# APPENDIX A
# SUBDIVISION/SITE PLANNING

## A.1 Overview of Process

The term subdivision/site planning applies to subdivision planning, site planning and engineering, landscape design, architectural and building design, as well as local street design. Integrated subdivision/site planning is an effective means to ensure that parallel social, environmental, economic and functional objectives are achieved. The salient aspects of this process are described below.

- **Establish Objectives**
  Based upon an understanding of the natural features, context and the vision for future use of the site, a multi-disciplinary team should establish specific ecological, social, functional and economic objectives. This approach ensures that all objectives are defined and initiates the process of identifying parallel objectives, which is essential to achieving integrated solutions.

- **Set Targets**
  Related to each objective, identify specific performance criteria or design parameters. These 'targets' will guide the exploration of solutions and ensure that all necessary elements are addressed in the final design, including stormwater management, in terms of quality improvement and quantity control.

- **Establish Objectives Identify Techniques**
  The goal of this step in the process is to explore the range of techniques that could be employed to address each target. This should be done with an emphasis on research and innovation, rather than acceptance of standard solutions. It is at this stage in the process that the overlap of techniques, which yields integrated solutions to achieve multiple objectives, begins to become evident.

- **Explore Opportunities**
  Opportunities to achieve more than one objective through the application of single or multiple techniques should be identified. The unique attributes of the site and its context are the basis for the exploration of opportunities. The design team should collectively evaluate opportunities in order to ensure that objectives are addressed with a balanced perspective and to facilitate the thoughtful resolution of conflicts between competing objectives or contrary techniques.

- **Generate Conceptual Alternatives**
  Opportunities should be assessed to confirm suitability, practicality and compatibility with legislative requirements. Opportunities assessed and determined to be feasible are

then integrated into a comprehensive plan or plans, which illustrate a conceptual alternative for the integrated design of the site.

- **Develop the Final Plan**
  Through an interactive process of design, evaluation and refinement, the final plan is evolved from the concept plan. Individual components of the final plan should be resolved with a continued emphasis on innovation within a multi-disciplinary forum. The final plan should not only address the implementation of physical initiatives, but also the recommendation of management-based solutions.

## A.2 Subdivision/Site Planning and Stormwater Management Practices

It is important to understand that subdivision/site planning is a fundamental determinant of the overall change in the hydrologic cycle for a given development. However, the significance of subdivision/site planning is not always well understood by the landowners, their consultants, local decision makers or the public. The following discussion provides an appropriate framework to understand this important aspect of the development process.

- **Watershed and subwatershed planning: environmentally responsible land use policies must be supported by environmentally responsible site design.**

  The preparation of watershed and subwatershed plans is recognized as an essential part of the land use planning process. The watershed and subwatershed planning process is integrated with the official plan preparation and review process to ensure that an ecosystem approach is adopted in making land use planning decisions.

  Watershed and subwatershed plans address the ecosystem at a regional level. At this level, land use decisions are made as generalized policies and guidelines, and environmental information is often collected and interpreted at a broad scale. While these broad scale evaluations allow the development of strategies which are not possible through site specific evaluations, it is not always possible to interpret the merits or demerits of various individual development proposals at this stage.

  The fundamental objectives of watershed and subwatershed planning can only be realized if the principles of watershed/subwatershed planning are also applied during the planning and design of individual development projects. At this point of the development process, detailed site information is available and the physical parameters of the proposed development are determined. The subdivision/site planning stage is therefore an important step in the planning process when the impact of the development proposal on the environment can be specifically assessed. The integration of land use planning and environmental planning at a regional or district level must be extended to the process of site development and design.

- **Good planning integrates the design of a site and the design of the stormwater management facilities in one process.**

  Historically, the preparation of subdivision plans, site development plans as well as building and architectural design plans has not involved early input from environmental planners, hydrogeologists, ecologists and water resources engineers. The landowners and the planners/designers prepare the plan based on the performance standards set by the municipal by-laws or guidelines (such as setback, floor space index, density, height, etc.), and the business objectives set by the landowners (such as total leasable floor area to be achieved, number of units for sale and the number of parking spaces to be provided).

  Water resources engineers, and other associated professionals, are typically employed to address stormwater management after a preliminary site plan has been prepared. This process has inevitably made the proposed stormwater management facilities 'remedial' in nature since they are designed to handle a predetermined amount of runoff and to mitigate the negative impact of the proposed development. An alternative approach is advocated. The objective of reducing the root causes of negative impact on water management should be adopted as one of the basic design criteria directing the preparation of the site plan. The important aspect of good subdivision/site planning is that it should aim at reducing or preventing adverse impacts instead of mitigating them.

- **Public perception and implementation of innovative subdivision/site planning approaches.**

  There is a perceived public attitude that many of the proposed environmentally friendly subdivision/site planning techniques such as cluster housing forms, roadside ditches and the inclusion of runoff infiltration devices within residential lots are undesirable and represent a reduction in the level of service. This perception extends to some municipalities whose development standards may constrain the use of innovative subdivision/site planning techniques. As a result, developers may hesitate to include these design alternatives in their site development plans. Nevertheless, the attitude of the public is changing as more innovative projects are delivered into the market and the public sees the value of these new design concepts. Creative stormwater management design ideas should be encouraged and adopted as part of the design during the subdivision/site planning stage of the development process.

