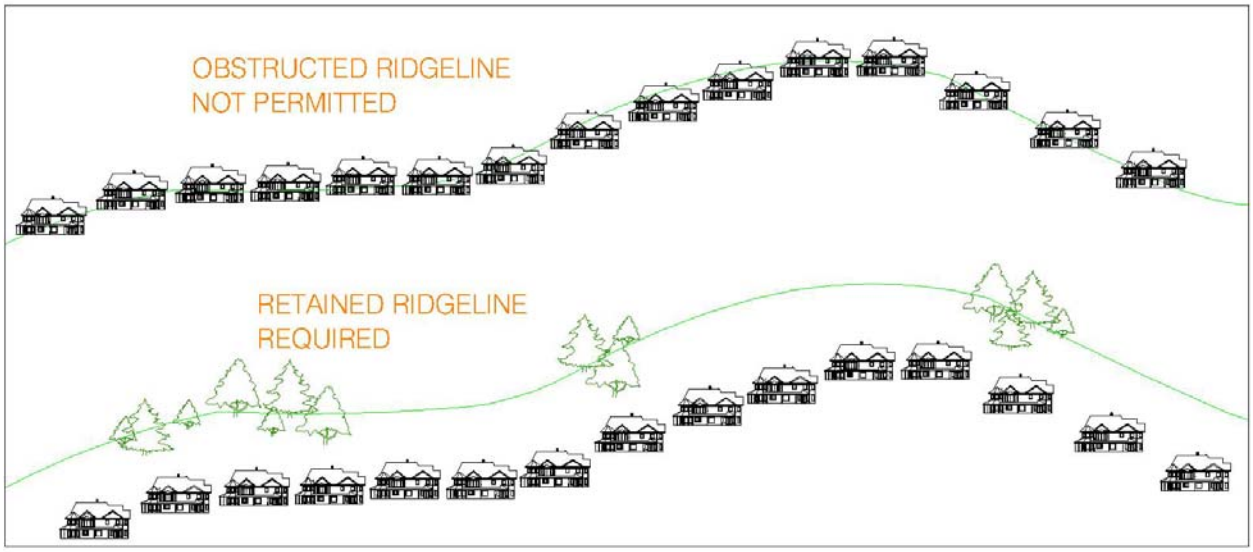


Figure 8: Ridgelines

Scenic features are components of the site that are visually unique and visible from the site, neighbourhood or community (rock outcrops, talus slopes, cliffs, overhangs, ridgelines, knolls, ravines, gullies, water bodies, water courses, wetlands, etc). The following criteria should be considered:

a. Development should be sited and designed in a way so as not to alter, disturb or remove significant scenic or environmentally functional features of a parcel.
b. Development must be sited so as to minimize the impact on views towards the site by periodically interrupting the horizontal line of housing with undeveloped breaks where clustering of re-vegetation with significant native trees will break the massing effect of levels of housing.
c. Provision of computer generated views of the development is required for the following four phases of development (artist renditions may be acceptable for smaller or infill development):
    - predevelopment,
    - post utility and road construction,
    - at full build out, and
    - at full growth of required landscaping.

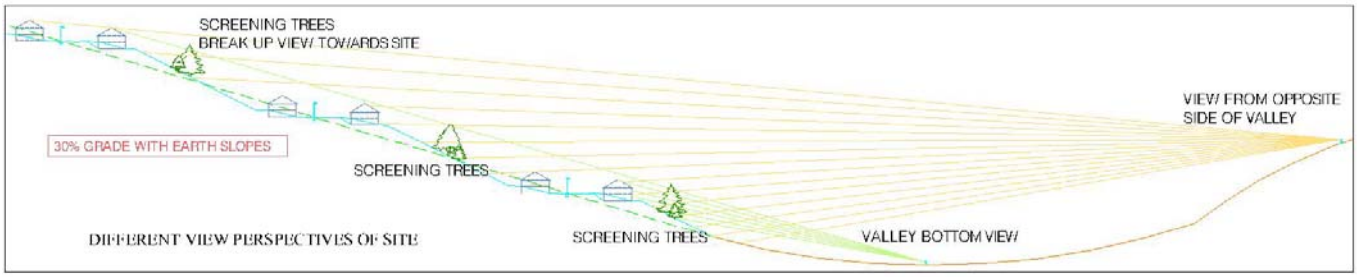


Figure 9: View Perspectives

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 to achieve views. View corridors must be identified and strictly maintained for all lots to enable re-vegetation in non-view locations on each lot. Due to the southern exposure of many areas, this is especially critical as a means of establishing shade that will improve the livability of developed lots. Additional criteria include:

a. Locate buildings to face the view and minimize interference with the views of nearby residences. Stagger buildings where appropriate to provide views between units that may otherwise limit the field of view.
b. Locate buildings and create building pad heights so that upslope buildings have views over down slope 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.
c. Public realm views must be provided from the site by locating key public open spaces (e.g. park, street end, sharp corners etc) to capitalize on scenic view opportunities.

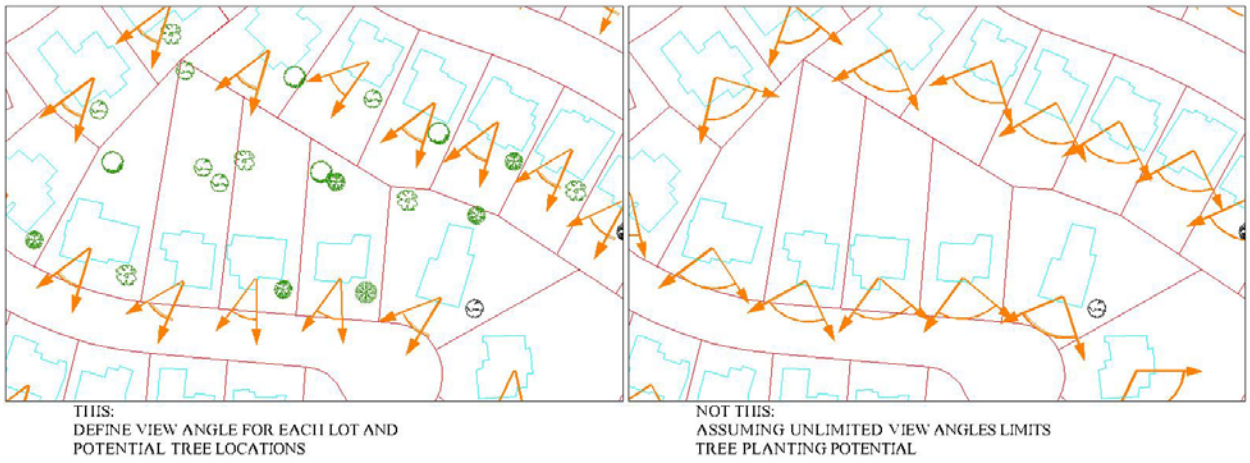


Figure 10: View Angles

3.2 NATURAL ENVIRONMENT

This section addresses how to minimize the impact of development and ensure its compatibility with the hillside environment. These issues are in addition to any requirements specified under the Environmental Management Areas Strategy.

3.2.a Environmental Protection

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

The Development Permit will provide the minimal environmental requirements for the site. Development size and adjacent natural features must also be considered to ensure a comprehensive plan that addresses general area issues.

3.2.b Vegetation in the Landscape

Objective: To identify and protect significant ecological communities including grasslands and stands of trees and reduce hazards and all other areas of significant habitat value.

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

a. Use clustered development and varied lot size and configuration to retain significant ecological communities that preserve environmental value (e.g. habitat, biodiversity, heritage trees, etc.) maintain soil stability, provide a buffer between development cells and define neighbourhood character.
b. Make strategic use of existing vegetation to retain the site's natural character and to break up views of buildings, roadways (e.g. cut and fill slopes) and other site works.
c. Alignments and profiles of roadways and utilities should avoid disruption of significant and unique stands of vegetation and environmentally sensitive areas. Provide sufficient clearance between roads, services and vegetation root zones to ensure viability of the vegetation.
d. 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.
e. Firesmart principles must be adhered to and the City requires a registered foresters report for development in the fire interface area. When preparing a land clearing and tree retention/removal plan (Section 3.5.e), apply the following criteria to existing vegetation in determining whether it is to be retained or removed:

RETENTION CRITERIA	REMOVAL CRITERIA
▪ retains special features and the character of the site ▪ retains slope stability ▪ prevents erosion ▪ comprises special or rare trees, plants and plant communities ▪ has habitat values ▪ selectively screens development or provides buffering ▪ located in future open space	▪ necessary for site development or improvements ▪ endangers public safety ▪ constitutes an unacceptable fire hazard as identified by a professional forester. Where a conflict with ESA concerns exists this will take precedence over the ESA.

