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THE INTEGRATED COMMUNITY

A STUDY OF ALTERNATIVE LAND DEVELOPMENT STANDARDS

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THE INTEGRATED COMMUNITY

A STUDY OF ALTERNATIVE LAND DEVELOPMENT STANDARDS

June, 1996

by
Berridge Lewinberg Greenberg Dark Gabor Ltd.,
Cosburn Patterson Wardman Limited
and Glatting Jackson Kercher Anglin Lopez Rinehart

Prepared for
David D'Amour,
Social and Economic Policy and Research, CMHC

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The Integrated Community, Acknowledging Complexity is a study which explores the status of alternative development standards in North America. The need to establish an alternative approach to the conventional standards applied to community development has been identified. Alternative development standards would encourage development patterns which are more affordable, discourage sprawl, are environmentally responsive, support transit, reduce auto dependency and create more liveable communities.

The study has undertaken a literature review, examined four case studies, developed a set of principles and guidelines for an alternative approach to development standards and demonstrated the potential of an alternative approach through the design of a fictitious community entitled the Integrated Community.

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1 INTRODUCTION

1.1 What are Alternative Development Standards?

The shape and function of new communities in North America has become increasingly controlled by an accumulation of standards and guidelines. These standards have evolved from a perceived need to ensure consistent levels of design, safety and servicing and have inadvertently fostered a 'standardized' vision of community form. They cover a wide spectrum of elements ranging from road widths, size of parks and front yard setbacks and are contained within engineering manuals, municipal guidelines and zoning and official plan regulations.

Important changes in approaches to the environment and new thinking about community design suggest a need to revise curren standards. Many of these prescriptive, and, in some cases, outdated development standards hamper desirable innovation and produce inherently restrictive and expensive forms of development. This study reviews a selection of current standards, examines the resultant urban form and proposes a set of principles which can provide the basis for developing alternative development standards. In order to demonstrate the potential of applying the proposed base principles and an alternative set of development standards, a hypothetical community entitled the Integrated Community has been designed.

In this report, development standards are considered at two scales: 'local' and 'regional'. The standards applied at each scale differ and are generally the responsibility of different levels of government or departments within those governments. 'Local' development standards apply at the neighbourhood scale or within individual subdivisions and define such elements as local road rights-of-way, roadway geometrics and below grade servicing allowances; lot regulations such as frontage, setbacks, orientation to the street, and parking; lot drainage and grading issues.

While reviewing the status of local standards, this report focuses primarily on regional standards. Alternative local standards have been addressed in a number

of previous studies, yet, there has been very little exploration of alternative regional standards. 'Regional' standards generally apply to the community level, the geographic area in which employment and special needs are met. In order to differentiate this definition of 'regional' from other definitions which may adopt the common, larger interpretation of regional, such as the Greater Vancouver Region, this scale will be referred to as 'community'. The 'community' scale is comprised of a cluster of neighbourhoods which are connected by a road network, park system and other infrastructure elements. Typical systemic elements normally considered at the community scale include: the size and design of 'regional' roads; urban structure and land use patterns; parks and schools; and natural systems and storm water management at the subwatershed scale.

1.2 Why Do We Need Alternative Development Standards?

There is a growing concern that contemporary development standards are excessive, outdated, contribute to an expensive and land consumptive pattern of development and constrain innovation to community design. There is a need to critically examine existing standards, assess their intent, their current relevance, explore potential overlaps or synergies between standards and observe their physical consequences. Where appropriate, alternative standards need to be developed and implemented.

A number of factors contribute to the current status of development standards. A unilateral approach taken by various professions working in isolation of one another has resulted in a complex layer of fragmented development standards. Generally, designers, engineers, and planners work exclusively in their area of expertise, claiming ownership of pertinent portions of development standards. In order to disentangle the layers of standards, the current framework in which standards are established needs to be reviewed.

Currently, development standards independently address a broad range of design and infrastructure elements. Standards are often created to address particular elements without consideration of the complexity of the whole community environment. The cumulative result of a number of independently established standards is often an over-designed, over-engineered, land consumptive and

expensive system of infrastructure. These standards attempt to minimize risk, maximize safety and produce efficient engineering systems for each concern. Yet, in focussing on efficiency and safety on an issue by issue basis, the standards often neglect the overall quality of community form and the interrelated nature of the elements being addressed.

Development standards have been in existence in North America since early in the 19th century. The intent and focus of standards has changed over time depending on political environment, social priorities and economic conditions. Initially, standards were introduced to control design elements (lot size, street patterns), address inadequate sanitary conditions and water services and preserve open spaces. Between 1930 and 1950, municipalities became actively involved in community planning and so began the bureaucratization and standardization of planning standards. Documents such as the Institute of Transportation Engineer's Recommended Practice for Subdivision Streets were published in the United States and became the authority for street standards. Since the 1950's there has been an increased technocracy and specialization which has been produced, amongst other things, an increasingly complex maze of prescriptive development standards.[1]

The economic climate has been a significant determinant of the level and scope of development standards. High levels of economic growth in the post World War II period resulted in vast expenditure on infrastructure, housing and development and few restraints on the low density form of development. This perception of the availability of land enabled the establishment of development standards in which each element claimed its own space with minimal contact or 'friction' with other elements. Based on this premise, rapid suburbanisation has resulted in a 'sprawled' urban form which has been enshrined by development standards.

Budget surpluses of the 1950's and 1960's have been replaced by tight economic times and budget deficits in the 1980's and 1990's. Public infrastructure investment in Canada has not grown since 1975, while private construction investment has increased significantly.[2] This gap will likely widen as infrastructure demands within Canada are expected to continue growing while existing infrastructure ages, deteriorates and needs replacement.[3] The result is a commit-

ment to standards which prescribe a form of urban development that is inherently expensive to build and maintain at a time when infrastructure investment declines.

Traditionally, planning practice in North America has been policy oriented and has generally focussed on land use, transportation and housing issues. Insufficient attention has been paid to the economic consequences and aggregate physical manifestations of these policies. Urban design has only recently been recognized as an important element of planning, as have more graphic and visual analysis of the impacts of development.

Engineering practice, while becoming increasingly specialized over the past several decades, did not develop a corresponding capacity to understand and respond to 'second order' impacts of major public works. These second order impacts - such as changes in household vehicle ownership, profound aberrations in retail sales location practice and transportation subsidy promoting flight from cities - are the most important impacts of transportation decisions and have gone largely unmeasured until finally appearing, in the public's view, as a 'traffic mess'.

Specialists, applying their own narrow range of criteria are unwilling, then often finally unable, to balance criteria for the sake of attaining a superior design that optimizes qualities from not only their own specialty but other relevant viewpoints. A 'vicious cycle' of loss of engineering judgement sets in, with engineers becoming fearful of 'deviating' from 'published' standards and with the public coming to see engineers as mere technicians and not designers or problem solvers.

By failing to challenge inherited standards, we have been protecting the eternal adolescence of cities in which assumptions of unbounded growth have gone unchallenged. Examined critically, the current system of development standards can be seen to be restrictive, inflexible, unaffordable, environmentally unresponsive and does not consider the quality of community designs.

A need for a new approach has been identified. In order to overcome the complexity and compartmentalization of the existing standards, this new approach

must be integrated and flexible. New standards need to operate at the point of intersection between disciplines. The challenge before us is to address cost-consciousness, environmental issues, problems with urban form, quality of life and affordability in a coordinated and efficient manner. This study begins to meet this challenge by examining the current development standard context, suggesting an alternative approach and set of principles to guide innovation in standards. The approach and principles embodied here are intended to serve as a basis for examination of alternative standards in different localities, not toconstitute a new set of universal solutions.

2 CURRENT STATUS

The shortcomings of contemporary development standards have been identified and are being addressed by a wide range of agencies and bodies, both public and private. Initiatives include:

developing innovating standards on a site specific basis;

exploring alternative funding mechanisms for hard and soft infrastructure investment;

reconsider space requirements and the potential for multiple use facilities such as community buildings and schools;

exploring the integration of different land uses;

rethinking of how, where and when services and sites are used; and

rethinking the mechanisms to implement those rules.

This study assesses the current state of development standards and initiatives related to development controls by undertaking two tasks: conducting a literature review and by identifying the current development standards and exploring their physical manifestations in four North American cities.

2.1 Literature Review

A review of the literature on the topic of alternative development standards in North America reveals that there is still much research to be undertaken. The literature focuses on examples and experiences with local standards at the scale of the individual neighborhood as the 'unit' of development. For example, the Ontario Ministry of Housing and Municipal Affairs' Making Choices is a 'guideline' on alternative development standards that would allow a wider range of choice in approaches to infrastructure at the 'local' level. However, little research has been conducted at the community level which transcends individ-

ual project standards. When standards relating to storm water management, parks and community centres have been addressed, this has been undertaken in a fragmented and indirect manner.

The breadth of perspectives from which articles are written on development standards emphasizes the importance of adopting a multi-disciplinary approach in tackling this matter. Engineers, architects and planners are not the only professions that are concerned with the status quo. Educators, fiscal managers, developers and environmentalists have been contributing their thoughts, experiences and research to the topic. This suggests that while the problem is complex, solutions may lie in integrating these perspectives in order to update our current standards and approaches.

Innovations in transportation standards and lot design are prominent in the literature. While these are important areas for innovation, their consideration in isolation from the broader issues of community form provides only a partial solution. The lack of documentation and research on standards with a more qualitative character and which relates to the community level such as parkland dedication and design, community services, storm water management practices and urban design is notable.

Urban, suburban and rural contexts are addressed independently in the literature. Suburban and greenfield development is the arena for much research which generally focuses on reducing the conventional standards while maintaining an established low density form of development. Fedorowick, in her book, Housing in the Countryside, proposes alternatives for creating compact development in the rural context which respect agricultural and natural features and are environmentally responsible.[4] Literature on urban development and redevelopment explores initiatives such as 'main street' policies, office conversions to other uses and the naturalization of parkland.[5,6]

2.1.1 Areas of Consensus

There is a consensus in the literature on the need to reevaluate current development standards and for better coordination of players in the development process. The arguments prompting change are based on demographic, economic, quality of life and environmental concerns. However, the principal force driving many of the initiatives being undertaken is the inability to afford the current standards.

Demographic Realities

The mono-culture of the conventional neighbourhood, planned for the traditional nuclear family - the breadwinner father, the homemaker mother and children - has resulted in assumptions which no longer accurately reflect the demographic realities of the 1990's. According to CMHC, this traditional family represents only 14% of young Canadian families.[7] There are a greater number of single parent families, more mothers moving into the paid work force and extended families and non-family households, all of which has a tremendous impact on the form and function of communities. Demands for a diversity of housing types, more affordable housing, better public transportation services, community services, such as day care, and less separation between place of work and home are placing pressure for change on current development standards which generally enforce dispersed developments, segregation of uses and uniformity.

Economic Constraints

From an economic point of view, North American infrastructure is becoming increasingly difficult to afford.[8] This is occurring for a number of reasons. Generous engineering standards designed to optimize efficiency, reduce risk factors and impose physical segregation of different services produce a land consumptive infrastructure system which in turn produces a larger linear servicing area. Secondly, conventional suburban development patterns demand dependence on the automobile and require services such as water and sewage to be extended over large distances. Thirdly, declining investment in the maintenance of infrastructure since the 1960's has resulted in a poor state of existing infrastructure. The Federation of Canadian Municipalities estimates that the 1995 'gap' in spending between real needs and actual expenditures on infrastructure

for essential services in Canadian urban areas was in excess of $44 billion.[9] Finally, the existing literature identifies but does not address the additional investment in infrastructure necessary to meet future growth in population and demands of new development.

The implications of current development patterns and infrastructure standards go beyond domestic fiscal management. The efficiency and affordability of urban infrastructure has implications for the ability of Canadian industry and business to be competitive in international markets. Further, at a time when structural changes in the economy have resulted in traditional distinctions between sectors becoming blurred, infrastructure which efficiently connects and networks sectors, such as transportation and communications, becomes more important.[10]

Quality of Place

There is a growing concern for the kinds of places which result from current development standards. The 'new urbanism' movement supports alternative development forms which seek to recreate the vitality, scale and diversity of traditional neighbourhoods and towns. Integrated and flexible standards would facilitate rather than hamper proposals which attempt to achieve innovative, more compact and more liveable urban form.

Environment Sustainability

Environmental concerns related to the impact of current development standards include: loss of natural areas; high land absorption rates; car dependence; failure of septic systems and disappearance of agricultural land.

Storm Water Management

In the field of stormwater management there is increasing recognition of the multifaceted aspects of water resources management in developing drainage plans for new developments. The growth in the number of stormwater management issues in recent years for many jurisdictions in southern Ontario is shown in Figure 1. As illustrated, development impacts often include elements such as aquatic life, groundwater and erosion in addition to the traditional flood control aspects. In many cases, the completion of studies is now undertaken on a larger

Evolution of Watershed Planning

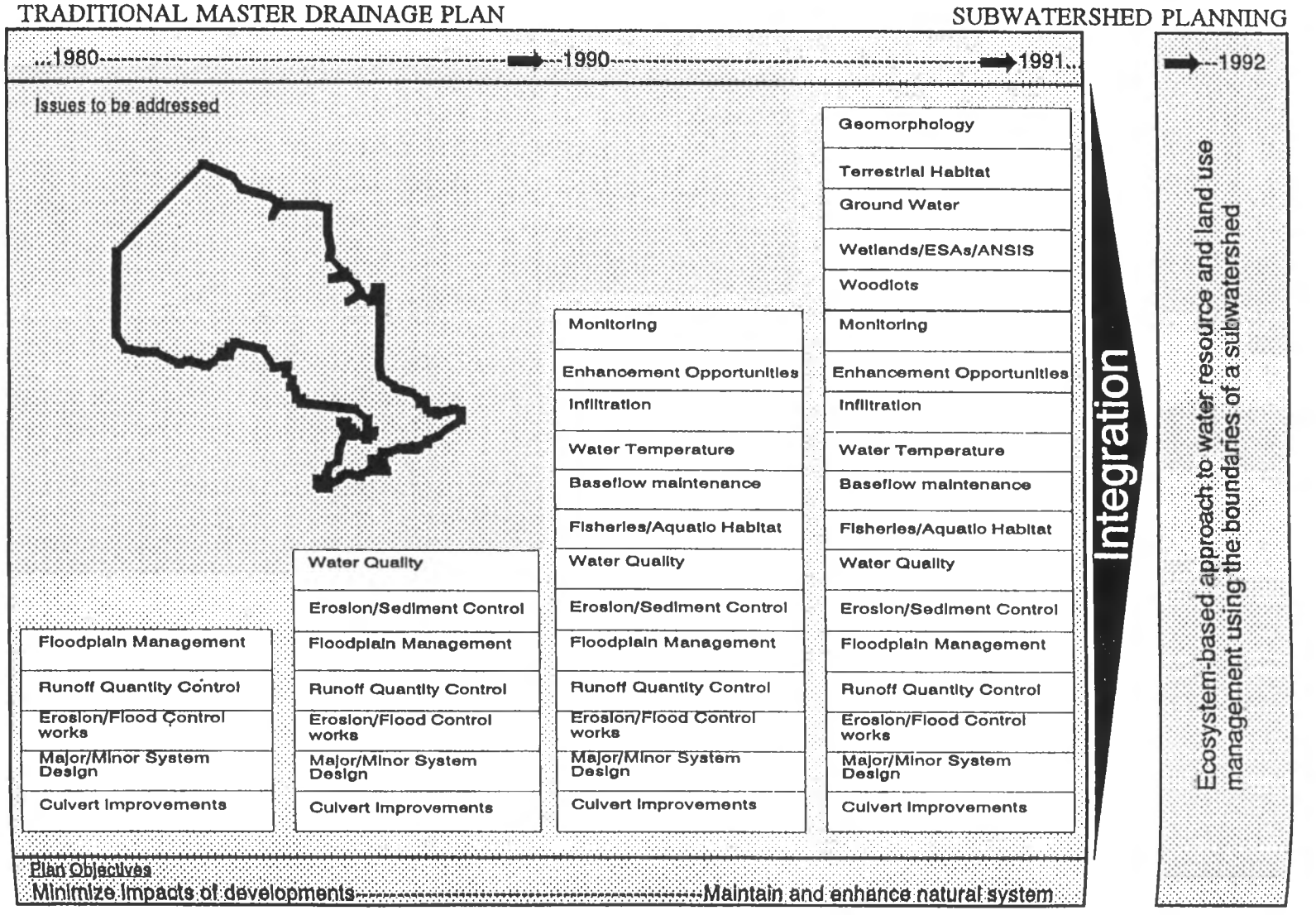


Figure 1 *Source: Subwatershed Planning, June 1993, Ministries of Environment and Energy and Natural Resources*

geographic scale to ensure that offsite impacts are given appropriate consideration. Unfortunately, the jurisdictions of controlling agencies for watershed management are often fragmented which creates difficulties in developing and implementing coordinated plans. More stringent stormwater management requirements coupled with preservation and rehabilitation efforts for natural features have been increasing land demands for stormwater facilities and linked natural feature systems.

In the case of Markham, Ontario, for example, which lies in the headwaters of the Rouge River system, land dedications to stormwater management facilities are often in the range of 4% of the total developable land area which is approaching, in magnitude, the 5% dedication required for park space. Many municipal jurisdictions are not supportive of approaches which seek to limit the cost of this impact by integrating appropriate components of stormwater management within parks or integrating stormwater functions within a park block. Further, as a consequence of gravity operation, the design of storm drainage systems typically results in desirable stormwater pond locations in the immediate vicinity of watercourses/valley systems. The opportunity to limit the land cost impacts by placing/integrating facilities within valleys/natural feature systems is often restricted based on interpretations of floodplain management or environmental guidelines, usually on the part of Provincial agencies.

In addition to the land component issues, storm servicing, from an infrastructure perspective, typically accounts for about 30% of subdivision construction costs. These costs can also be indirect as stormwater management requirements often drive extensive earthworks or oversized and over depth storm sewers to resolve drainage issues. Often the cost/benefit value of works undertaken to comply strictly with 'blanket' design criteria and policies is poorly understood. Flexibility, in applying these design requirements and criteria would in many cases create negligible impacts to public safety and service levels but provide substantial cost/land savings.

Similar issues apply to land set aside to preserve natural features, buffer them or provide linkages between them. Knowing that land is a critical component of housing costs the value and significance of these dedications to the future community must be carefully evaluated to ensure they have real value as natural systems and are a positive feature for the community.

Opportunities for and Constraints to Alternative Development Standards

The literature identifies opportunities for and constraints to implementing alternatives in development standards. Technological advances provide an opportunity for innovative infrastructure design and construction and can reduce development standards without reducing levels of service. New technologies and new materials have set the stage for the 'third generation of urban systems'[11] which may completely reconfigure current practices in infrastructure. For example, it has been estimated by the Canadian Institute for Research in Construction that the innovation of 'trenchless technologies' which could replace cut and cover technologies for repair of water and sewer networks could save 30%-60% on rehabilitation costs for services, with less disruption to traffic. [12]

The lack of investment over the past few decades has been identified as a crisis in the state of Canadian urban infrastructure. This crisis however, may create an opportunity to direct investment to new technologies which replace older systems and produce cost efficiencies to the system.

Constraints to implementing alternatives in development standards include an increased level of standards over the past twenty years, high public expectations and resistance of municipal bodies to innovation.