- **The most environmentally sound design is generally the most economical.**

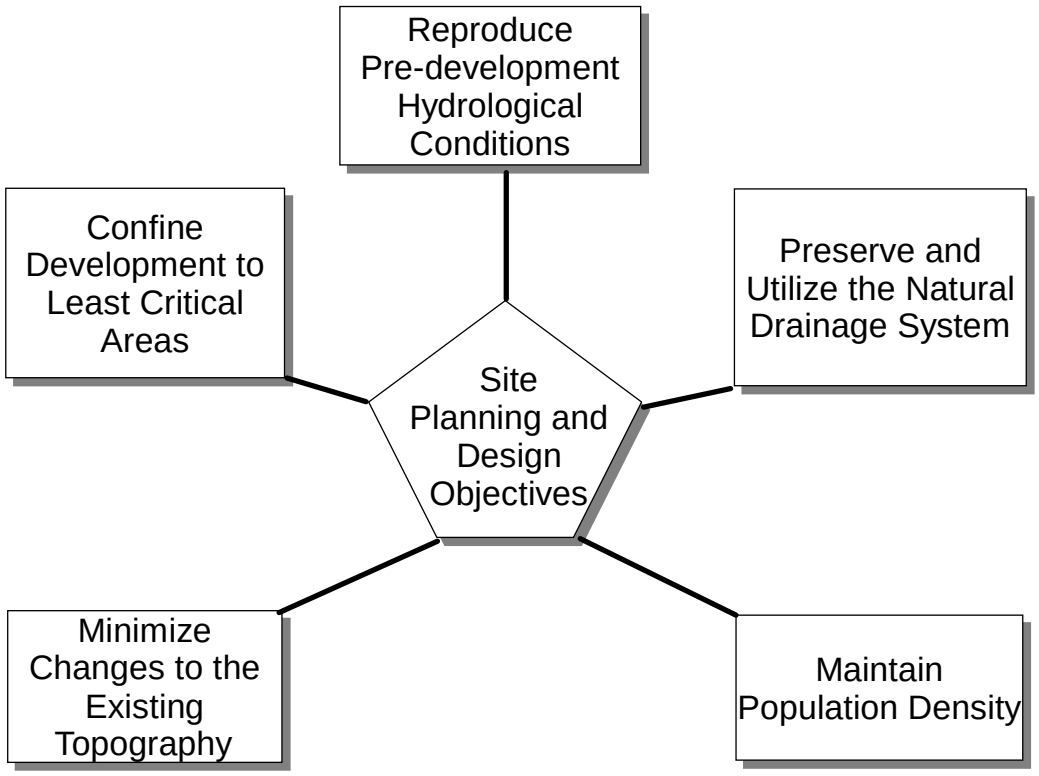
  Subdivision/site planning generally reduces the cost of the development due to:

  - lower grading requirements/costs;
  - lower tree clearing costs;
  - lower servicing costs (swales instead of storm sewers);
  - lots with mature trees are more saleable/valuable;
  - lots that back on to greenbelts are more saleable/valuable;
  - tourism dollars in areas with sports fishery; and
  - lower end of system clean up costs (i.e., dredging, etc.).

## A.3 Subdivision/Site Planning and Design Objectives

There are many excellent references, such as "Protecting Water Quality in Urban Areas – Best Management Practices for Minnesota" (Minnesota Pollution Control Agency, 1989) which illustrate the value of subdivision/site planning. These references were reviewed in the formalization of the objectives shown in Figure A.1. Design decisions made during the subdivision/site planning stage of a project should be assessed against these objectives.

**Figure A.1: Subdivision/Site Planning and Design Objectives**




## A.4 Subdivision/Site Planning Methodology

To assist site designers, the objectives have been translated into a subdivision/site planning methodology which may be used to prepare a development layout. The process may be summarized as follows:

1. **Agency Consultation** – identify existing resource mapping/data and natural resource concerns.

2. **Resource mapping** – identify significant natural functional areas for protection.

3. **Designation of development area** – determine the areas for development based on the resource mapping information.

4. **Evaluate stormwater management requirements** based on the preliminary site plans. Indicate locations and land area to be formalized in the site plan for the purposes of stormwater management.

5. **Adoption of environmentally responsible site planning and design criteria** – apply a set of environmentally responsible design criteria to the development area during the preparation of the site plan options.

6. **Finalization of the subdivision/site layout** – examine the various site plan options based on the criteria and select the option that best meets the site planning and design objectives.

### A.4.1 Agency Consultation

The regulatory agencies (Local Municipality, Ministry of Natural Resources, Ministry of the Environment, Conservation Authority) should be contacted for information on existing areas which are deemed to be environmentally significant.

### A.4.2 Resource Mapping

Resource mapping is required to ensure that significant natural resources are maintained or enhanced. On an appropriate scale ($\leq$ 1:2000) map of the proposed development site an outline of the following resources should be clearly delineated:

- ESA/ANSI areas;
- watercourses, lakes and other water bodies;
- wetlands;
- significant vegetation/woodlots;
- wildlife corridors;
- high recharge potential areas;
- regulatory floodlines and/or fill lines;
- stream and valley corridors;
- bank instability and erosion setbacks; and
- steep sloped areas.