Table 1: Vegetation Retention/Removal Criteria

Phased removal should adhere to the following criteria:

a. Phase land clearing to minimize the area exposed to dust, mud, soil loss and erosion. Phasing may be service related (e.g. clear initially only enough to install roads and main service lines) or spatially related (i.e. clearing only one portion of the parcel at a time, completing development and re-vegetation to control erosion before starting the next portion).
b. On individual large lots, limit clearing to what is required for services and the building footprint. Any additional clearing should be immediately re-vegetated, watered and weeded until the re-growth is self-sustaining and out competing weeds.
c. For areas of the site where vegetation must be removed but no construction will occur, leave soil intact (i.e., avoid compaction, excavation, filling, etc) and seed disturbed areas with native plant species to allow for more successful replanting in these areas.

3.2.c Re-vegetation & Landscaping

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

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. The following criteria should be considered:

a. In order to maximize the potential for quick and cost effective site restoration the development should:
   - Grade to natural contours
   - Stabilize the slope/bank
   - Alleviate soil compaction
   - Control erosion
   - Prepare the soil
   - Utilize hydraulic seeding for large areas in early spring or winter
   - Plant hardy native trees, shrubs and grasses in early spring or late fall
   - Irrigate until established
   - Maintain and follow-up (i.e. weed and replant)
b. 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.
c. Employ restoration practices specifically tailored to the type and degree of disturbance and the specific conditions of the site.

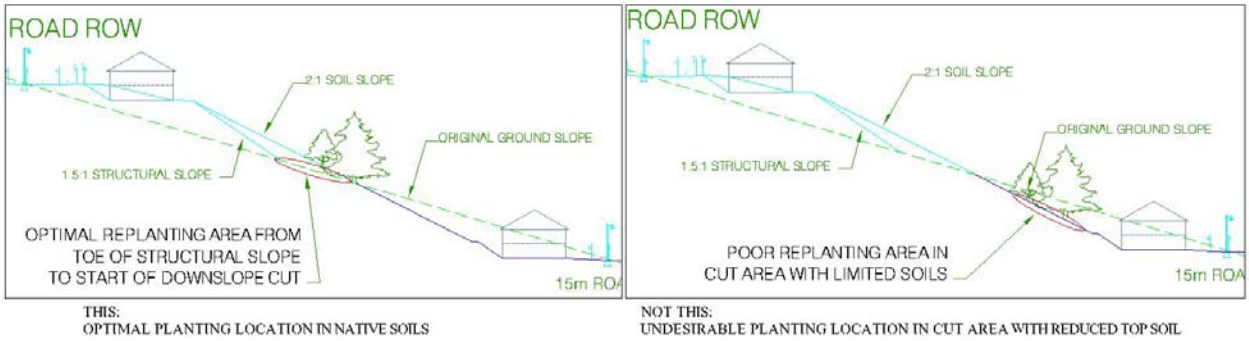


Figure 11: Optimal Revegetation Location

A Section 219 Restrictive Covenant is required to be registered on all lots enforcing re-planting and maintenance of native trees and shrubs by the homeowner. Other criteria to consider include:

a. Use of storm water runoff to establish and maintain plantings is preferred and should be assumed as part of site grading.
b. Replace trees, shrubs and grasses in a manner that helps to restore the natural character of the hillside site. Specifically, plant trees to screen undesirable views and buffer mixed uses. Arrange trees in natural groupings or irregular clusters.
c. Utilize hardy low maintenance native plant material for site restoration and residential landscaping as much as possible. Where the use of native plant material is not possible given site or maintenance constraints, select plant material that is similar in appearance, growth habit, colour and texture to native plants that will not out compete native plants, provide habitat for undesirable wildlife, or act as a host for insect pests.
d. Plant trees, shrubs and grasses in masses and patterns characteristic of a natural setting and with the intent of encouraging biodiversity.
e. Do not plant trees that will encroach on the viewscapes of others. Take into account the location, height and foliage density at maturity of tree species being planted.
f. For restoration or creation of habitat areas (e.g. riparian areas, ravines, greenways, etc.) use plant species that have wildlife food or cover value.
g. For dry slopes, replant with drought and fire-resistant species.
h. Plant tree and shrub species of significant individual size that they will survive natural predation.
i. Where native species may grow so large as to ultimately block views re-planting over time is required to provide a continuous plant cover and still enable removal or mature plants. Requests for removals will require review and approval by the City. The applicant is required to pay for removal by a City contractor and replanting as required, typically 3 to 1.

Irrigation is only supported as a means of re-establishing planting for a maximum of three years and regular irrigation should not be necessary for any plant species proposed on the site, including those on private property. Employ water-conserving principles and practices in the choice of plant material (“xeriscaping”) and in the irrigation design and watering of residential and public landscapes on hillside sites. Temporary drip irrigation systems and hand watering are preferred.

a. Ensure no over-spray or run-off due to watering.
b. Provide automatic shut-off valves for irrigation systems to reduce the risk of accidental erosion in the event of a break.

3.3 WORKS AND SERVICES

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

3.3.a Stormwater Management

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

SDSB #3843 requires limiting of minor storm event offsite flows to pre-development conditions and protection of major event flow routes. Attention to these requirements is particularly critical on slopes due to the potential for significant impacts on downstream drainage.

With regard to drainage planning, the following criteria should be considered:

a. A Section 219 Covenant registered against the title of all lots is required to prohibit roof gutters connecting directly into the storm sewer system. If, due to geotechnical constraints of the native soil conditions, storm runoff from roofs must be collected, the covenant must define the engineered design, require supervised installation and continued maintenance of an onsite disposal system that compliments plantings of native plant species.
b. Plans for all development on hillsides must indicate current drainage routing for minor and major storm events and indicate how development proposes to alter these patterns. Identify storm recharge areas and maximize onsite ground recharge at all scales from individual lots up to the basin catchment area. Mitigation is required to address unavoidable changes in stormwater patterns that could result in changes in the viability of native plant habitat, onsite and off.
c. See Section 3.5.f for the basic requirements of a Drainage Management Plan.
d. For hillsides, 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 quantity and quality prior to, during and after development;
    - Sediment and erosion control during and after construction until final revegation on all lots is established; and
    - On and off-site drainage impacts (e.g., drainage from an upper lot to a lower lot).

3.3.b Road Design

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

Roads are the skeleton of a neighbourhood, providing car, pedestrian and emergency access. They contain many other necessary services (sewer, water, electrical, etc.) and establish the pattern for lot development. Roads must help achieve a sense of neighbourhood while respecting the terrain. The following criteria should be considered:

a. Road widths must be kept to a minimum to reduce cuts, fills and retaining walls associated with achieving a "flat land" road standard which can have a devastating visual impact.
b. Major roads must be vehicle oriented and designed to convey vehicle traffic safely and efficiently. Local road design, on the other hand, must be designed to enhance the outdoor living space and not be vehicle dominated.
c. Double loaded (development on both sides of the road accessing off the road), road design is preferred as it minimizes infrastructure requirements and site use per lot created. Where this is not feasible or results in significant cuts and fills, single loading, utilizing laneways between roads to access building sites, may be permitted.
d. Design roads with a hierarchy characterized by numerous local roads connecting to local collector roads that follow the topography as much as possible.
e. Avoid large grid-like streets and major collector roads that are not well adapted to hillsides.
f. 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.

Local roads (serving houses that front on them) should be kept to a minimum scale and reflect the local resident/pedestrian use. Provision of on-street parking is discouraged as it increases the development footprint and impervious surface area and tends to result in a vehicle dominated streetscape. Additional criteria include:

a. With the use of narrower roads, widened areas for specific purposes must be provided. These can take the form of a widened road, curb to curb, or pullout areas behind the curb. Increased road width areas that must be included in the design and construction are for small radius curves, bus stops (transit and schools), area recycling and mailbox locations, with at least one parallel parking stall per 2 mailboxes.
b. Locations for bus stops must be confirmed with transit and the school district however preferred locations are near intersections of major roads in zones of higher density.
c. Split roads and one way roads, with horizontally or vertically separated lanes are not encouraged due to increased curb, gutter and lighting infrastructure however they may be utilized where:
    - A minimum of 6m of unobstructed width is maintained;
    - Special features or significant natural habitat can be protected;
    - The amount of slope disturbance or the amount of cut and fill compared to a standard two-way road is reduced;
    - Using a conventional road on very steep sections makes parcel access difficult;

- Through traffic can continue to a conventional road connection, or a turn around can be provided;
- Intersection clearance is maintained before the split is allowed to occur; and
- 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.