The Property Standards Fact Finding Project undertaken by Canada Mortgage and Housing Corporation identified an increase in the number of municipalities utilizing development standards, a greater number of standards and more restrictive standards in Canadian municipalities since 1952.[13] The public perception that lowering standards had a negative connotation was observed - the perception that a reduction in street width had the impact of reducing the safety of the street. The study also noted that innovations most often meant adapting existing standards on the basis of specific applications rather than undertaking a broader examination and review of the existing standards.

The Principles of Alternative Development Standards

Throughout the literature, principles are identified to guide the development of alternative development standards. They include:

achieving sustainability;

improving the quality and liveability of our communities;

improving the cost efficiency of building and servicing development;

promoting diversity; and

adopting a more environmentally sensitive approach.

The emphasis and priority of these principles varies somewhat in the literature but generally provides a consensus upon which to build.

Alternative Mechanisms

A number of initiatives and innovative mechanisms developed to update current development standards have been documented. These mechanisms include:

performance standards;

special zones such as development zones or transit oriented zones;

new development forms;

financing alternatives; and

cooperation and coordination of service.

However, most initatives in North America seem to have produced short term and piecemeal solutions rather than fundamentally rethinking the planning regulations in place. Of initiatives undertaken elsewhere, the most notable is the Australian Model Code for Residential Development which adopts a performance approach to a series of 12 control elements. These elements range from

lot size to parking to public and private open space to drainage networks and are applied to both the local and community level.[14]

2.1.2 Areas of Debate

Implementing Alternatives

There is less consensus on the 'who's' and 'how's' of implementing alternative development standards. Municipalities are considered to be in an optimal position to adopt and encourage innovation as they are the ultimate owners of urban infrastructure and control the development process. However, they are often the slowest to adopt new technologies and innovation due to liability concerns.[15] More exploration and discussion regarding coordinating innovation between levels of government and jurisdictions needs to occur. Local standards are generally within the jurisdiction of local municipalities, while community standards are within the realm of regional or provincial levels of government. Once developed, local and community infrastructure must connect and thus a coordinated approach is necessary. The question becomes whether a top down or bottom up approach or some combination is most effective.

As a result of the bureaucratic inertia in the public sector, the developments which have adopted alternative development patterns have most often been undertaken by private developers or in partnerships between public and private sectors. For the most part, these innovations have been implemented on a site specific basis and have not been the result of a broader regulatory review and reform.

Cost of infrastructure - are alternatives cost-saving?

The great debate in the field of alternative development standards is cost efficiency. Can it be proven that alternative development standards when applied consistently are more cost efficient than conventional forms of development? As early as 1955, Wheaton and Schussheim were conducting studies on the comparative costs of various development patterns and a classification of costs. Since that time, the debate has been continuing furiously. Disputes over methodology, comparative factors and findings have been ongoing.

Generally, there is a body of research which finds that compact development is neutral or more cost efficient than conventional suburban development, and there is a body of research which, by assuming higher ongoing costs and constant densities, argues that compact development is more expensive. An accurate comparison of costs is complicated by the fact that community level costs are usually not passed fully on to the individual consumer. Indirect subsidies such as the construction of highways and arterial roads are not accounted for in the price of housing - a factor which is often used as a basis for cost comparison.

Within the literature, there appears to be a consensus that land savings are the major source of reduced development costs. For example, a 1990 Ontario Ministry of Housing study found that a reduction in lot size led to a savings of $337-$380/unit and a reduction of 9%-12% in per-metre servicing costs. Reduced rights-of-way alone can result in savings in land consumption of approximately 10% without changing other characteristics of development.[16] Further, it is agreed that the greatest land and cost savings come from increased densities in compact development but a portion of cost savings can also be attributed to changes in development standards.

A recently completed study by CMHC, which takes into account capital, operating, maintenance and replacement costs for a wide range of hard and soft infrastructure over a 75 year lifespan found that alternative development patterns result in life cycle savings of approximately $11,000 per unit. Most of this cost savings can be attributed to more efficient use of infrastructure resulting from increased densities.[17] The study incorporated figures for local but not regional infrastructure. Local development patterns directly affect regional infrastructure costs. Compact development patterns result in fewer linear metres of regional infrastructure such as water, sewage and regional roads.

Shared use of community facilities is acknowledged as a method of cost saving. A feasibility study undertaken for the Bridgehome development in North York, Ontario estimated the potential savings in a shared use facility of school, community centre and park to be $5,534,760 or 15% compared to the cost of constructing segregated facilities for the development.[18] The Region of Peel, one of the fastest growing Regions in Ontario, has undertaken a study on School Accommodation and Financing Options which recommends, as one of the most promising solutions, the inclusion of school sites as part of parkland dedication requirements, thus providing for a reduction in the amount of dedicated land.[19]

In terms of municipal infrastructure, the Cornell Development Group commissioned a comparative study of the engineering costs associated with alternative development standards.[20] The study compared capital, maintenance and replacement costs of the Cornell community, a proposed "new urbanism" development in Markham, Ontario, with two typical examples of post World War II development near the Cornell lands. Capital costs associated with the construction of sewers, utilities, roads, sidewalks, trees, etc. for Cornell were estimated to be reduced by as much as 20% per dwelling unit compared to conventional developments. Maintenance costs, including sewer cleaning, street sweeping, snow plowing, street lighting, grass cutting and garbage collection, were estimated to be reduced by as much as 13% per dwelling unit even with an assumed 'high' level of snow clearing service in the lanes. Replacement costs were estimated to be up to 25% less per dwelling unit.

The determinants and methodologies of these studies are so varied that it is difficult to make any conclusions with respect to the relative costs of alternative development standards.[21] Part of the difficulty in undertaking comparative costing exercises is that there are few alternative development initiatives that have been implemented on a significant scale and for examples that do exist, a detailed accounting of costs has not been undertaken, making cost comparisons theoretical in nature.

2.1.3 Gaps

Having reviewed the literature, there is a need for further research in the following areas:

exploring community level development standards; and

assessing the comparative costing of alternative development standard initiatives as they are built;

creating or identifying an effective coordinating body (ies) to provide an overview and bring about changes needed.[22]

2.2 Case Studies

2.2.1 Introduction to the Case Cities and the Patches

Four urban centres were chosen as case studies in order to explore existing development standards, explore the relationship to urban form and to assess the current status of regional and local development standards in the North American context. The four case studies selected were:

Toronto/Markham, Ontario

Calgary, Alberta

Portland, Oregon

Ottawa/Kanata, Ontario

Each of these centres has been undertaking innovative initiatives that challenge conventional development standards. Within each centre, an urban and a suburban sample patch of approximately 7 km by 11 km - large enough to explore the 'community' scale - was identified and analysed.

The case city analysis was undertaken in two components: a study of the morphology of each place in order to identify patterns of urban and suburban development; and identification of typical development standards and observations on the resultant urban form. The findings of each component are summarized in a set of matrices for each 'patch'. Conclusions are drawn about the impact of current development standards on the patterns observed. Where innovative new

development is occurring within a centre, an analysis of developemnt standards and resultant urban form is provided.

The following elements were analysed within each patch:

Major Geographic Features were defined to include water-oriented features, topography and significant man-made land features such as the Rideau Canal in Ottawa.

Green Open Spaces identified were primarily parks and school yards but also included large church yards, cemeteries, golf courses and large open spaces such as the Ottawa Experimental Farm and the Ottawa Greenbelt.

Schools are represented as small dots. In the Canadian case cities this includes both private and public schools, while in Portland only public schools were identified.

Transportation routes were shown at the highway and regional road levels.

The Land Use analysis identifies industrial, commercial, institutional and residential uses. A heavy black line indicates main street commercial uses and regional roads with street oriented commercial uses.

Development standards related to parks, hazard lands, storm water management, schools, roads, cycling, transit and land use were explored for each case city. Drawing from the morphological analysis, observations on the relationship between development standards and the resultant urban form are noted.

The information presented in the development standard matrices represents a cursory exploration, intended to provide a sampling of the 'current state of affairs' with municipal development standards. In reviewing the matrices, the following considerations should be taken into account:

> Regional or 'community' level standards were the focus of the analysis. Local standards are presented in the table only when particularly notable.

The 'urban' standards are current day standards. As the urban form is not necessarily derived from current standards but rather from an evolution of development over time, the observations on urban form are titled cumulative urban form. Suburban form is more directly related to existing development standards and therefore is titled resultant urban form.

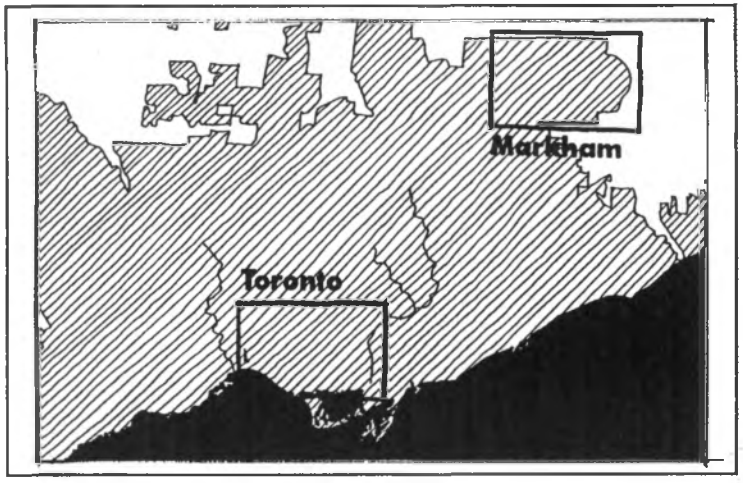
The development standards identified have been isolated out of their development context. In isolation, a development standard may not reflect the true nature of the standard. For example, an arterial road in one city may or may not include elements such as boulevards, pedestrian, cycle lanes and therefore the differentiation between right of way standards may be due to design factors rather than the level of standards.

Differences in physical geography can have a significant impact on standards. For example, storm water management in a mountainous region will be approached much differently than in a prairie region.

2.2.2 Toronto/Markham

The Greater Toronto Area is documented by an urban patch in the heart of the City of Toronto and a suburban patch in the Town of Markham. Development of most of the downtown area occurred in the first half of the twentieth century and illustrates the application of development standards and approaches to urban development at that time.

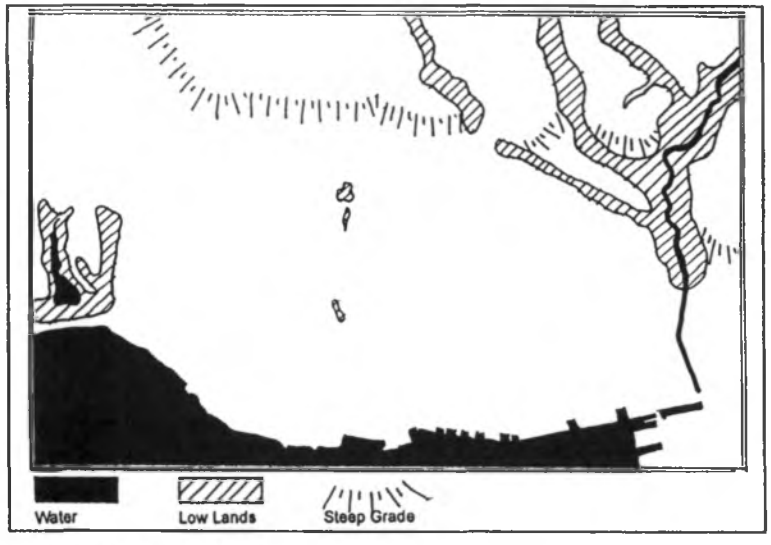
Markham is a community, located within the Region of York, which has developed in a predominantly suburban pattern since the 1950's around the existing villages of Unionville, Thornhill and Markham. Expansion to the urban boundary has resulted in proposals for conventional low density development with some emerging pockets inspired by 'new urbanism' such as the Cornell community. As such, the analytical drawings of the Markham patch illustrate both the implications of the generous development standards of the 1970's and 1980's and newer attempts to reconfigure and reconnect this urban form with more flexible development standards.



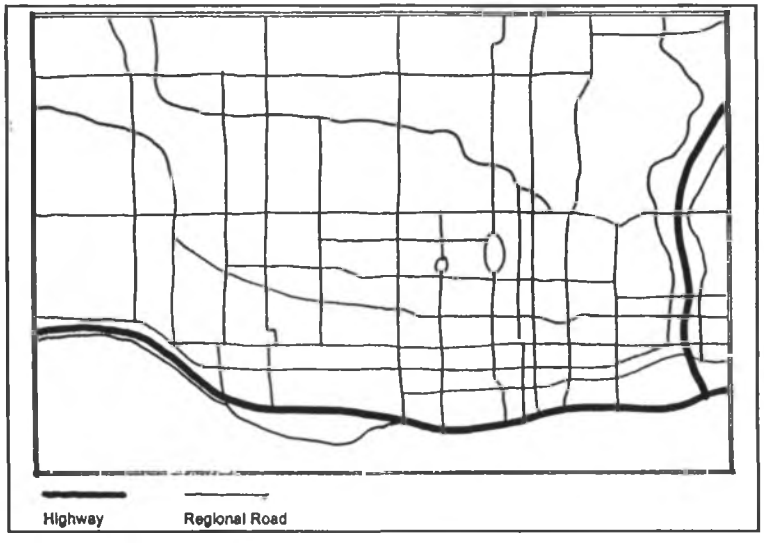
Context: Location of Patches

On a regional level, the Regional Municipality of York has been one of the first regions in Canada to explore alternative development standards for transportation, land use and schools. To this end, the Region has introduced a set of Streetscape Design Guidelines to address practices such as reverse lotting, a condition which undermines quality of place and perceptions of safety. The Guidelines attempt in a comprehensive way to address issues of design, use, noise attenuation and rights-of-way and present some alternative treatments. The Region is currently undertaking a Development Standards Study exploring alternatives to existing regional road standards.

York's regional development standard study has been exploring alternative road standards and proposes to control the maximum right of way for all future regional roads.



Geographic Features.



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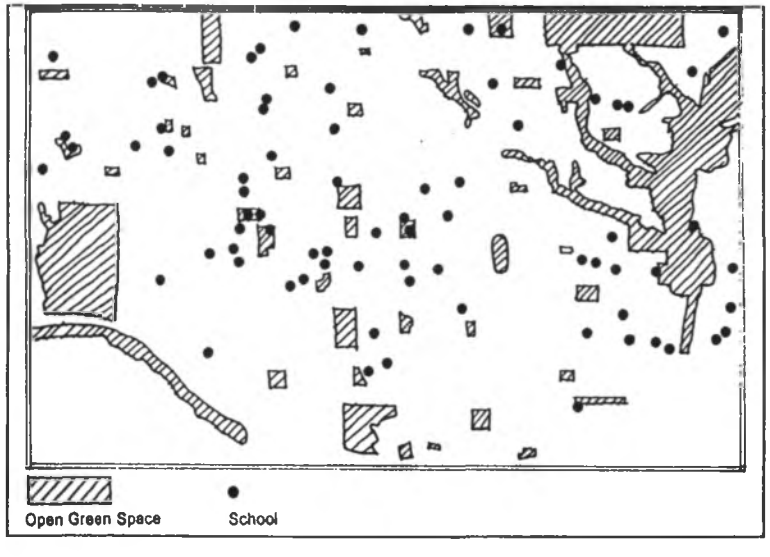
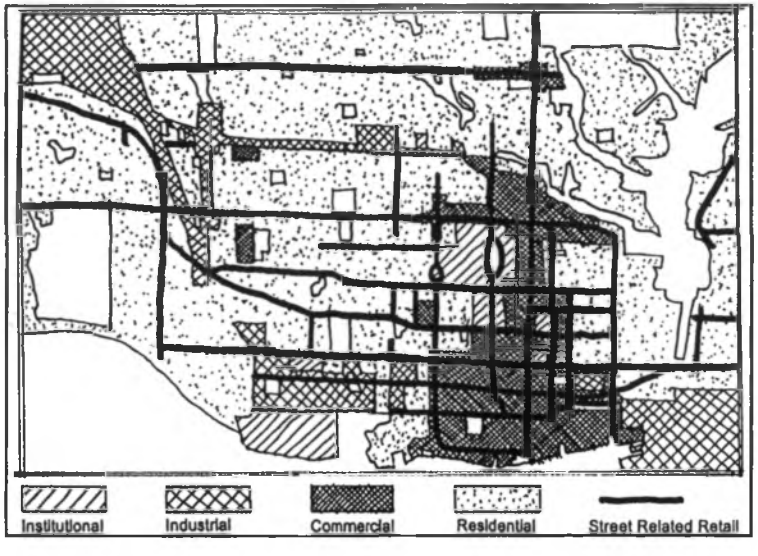
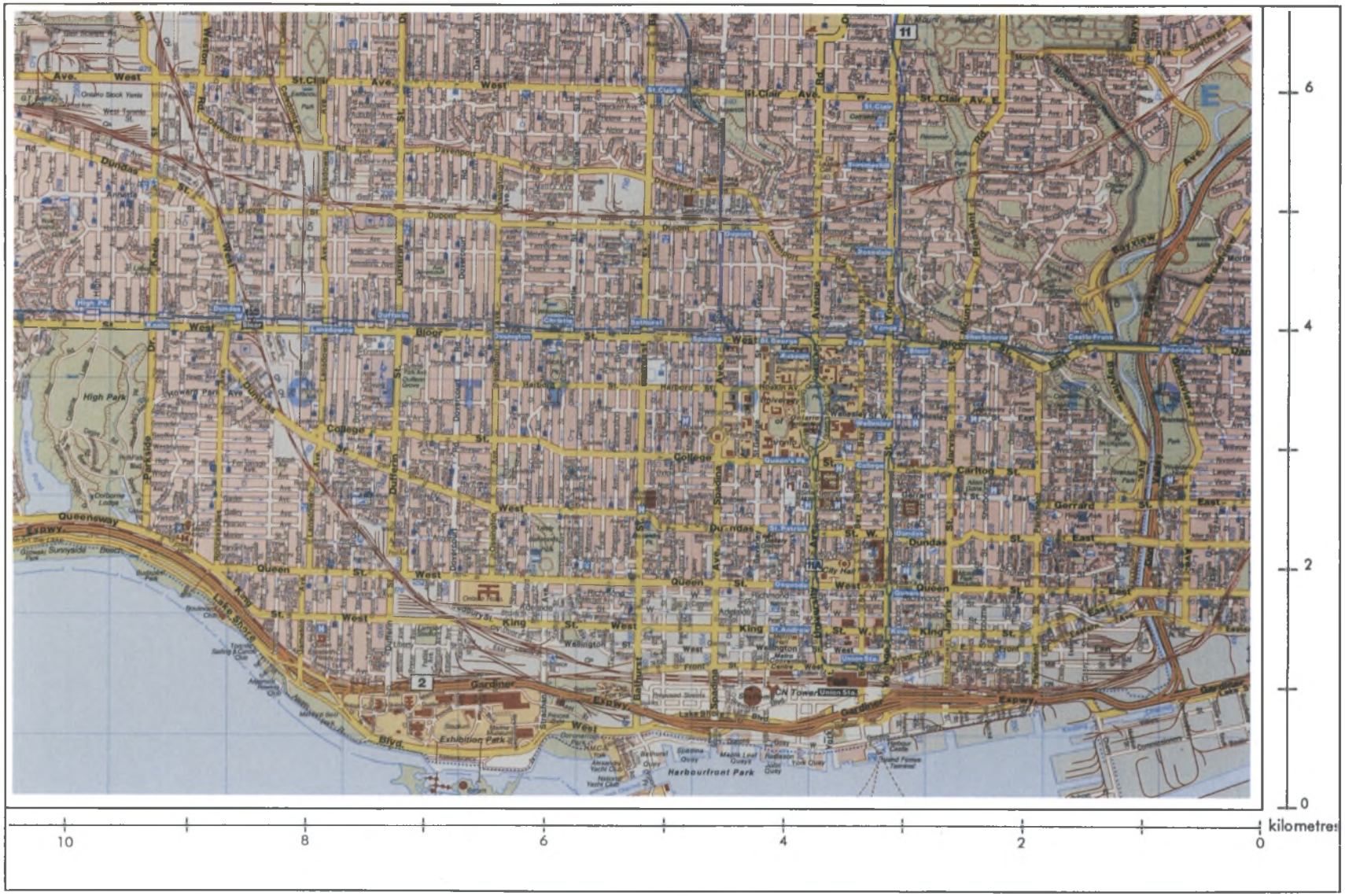