Much of the information required for resource mapping may have been delineated (usually at a larger scale) in the watershed or subwatershed plan (if it has been completed). Reference should be made to these plans as part of the site investigations.

**ESA/ANSI Areas**
The Ministry of Natural Resources and the Conservation Authority should be contacted for mapping which indicates Environmentally Sensitive Areas (ESA) and Areas of Natural and

Scientific Interest (ANSI). Municipalities should also be contacted for mapping related to any Locally Significant Areas (LSA). These areas should be transferred to the site mapping and be clearly shown on development submissions.

**Watercourses, Lakes and other Water Bodies**
Watercourses, lakes, and other water bodies should be denoted on the resource mapping. Ontario Base Mapping (1:2000, 1:10000), where available, is a useful source of information which will indicate surface water resources. Larger scale topographical mapping will also indicate most surface water resources. In some cases, however, not all surface water resources may be delineated to preserve clarity (i.e., in areas with high topographical relief – many contours). In all instances, a site visit should be undertaken to confirm the surface water resources in the vicinity of the proposed development.

**Wetlands**
Wetlands should be shown on the resource mapping and Provincially Significant Wetlands should be identified. An environmental impact study (EIS) will generally be required if development encroaches within 120 m of a Provincially Significant wetland boundary, and it may be required for other wetlands as well. This study will assess the potential impacts of development on the wetland and recommend an appropriate buffer width and/or other mitigative measures.

**Areas of Significant Vegetation**
A terrestrial biologist should walk the site to identify the areas of the site with significant vegetation. Significant vegetation includes provincially significant, regionally significant, and locally significant species. An area can also be deemed significant, in terms of its vegetation, if it provides a corridor or refuge area for wildlife, a food source for terrestrial/aquatic species, a significant hydrological function, and/or a buffering capacity to mitigate the effects of urban development on the stream and valley corridor system.

In some cases, information on the vegetation of a site can be obtained from the Conservation Authority, Ministry of Natural Resources, and/or local naturalist groups. However, where mapping/information is dated, a site walk/inventory should be done. Not only may site conditions have changed, but also, values with respect to the importance of vegetation have evolved dramatically and may influence the mapping/information collected. The limit of development should be the drip line of the vegetation. No earthworks should be permitted within 3 to 5 metres of the vegetation drip line to protect root systems.

**Wildlife Corridors**
The significance of wildlife corridors is best addressed in Watershed or Subwatershed Plans. These plans should be reviewed if they exist. If a watershed plan and/or subwatershed plan has not been completed, the Ministry of Natural Resources should be consulted for input. A site walk by a terrestrial biologist should be undertaken to confirm the recommendations of the watershed/ subwatershed plan and the information provided by the Ministry of Natural Resources. Information from the site walk should be compared to the greenspace areas in the surrounding

geographic area to determine if a wildlife corridor exists on the site. Significant wildlife corridors should be drawn on the resource map.

**Recharge Areas**
Boreholes and test pits are required to determine the groundwater recharge potential for the site. This investigation must be undertaken by a qualified soils consultant or geotechnical engineer. Information which needs to be collected includes soil types, soil depths, the depth to the water table, the degree of soil compaction, soil percolation rates, the estimated high seasonal water table depth, the depth to bedrock, and soil particle size distributions.

Percolation rates measured in the field may be used as an indicator of the potential for groundwater recharge. Areas with a percolation rate greater than 50 mm/h should be identified as important recharge areas (i.e., any development must ensure that recharge is maintained), and areas with a percolation rate greater than 100 mm/h should be identified as critical recharge areas (i.e., areas that may be non-developable or require significant investigation in support of development), given that the depth to bedrock and depth to the water table are greater than 3 m below the ground surface.

It is important to identify other hydrogeologically sensitive areas, such as locations where aquifers may be susceptible to contamination due to their proximity to the surface and the nature of surficial deposits.

**Regulatory Floodline and/or Fill Line**
The regulatory floodline and/or fill line should be shown on the resource map if the proposed development is adjacent to a watercourse. If a floodline or fill line has not been delineated, and is not required to be delineated (i.e., upstream drainage area is small (< 125 ha) and the Conservation Authority is not concerned with flooding) it does not need to be shown on the map of the site. In cases where the flood or fill line is not shown, the watercourse should still be shown as it may serve an important ecological function.

**Stream and Valley Corridors**
The area required to protect stream and valley corridors is best decided at the subwatershed plan level. The stream and valley corridor area should be shown on the resource map.