Where cul-de-sacs are contemplated, pedestrian connections linking the cul-de-sac to other streets and open spaces should be incorporated. Cul-de-sacs over 150m in length are to have an emergency access, where possible. A reduced radius cul-de-sac or hammerhead turn around, rather than the standard 11.5m radius cul-de-sac bulb, may be utilized on a site-specific basis where:

a. The design permits large emergency vehicle turnaround including a minimum depth of 1.5m for snow storage;
b. An area with a grade of 6% or less for the turnaround movement can be provided;
c. There is lack of sufficient land for a standard cul-de-sac bulb or very steep slopes would require excessive cutting and filling or;
d. The road serves fewer than 16 lots and/or is less than 100 metres in length.

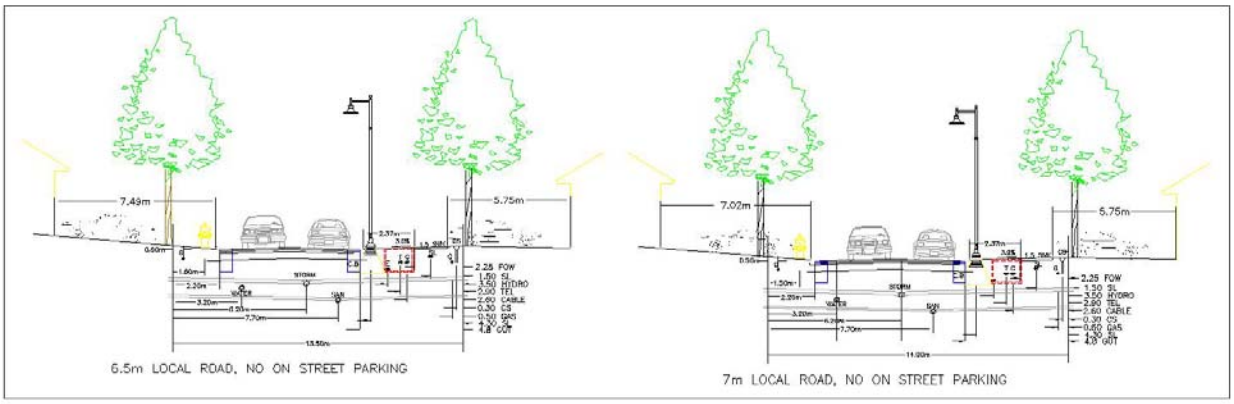


Figure 12: Road Width Options

Design criteria that should be considered when undertaking planning for sidewalks include:

a. Sidewalks must be set back from the road a minimum of 1.5m to accommodate snow storage.
b. Sidewalks are to be located on the same side of the road as fronting development however, due to the winding nature of hillside roads, development may not continually front on one side of the road throughout its length. Where sidewalks exist a continuous sidewalk must be maintained on that road regardless of location of fronting development. The location for sidewalks must be set to maximize the function as a safe pedestrian corridor through the development and provide scenic views where possible.
c. Sidewalks must be extended to all bus stop locations.
d. Sidewalks on both sides of the road may be required for short distances to provide walking linkage between roads and to provide improved sight distances for road crossings.
e. The requirement for sidewalks on local cul-de-sac roads may be waived where low traffic volume is generated, provided alternate off street pedestrian facilities exist.
f. 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.

Flexible grades and radii with resulting lower design speeds are to be integrated into all road design. Conventional road grade and speed design require road geometry that is less able to respond to local topography and increases the need for significant cut and fill sections. Conventional design has been proven to increase traffic speed thereby requiring traffic calming measures. Additional criteria to consider include:

a. All roads must be designed to minimize traffic speed achievable to no more than the proposed posted speed. Design speeds of less than 50 km/h are appropriate for local roads or local connectors to approve livability of neighbourhoods and allow a more responsive approach to topographic conditions, significantly reducing grading requirements.
b. The design must consider winter safety stopping and sliding concerns and maintenance issues including snow clearing. The design must reduce maximum grades by at least 1% per 30m reduction in centerline radius less than 150m. Sight lines and stopping distances are to be maximized in all cases.
c. Upright curbs are to be used as much as possible and specifically on the outside of sharp curves with road grades over 8% and directly across from intersections. Driveway locations for down slope lots must be designed to minimize the potential for accidental egress by road traffic failing to negotiate a curve or stop.
d. The “stopping sight distance” at sharp curves (60m radius or less) and at intersections must be maximized and landscaping designed to support this.

Where alternatives to the City’s existing Hillside Standards are being proposed to accommodate hillside conditions, the City Engineer commits to review the individual merits of each application on a case by case basis.

3.3.c Property Access

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

On steeply sloping sites, designing and installing driveways presents many challenges, such as significant elevation change, limited parking capacity, limited visibility at the road, difficult access in winter conditions and space for residential pick-up and delivery. The following criteria should be considered:

a. In general, driveways shall have an onsite grade no greater than 15%.
b. Driveway grades must not compromise cover over buried services to the lot.
c. Driveways over 10m in length must conform to the Fire Department Operational Guidelines for Private Access Roads.
d. Parking should be provided onsite at an angle or perpendicular to the driveway to enable uninhibited use of the garage.

Common driveways are vehicle access routes shared by two or more lots. These must be designed and built as part of the larger development. Other considerations include:

a. Common driveways are encouraged when significant site grading can be reduced.
b. The design of common driveways must conform to the Fire Department Operational Guidelines for Private Access Roads with an unobstructed width of 6.0 m, assuming private vehicle parking and grades not exceeding 12%.
c. Two directional shared driveways must be limited to no more than six lots and provide adequate width for two way traffic at the street and at all limited site locations.
d. Up to 15 lots may be serviced with a one-way through-access driveway exiting onto a municipal road, depending on site-specific conditions.
e. Cluster onsite parking where possible with one additional parking spot per dwelling serviced by the common driveway.
f. A reciprocal access and maintenance agreement among property owners is required for approval of a common driveway. The City is not a party to these agreements but requires a copy of the documents for file. In some cases, the City may determine that a Section 219 Restrictive Covenant in the name of the City is registered over the easement to ensure that the private property owners do not seek to discharge the easement in favour of some other arrangement that does not require City approval.
g. The civic addresses of the residences located on a common driveway must be displayed on a lighted sign visible from the street.
h. An appropriate location and space must be provided at the street for common garbage and recycling pick-up. 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.d Municipal Services and Utilities

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

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

a. Where practical, the offset between sewer mains is reduced from 3m to 1.5m and services are installed in a common trench to reduce the number of trench excavations and blasting.
b. Depth of mains is kept to a minimum, especially in narrow roads. Provision of gravity service to basement elevation of low side lots is not supported however all main floor elevations should have gravity service. Single loaded mains and rear yard mains are not supported as an alternative to pumping from basement levels of low side lots. Any mains not located within a finished road must include provision of a 4.0m wide all weather surfaced road with a grade not in excess of 15% that permits access to all manholes valves etc. A Section 219 Covenant must be registered on the title of all low side lots indicating the requirement for pumping from basement elevations until such time as SDSB#3843 is amended.
c. If connecting sewer mains are required outside the road areas where it is not practical to provide maintenance access butt fused HDPE pipe with no manholes or services between roads may be permitted.
d. Locate access to curb stops, fire hydrants and other services that require periodic inspection in areas where slopes do not exceed 15% or utilize precast retaining structures to provide the required adjacent working space. If fire hydrants are not clearly visible from the road, signage is required.
e. Provide emergency vehicle access to open spaces and locate fire hydrants to enable wild fire suppression from these locations.
f. Water service curb stop offset may be varied to maintain ease of access and maintenance. Locate these where future grading or landscaping of boulevards will not make access difficult.

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

a. Design roads and road rights-of-way to allow flexible offsets for utility trenches and other facilities such as transformers (i.e. provide additional spot "cut out" road dedication at transformer locations to facilitate counter poise installation). This will allow more flexibility to grade rights-of-way to match existing ground within the road rights-of-way, which will reduce physical impacts and provide easier servicing in hillside neighbourhoods.
b. Where permitted, install conduit for telephone and cablevision in a common trench with minimal offset to hydro conduit. Bundle the conduit and stagger vault locations to reduce the width required for each utility. Installation of these services under sidewalks is permitted where this reduces the effective right-of-way required.
c. For utility installation of the high side of the road where no sidewalk is present conduit could be installed based on final grading over the works with the surface grading upward from the back of the curb within the road right-of-way. Utility service and transformer boxes, which need to be accessible would require suitable grading and retaining structures.