Open space and Schools



Land Use

ANALYSIS DRAWINGS



SAMPLE PATCH

Map Art Publishing Corporation
70 Bloor St. E. Oshawa, On L1H 3M2

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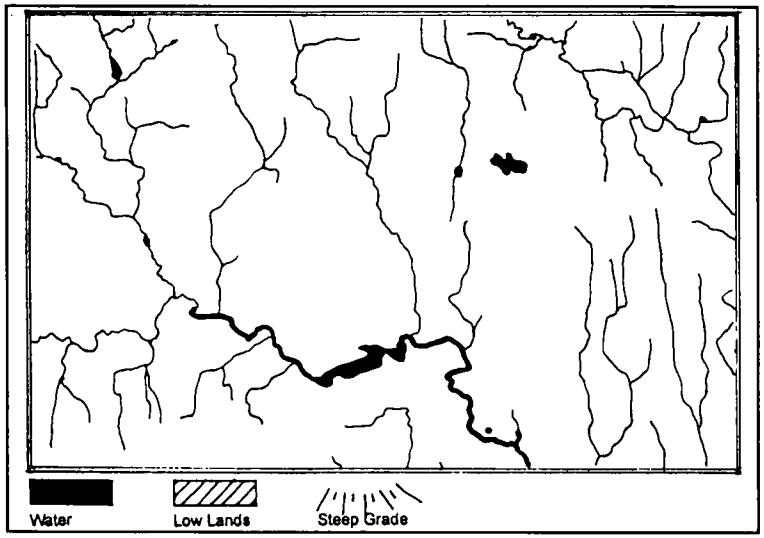
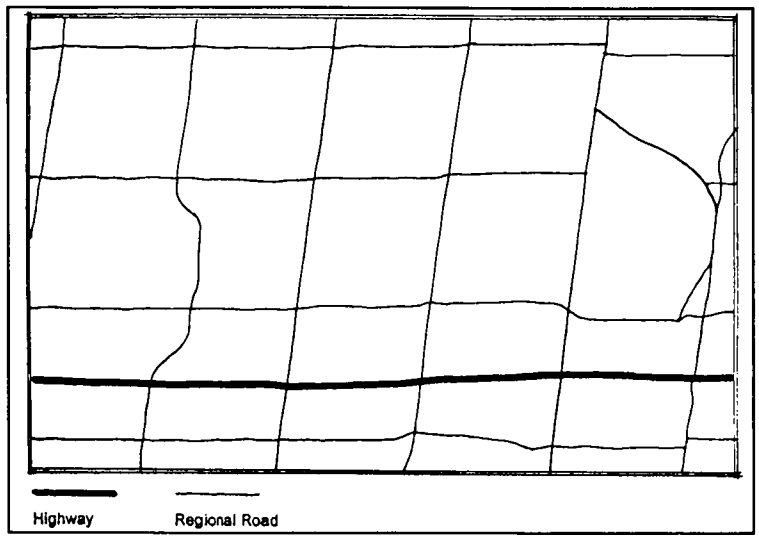
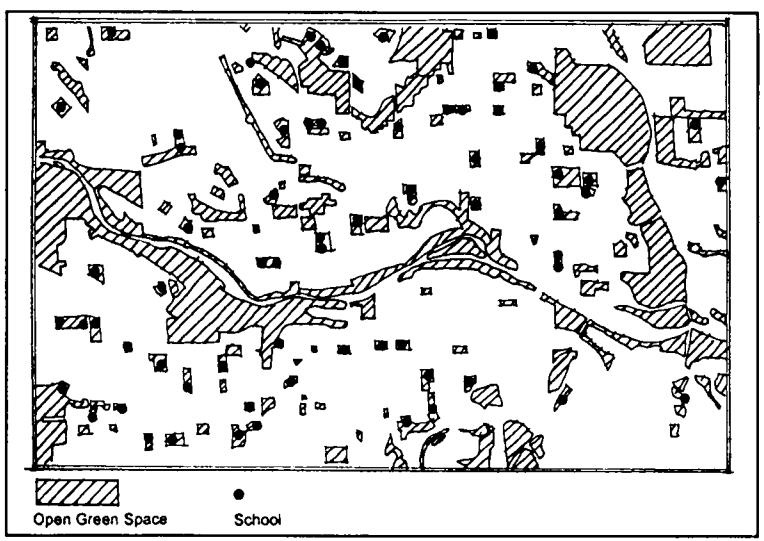


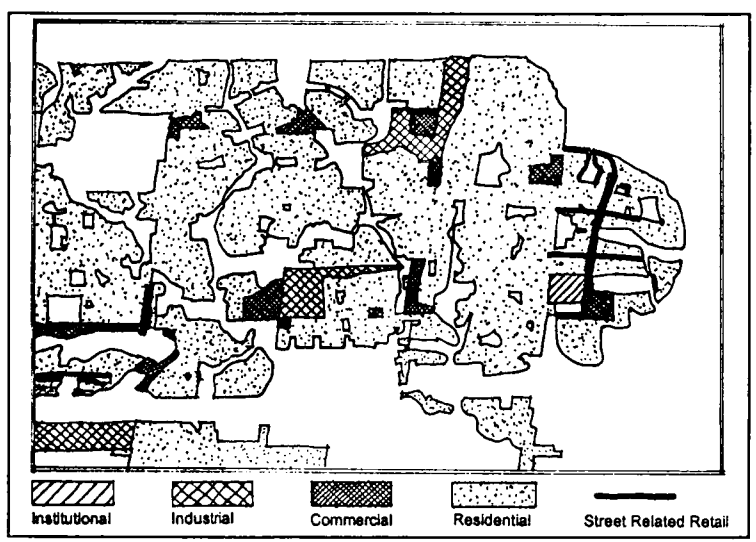
Geographic Features



Road Network

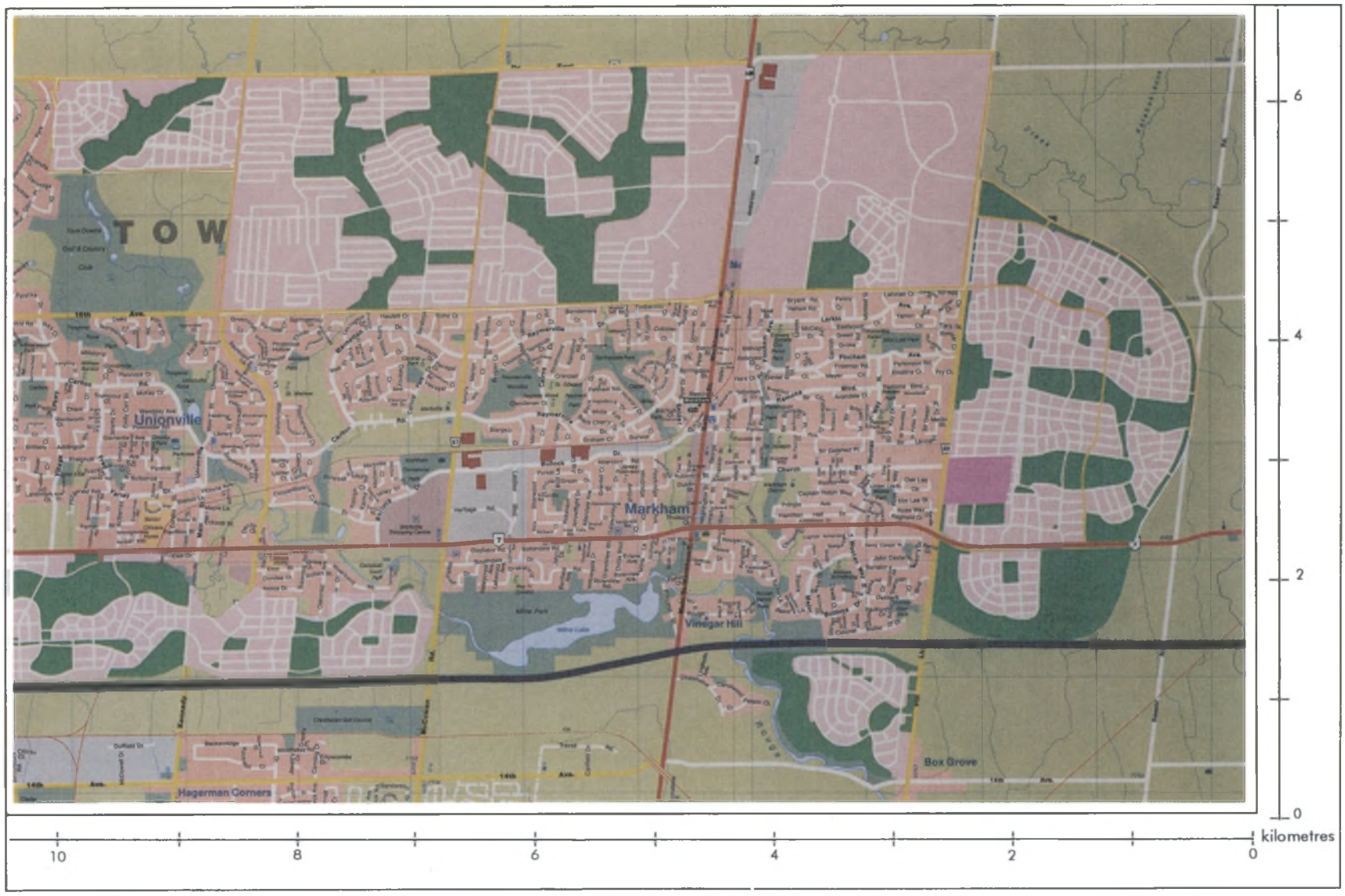


Open space and Schools



Land Use

ANALYSIS DRAWINGS



SAMPLE PATCH

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Morphological Analysis

ELEMENT	TORONTO	MARKHAM
MAJOR GEOGRAPHIC FEATURES	▸located on the shoreline of Lake Ontario ▸gradual slope upward from shoreline is punctuated by steep slopes at the pre-historic Lake Iroquois shoreline ▸3 major valley systems: Rouge, Don and Humber Rivers ▸minor geographic features have been obliterated by development	▸located at headwaters of Don River ▸gentle topography is etched by series of minor watercourses ▸development has occurred around geographic features, in particular watercourses
GREEN OPEN SPACE	▸small isolated pockets of open space ▸large open space systems relating to ravines and lakefront ▸High Park	▸open space corridors related to major and minor geographic features and creeks ▸fewer isolated open spaces
SCHOOLS	▸large number of school sites evenly distributed throughout patch ▸sites relate to urban fabric and residential neighborhoods	▸fewer and larger sites ▸located adjacent to or within green open spaces
TRANSPORTATION	▸dense, highly interconnected street grid ▸small block size; dense spacing of major streets; highly interconnected; rectilinear geometry ▸1960s-1970s highway legacies located along waterfront and within Don Valley	▸sparse network of roads on a base of inherited rural concession roads ▸regional road grid of individual superblocks which 'isolate' rather than 'weave' together ▸dendritic street operation in which traffic is exported to an external street system
LAND USE	▸finely grained mixture of uses ▸highest densities at core ▸higher densities supported along main streets ▸large parcels of currently underutilised industrial areas	▸predominance of residential uses ▸employment and mixed use zones in isolated patches along regional roads ▸finer grain of uses re-introduced in Cornell and other new neighborhoods

Development Standard Analysis

ELEMENT	URBAN - Toronto		CONVENTIONAL SUBURBAN-Markham	
	Typical Development Standards	Cumulative Urban Form	Typical Development Standards	Resultant Urban Form
Open Space *Parks* *Hazard lands* *Storm water*	Parks ▸0.6 hectares/ 1000 residents and 0.3 hectares/1000 employees[2] ▸siting district parks such that every place of residence or employment is within 200 metres walking distance from a park[2] Hazard Lands ▸only significant natural features were maintained; ravine by-laws restrict development in ravines by preventing removal of trees ▸woodlots were cut and less significant valley systems were filled in to create developable land Storm Water management ▸historically no storm water management quantity or quality facilities were required	▸small isolated pockets of open space ▸large open space systems relating to major geographic features: Don and Humber Rivers and shores of Lake Ontario ▸High Park is a major regional open space ▸wetland restoration projects underway ▸storm water feeds into channelized rivers	Parks ▸community parks: 0.8 hectares/1000 people[1] ▸town parks: 1.0 hectares/1000 people[1] Hazard lands ▸significant woodlots protected ▸hazard lands not considered part of 5% parkland dedication Storm Water Management ▸development incorporates valley lands, storm water management blocks, creek and valley setbacks ▸100 year storm quantity control required	▸open space corridors related to major and minor geographic features creating linear bands of green space ▸fewer isolated open spaces ▸reverse lotting of open space results in little public access to green space ▸reverse lotting ▸a greater percentage of land devoted to parks and open space
Schools	▸no site standards ▸average existing site areas[4]: Elementary schools - 1.4 hectares Secondary Schools - 2.8 hectares	▸small sites with multi-storey buildings ▸large number of school sites evenly distributed throughout patch ▸residential lots front onto school sites	Elementary school: 2.4 hectares; minimum frontage of 122m Secondary School: 6 hectares; minimum frontage of 183 m[7]	▸fewer and larger sites ▸located adjacent to or within green open spaces ▸1 storey ▸development backs onto school site
Transportation *Roads* *Transit* *Cycling* *Pedestrian*	Urban arterial 20 - 36 m ROW[8]	▸dense, highly interconnected street grid ▸small block size; dense spacing of major streets; highly interconnected; rectangular geometry Transit ▸multi-mode transit and subway Cycling • bicycle lanes and pathways which connect to greenway systems.	Regional roads: 36-45m ROW[9]	▸sparse network of roads on a base of inherited rural concession roads ▸regional road grid of superblocks which 'isolate' neighborhoods rather than 'weave' together neighbourhoods Transit ▸sparse and infrequent ▸not cost effective
Land Use *Density* *Mixture*	Gross Reurbanization Density Ranges[11] (employees and residents per hectare) Major Centre: 690-1000 Intermediate Centre: 345-545 Metropolitan Corridor: 345-545 Local Corridor: 200-250	▸hierarchy of centres is evident in character of place ▸spectrum of types of place: neighbourhood to city centre ▸specialization for economies spectrum of densities and mixture of use	▸mixture targets of 40-50% green space parks, roads and schools; 35-40% residential lands; 15-20% employment lands[4]	

Notes

[1] Town of Markham Official Plan
[2] City of Toronto Official Plan, Policy 4.14
[3] City of Toronto Official Plan, Policy 7.18
[4] Region of York Official Plan, Typical New Community, p. 35
[5] OPA 400
[6] Discussion with Grant Moore, Toronto Board of Education
[7] York Region Roman Catholic School Board School Site Standards
[8] Metro Toronto Official Plan, Map 7
[9] Region of York Official Plan, Map 8
[10] Cornell Community Design
[11] Metro Toronto Official Plan, Table 3

Innovative New Development: Cornell

The proposed new community of Cornell, situated on the eastern edge of the Town of Markham, is planned as a series of neighbourhoods and villages each with a centre for daily convenience shopping, services, workplace, a public square and a transit stop within a 5 minute walk of all residents. The provincially owned site provided an opportunity for a planning exercise which incorporates many innovative and alternative approaches to community design. A community plan, Open Space Guidelines, Urban Design and Streetscape Guidelines have been prepared.

The development of the Streetscape Guidelines required the negotiation of servicing and engineering solutions for a streetscape system which was part of a comprehensive public realm for the new community. The Guidelines were prepared for a variety of street types and associated uses and ranged in width from the 7.2 m ROW Lane to the 36 m ROW Grand Avenue and included the specific streetscape treatment.

The development of the Open Space Master Plan involved a land base and park distribution exercise that was carried out with input from both the school boards and the town planning and design staff. The Master Plan created the framework for an overall system of open spaces in which individual park and school sites will be used to guide the preparation of development plans for neighbourhoods.

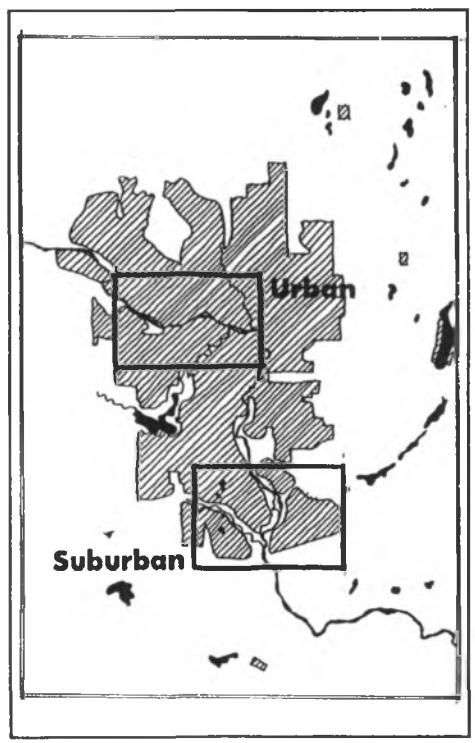
ELEMENT	CORNELL	
	Typical Development Standards	Resultant Urban Form
Open Space *Parks* *Hazard lands* *Storm water*	Parks ▸open space comprises 28.3% of development area Hazard Lands ▸Envvironmental Study Areas protected ▸woodlots retained and integrated into community design	▸open space abutting road makes it more accessible to public ▸Efficient use of open space by joining uses and integrating parks, hazard lands and SWM into Green corridors (quantity pond in valley or major pond in park)
Schools	large, shared school sites	▸schools share sites with open space and community facilities; located in greenways
Transportation *Roads* *Transit* *Cycling* *Pedestrian*	Laneway 7.2 Row to Grand Avenue 36m Row	▸linear main street spine ▸modified grid ▸parkway road defines perimiter of community
Land Use *Density* *Mixture*	▸projected residential population of 27,000 and employment of 16,000 ▸ gross residential density of 6-7	•mixture of uses and densities concentrated at node of development

A subregional plan for a new urban area in the City of Vaughan, Official Plan Amendment, 400, outlines development standards which incorporate the principles of shared facilities, amenities within walking distances and greenway connections:

Park Standards Neighbourhood Parks: (0.8 - 2.4 hectares) located within 5 minute walk of neighbourhoodDistrict Park: 12-15 hectares in size, to serve 10,000 to 20,000 people can include community centres, pools, etc.Greenway system is defined which can be used for public and private institutions and storm water management facilities

Schools: Elementary school site of 2 hectares; Secondary school site of 6 hectares

Roads: *Primary roads of 23 m in width, designed with facing development, on-street parking and landscaping*



Context: location of patches

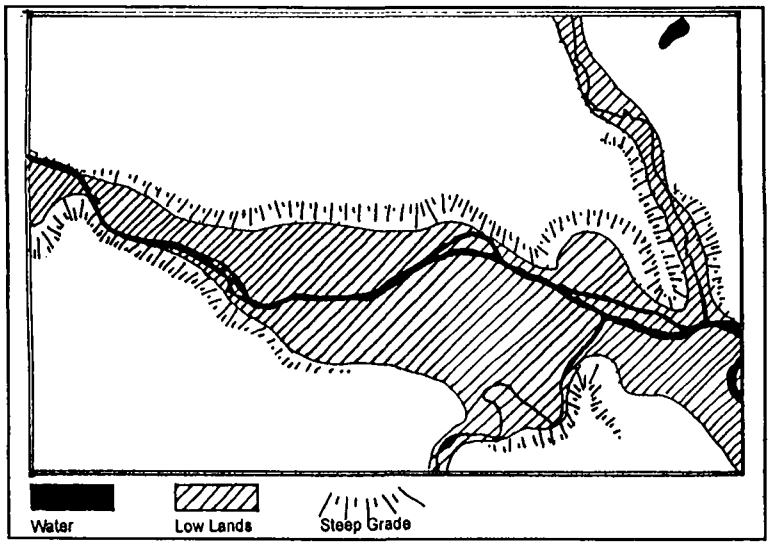
2.2.3 Calgary

The urban patch selected in Calgary incorporates a good portion of the original city as it follows the Bow River from the Scarcee Trail to the Deerfoot Trail or Highway 2. Located in the floodplain of the Bow River, the core of the downtown is situated close to the south river-shore. The fine "Dominion gridiron predominates the form and function of the urban patch.