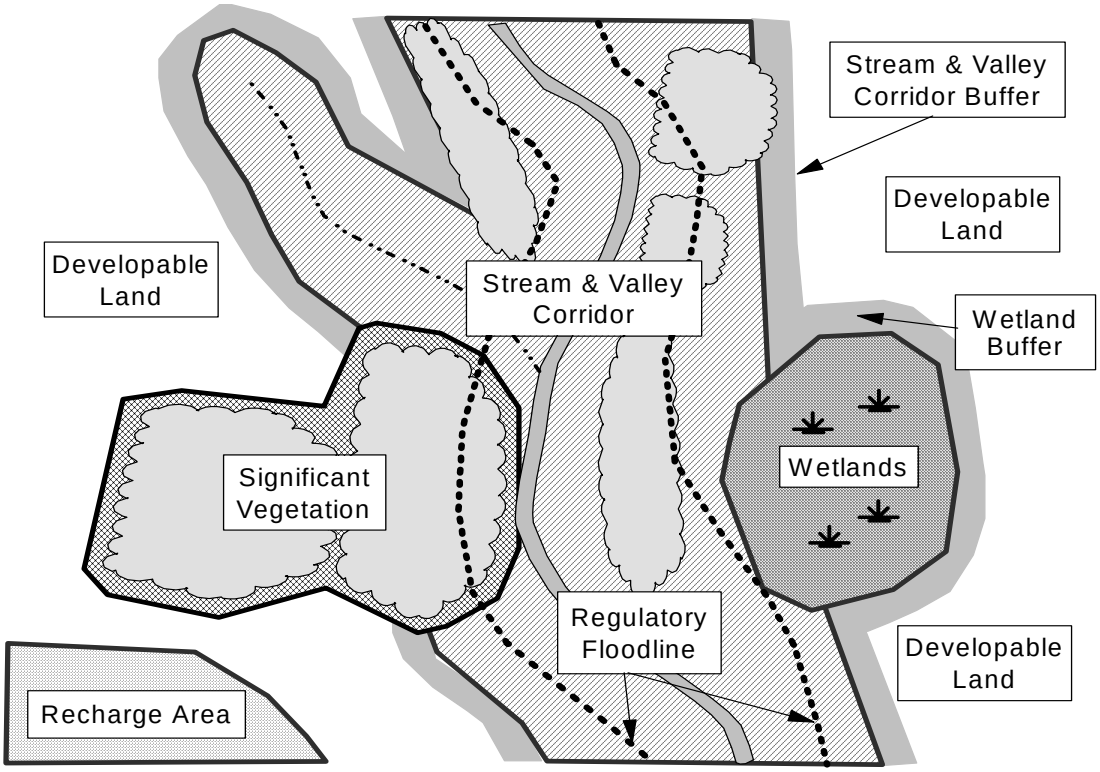
**Bank Instability and Erosion Areas**
Areas susceptible to bank instability and erosion should be identified on the resource map. These areas will typically be within the stream and valley corridors. Tables C.1 and C.2 provide guidance on identifying areas susceptible to erosion.

**Steep Sloped Areas**
Areas with a slope of greater than 20% should be identified on the resource map. These areas may be difficult to develop (i.e., result in significant alteration to the natural topography) and should be noted as constraint areas.

### A.4.3 Designation of Development Area

The resource mapping information should be compiled into overlays of information sheets and maps for easy cross referencing. These overlays will illustrate the inter-relationship between the different elements of the ecosystem. At this stage, the planner/designer should determine where development should occur within the site to minimize impacts on the environment. Figure A.2 illustrates the concept of resource mapping to determine developable land. Once the area of developable land has been identified, a development layout should be prepared based on a set of environmentally responsible subdivision/site planning and design criteria.

**Figure A.2: Resource Mapping**




### A.4.4 Reserve Appropriate Areas for Stormwater Management

Subdivision/site planning must reflect the need for stormwater management. This requires interaction between planners/designers and stormwater management professionals to ensure that there is adequate land area in appropriate locations designated for the purpose of stormwater management. The requirements for stormwater management will depend on the water management criteria which have been established for the site, the stormwater management

measures that are contemplated, and the actual site planning that is proposed. The full range of stormwater management measures (lot level, conveyance, end-of-pipe) should be contemplated. At this stage, preliminary design and siting of stormwater management controls would be appropriate.

Urban stormwater management practices should be located outside of the floodplain wherever possible. In some site specific instances SWMPs may be allowed in the floodplain if there is sufficient technical or economic justification and given that they meet certain requirements:

- The cumulative effects resulting from changes in floodplain storage, and balancing cut and fill, do not adversely impact existing or future development;

- Effects on corridor requirements and functional valleyland values must be assessed. SWMPs would not be allowed in the floodplain if detrimental impacts could occur to the valleyland values or corridor processes;

- The SWMPs must not affect the fluvial processes in the floodplain; and

- The outlet invert elevation from any SWMP should be higher than the 2 year floodline and the overflow elevation must be above the 25 year floodline.

In most cases, online facilities (those located within a watercourse) are discouraged because of concerns for wildlife movement, fish passage and disruption of energy inputs. Online stormwater quantity facilities may be acceptable if designed such that the bankfull flows, and hence fish movement, are not impeded/obstructed, and provided that the foregoing requirements are met. Online quality ponds can only be approved if issues of aquatic habitat can be resolved. An online facility could only be proposed in the context of a subwatershed plan.

The location of end-of-pipe stormwater management facilities is a contentious issue since the use of tableland reduces the overall developable area. In an effort to minimize the loss of developable land municipalities can consider the use of parkland dedication for SWMPs which offer passive recreational opportunities and follow the municipality's greenland strategies (parkland objectives) wherever possible.