3.4 BUILDINGS AND STRUCTURES

This section works to address the height, mass and setbacks of buildings on hillsides prior to the development of specific hillside zoning districts. This regulation is required in order 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 hillside settings.

3.4.a Building Setbacks

Objective: To allow greater flexibility locating a building and reduce the visual massing effect.

Providing some flexibility in front and side yard setbacks can help to reduce the amount of cutting or filling required, and better support a level entry and presence of the house on the street. The Zoning Bylaw currently requires a minimum 5 m setback from the front property line and a minimum 1.5m side yard setback for most residential zones. On hillsides with narrow lots and large homes built to the minimum setback, this minimum creates a massing effect that "blurs" together the houses and significantly increases the negative visual appearance of hillside development. Allowing a lesser setback may reduce the need for cut/fill for driveways, create more street presence, and provide a more level entry. The following criteria should be considered:

a. Any change in setbacks must enable off-street parking and utilizing the road right-of-way behind the curb or sidewalk to accommodate parking is appropriate.
b. Side facing or setback garages are supported as a means to reduce excessive cut/fill, help to avoid hazardous slopes or sensitive areas, and enhance the neighbourhood. The front yard setback may be reduced to 3 m provided this is permitted in the statutory building scheme.

c. Side yard setbacks should be the lesser of either 5 m or 30% of the lot width in total, and 1.2m minimum on each side for single storey and 1.5 m for 2 or more storey buildings.
d. Due to placement of structural fill required to create down hill building pads and rear yards, there is a requirement to protect the structural slope by means of a covenant registered against the title of the lot. The covenant will prohibit re-grading of this area or construction of any improvements. Uphill lots also require a covenant to protect the top of cut provided during site development so as to not undermine uphill development or native slopes.

3.4.b Building Height and Mass

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

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

- house entries that are well below the road grade; or
- three-storey walls on the downhill side that create a dominating presence when viewed from down slope.

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

a. Height of adjacent buildings should be considered and consistency maintained where possible.
b. Overall height should be reduced for flat-roof buildings due to the wider size of the upper floor relative to that of peaked roofs.
c. Limit perimeter walls to 2.5 storeys. This is required to limit the impact of down slope facades on neighbours. Any additional wall height should be set back at 2 horizontal to 1 vertical in order to have the house step uphill.
d. Consider the use of a reduced front yard setback to resolve issues such as steep driveways.

Building mass refers to the prominence of a building on a hillside in relation to the site, other buildings, the street or views from offsite. The Zoning Bylaw stipulates maximum lot coverage for each residential zone which addresses building mass to some extent. The following provides additional guidance for hillsides:

a. 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.
b. On downhill elevations, avoid the use of single plane walls that exceed one storey. Rather, step upper storeys back from the level below.
c. Avoid large, unbroken expanses of wall and long building masses. Rather, design buildings with smaller or less massive building components articulating the building presence which better reflects the sloped character of the site.

4.0 INVENTORY, ASSESSMENT AND PLAN REQUIREMENTS

This section brings together all the inventory, assessment and planning requirements to support the objectives of the Hillside Guidelines, as described in Section 3.0.

A Development Permit is required for any development application in Development Districts 2 and 3, as defined in Schedule A: Development Permit Areas, as well as any area of hillsides as defined in Section 2.1. The following information is the minimum required for inclusion in the Development Permit application. A submission without all noted information is incomplete and the application may not be reviewed by staff until all information is presented. The Manager of Planning, Development and Engineering Services has been delegated the authority by Council to vary the information required on a site-specific basis.

4.1 **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 at 1.0 metre intervals, spot elevations;
- Natural physical features including swales, knolls, ridgelines, bedrock outcrops, cliffs natural drainage paths and slope transitions or break lines;
- Existing manmade features including roads, curbs, sidewalks, above and below ground utilities, trails, buildings, structures, fences and retaining walls;
- Slope analysis showing slope intervals of 0-12%, >12-20%, >20-30%, >30%. This information is required to be provided for an area at least 20 m beyond the development site;
- Potential hazards and hazard areas (see 3.5.b Geotechnical Evaluation below);
- Environmental attributes as identified in the EMA Strategy; and
- Archaeological and historic resources.

4.2 **Geotechnical Evaluation:** A geotechnical survey and evaluation of all or portions of the site, prior to site planning or design, is required. The survey must include:

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

4.3 **Environmental Management Areas Strategy Requirements:** These requirements are to be completed for all development sites prior to initiation of design or any onsite works including grading or vegetation disruption.

4.4 **Grading Plan:** A grading plan is required for development on hillsides. This plan integrates site survey topographic information, geotechnical analysis of the site, physical and natural features ensuring there is no excessive manipulation of the site. The plan must indicate:

- Existing and proposed topography and features in plan view and a minimum of 3 key site sections;
- Native undeveloped areas and the limits of disturbance by the proposed earthworks/grading;
- Cut and fill contour information at a maximum of 0.25m vertical intervals showing maximum depths of all cut and fill proposed;
- Retaining wall locations complete with base wall elevation(s) and top of wall elevation(s); and
- Building site envelopes including accesses to individual building sites.

4.5 **Tree and Vegetation 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. The plan must also include proposed replanting of trees and other vegetation required to enhance and re-establish disturbed and natural areas. Details of tree management plans are specified in the Tree Protection Bylaw.

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

4.6 **Drainage Management Plan:** A Drainage Management Plan is particularly critical on hillsides. Developers of hillsides should pay close attention to the requirements of the City's Stormwater Master Drainage Plan.

Inventory requirements for a Drainage Management Plan on a hillside site include:

- 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 major storm event detention volumes or drainage conduit sizes.
- Review of hydrometeorological data. If the site has different 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, via ditch/swale seepage systems, infiltration galleries, or basins;
- Detention or retention vs. direct discharge and water quantity/quality considerations.
- Impacts of irrigation on short and long term stability of any slopes.
- Protection of drainage swales and major event flow routes (e.g. covenant, rights of way).
- Proposed roof and footing drains for individual lots, on-site treatment or connections to storm sewers, appropriate means of controlling short or long-term erosion if on-site.
- Hydrogeological considerations including maintenance of existing groundwater regimes.
- Energy dissipation into existing ravines at source and down slope where re-concentration or erosion may occur.
- Individual lot drainage and siltation control during and after construction, and impacts of overland drainage from one lot to another.
- Provision of settlement areas that are readily accessible for maintenance.

4.7 **Erosion Control Plan:** An erosion control plan is required for subdivision and development permit approvals on slopes, as follows:

- The erosion control plan must be prepared by a qualified registered professional engineer. 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.

4.8 **Infrastructure Summary and Service Life:** An infrastructure summary for the overall development area and each development stage is required:

- The infrastructure summary must be prepared by the qualified registered professional engineer. The summary must identify all infrastructure required to support the development and any sharing of that infrastructure with existing or future development by others. Table 3 indicates the minimum requirements
- The summary must also indicate any changes in materials or workmanship that would influence the estimated service life of any part of the infrastructure.