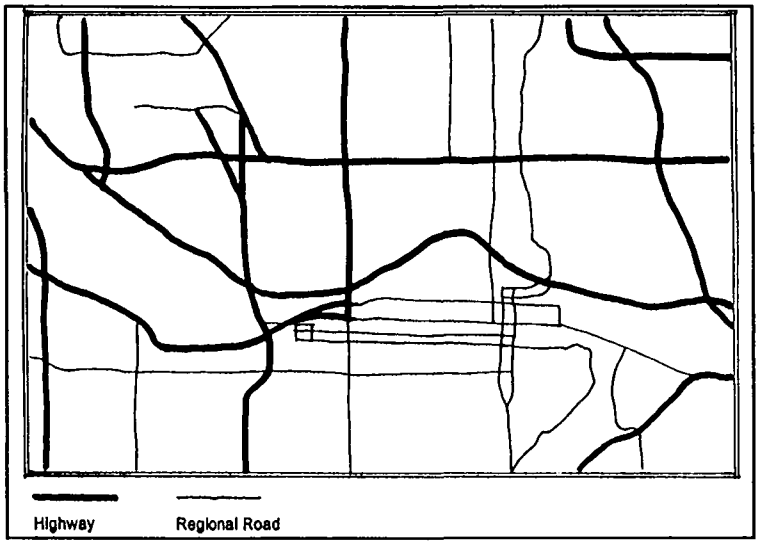
The selected suburban patch, located in the southeast portion of Calgary, illustrates both the suburban form typical of the 1970-1980's and the new greenfield development of McKenzie Town, planned according to the principles of "new urbanism". In contrast to the interconnected urban gridiron, the suburban communities such as Midnapore, Sundance, Bonavista and Bonaventure are pocket communities configured around community open space and pocket lakes.

The Sustainable Suburbs Study published by the Calgary Planning and Building Department outlines alternative community design guidelines intended to create more fiscally, socially and environmentally sustainable new communities. The study provides principles and guidelines on community design elements including size and location of community facilities, mixture of uses, integration of natural areas into open space systems, housing types, density levels, transit and pedestrian environment and choice of construction materials and methods. The design focus is on improving the public realm, making communities more liveable for a diverse population, while significantly reducing the dependence on the automobile.

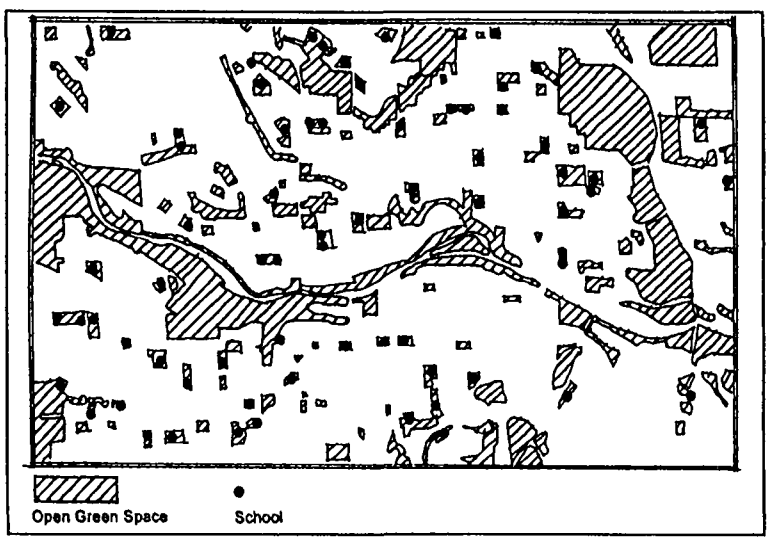
Calgary utilizes the Municipal Reserve system established in the Alberta Planning Act. The Planning Act permits municipalities to require a 10% dedication for 'Municipal Reserves' which can be used for school sites, hazard lands, parkland and dry storm water ponds.



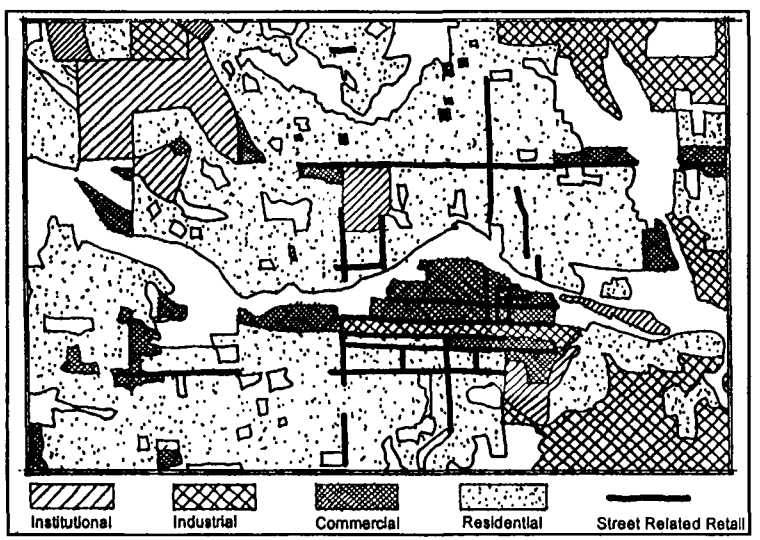
Geographic Features



Road Network

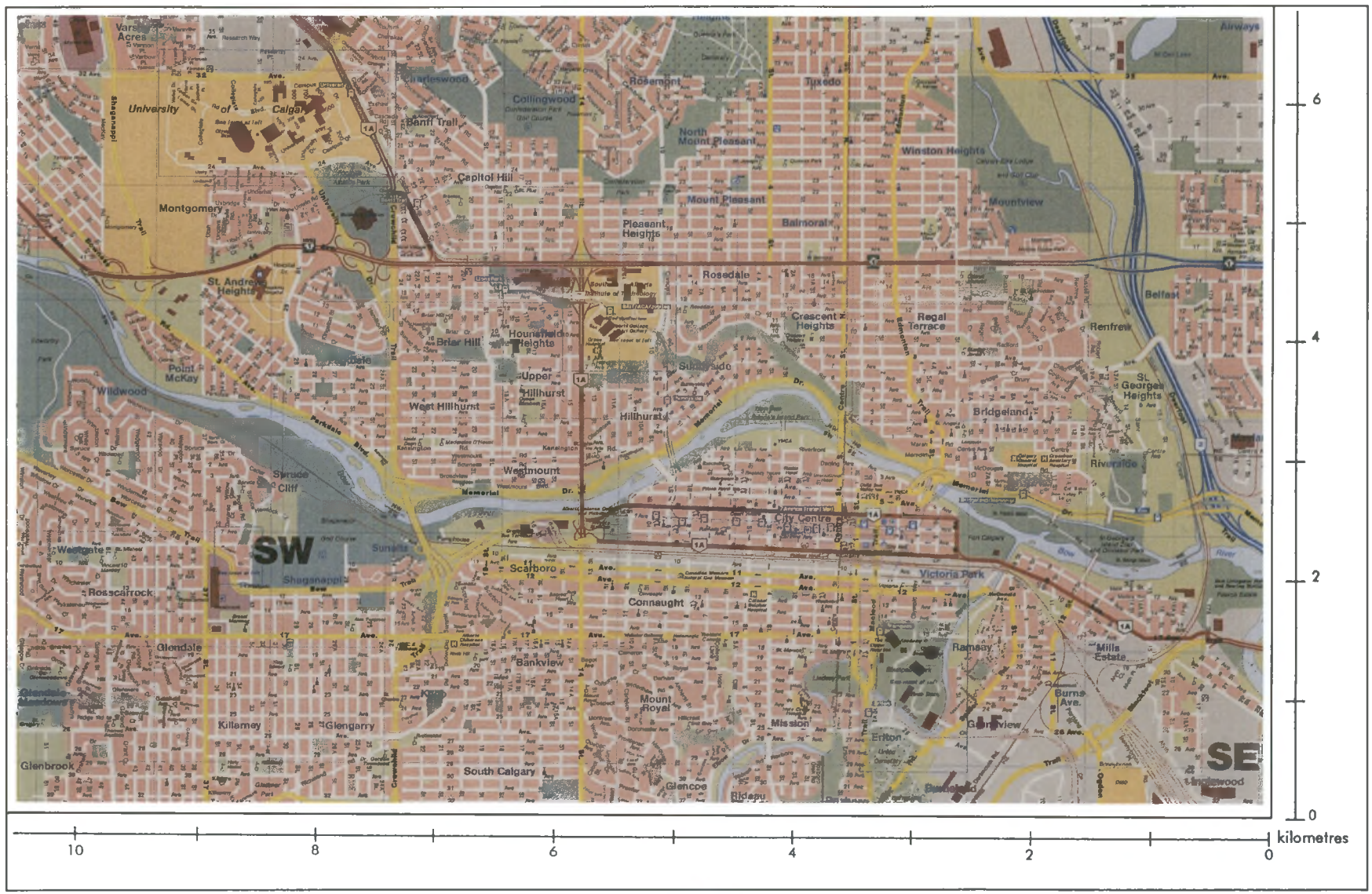


Open space and Schools



Land Use

ANALYSIS DRAWINGS



SAMPLE PATCH

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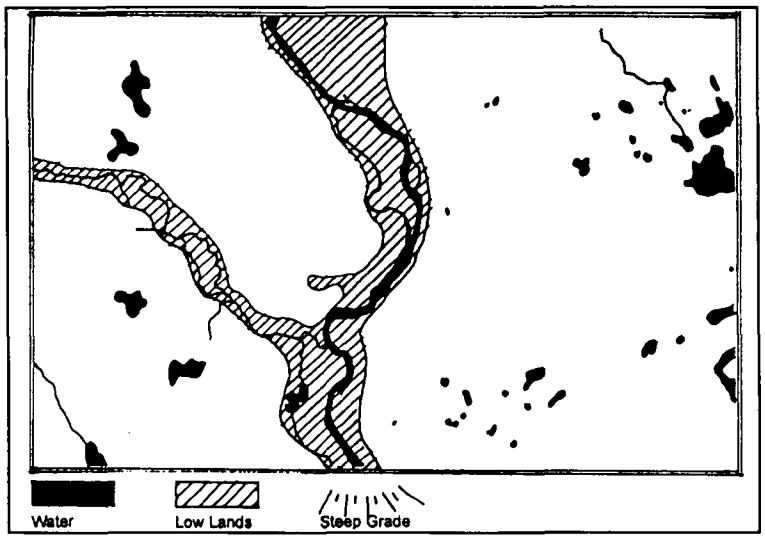

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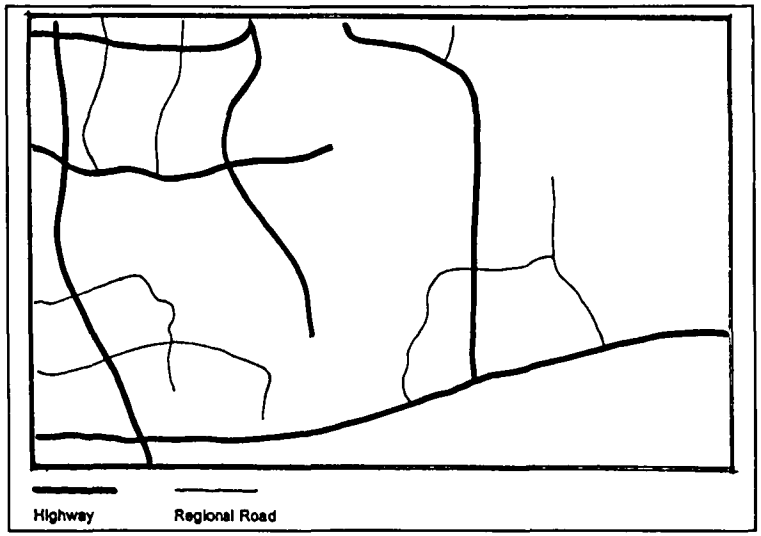

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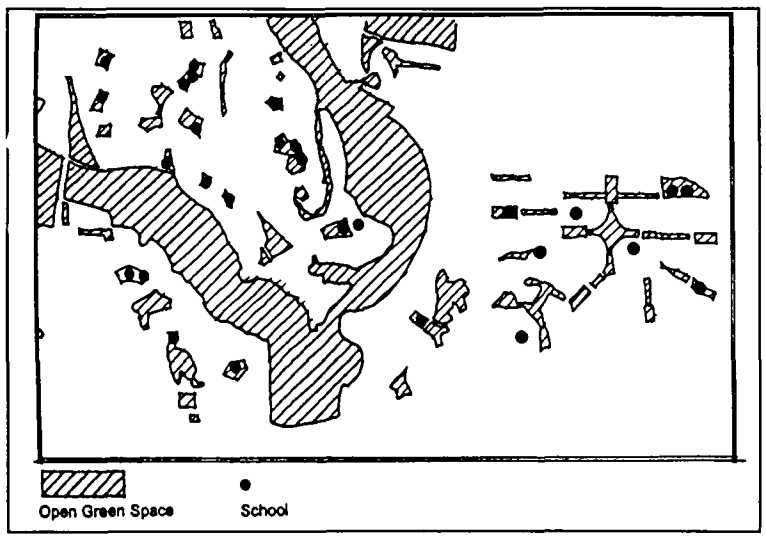
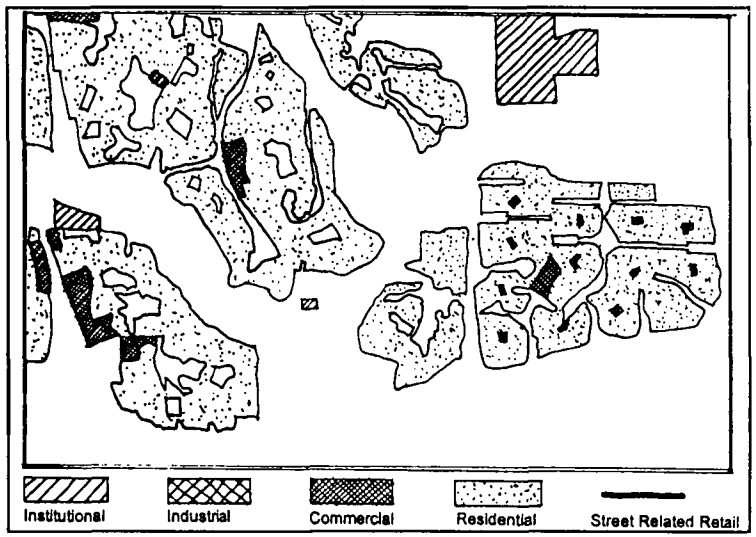
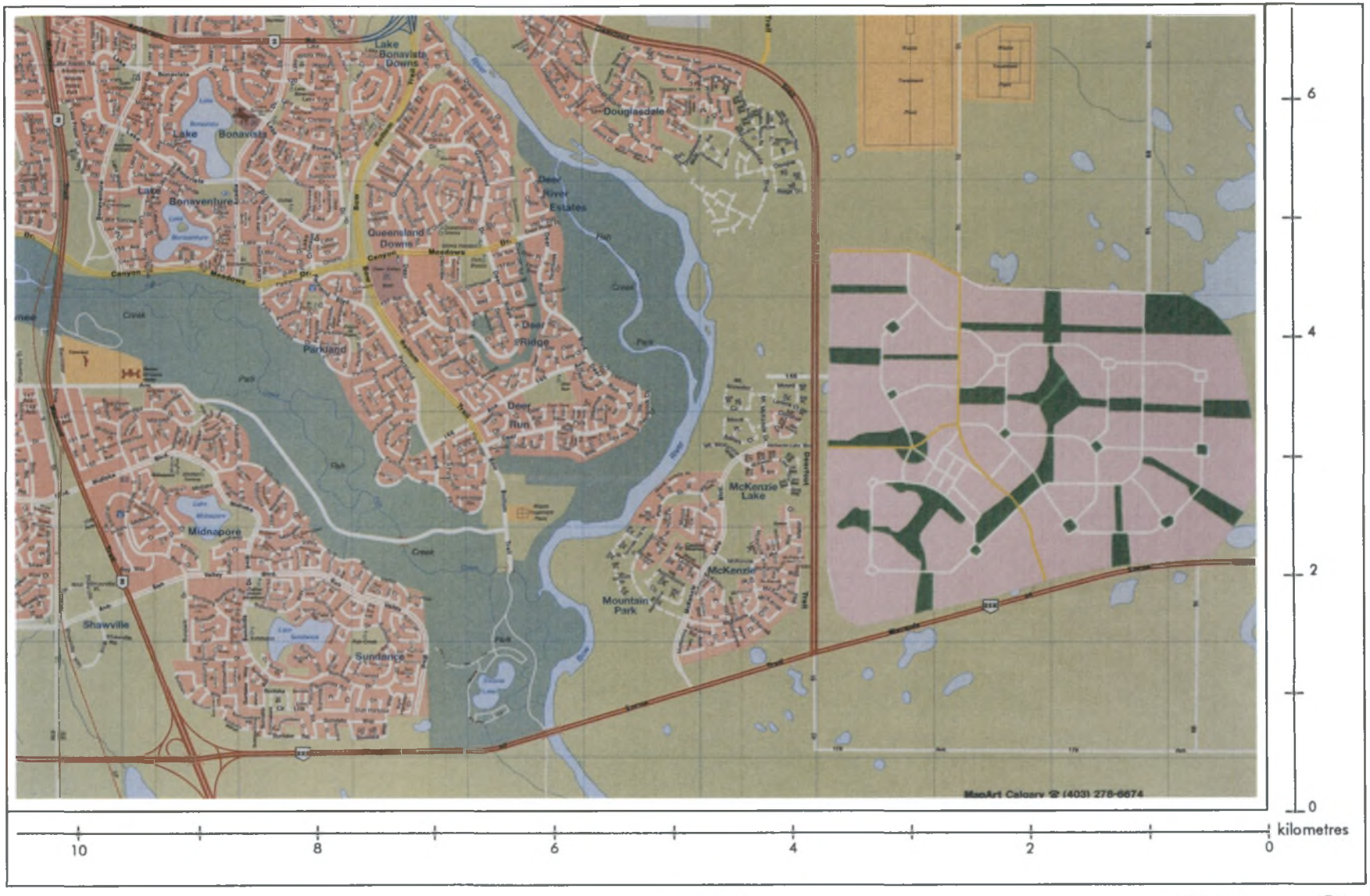