### A.4.5 Adoption of Environmentally Responsible Subdivision/Site Planning and Design Criteria

The following general planning and design criteria are recommended:

- preserve existing topography and natural features;
- protect surface water and groundwater resources (stormwater management);
- adopt compact development forms;
- adopt alternative site development standards; and
- re-create natural habitats within the development areas.

These criteria, and techniques which can be used to accomplish them, are discussed in the following sections.

**Preserve Existing Topography and Natural Features**

In order to preserve the existing topography and natural drainage system, buildings and roads should be located along high points and on flat slopes (Figure A.3). Natural drainage swales should be used to convey runoff from the development to the receiving waters (Figure A.4). This approach will reduce the area disturbed by cutting and filling along the slope and minimize the amount of surface area susceptible to erosion.

**Figure A.3: Preservation of Existing Topography**

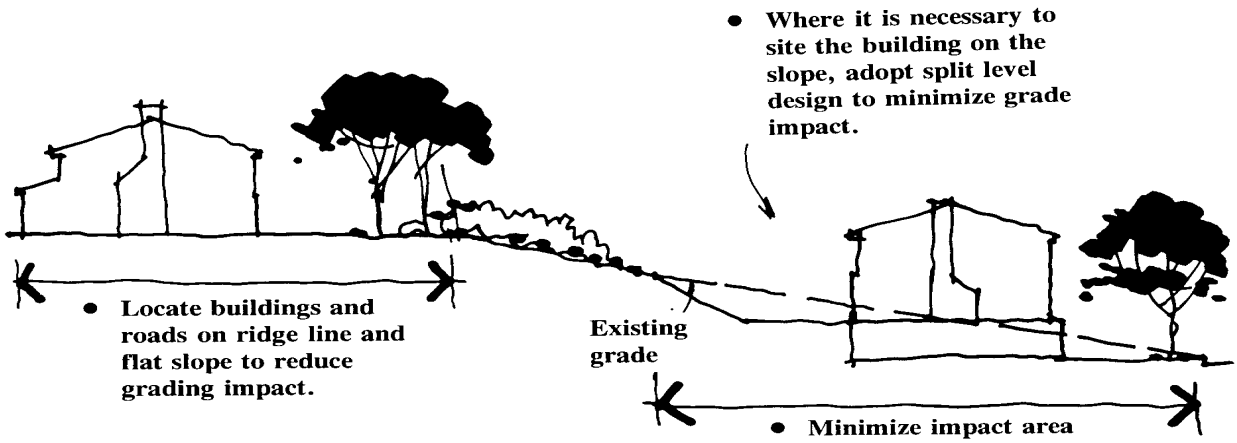
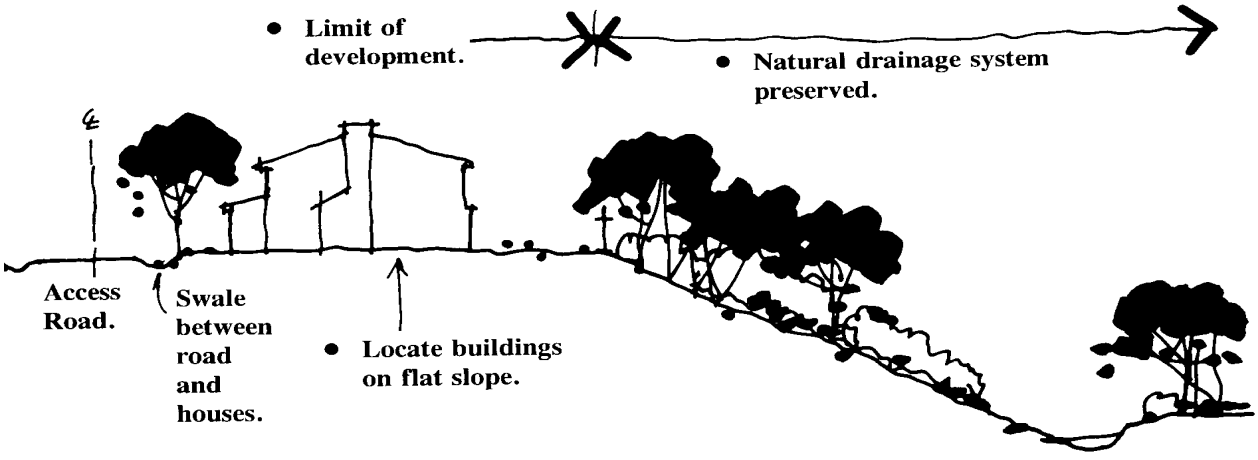



**Figure A.4: Preservation and Utilization of the Natural Drainage System**



The application of this criterion must be made with consideration for the visual impact of locating buildings on and along the ridgelines of the landscape. To avoid the visual intrusion of buildings along attractive natural ridgelines and the disruption of existing prominent landforms, it may be necessary to site the buildings and the access roads along the contouring slopes.