Table 3 INFRASTRUCTURE SUMMARY AND SERVICE LIFE

By Project Engineer				By City			
Infrastructure Installed	number	average capital unit cost	estimated service life, (years)	replacement cost per annum	average yearly maintenance costs	total yearly costs	removal and replacement unit cost
Road length, (m)							
Road width, (m)							
Asphalt thickness, (mm)			25	$0.00	$0.00	$0.00	
Crush Base thickness, (mm)							
Sub-base thickness, (mm)							
Upright curb length, (m)			50	$0.00	$0.00	$0.00	
Rollover curb length, (m)			50	$0.00	$0.00	$0.00	
sidewalk area, (m2)			50	$0.00	$0.00	$0.00	
streetlight poles, (#)			25	$0.00	$0.00	$0.00	
streetlight bases, (#)			50	$0.00	$0.00	$0.00	
streetlight lamp, (#)			4	$0.00	$0.00	$0.00	
streetlight fixture, (#)			8	$0.00	$0.00	$0.00	
streetlight conduit, (m)			150	$0.00	$0.00	$0.00	
traffic signal poles, (#)			25	$0.00	$0.00	$0.00	
traffic signal bases, (#)			50	$0.00	$0.00	$0.00	
traffic signal lights, (#)			50	$0.00	$0.00	$0.00	
traffic signal controller, (#)			25	$0.00	$0.00	$0.00	
catch basins, (#)			50	$0.00	$0.00	$0.00	
storm main, (m)			150	$0.00	$0.00	$0.00	
storm manholes, (#)			100	$0.00	$0.00	$0.00	
service line in road including inspection chamber			150	$0.00	$0.00	$0.00	
storm retention structures			150	$0.00	$0.00	$0.00	
General taxation Subtotal			NA	**$0**	**$0**	**$0**	
sanitary main, (m)			150	$0.00	$0.00	$0.00	
sanitary manholes, (#)			100	$0.00	$0.00	$0.00	
service line in road including inspection chamber			150	$0.00	$0.00	$0.00	
lift station pumps, (#)			10	$0.00	$0.00	$0.00	
Lift station genset, and controls			50	$0.00	$0.00	$0.00	
Lift station wet well			100	$0.00	$0.00	$0.00	
Sanitary Subtotal				**$0**	**$0**	**$0**	
water main, including fittings, (m)			150	$0.00	$0.00	$0.00	
service piping in road including curb & corp. stops, (m)			50	$0.00	$0.00	$0.00	
fire hydrants, (#)			100	$0.00	$0.00	$0.00	
pump station building			150	$0.00	$0.00	$0.00	
pump station pumps & motors, (#)			20	$0.00	$0.00	$0.00	
pump station piping and controls			40	$0.00	$0.00	$0.00	
reservoirs, (#)			100	$0.00	$0.00	$0.00	
pressure reducing station vaults, (#)			150	$0.00	$0.00	$0.00	
station piping, controls and PRV			50	$0.00	$0.00	$0.00	
Water Subtotal				**$0**	**$0**	**$0**	

By Developer			By City			
Serviced properties	number	lot sale value	house assessed value	mil rate	estimated tax revenue per year	Percent of revenue required for infrastructure maintenance and
large lots					$0	
medium lots					$0	
small lots					$0	
multifamily units					$0	
higher density units					$0	
Subtotal of directly benefiting lots	0				$0	#DIV/0!
commercial units					$0	#DIV/0!
Additional Lots utilizing road infrastructure						
Additional Lots utilizing sanitary infrastructure						
Additional Lots utilizing water infrastructure						
Total	0				$0	#DIV/0!

Prepared by: Ed Stranks, Municipal Technician

Acknowledgments:

City of Kelowna, Hillside Development Audit, UMA, down loaded June 20, 2007
http://www.city.kelowna.bc.ca/CityPage/Docs/PDFs/%5CStrategic%20Planning/Hillside%20Development%20Audit.pdf

City of Kelowna, Hillside Development Guidelines, down loaded June 20, 2007
http://www.city.kelowna.bc.ca/CityPage/Docs/PDFs//Development%20Services/Hillside%20Development%20Guidelines.pdf

City of Nanaimo, Slope Development Permit Area Guidelines, down loaded June 20, 2007
http://www.nanaimo.ca/uploadedfiles/Site_Structure/Development_Services/Engineering_and_Environmental_Services/Environmental_Services/SSguidelines.pdf

APPENDIX A: Fire Protection for 'Interface' Areas

Hillside areas in Vernon are very dry through most of the late spring, summer and early fall and whether forested or grass covered, have a high potential for wildfire. Any proposed development in these locations creates an interface area. These locations are indicated in Plan Vernon 4676, Map 6. Guidelines in the Firesmart Manual http://www.pssg.gov.bc.ca/firecom/pdf/homeowner-firesmart.pdf should be followed to minimize the risk of wildfires. Development sighting, construction materials and vegetation management recommendations are provided in the manual. For more information contact the Kamloops Fire Centre at 4000 Airport Road, V2B-7X2 or phone at (250) 554-5500 or the Vernon Fire Department.

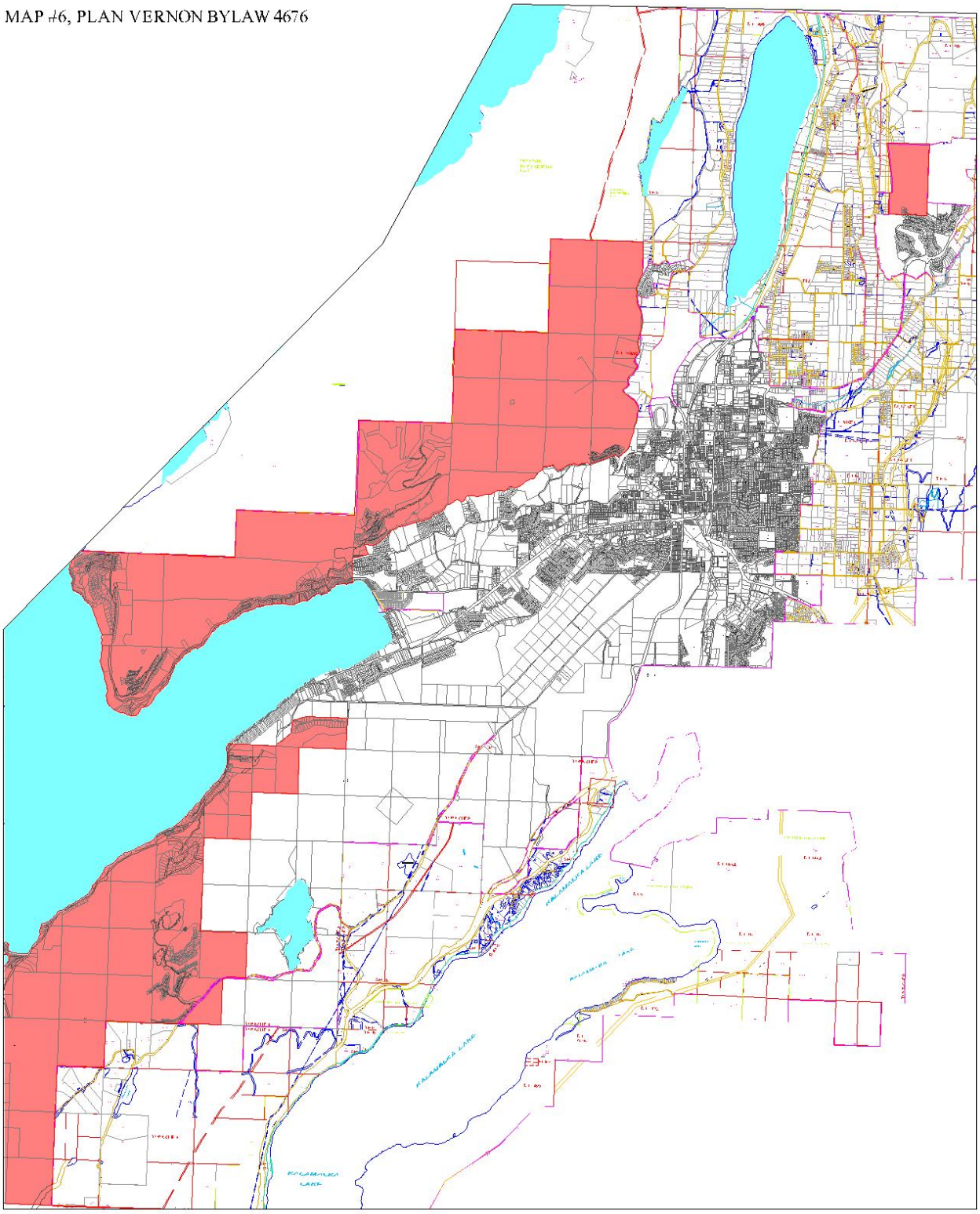
In interface areas development must use fire resistant siding and roofing and should establish and maintain an area of "defensible space" between their house and wild land vegetation. This defensible area should be up to 10 metres in width and be free of highly flammable vegetation. Low growing and woody plants that provide low fuel volume are ideal replacements for more flammable species growing close to a home. A group or community defensible space should also be considered by creating a 30 m to 50 m wide firebreak along a series of properties edging a forest. 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. Local nursery and landscape professionals are a source of information for appropriate fire resistant species.