Open space and Schools



Land Use

ANALYSIS DRAWINGS



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Morphological Analysis

ELEMENT	CALGARY URBAN	CALGARY SUBURBAN
MAJOR GEOGRAPHIC FEATURES	▸located in the floodplain of the Bow River and is bounded by steeply sloped edge of the floodplain	▸located in the foothills of the Rocky Mountains ; bisected by Fish Creek ▸a series of pocket lakes provide a focal point for development
GREEN OPEN SPACE	▸open space corridors exist along shores of Bow River and Nose River ▸isolated pocket parks in the urban core	▸Fish Creek Park as a significant open space corridor performing floodproofing, waste treatment and open space functions is adjacent to development ▸ McKenzie Town integrates open spaces as connectors within the community and linking to natural features
SCHOOLS	▸integrated with green open spaces ▸distributed throughout the patch ▸often found in clusters of 2-3	▸pattern is similar to urban patch ▸Mackenzie Town introduces schools as part of a series of linear linkages within the community, not always connected to open spaces
TRANSPORTATION	▸highly connected arterial grid ▸local street grid 'warped' to accommodate hills or riverfronts ▸waterfront parkway reduces pedestrian access to the amenity ▸suburban logic imposed by designing a series of one-way streets where freeways enter urban fabric	▸highly dendritic street pattern (single entry, many cul-de-sac branches ▸land uses back onto arterials ▸street layout follows major topographic features ▸greater than average amount of frontage along natural features is in public realm
LAND USE	▸concentration of mixture of uses in the core ▸beyond edge of floodplain, greater segregation of uses and a coarser grain of uses	▸pods of residential use are separated by expanses of open spaces ▸central node of non-residential uses exists within each pod ▸Mackenzie Town introduces a level of local commercial as well as community commercial facilities

Development Standard Analysis

ELEMENT	URBAN - CALGARY		CONVENTIONAL SUBURBAN - CALGARY	
	Typical Development Standards	Cumulative Urban Form	Typical Development Standards	Resultant Urban Form
Open Space *Parks* *Hazard lands* *Storm water*	Parks ▸Planning Act requirement of 10% dedication for Municipal Reserves including schools Storm Water Management ▸Used wet lakes or dry ponds for quantity control but no pretreatment or sediment control for quality ▸Major river corridors, such as the Bow River, set aside as open space although some development has occurred in the valleylands	▸open space corridors exist along shores of Bow River and Nose River ▸isolated pocket parks in the urban core	Parks ▸10% dedication for Municipal 'parkland' Reserves Hazard Lands ▸Environmental Reserves are set aside for floodplains, unstable slopes and ecologically valuable systems Storm Water Management ▸storm water quality being explored ▸ recent flooding problems will instigate legislation regarding development in floodplains ▸dry ponds for quality control can be located in Municipal Reserves as long as they serve a dual purpose ie. play field and pond	▸Fish Creek Park as a significant open space corridor performing floodproofing, waste treatment and open space functions ▸small neighbourhood parks and pocket parks form the focus for neighbourhoods
Schools	▸average existing site area of approximately 2.4-2.8ha[5]	▸often found in clusters of 2-3 ▸small sites; typically square and surrounded by roads; 2 storey buildings[5]	▸Elementary (part of Municipal Reserve): 4 hectares school, 6 hectares playing fields ▸Junior (part of Municipal Reserve): 6 hectares school; 6 hectares playing fields ▸High School (purchased in addition to Municipal Reserve): usually 20 hectares[5]	▸larger sites located within open spaces ▸typically 1 storey buildings ▸sometimes clustered into 2-3 per open space
Transportation *Roads* *Transit* *Cycling* *Pedestrian*	Roads[1] ▸Collector 10-12.5 m road; 19.5 -22 m ROW ▸Primary Collector 2-7.5 m roads; 27.5 m ROW ▸Undivided Major 14.8 m road; 30 m ROW Transit[6] ▸most houses within a 450 m walking radius of a bus stop	▸Diversity of road types: fine arterial grid; waterfront parkway; highways become one way arterials in downtown	Roads[3] ▸Collector 10-12.5 m road; 19.5 -22 m ROW ▸Primary Collector 2-7.5 m roads; 27.5 m ROW ▸Undivided Major 15.8 m road; 30 m ROW ▸Divided Major 2-8.4 m road; 36 m ROW Transit[6] ▸most houses within a 450 m walking radius of a bus stop	▸wide range of road types ▸street layout follows major topographic features ▸greater than average amount of frontage along natural features is in public realm •collector standards are same as urban; difference in major routes
Land Use *Density* *Mixture*	▸average density of 2.8 uph[5] ▸minimum lot width of 7.6 metre	▸relatively low residential densities in urban area ▸small lot configurations •high density CBD is surrounded by lower density residential	▸average density of 2-2.5 uph[5]	▸marginally lower residential densities •predominantly residential in nature

[1] Conversation with Doug Macdonald , Planner, City of Calgary
[2] Plan of Subdivision, McKenzie Town, p. S-3
[3] City of Calgary Road Standards
[4] McKenzie Town roadway design standards
[5] Discussion with Doug McKenzie, City of Calgary
[6] Discussion with Ted Grant, Department of Transportation, City of Calgary

Innovative New Community: McKenzie Town

McKenzie Town, a new community located on the eastern edge of the suburban patch, is predicated on traditional town planning principles including the introduction of back lanes and neighbourhood squares in addition to the conventional open space dedications. The community plan establishes a series of multi-purpose connectors which incorporate pedestrian, bicycle, transit, and greenway systems organized in a coarse modified grid. Thirteen residential neighbourhoods are defined by a radius of 450 metres from a central square. Proposed densities are typical of the neighbouring suburban areas, although a greater mixture of uses is foreseen.

The City of Calgary has developed a special review process for McKenzie Town which enables consultation between administration and the developer. As an 'experimental area', the municipality is less constrained by concerns of precedent setting.

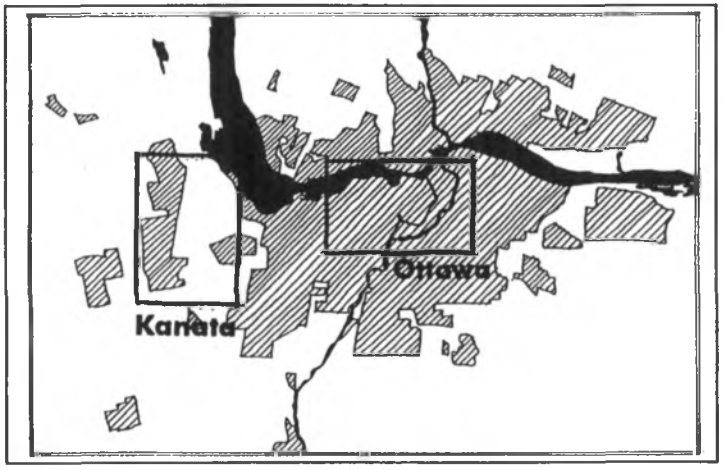
ELEMENT	MCKENZIE TOWN	
	Typical Development Standards	Resultant Urban Form
Open Space *Parks* *Hazard lands* *Storm water*	Parks ▸ornamental parks introduced as new element ▸private park space to be maintained by business associations ▸neighborhood parks are located to integrate a greenway linkage within development Storm Water Management ▸conventional 100 years storm standard and dry ponds	▸Formal open spaces are provided in the Town Centre and Neighborhood Squares[2] ▸Greenways are large continuous areas designed to imitate a portion of the landscape and integrates open spaces as connectors within the community and linking to natural features[2] ▸greenway 'system' connects elements of the community
Schools	▸School sites incorporated within 10% Municipal reserve	▸6 hectares shared site for a public elementary and junior high school with associated sports facilites and dry pond ▸Schools and their playing fields are confined to greenways in order to ensure continuous pedestrian linkages[2]
Transportation *Roads* *Transit* *Cycling* *Pedestrian*	Roads ▸Residential lane: 4m road; 9 m ROW ▸Residential road: 8.5 m road; 15.5 m ▸High street: 11 m road; 22 m ROW ▸Commercial street: 13.4 road; 22 row ▸Major road (boulevard): 2-7.4 m roads, 4 m walking and bicycle path; 6 m median; 36 m ROW ▸Major road:14.8 m road; 30 m ROW Pedestrian ▸hierarchy of street system accommodates a dual objective of accommodating cars and creating a safe and effective pedestrian movement	▸larger carriageways ▸ROW decreased ▸introduction of rear lanes ▸roads are part of multi-purpose connectors which incorporate pedestrian, bicycle, parking, transit and greenway systems
Land Use *Density* *Mixture*	▸Residential and commercial community ▸13 residential neighborhoods defined by a 450 m radius from the central square ▸density of 2 uph	▸Mackenzie Town introduces a level of local commercial as well as community commercial facilities

2.2.4 Ottawa/Kanata

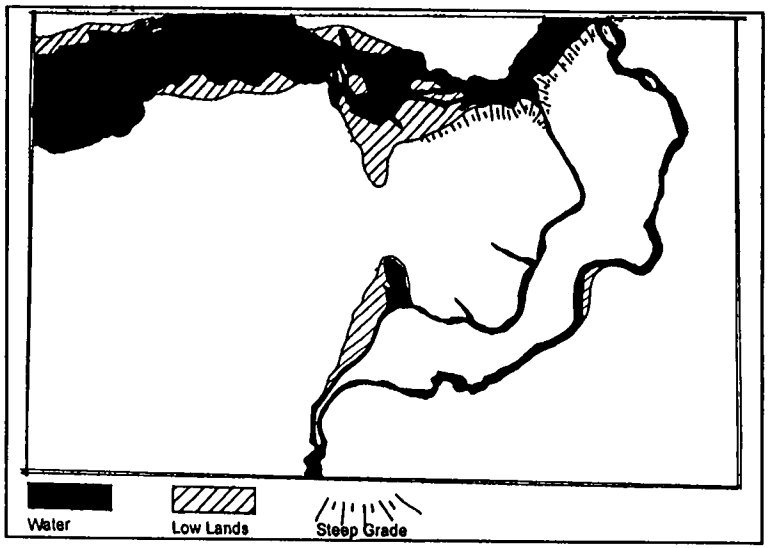
The urban patch in Ottawa covers much of the downtown area along the shore of the Ottawa River including the site of the National Capital Commission Experimental Farm. The suburban patch incorporates the City of Kanata, west of the City, a large institutional site utilized by the Ministry of National Defence and large portions of undeveloped lands.

The Cities of Ottawa and Kanata are located within the Regional Municipality of Ottawa-Carleton. The Regional Municipality has actively been exploring alternative forms of development and development standards. In 1990, the Regional Planning Department began a review of the key physical development standards affecting the cost of housing. In 1992, the Region produced a final report on the topic which found that the use of alternative residential development standards lowered unit costs by facilitating compact development and more efficient use of land.

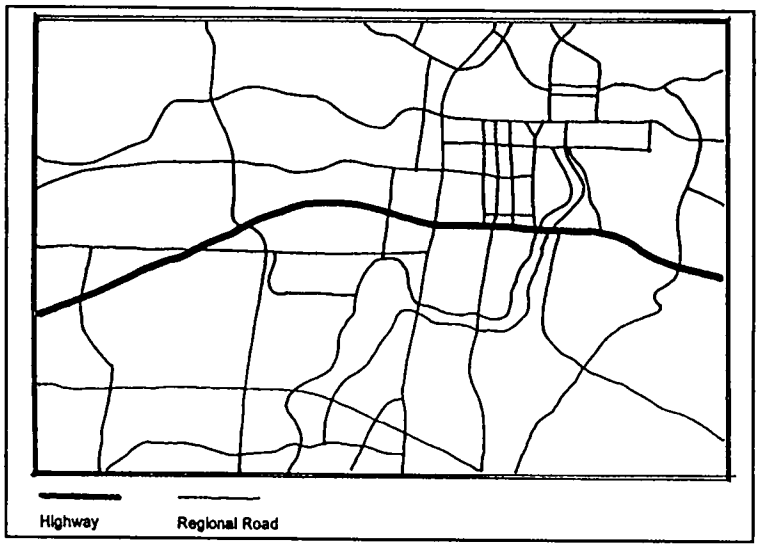
The Region is currently in the process of reviewing their Regional Development Strategy. The review will propose alternatives to residential and non-residential development standards and address questions of the amount of urban land, staging of urban areas, structure of urban areas, urban servicing, schools, recreational facilities, parks and transportation within the Region.



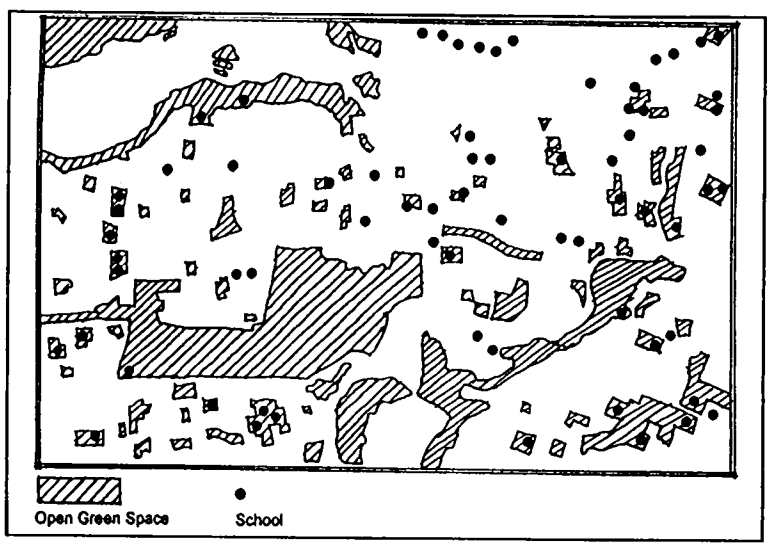
Context: Location of Patches



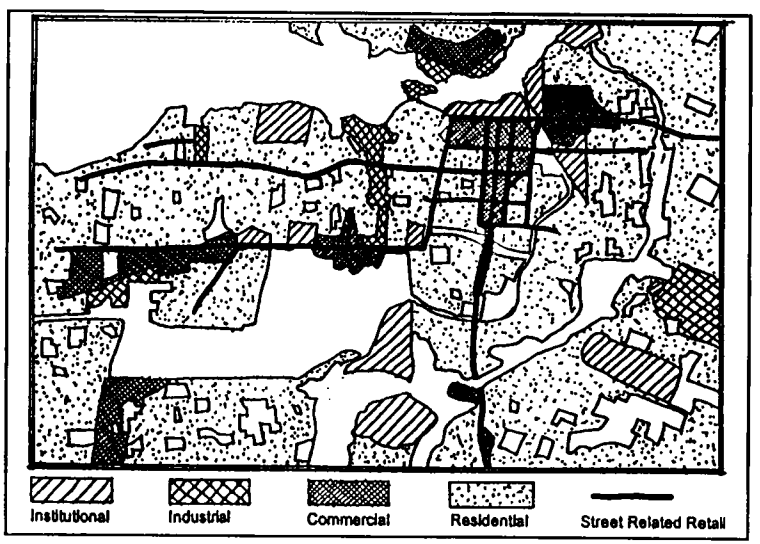
Geographic Features



Road Network

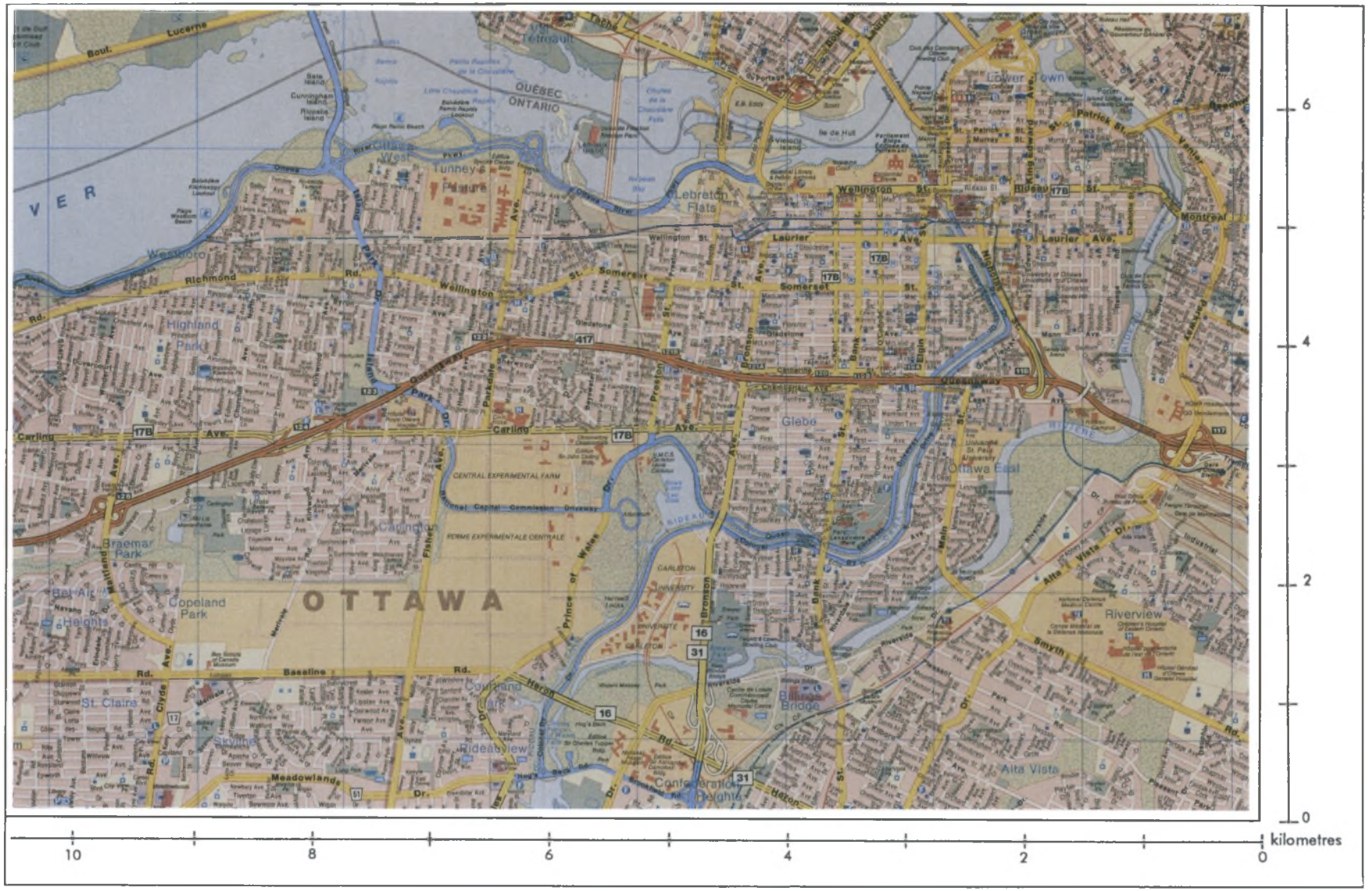


Open space and Schools



Land Use

ANALYSIS DRAWINGS



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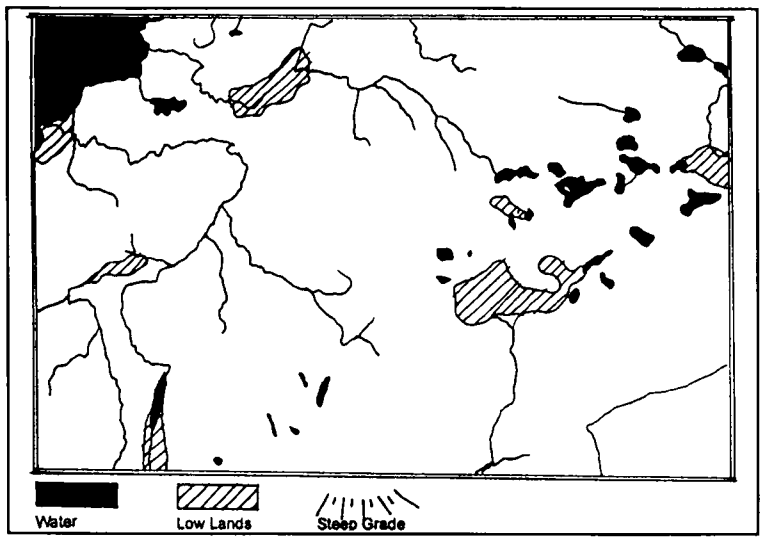