**Protect Surface Water and Groundwater Resources**
The concerns with respect to surface and groundwater resources must be identified and the level of control required to address these concerns must be defined. The site plan should adopt a combination of lot level, conveyance and end-of pipe stormwater management approaches that will mitigate the effects of urbanization on surface and groundwater resources. The constraints and opportunities presented by the physical site conditions (e.g., site hydrology and soils) must be considered in the selection of stormwater management controls.

**Adopt Compact Development Forms**
Adoption of compact housing forms such as cluster single dwellings, medium density townhouses and low-rise apartments, and high-rise apartments can compensate for restrictions in the area of developable land due to environmental features. A certain level of development density may be achieved while reducing the extent of disturbance to the site and the amount of site works required. Figure A.5 illustrates the concept of maintaining density with single detached cluster housing while reducing the overall development area. The feasibility of single detached cluster housing is dependent on the use of alternative development standards.

The Ministry of Municipal Affairs and Housing promotes compact, higher density housing forms. Compact, higher density housing forms are shown in Figures A.5 and A.6, and may include:

- cluster single lots with reduced lot frontages and alternative road/grading standards;
- higher density forms such as duplex and semi-detached;
- condominium singles;
- medium density housing forms such as townhouses, fourplex and low-rise apartments; and
- high density housing such as high-rise apartments.

**Adopt Alternative Site Development Standards**
Many of the compact development forms recommended above can only be implemented with flexible site design standards (building setbacks, grading requirements, minimum street gradient and turning radius, width of internal streets, locations of site services, provision of street boulevard areas).

Alternative development standards are generally allowed in non-freehold development projects (i.e., projects in which the services (roads, stormwater management facilities, etc.) are not municipally maintained – such as condominiums). Any public right-of-ways, public areas, and freehold residential lots, however, have to comply with the normal municipal planning and engineering (grading, servicing) standards. Public streets are designed to have a wide right-of-way and gentle gradients. These standards may limit the implementation of alternative housing forms to non-freehold developments. The adoption of alternative cluster single lots for the typical freehold development, for example, will be less effective if alternative development standards are not utilized.

Alternative development standards complement reduced lot frontages and depths to reduce the overall development footprint. “Making Choices: Alternative Development Standards Guideline” (Ministry of Municipal Affairs and Housing, 1995) reviews municipal standards and recommends alternative standards to reduce development costs, promote compact urban form, and mitigate environmental impacts.

**Figure A.5: Cluster Single Detached Dwellings**

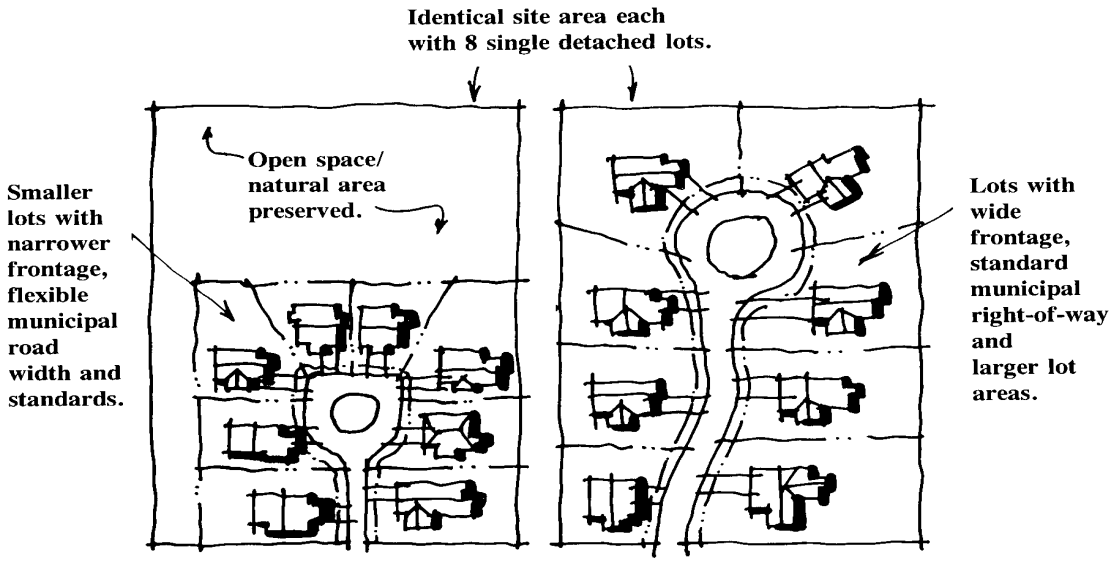
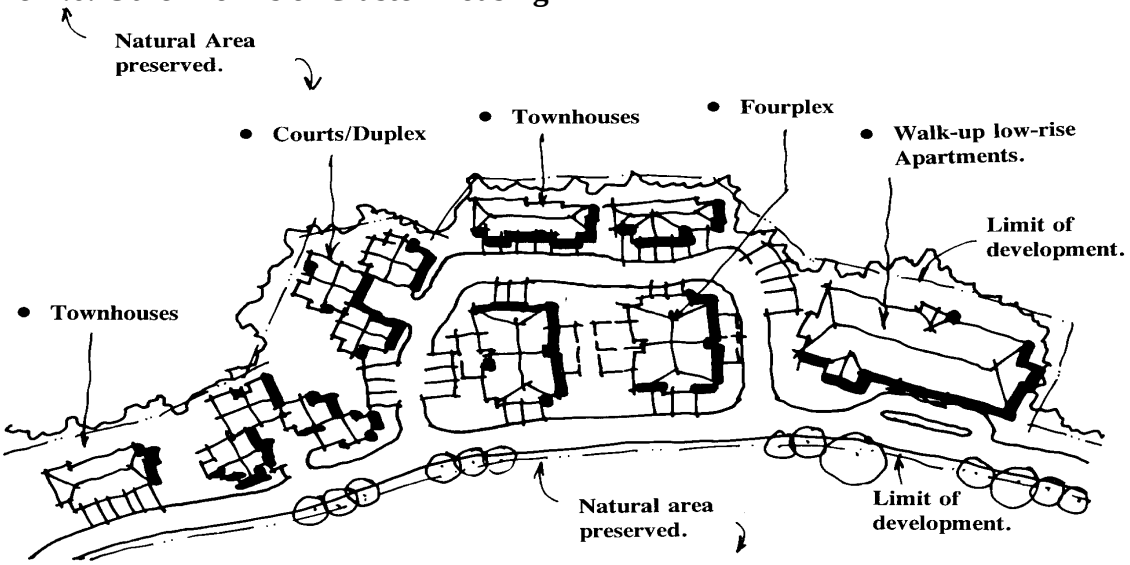