Flammable Vegetation	Fire Resistant Vegetation
Areas of largely dead vegetation (forest with disease or insect infestation)	Little or no accumulation of dead vegetation
Resinous plants that produce flammable sap or pitch (e.g. pine or juniper)	Non-resinous plants (most other deciduous species)
Drought intolerant plants (many shallow rooted or wetland species subjected to drought)	Drought tolerant plants (e.g., deeply rooted plants with thick heavy leaves)
Trees with lots of lower branches that can "ladder" a ground fire into the crown	Trees with fewer branches between ground and the canopy.
High maintenance vegetation (plants that grow or reproduce rapidly such as annual grasses)	Low maintenance vegetation (slow growing plants that require little care)
"Flash fuel" vegetation (plants that ignite easily and burn rapidly such as dry grass)	Plants that require prolonged heating to ignite (those with woody stems and branches)

Table 2: Vegetation Fire Resistance

FIRE INTERFACE AREA

MAP #6, PLAN VERNON BYLAW 4676



APPENDIX B: Suggestions for Building Design on 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 suggest ways of harmonizing built structures with hillsides in ways that benefit the owner and the neighbourhood.

House Design

- A building should be designed for the physical and visual context of the site, rather than the ease and availability of plan book 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 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 provide articulation by including several smaller decks rather than one large one.

Rear Yard Treatment

Avoid fencing or overly manipulating the landscaping beyond the building pad area. Retain natural landscaping outside of the building pad area.

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 from the perspective of the adjacent streetscape. Separating, rotating or setting the garage or parking area different from a house can sometimes allow the house to be stepped up or down a slope and avoid excessively driveways.

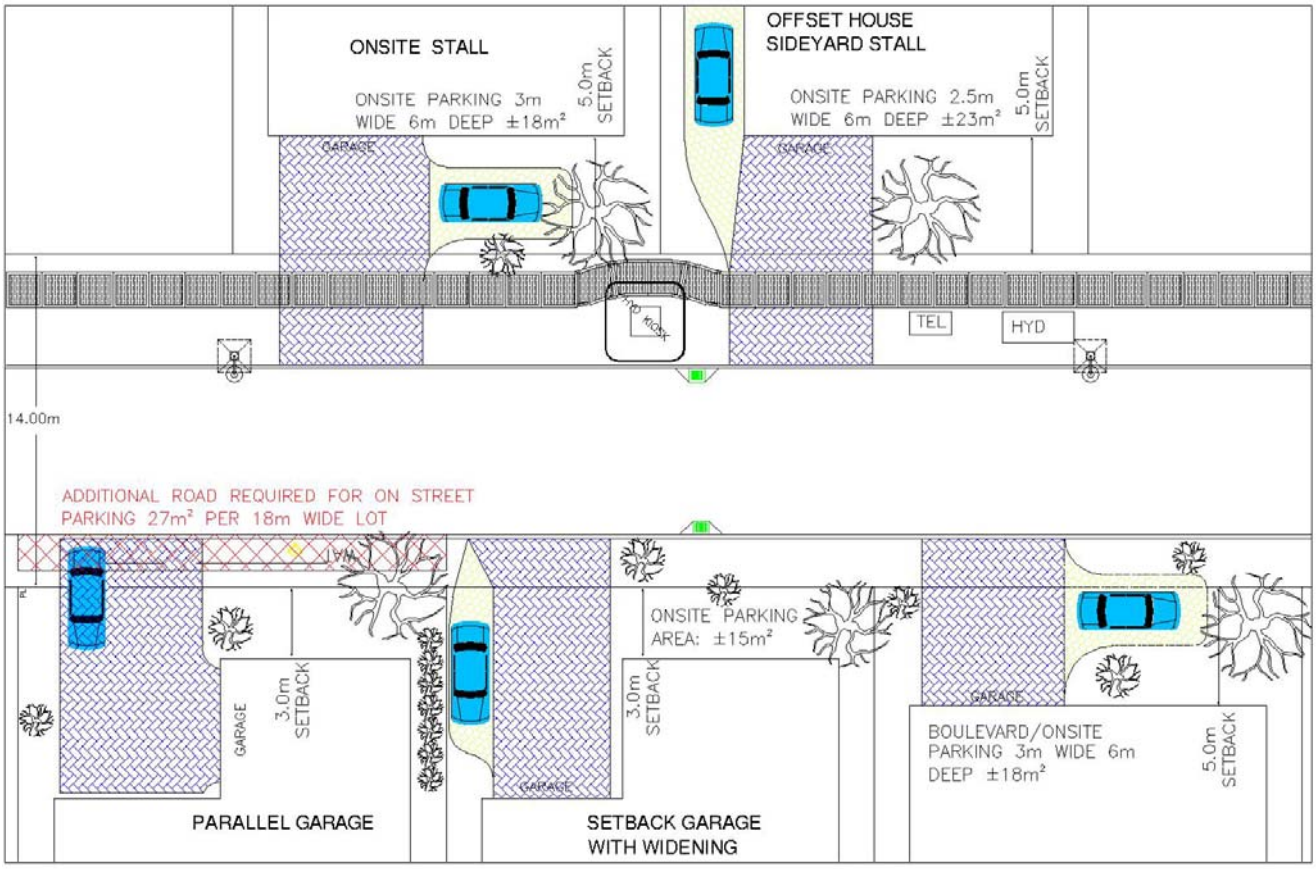


Figure 13: Parking Options

- Use detached garages or parking areas where this can reduce impacts on the slope and provide easier, safer vehicle access.
- For attached garage structures, rotate parallel to the street or set the garage back from the house. Stories above garages should be set back from the front of the garage to reduce the apparent mass.
- For higher density units, put parking under the building. For above ground parking provide screening from the street, public spaces, and viewpoints by using arbours, trellises and landscaping.

Building Materials

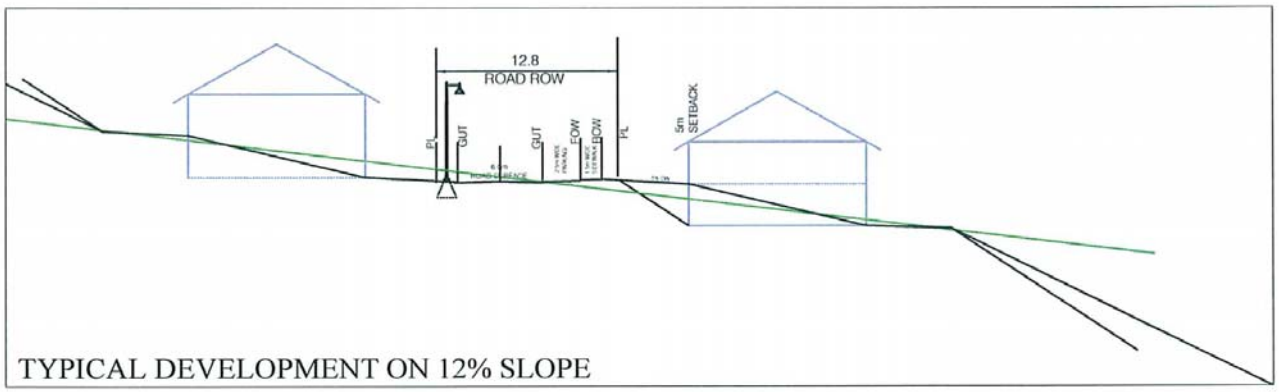
Materials, colours and textures that reflect the natural setting and landscape of the hillside setting allows a house to blend with its surroundings.

- Avoid smooth, shiny, reflective surfaces or bright colours for building walls that clash with the slope.
- Decks and roof overhangs should be integrated to minimize glare from windows.

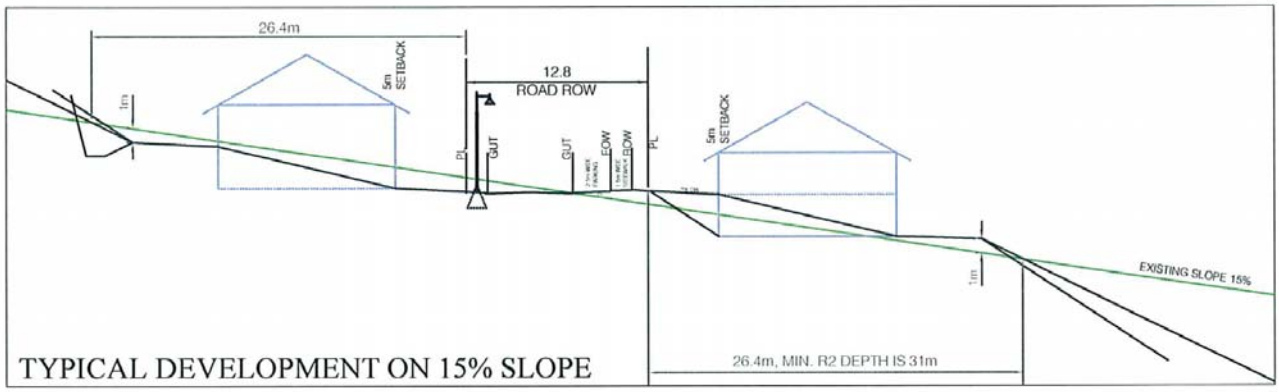
Hedging

For dry or south facing slopes, replant with drought and fire-resistant species.