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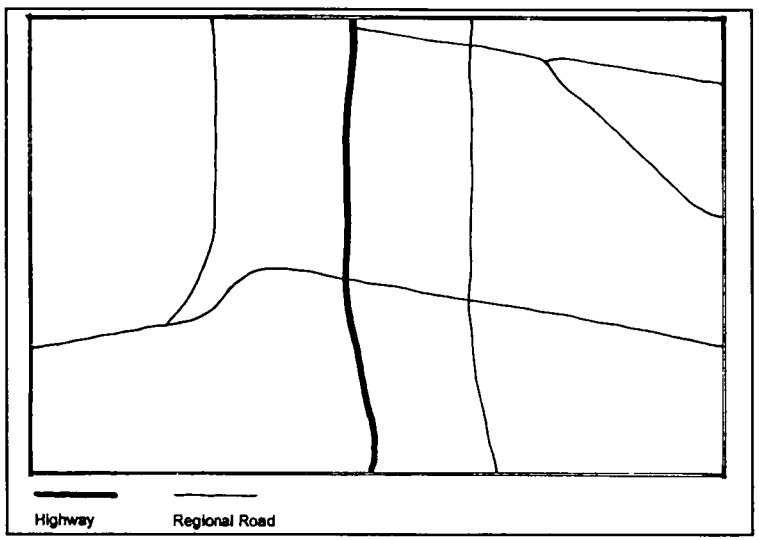
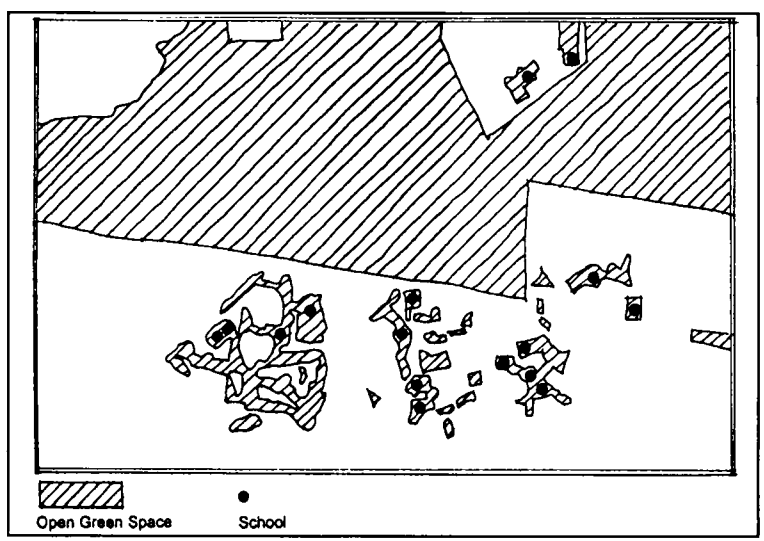
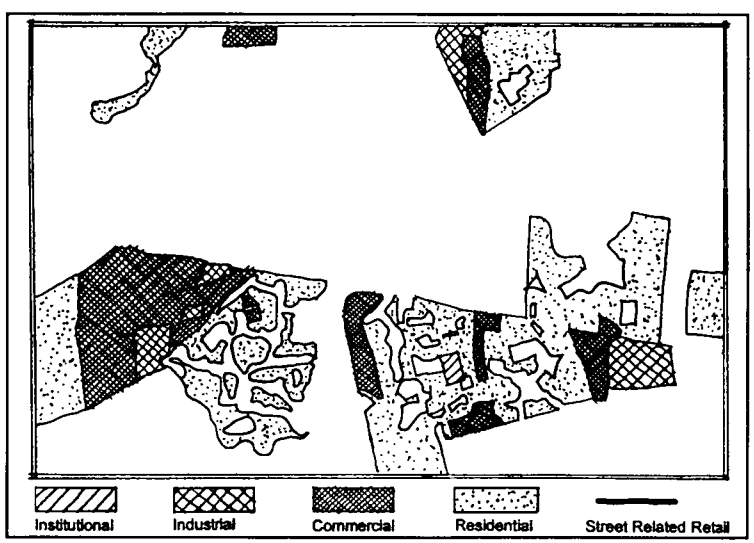


Road Network

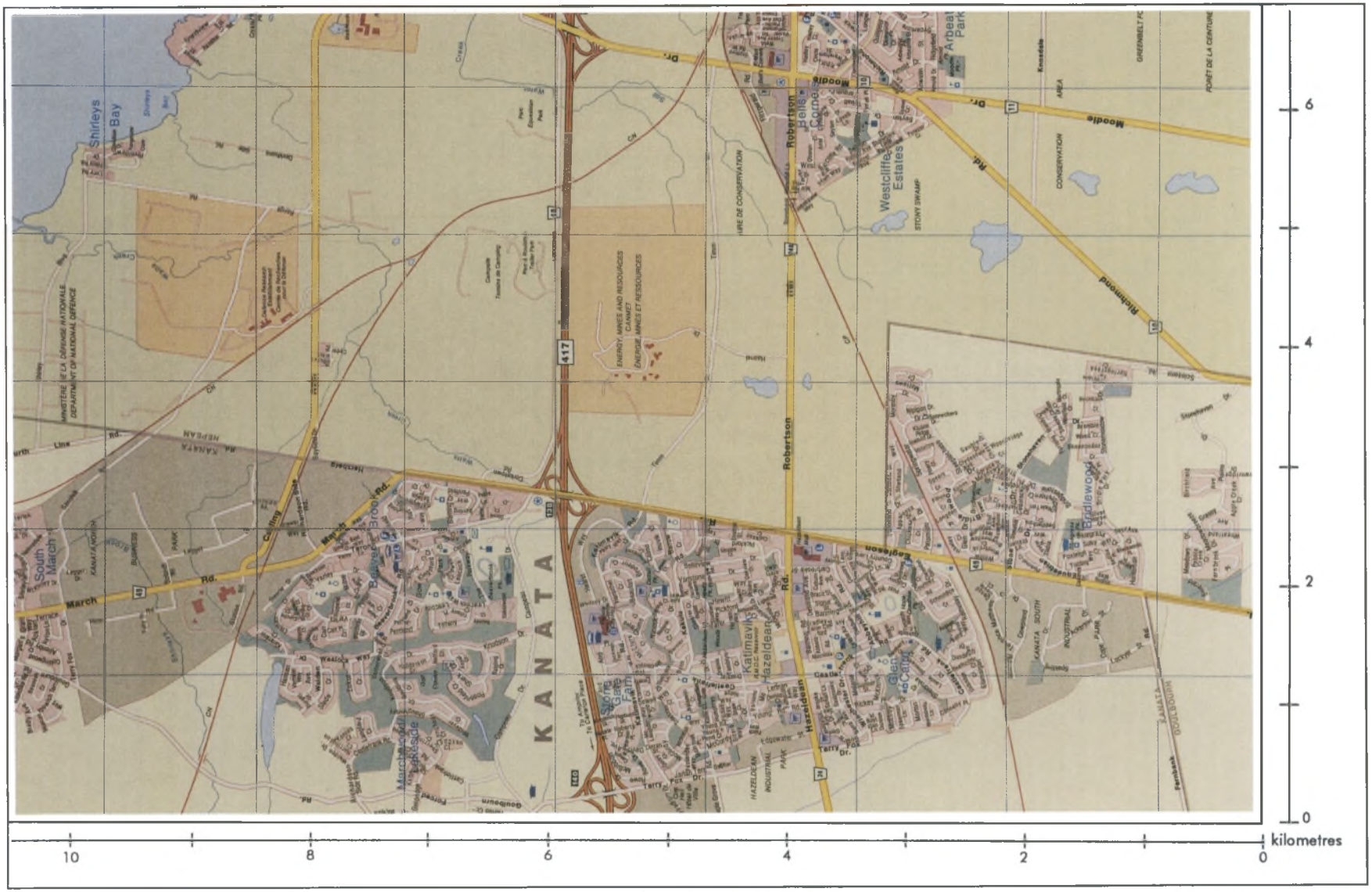


Open space and Schools



Land Use

ANALYSIS DRAWINGS



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SAMPLE PATCH

MapArt
Map Art Publishing Corporation
70 Bloor St. E. Oshawa, On L1H 3M2

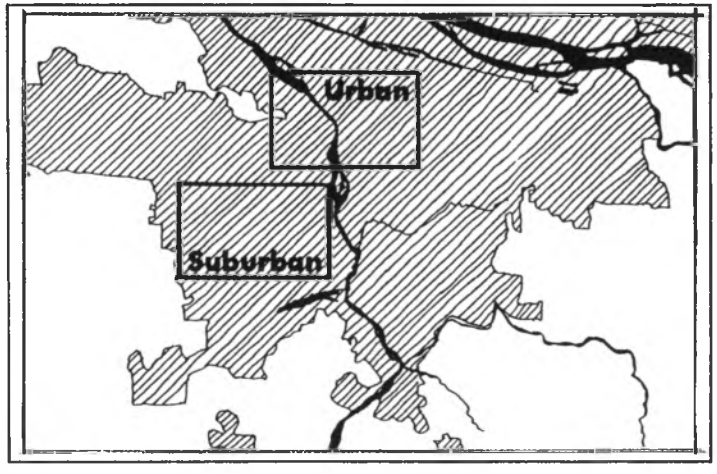
ELEMENT	OTTAWA	KANATA
MAJOR GEOGRAPHIC FEATURES	▸development relates to the shores of the Ottawa and Rideau Rivers; bridges to Hull enhance this focus ▸Rideau Canal represents significant engineering of the landscape ▸Greenbelt initiative attempted to establish a boundary for growth	▸low lying landscape within the watershed of the Ottawa River ▸small tributaries and lakes create a rolling terrain with valleys and wetlands ▸development occurs in pods
GREEN OPEN SPACE	▸open space systems along the Rivers and Canal ▸Experimental Farm ▸small isolated pocket parks	▸system configured around a series of golf courses developed in relation to the valleys and water features
SCHOOLS	▸clusters of school sites distributed throughout the patch ▸some relate to open spaces	▸connected with open spaces ▸large parcels of undeveloped or institutional land result in cluster of schools in Kanata
TRANSPORTATION	▸highly connected network of streets influenced by the course of the Rivers and Canal ▸road system relates to Rivers either by 'marching over' the obstacle or by creating an edge along the shore with parkways ▸parkway network is unique ▸fine grid on local street pattern	▸'pod' pattern of development in which connections to arterial or collector streets is limited ▸potential for future connections is limited due to lack of 'stubs'
LAND USE	▸ mix of use and density is concentrated in the core, extending from the River shore ▸commercial uses locate along 'main streets' ▸national capital uses focus on the shores and at the periphery ▸industrial uses relate to water features or are located on periphery	▸ pods of development in which residential use is adjacent to open spaces and non-residential uses are displaced to the edge of pods and on arterial roads

ELEMENT	URBAN - Ottawa		CONVENTIONAL SUBURBAN- Kanata	
	Typical Development Standards	Resultant Urban Form	Typical Development Standards	Resultant Urban Form
Open Space *Parks* *Hazard lands* *Storm water*	Parks ▸Current Ratio: 5.2 ha/1000 [1] ▸1991 Land Use Survey: RMOC 4.5 ha/1000 Ottawa 5.2 ha/1000 inside greenbelt 7ha/1000 ▸federal government purchased large land holdings in the 1950's which made up the Greenbelt ▸open space was set aside for future transportation and utility needs which have not transpired	▸large parcels of open space: Experimental Farm and Greenbelt lands ▸many, small pocket parks	Parks ▸current ratio: 7ha/1000 population [1] Storm Water Management ▸Master Drainage Plans establish a storm water management approach ▸storm water management quality controls for the Rideau River have strict standards ▸quantity control governed by conservation authorities and includes criteria to reduce downstream flooding and erosion Hazard Lands ▸City of Nepean purchased woodlands funded through regional development charges (goes beyond 5% dedication) ▸dross & river corridor	▸green system configured around a series of golf courses developed in relation to the valleys and water features •efforts to remove environmentally sensitive areas from private realm
Schools	Ottawa Boards do not have a standards for minimum lot area or parking	▸Many schools; some clustering ▸some relate to open spaces	▸shared sites and combined with parkland is encouraged ▸Preferred lot size of 2.7 ha for elementary and 8 ha for secondary schools [4] ▸parking standards: high school 3.5 - 5 spaces/classroom; elementary schools 1 - 1.5 spaces/classroom	▸All sites connected with parkland
Transportation *Roads* *Transit* *Cycling* *Pedestrian*	Regional Roads [2] ▸20m- 40 m ROW	▸diverse array of road configurations range from fine grid to parkway type	Roads ▸Regional roads: 34-40 m ROW [2] ▸all new development located in a 400 m walking distance from an existing or proposed transit stop ▸Primary Employment Centre to be within 40 minutes travel time by public transit from most parts of urban area.	▸sparse regional road framework ▸disconnected 'pockets' of development
Land Use *Density* *Mixture*	▸Current Densities: City of Ottawa 26.6pph Inside Greenbelt 26.2pph Total Urban 18.4 pph	▸density highest at core ▸ mainstreets are focus of neighborhoods	Current Density: 10.8 ppha Land Use Mix [6] 25,000-35,000 residential units 30,000 - 43,000 jobs	▸ attempts to integrate uses

[1] 1991 Regional Municipality of Ottawa Carleton Land Use Survey
[2] Official Plan of Ottawa Carleton, 1991, Schedule C2
[3] Ibid Schedule C2
[4] Non-Residential Standards Review Ottawa - Carleton Urban Areas, p.5 figures for Carleton Roman Catholic Board
[5] 1991 Census Data 1991 RMOC Land Use Survey
[6] Official Plan of Ottawa-Carleton, 1991

2.2.5 Portland

The urban patch selected for Portland incorporates much of the original town of Portland and stretches from Willamette Heights across the Willamette River to the Montavilla neighbourhood. The suburban patch, separated to the south from the urban area by the Tualatin Mountain range exhibits development typical of the 1970's and 1980's suburban form.



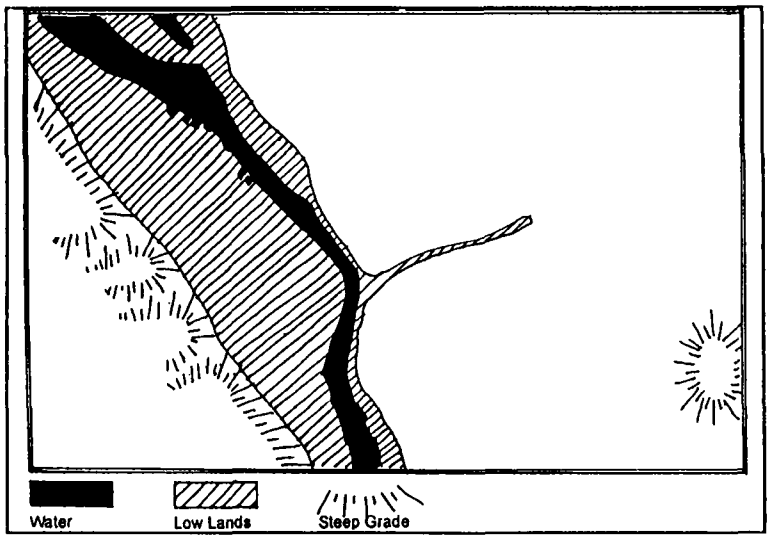
Context: Location of Patches

Portland has been actively exploring and implementing initiatives with respect to alterative forms and standards of development at both the local and regional scale. These initiatives redress the balance between liveability, function, locational decisions and economic viability. Local initiatives such as 'Skinny Streets' have provided new street standards which strive to meet the needs of residential neighbourhoods as well as transportation requirements of easing local traffic flow. Much progress has been made through the Transportation Element of the Comprehensive Plan for the City. The Transportation Element provides a street classification which includes designations for pedestrian, transit, bicycle movement, auto and truck traffic.

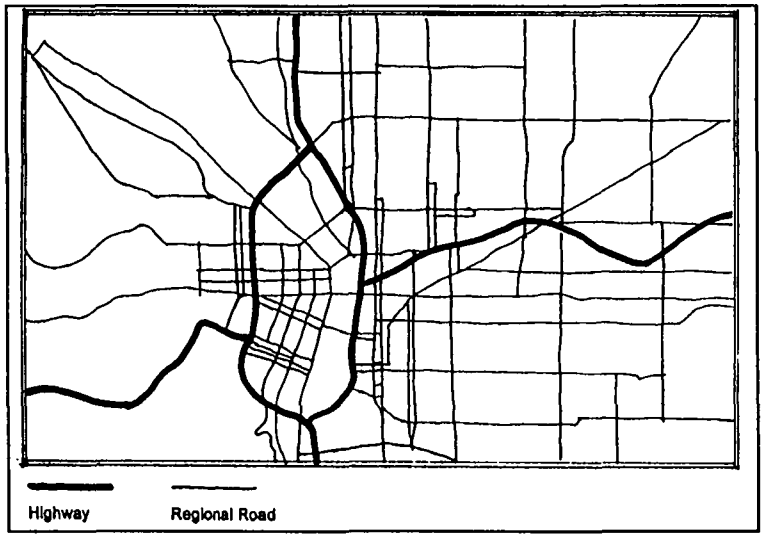
The Regional Plan, entitled Region 2040, proposes bold regional planning initiatives and policies such as the establishment of Rural Preserves to establish and retain rural areas between urban centres, which then retain a distinct compact physical entity, promoting a strong balance between jobs and housing, promoting higher densities in locations well serviced by transit and establishing a functional classification of roadways and other infrastructure elements which are consistent with neighbouring municipalities.