**Figure A.6: Other Forms of Cluster Housing**



Some alternative engineering standards which help to reduce the overall footprint of development include:

- reduced road widths on local roads

  Reducing the road width to 6 m on local roads allows for two way traffic without street parking or one way traffic with parking. This reduces the overall pavement area, and hence costs, for the subdivision. The reduction in the pavement area will minimize the amount of land to be disturbed and grading works. It will also provide more flexibility for the planner/designer to align the proposed road along existing contours and integrate it into the existing landform.

- reduced cul-de-sac turning radius

  A reduction in pavement and overall land consumption can be achieved if the cul-de-sac turning radius is reduced from 14 to 11 metres.

Other alternative engineering standards which minimize environmental degradation and changes to the natural function of the land are shown in Figure A.7 and include:

- a wider range in allowable lot grading

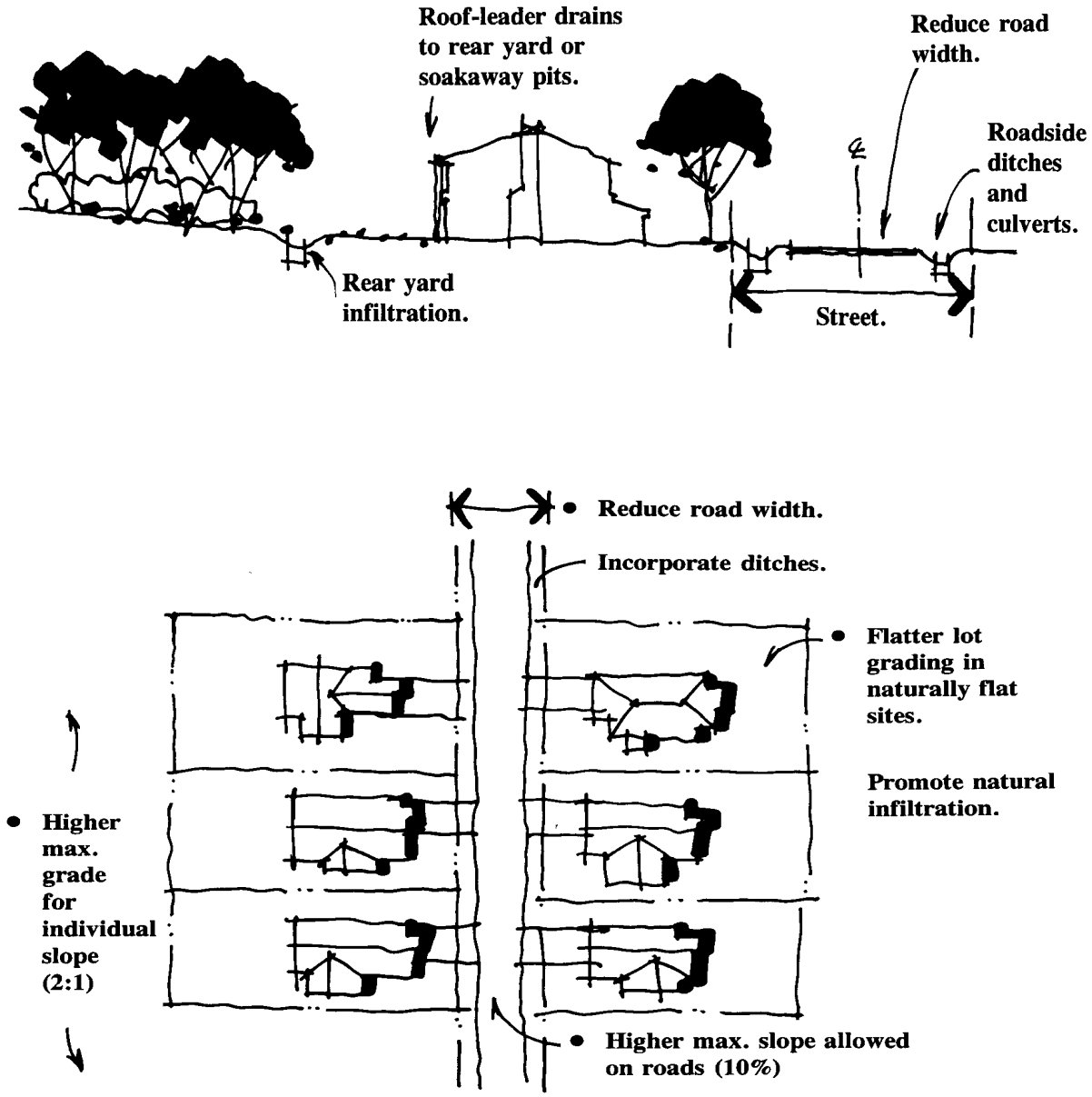
  A reduction in the minimum allowable lot grade promotes natural infiltration and creates greater depression storage. Due to the problems of physically being able to grade below 2%, there should be an elevated apron around buildings (within 2 to 4 metres) to ensure that water does not drain towards the building foundation.