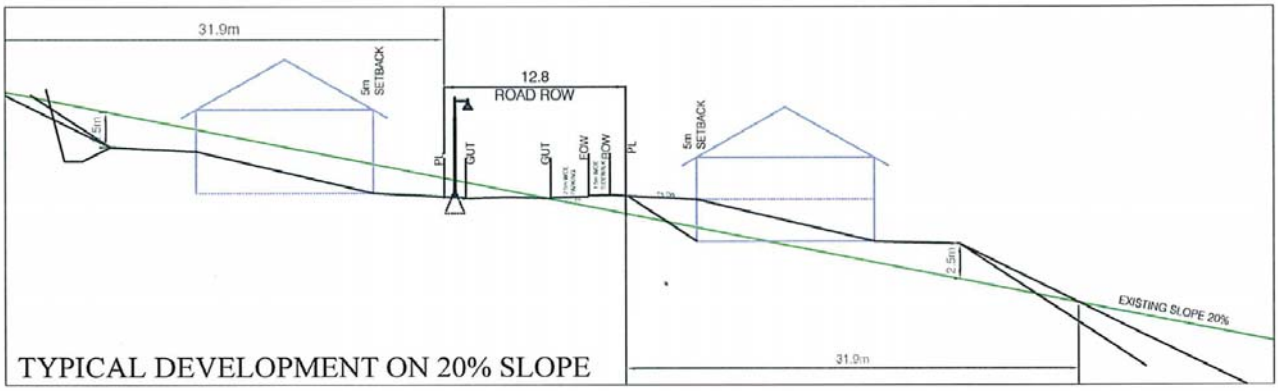
APPENDIX C: Typical Development Sections



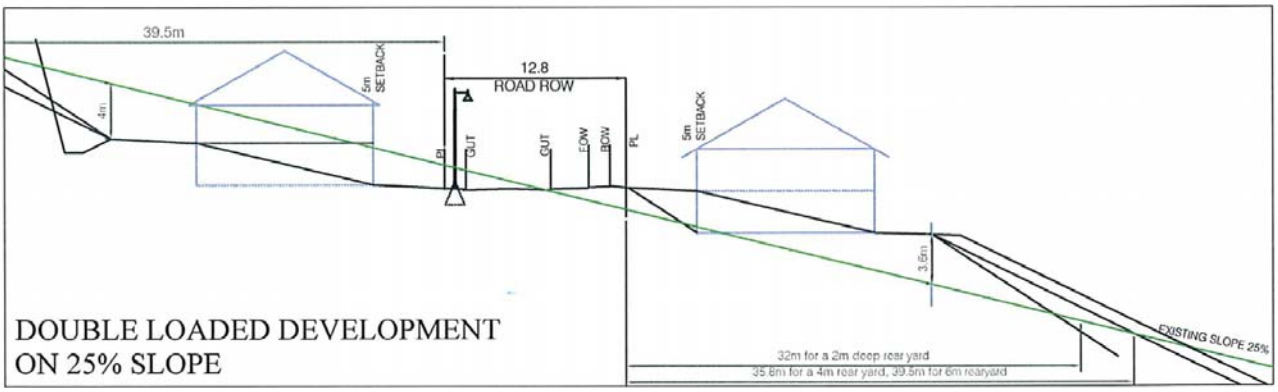
TYPICAL DEVELOPMENT ON 12% SLOPE



TYPICAL DEVELOPMENT ON 15% SLOPE

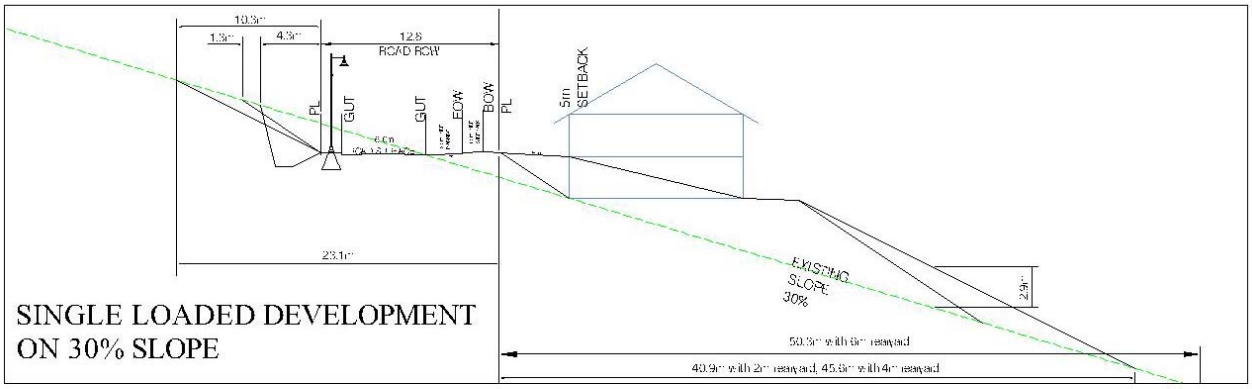


TYPICAL DEVELOPMENT ON 20% SLOPE

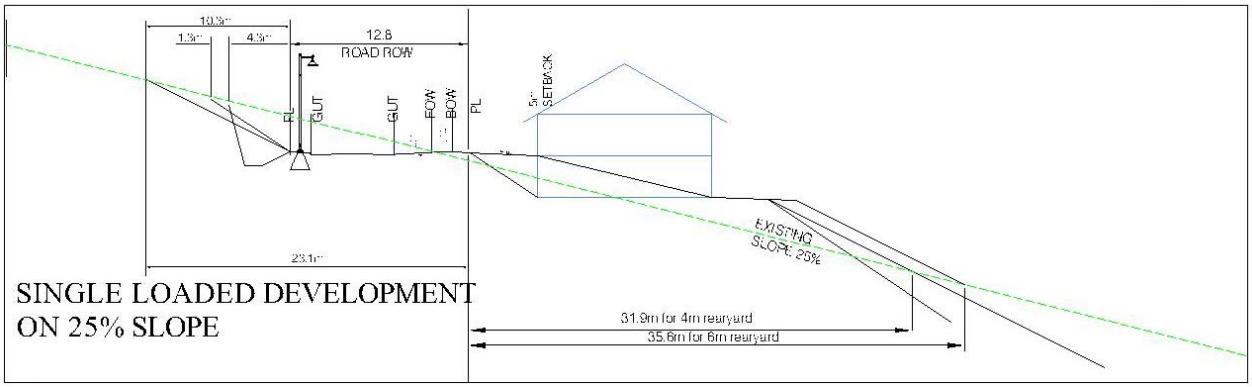


DOUBLE LOADED DEVELOPMENT
ON 25% SLOPE

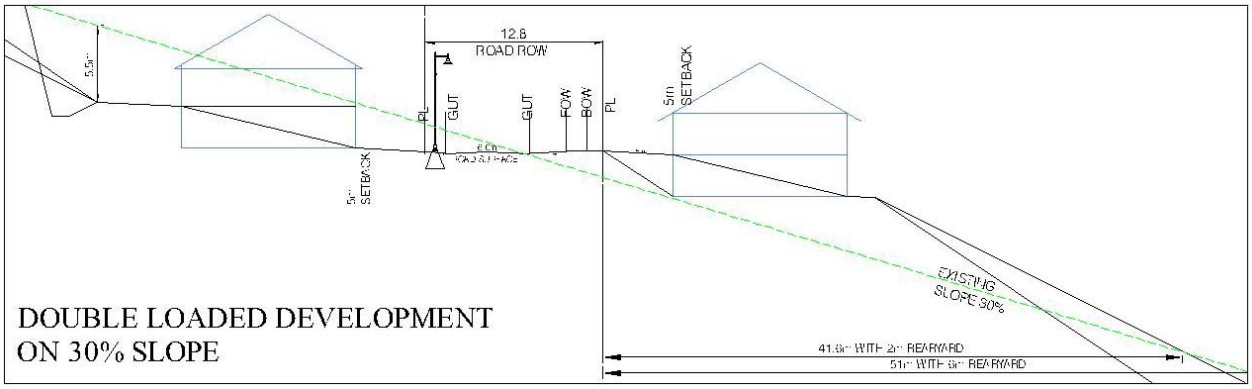
APPENDIX C: Typical Development Sections (Continued)