Metro Portland's Region 2040 initiative, Decisions for Tomorrow, is the Region's comprehensive planning effort which is attempting to integrate elements of urban form. Specific plans such as a regional Greenspaces Program and Regional Transportation Plan will ultimately be integrated into a Regional Framework Plan. The Region 2040 proposes a regional road standard of 3-4 thru-streets/km, encourages 18 metre travel width, multi-modal arterials with on-street parking and densities which accommodate employment and residential uses:

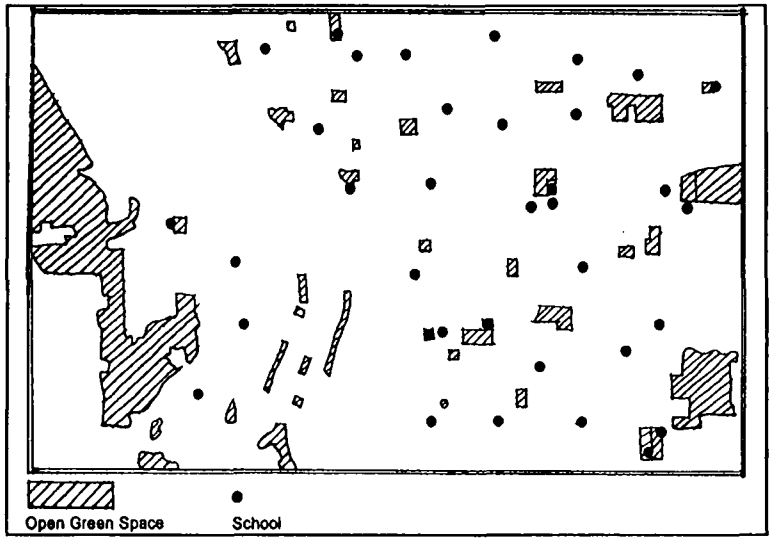
Portland 100 pph; Regional Centre 24 pph;Town Centre 19 pph;Corridors 10 pph



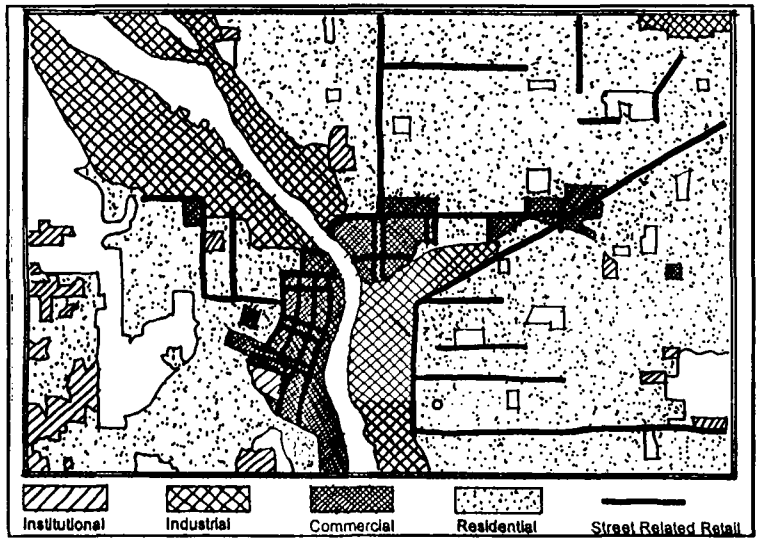
Geographic Features



Road Network

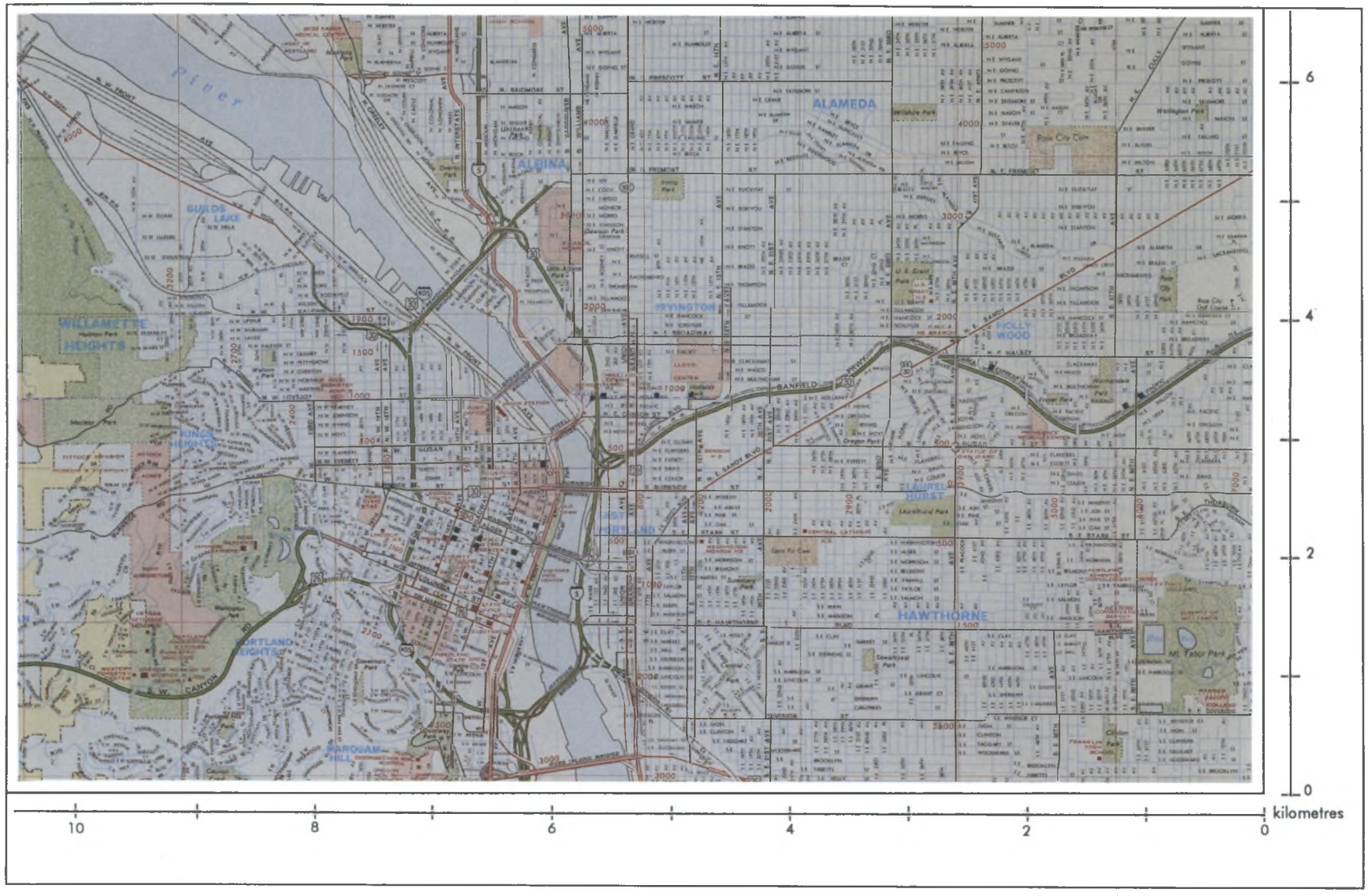


Open space and Schools



Land Use

ANALYSIS DRAWINGS



SAMPLE PATCH

RAND McNALLY

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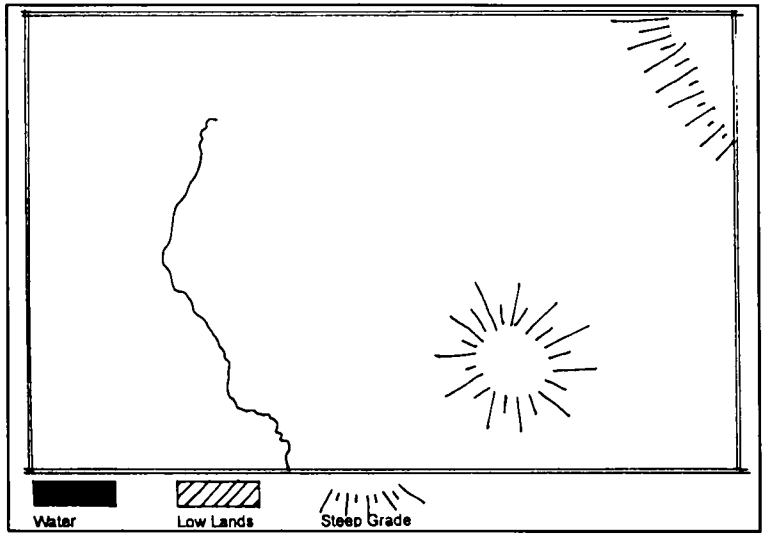
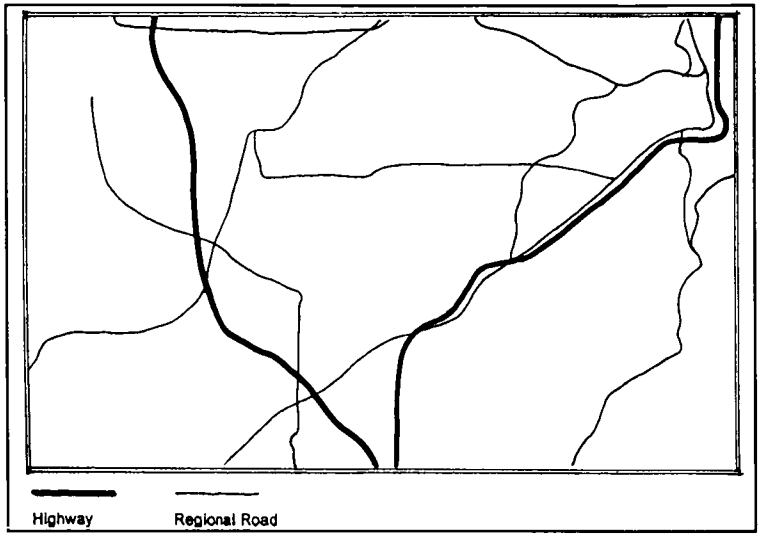
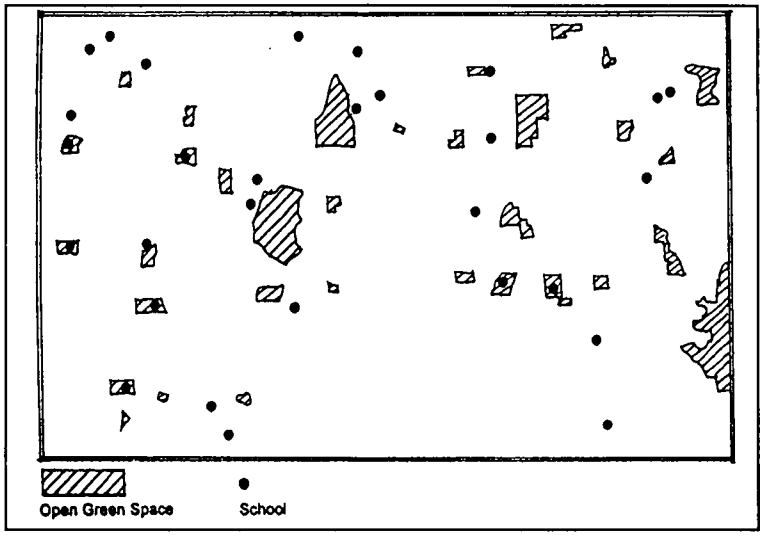


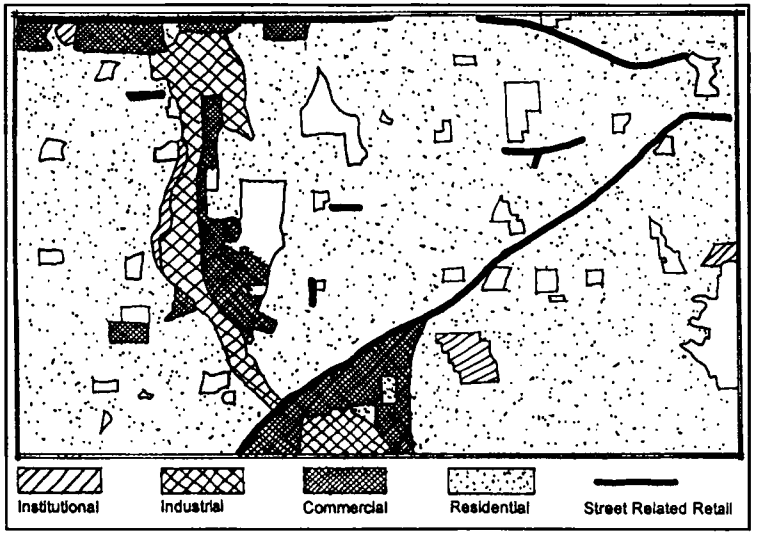
Geographic Features



Road Network

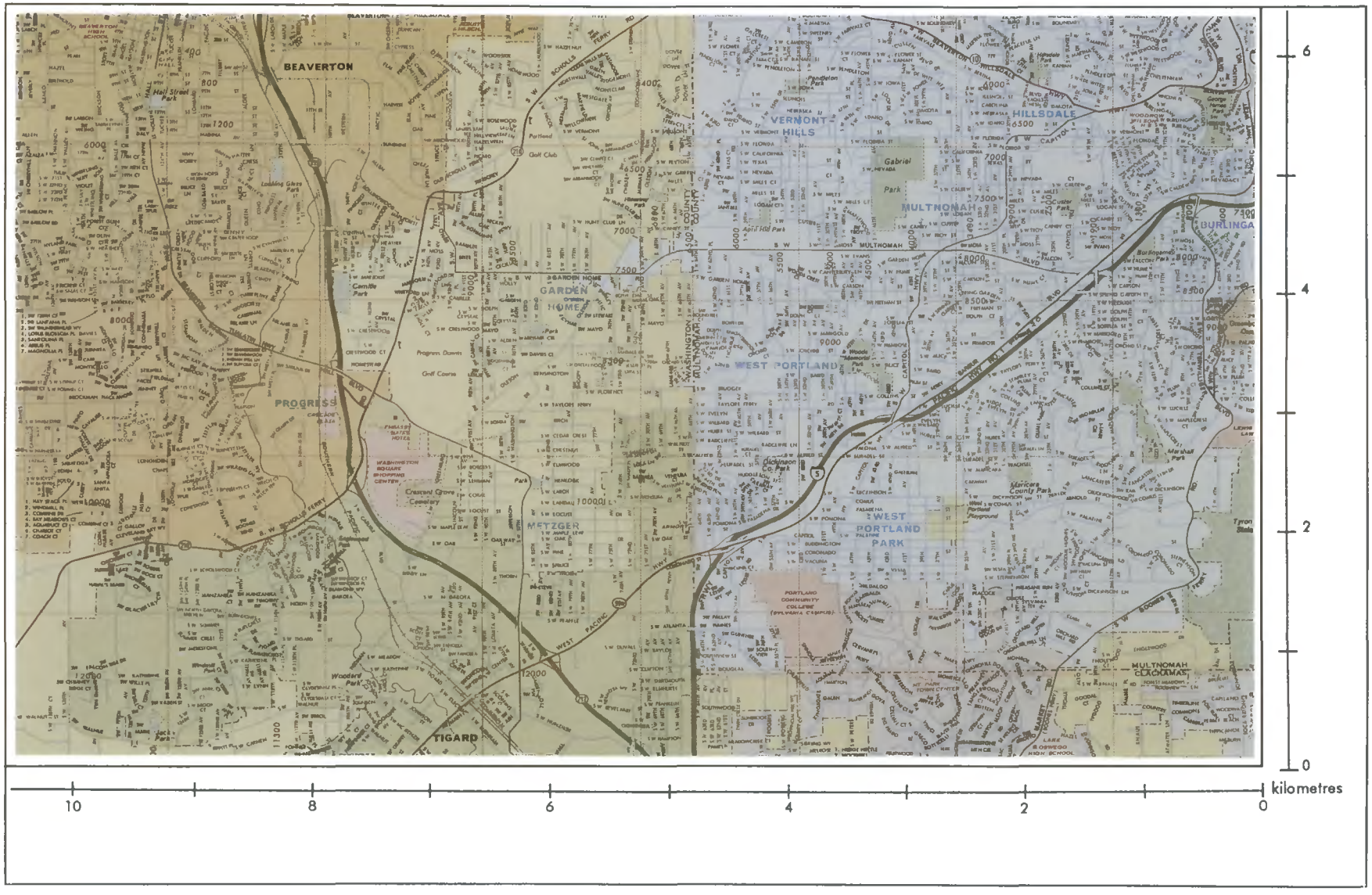


Open space and Schools



Land Use

ANALYSIS DRAWINGS



RAND McNALLY

Portland Street Map ©1995 by Rand McNally, R.L. 95-S-216

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SAMPLE PATCH

Morphological Analysis

ELEMENT	URBAN PORTLAND	SUBURBAN PORTLAND
MAJOR GEOGRAPHIC FEATURES	▸located in the floodplain of the Willamette River and at the base of the Tualatin Mountains ▸extreme topography presents significant constraints to development	▸separated form urban Portland by the Tualatin foothills ▸ impact of extreme topography on development is evident
GREEN OPEN SPACE	▸quantity of parkland is substantially less than in Canadian patches ▸isolated pocket parks ▸the eastern portion of Forest Hills Park, a large open space is located within the patch ▸otherwise parkland is disconnected and has little relation to the River	▸Pattern similar to urban patch
SCHOOLS	▸evenly distributed; relate to both open spaces and street grid	▸evenly distributed; relate both to open space and local road system
TRANSPORTATION	▸catalogue of US transportation philosophies ▸inherited underlying dense street grid 'marches' across steep terrain ▸steep slope configuration on steeper slopes and rectangular grids on hilltops ▸freeway layout consists of inner loop consuming the waterfront, slices fine inherited grid and interrupts downtown with land consumptive interchanges	▸evidence of traditional urbanism, early suburban and contemporary suburban patterns as city grew westward ▸sole arterial roads are inherited from rural roads; resulting in travel being 'hostage' to few arterials ▸pod development characterized by lack of connection and few opportunities for access
LAND USE	▸mixture of uses and density are most intense in the core located along the waterfront. ▸ industrial uses surround the core beyond which residential uses predominate with small pockets of other uses	▸non-residential uses front along the regional road system ▸open spaces are the only interruption to residential uses nestled within arterial edges.

The City of Portland has initiated an alternative local street development standard program called Cheap and Skinny Streets. Included in the program is the promotion of multi-modal arterials, local streets with a 6-8 m ROW, Queuing streets (2 lane streets with on-street parking, which forces opposing traffic to yield to one another thus being self enforcing) and cost savings incurred by the coordination of sewer installation and street construction programs..