  Flatter lot grading should be promoted in naturally flat areas but radical changes to the existing topography should not be made. Municipal grading standards may also need to be modified for development within areas of varying topography to permit steeper lot grading. This flexibility will assist the designer to site the buildings along the slope and fit the built form into the terrain with minimum disturbance to the existing topography.

- higher maximum allowable slopes on roads (10% instead of 6%) and individual lots (2:1 instead of 3:1)

  The increase in range of maximum allowable slopes allows planners/engineers greater flexibility in designing developments within the existing topography. Economic and environmental benefits accrue from reduced grading requirements, although there may be some drawbacks such as greater requirements for sanding/salting these roads during the winter and increased erosion potential in roadside ditches. On the other hand, narrower road surfaces will also mean reduced amounts of road salt/sand and lower construction costs. These issues are best addressed from a holistic perspective recognizing the environment, the economy, and the functionality of the subdivision/site design.

**Figure 1.7: Alternative Development Standards**




- discharge of roof leaders to soakaway pits or rear yards for natural infiltration/evaporation

  Water that is discharged from roof leaders is relatively clean water. The only potential contamination of this water is by atmospheric deposition and roofing materials. Options that promote the infiltration of this water into the surrounding native soil material are promoted since they reduce peak flows and enhance

groundwater/baseflow recharge. Roof leaders discharge to the surface should be minimum standard practice even in areas where there are physical constrains on infiltration.

- servicing via enhanced grassed swales and culverts instead of storm sewers

  The use of grassed swales (commonly referred to as ditch and culvert servicing) is viable for lots which will accommodate swale lengths ≥ the culvert length underneath the driveway (not just the driveway pavement width). The swale length should also be ≥ 5 m for aesthetic and maintenance purposes. This is generally achievable for small lots (9 m) with single driveways or larger lots (15 m) with double driveways. Grassed swales provide numerous benefits (water quality enhancement, reduction of water quantity peak flows and volumes, easier snow removal, storage for snow removal) and are recommended for implementation wherever feasible.

- foundation drains to soakaway pits or sump pumped to the rear yards for natural infiltration

  Foundation drainage is relatively clean water having been filtered by the backfill surrounding the foundation. Options that promote the infiltration of this water into the surrounding native soil material reduce peak flows and enhance groundwater recharge. In areas where infiltration is not appropriate (i.e., percolation rate < 15 mm/h), a separate foundation drain should be considered to reduce the volume of water being treated by any end-of-pipe stormwater management facility.

- increase rear lot overland drainage

  A greater tolerance for designs that allow overland drainage across lots is preferred from an environmental standpoint since they provide greater opportunities for reducing peak flows and stormwater volumes. Overland drainage also provides opportunities for water quality improvement through settling, adsorption, filtration, and infiltration.

  Opportunities to increase rear lot overland drainage include:

  - allowing lots backing on to one another to drain through each other; and
  - increasing the allowable length of rear yard swales and contributing drainage area.

- increase the allowable vertical sag at intersections (K of 4 instead of 10)

  An increase in the allowable elevation differences for intersection approaches will allow a development to be designed with less changes to the existing topography. This alternative standard is promoted for stop intersections, but may not be applicable for through-type intersections due to increased traffic safety concerns.

**Re-create Natural Habitats within the Development Areas**
Within the designated development areas, and as part of the overall subdivision/site planning concept, opportunities to recreate natural habitats should be identified. Opportunities could include selected areas within public parks, roadside revegetation with native woodland species, naturalization of any disturbed slopes, and assisted natural regeneration along existing or new watercourses.

### A.4.6 Finalization of the Subdivision/Site Layout

Different design options which meet the adopted subdivision/site planning criteria will have been generated. To select a preferred subdivision/site layout, the planners/designers should evaluate the options against the objectives outlined in Section A.3. The subdivision/site layout which best satisfies these objectives should be endorsed as the appropriate development strategy.