SINGLE LOADED DEVELOPMENT
ON 30% SLOPE



SINGLE LOADED DEVELOPMENT
ON 25% SLOPE



DOUBLE LOADED DEVELOPMENT
ON 30% SLOPE

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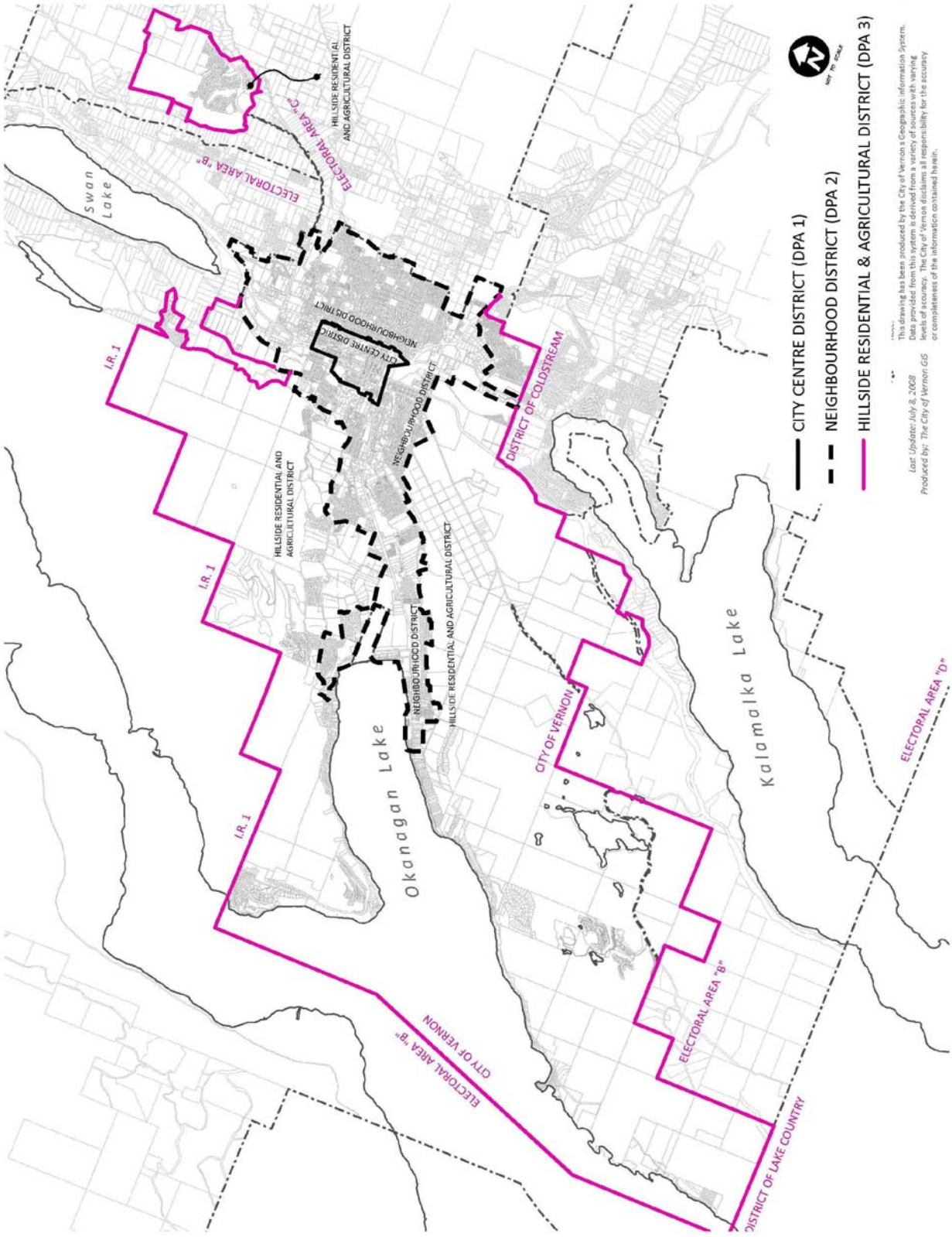
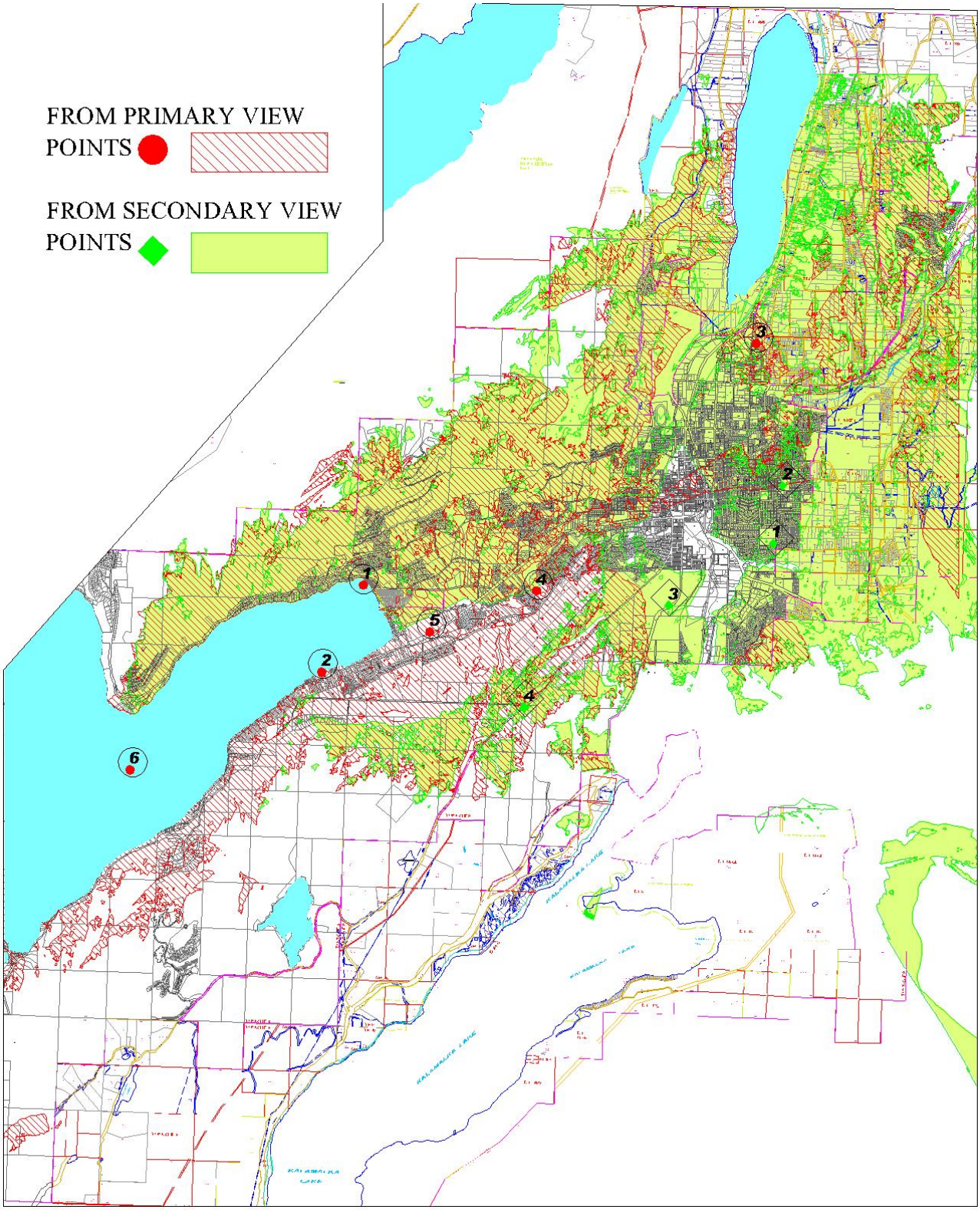
SCHEDULE A: DEVELOPMENT PERMIT AREAS



SCHEDULE B: VISIBLE SLOPES



SCHEDULE C: RIDGELINES