ELEMENT	URBAN - PORTLAND		CONVENTIONAL SUBURBAN - PORTLAND	
	Typical Development Standards	Cumulative Urban Form	Typical Development Standards	Resultant Urban Form
Open Space *Parks* *Hazard lands* *Storm water*	Parks[4] ▸neighbourhood: service area of 0.8km and(½ mile) hectares in size 1-4 hectares ▸community: serves several neighbourhoods; size of 4+ hectares Hazard Lands ▸Environmental Zones established to protect riparian areas and significant geological features such as wetlands and forests Storm Water Management ▸no quantity or quality facilities required in developed areas	▸Forest Park, a large open space is located adjacent to the River is part of parks master plan prepared in 1903 ▸park blocks planned in original layout of the city ▸less parkland than Canadian cases	Hazard Lands ▸Environmental Zones divided into 2 categories: Protected Zones (P) where no development can occur and Conservation zones which can be used for stormwater management facilities and parkland dedication ▸Storm water management ▸quantity and quality control requirements are being developed	▸sparse, disconnected public open spaces •largest open spaces are golf courses
Schools	▸no site standards	▸evenly distributed; relate to both open spaces and street grid ▸innovation in new schools: elementary school in married students residence	▸site selection criteria includes adjacency to park lands ▸site standards 4 ha elementary 8 ha middle school, 16 ha high school	▸evenly distributed; relate both to open space and local road system
Transportation *Roads* *Transit* *Cycling* *Pedestrian*	No adopted standards, typically: Local: 8.5 m - 9.75 m ROW Collector (3 lanes): 15m ROW[6] Minor arterial (3-4 lane): 18 m ROW[5] Major arterial (5 lane): 24 m ROW[5]	▸collage of road types: fine grid is overlayed by coarse ring of highway connections	No adopted standards, typically: Local: 8.5m - 9.75m ROW[3] Collector (3 lane): 18 m ROW[5] Minor arterial (3-4lane): 24m - 27m ROW[5] Major arterial (5 lane): 27m-30m ROW [5]	•meandering and sparse road network
Land Use *Density* *Mixture*	Current statistics Portland: 60 ppha Regional Centre: 10 ppha	▸mixture of uses and density are most intense in the core located along the waterfront ▸ industrial uses surround the core beyond which residential uses predominate	Current statistics Town Centres: 9.3 ppha	▸non-residential uses front along the regional road system ▸open spaces are the only interruption to residential uses nestled within arterial edges

1 Region 2040: Metro Region 2040 Update, p 10
2 Region 2040: Recommended Alternative Decision Kit
3 Skinny Streets Presentation to Fire Marshall's Roundtable, p7
4 Region 2040, Concepts for Growth, June 1994
5 Tom Kostler, Portland Metro Transportation Department
6 Parks Futures: A Master Plan for Portlands Park System, 4-17

Documentation and analysis of the four case cities have provided insight into current practices with regional development standards. Observations and conclusions related to each of the elements and on the status of development standards are summarized below.

2.2.6 Observations: Major Geographic Features

Historically, in urban areas development has significantly modified existing geographic features. Major regrading, filling of ravines and piping of major watercourses are examples of how the landscape has been substantially reshaped to comply with the imposed design, resulting in the disappearance of many natural features in urban areas. The exception has been the very prominent and more difficult to obliterate natural features such as Lake Ontario and the Don River in Toronto, the Rideau and Ottawa Rivers in Ottawa, the Willamette and Columbia Rivers in Portland and the Bow River in Calgary. However, in most cases, access to the water's edge has been hampered by urban infrastructure.

More recently, suburban development has generally been more careful in identifying and retaining major natural features in community design. As a result of the formation of Conservation Authorities and similar bodies, water courses and flood plains have been preserved. However, once preserved, these features are most often 'reverse lotted', isolated or privatized. Although natural features are retained to a greater degree in suburban design, they are not necessarily designed with the existing landscape as a primary determinant of community image or form. Further, although some major natural features are retained in their existing form or at the community scale, an 'industrial' approach to the landscape has been broadly applied where complete re-engineering of the land form and regrading occurs.

Storm Water Management

Historically, stormwater runoff in each of the urban patches was treated as a waste disposal issue. Collection systems were constructed to convey storm runoff directly to watercourses with little regard for downstream impacts on

flooding or aquatic life. This attitude was reflected in the common pre-World War II practice of building combined (single piped) systems to deal with both sanitary and storm flows. With combined systems, flows during rainfall events, which exceed the treatment plant capacity overflow to watercourses, discharging untreated sewage along with the stormwater. The treatment of watercourses also showed little regard for natural systems. Watercourses that were not eliminated outright by storm sewer works were often channelled and their riparian habitat and natural floodplain limits altered or eliminated.

Development in the past fifteen to twenty years has incorporated various strategies for flood or erosion control. In the past five years measures for providing some quality management of stormwater have been common in many jurisdictions. Implementation of stormwater management has occurred more consistently during this period in the suburban patches. This is a consequence of the need for both the land area and appropriate servicing infrastructure to provide stormwater facilities. Early implementation of stormwater practices in suburban areas also tended to be handled on a piecemeal basin in response to individual development applications. The current trend, through watershed and subwatershed planning, has advanced stormwater management in the planning process, resulting in more centralized facilities which are better integrated with their surrounding land uses.

2.2.7 Observations: Green Open Space and Schools

Parks and open spaces in urban patches are often remnant pieces of natural systems, associated with the neighbourhood fabric but disconnected from one another. Urban open spaces are idiosyncratic in size, shape and form and represent a broad mix of passive and active spaces. Generally urban open spaces are greater in number and of smaller size than their suburban counterparts. A program of recovery of former industrial sites can be observed in urban areas which has resulted in riverfront and canal related park systems.

There is proportionately a greater amount of open space in suburban communities. In the Urban Density Study prepared for the Office for the Greater Toronto Area, open spaces in newer communities were found to occupy between 10%-16% of gross land area while in urban areas open spaces occupied from 2%-

6%.[23] Suburban open spaces are more standardized in size and form and rarely exhibit extremes in size with the exception of large sport facilities. A severe typological distinction between active park and passive park has arisen. Suburban open spaces are frequently located in conjunction with natural features and create a buffer between development and the feature. Accessibility to this open space is at times hampered by back lotting which reduces the perception of safety and public character of the space.

Schools

Although urban schools occur in a range of forms, they are generally multi-storeyed, urban in orientation and modest in land consumption. Urban neighbourhoods are often not designed with schools as the central focus of the neighbourhood. School sites are not generally combined with open spaces or parkland, and school yards are often hard surfaced.

Evolving from Clarence Perry's Neighbourhood Unit, schools have generally come to form the focus of the neighbourhood in suburban communities.[24] School buildings are generally one to two storeys and school sites are extremely land consumptive. For example, a study of school site standards in the Region of Ottawa-Carleton identified minimum lot areas of up to 8 hectares, minimum lot frontages of up to 30 metres, street setbacks of up to 23 metres, building setbacks between 7.5 and 12 metres and minimum landscaped open space requirements of up to 60% of the site.[25] Parking lots and bus drop off/pick up areas are significant elements in the site design of suburban schools, occupying large tracts of land. While schools in the central core of Ottawa have no parking requirement, suburban school standards range from 3.5 to 5 spaces per classroom for high schools.[26] Suburban school sites are set back from the street, thus weakening the relationship of the buildings to the street and adjacent uses are often back lotted on the remaining three site lines. Suburban school sites, in particular elementary school sites, often adjoin park sites but their uses are not integrated.

Figure 2 Yonge Street in Thornhill, Ontario is a suburban arterial that supports development and an active/safe pedestrian life

Figure 3 Bathurst Street in Thornhill, Ontario: conventional arterial suburban development turns away from the street.

Difficulties present themselves in planning for schools based on a homogeneous population base, as many suburban communities have been. The simultaneous aging of a generation of school children results in schools being initially over capacity and later under capacity. Therefore establishing a default use may become necessary. Encouraging a diversity in range of age groups would alleviate this situation.

2.2.8 Observations: Transportation

In comparing urban and suburban transportation networks in North America, several observations can be made. A finer grain and greater degree of connectivity of the local and major street pattern is found in the urban patches. Conversely, there are fewer but larger major streets in the suburban patches. As a result, the suburban pattern usually forces local trips to use major arterials due to the lack of an all-local route. A comparison of the road network within older and newer communities in the Greater Toronto Area indicates that the road network of older urban communities consisted of 20 metre, 26- 30 metre roadways and highways. In conventional suburban communities another level of roadway, the 36 metre right of way, is introduced. The study also showed that even though a wider type of road was introduced in new communities, the percentage of land area consumed by roads in the older communities was greater than that of the newer areas as a result of the finer grain of road pattern in older communities.[27]

Suburban development generally turns away from major arterials which have become undesirable locations for development due to scale and travel characteristics. Conversely urban development has a closer relationship to the street. Major streets in urban areas change character as they travel through communities, at times acting as main streets and at times acting as major transportation routes adjoining natural features. The large scale and auto dominance of suburban major routes inhibits such a transformation of character and underlines the unifunctional purpose of those routes.

A dense transit network can be supported within urban areas and in conjunction with a finer grained road network, which encourages pedestrian and bicycle

travel and provides opportunities for a range of transportation modes. Generally, the converse is true in suburban areas, a situation which produces over-dependence on the automobile.

2.2.9 Observations: Land Use

The urban patches exhibit a finely grained mixture of uses. Urban built form, which typically has a strong relation to the street, in combination with the availability of multiple modes of transportation in urban areas, supports a mix of uses and evolution of use over time.

Population densities decrease from the urban to the suburban patches. In Toronto the gross residential density for the downtown community of Riverdale (33.6 units per gross hectare) can be compared with an average greenfield development density in Markham of 17.8 units per gross hectare.[28] Land uses in suburban areas are characterized by large scale, segregation and large separations between uses. Homogeneous neighbourhoods, in which residential use is separated from other uses, characterize land use patterns. Within areas of residential uses, housing typologies are segregated and higher densities are utilized as buffers to arterials and servicing corridors.

In suburban areas, commercial services are concentrated and centralized in strip malls or 'shopping centres' generally located within a 'five minute drive' from most residents. Generally, all uses are separated and dependent on car access. Transit services are infrequent and utilize large arterials which are not pedestrian oriented.

Figure 4: Toronto's Bayview Avenue is a main street that supports a mixture of uses while remaining an important traffic arterials

Figure 5: The Markville Shopping Centre in Markham is typical in its introverted nature

2.2.10 Observations: Development Standards

The sampling of standards identified in the case studies illustrates a lack of consistency in the types, levels and approach to regional development standards in North America. While approaches may be subject to context and size of place, generally, the following trends can be observed:

there is a relative scarcity of regional or community level standards compared with local standards;

historically, an absence of regional level standards within urban areas has produced an urban form impacted by local standards and incremental growth;

a pattern of increased levels of standards exists in suburban areas - even above and beyond current day urban standards;

the treatment of road and school standards are among the most consistent across case studies; and

innovative standards in new communities are less prescriptive and encourage shared-site facilities, a finer mixture of uses and road open space networks which interconnect communities.

By combining the two sets of observations in the case studies - one relating to urban form and the other to development standards - it appears that while development standards may not be the only factor controlling urban form, they make a significant contribution in supporting urban form and function and the amount of land consumed by development.

Our current urban form developed from an incremental expansion in which regional standards were applied ex post facto in an effort to connect portions of the growing city. Suburban areas have grown sequentially in a more controlled manner, imposing a regional framework which neglected to interrelate the local form, thus producing in many instances isolated and pocket communities. There is an emerging need to create regional or community standards which are more

than 'bigger' local standards connecting and serving local places, but encourage another scale of place, form and function which is at least as complex as the local area.

2.3 Progress and Problems: Assessment

2.3.1 Lack of integration

Probably the single-most important problem related to both regional and local development standards is the compartmentalisation of related disciplines and the lack of an integrated approach to the planning of new urban areas. In practice, the city is divided up into single, component parts - natural systems, roads, buildings, stormwater management and drainage - with each part treated as a separate entity. Each practitioner tends to view problems only from within the narrow confines of his or her discipline. This offers no potential for an integrated, city-oriented approach, and no possibility of measuring and making tradeoffs between different areas. For example, a reduced road pavement may reduce stormwater runoff, but the traffic engineer will make his assessment only in terms of the impact on traffic flow.

At the regional scale, issues arising from points of intersection of the different disciplines have not been adequately addressed. The implications of a finer grid road network and green system protection has not been articulated or resolved. Under current approaches, green systems have typically become inviable strips which cannot be traversed by roads. Bridges may be a solution, but bridge standards have increased, and do not always meet transportation standards related to stopping distances and visibility.

The lack of integration can be attributed to a number of causes, including narrowly defined educational disciplines that do not overlap. However, bureaucratic structures are also frequently fragmented and organised along disciplinary lines, so that in the development approvals process there is little opportunity for integrated planning and for making informed inter-disciplinary tradeoffs.

2.3.2 Blanket practices

By their very nature, development standards set out to provide standardised solutions to specific problems or issues. While this approach can result in economies of scale by eliminating the need to 'reinvent the wheel' every time a new road is built or subdivision is planned, when entrenched too rigorously it can also prohibit the implementation of lower-cost and more sustainable local solutions. For example, blanket policies prohibit the location of stormwater management facilities within valley limits in some jurisdictions, while, when examined on a site specific basis, this approach may be very effective and appropriate. Similar restrictions have arisen to prevent the construction of on-line stormwater management facilities in some areas. Both of these policies are grounded in specific concerns over impacts that may arise with each of these practices in some instances, but the extension of these concerns to a simple prohibitive 'blanket' policy is an unreasonable restriction on options for solutions. The application of blanket policies, sometimes in situations where the original rationale behind the policy is not relevant, can often lead to expensive solutions to non-existent problems. Blanket policies in some cases have lead to:

the application of onsite runoff controls on commercial sites when centralized downstream stormwater management facilities exist to provide flood control;

underground siphon systems to avoid overland flows (flows in excess of storm sewer capacity) in connecting walkway blocks; and

stormwater management facilities with no calculable flood control benefits.

The simplicity of control provided by blanket policies is no longer affordable and the underlying issues behind their formation must be open for discussion with regulating agencies.

Criteria in the area of stormwater management varies widely between locales and regulating agencies. Consequently many common practices in one area would be considered alternative in another. Areas of regulation that most

strongly influence community form and layout are those associated with defining the extent of watercourses to be preserved and floodplain limits. It is interesting to examine the contrasts between design criteria for setting floodplain limits even in areas of close proximity. Regulatory floodlines in Ontario, for example, may be established on one watershed using the 100 year return event and on an adjacent watershed with Hurricane Hazel (500 + year return event dependent on drainage area). These two different criteria can often result in dramatic differences on the amounts of developable land area.

2.3.3 Resort to capital-intensive solutions

The specialization of design and engineering disciplines in a narrow range of practice tends to produce over-designed facilities. For example, transportation planners' traditional emphasis on traffic capacity does not recognize other claims on street space or budgets, so policy tends toward 'more capacity at any cost'. Such a strategy quickly encounters diminishing returns. Typical of all such situations, it is possible to achieve a large reduction in cost, with only a small reduction in performance. For example, the cost difference between a road with a 60 kph design speed and a 100 kph design speed is large. Yet, the 60 kph design will carry virtually the same traffic volume as the high-speed design. If the road is a surface signalized arterial, both roads will operate at about the same overall speed.

Over-designed and over-engineered solutions are not confined to vehicular traffic. For example, some bicycle facility designs already show the same over-design that has long been present in road building. The lack of an integrated approach prevents us from thinking about infrastructure from a comprehensive point of view, from thinking of roads not just as places for cars but also for transit, cycling, walking, and as elements of community.

This unilateral approach also impedes the implementation of joint-use facilities such as mixed school/community centre/park/and stormwater management facilities.

Often, the sources of demand for infrastructure lie outside narrowly defined disciplines and so cannot be addressed. Demand for travel by car, for example, has been clearly demonstrated to be determined by land use patterns. But land use lies outside the transportation planner's purview, and as a result they tend to deal only with providing adequate capacity and movement for vehicles rather than minimising the need for infrastructure through demand management.

2.3.4 Resistance to Implementation of ADS

Resistance to the implementation of ADS on the part of approval agencies often stems from a concern about liability. Typically staff in a reviewing agency are given specific guidelines and criteria pertaining to their area of jurisdiction. When these documents are prepared they do not always anticipate overlap with other areas of expertise. As staff are essentially operating in an enforcement role there is significant discomfort with deviating from the standard course. Giving leeway on requirements is also viewed as precedent setting and is seen to weaken their position in maintaining the status quo.

As a rule, the bureaucratic structures of governments do not reward staff or developers for innovation or for deviating from the tried and true, even when clear benefits to doing so are demonstrated.

2.3.5 Greater sensitivity to environmental issues

As the innovative development in the case studies show, there has been greater attention paid lately to treating natural areas more holistically, as systems. This is an improvement over previous practice, in which natural systems were often eradicated and green elements were unconnected. Current practice often requires the evaluation of servicing, stormwater management and environmental linkages and management goals. Current stormwater analysis would usually examine the drainage impacts to a subwatershed area and may have the benefit of a background watershed study to guide it. Thus, now more than at any time in previous development history, there is an emphasis placed on environmental issues.

However, the limits to the protection of green systems are tied to the costs associated with preservation and the economics of land development. Stormwater control requirements and the resultant facilities also enter into this equation. There is an inherent difficulty in attaching a monetary value to natural systems, particularly one that will work within the profitability constraints of land development. What represents a reasonable management goal for an urban fishery? What is the value of a cold water fishery, or a warm water fishery, and how much money should be spent to preserve them? These types of decisions are outside the development process and are not being made on the basis of an integrated analysis of the land use goals on a community level. Creating a practice of setting aside land of limited environmental value should be carefully considered in the context of development economics and density impacts.

Recent emphasis on the preservation and rehabilitation of natural systems in combination with stormwater and other requirements is influencing the density of suburban development and indirectly development costs. Looking at Markham, Ontario as an example, large scale urban development in the early 1980's could expect a developable yield of about 60% of the land area. Current development applications in north Markham, prepared to comply with new floodplain and stormwater management regulations, are yielding developable land areas of slightly less than 50% of the total, despite some reductions in local road widths.

2.3.6 The regional scale lags the local in implementing alternative approaches

As the case studies and literature review have shown, many 'new urbanism' projects at the local level have been or are being implemented. However, the community context in which these projects have been implemented has not been similarly reviewed and revised. As a result, there is, at present, an incompatibility between the local and the community context that is similar to having a 1995 Volkswagen Golf engine in a 1965 Buick Electra body.

At the community scale, visual tools now used so effectively at the neighbourhood level are also lacking, such as model codes or computer imaging. For example, simulated aerial perspectives such as those used to great effect in the Connecticut River valley plan could be applied at the community level.[29]

3 MOVING FORWARD: THE INTEGRATED COMMUNITY

3.1 Introduction to the Integrated Community

Clearly, there is a need to adopt a new approach to applying development standards. The literature and lessons drawn from four existing communities show that the status quo is not creating an adequate or sustainable community environment. Further, the disaggregated environment in which standards are developed and applied does not result in efficient use of resources. This unilateral approach does not recognize or respect the social, economic and environmental complexity of the urban environment.

The new approach must be integrated, iterative and flexible. It is iterative nature of planning and designing with an interdependent set of components which comprise a community. In order to illustrate this new approach we have illustrated a fictitious community entitled the Integrated Community.

The Integrated Community portrays an 'existing' fabric of rural concession roads, natural water features and an existing village - a generic set of elements which is commonly found in greenfields development. Before and after plans illustrate the evolution of this planned community. The design and function of the Integrated Community has taken into account: planning, transportation engineering, municipal engineering and storm water management considerations and has been planned based on the principles expressed below.

The Integrated Community is intended to graphically represent the potential urban form which would result from adopting a new approach and alternative development standards.

3.2 General Principles

ADOPT AN INTEGRATED APPROACH

'Intersections' between disciplines should be deliberately sought.

'Trade offs' between the values of different disciplines should be explored.

Decision making should be integrated

Approval agency staff should be accessible and empowered to commit to flexibility and compromise positions.

ESTABLISH A FLEXIBLE FRAMEWORK FOR COMMUNITY PLANNING

A flexible framework should be utilized in community planning. The configuration of this framework should consider the context and needs of the particular community rather than applying a prescriptive model which is built around a fixed focal point such as a school or a community centre.

The framework should be 'built for change' in order to allow for a flexibility, succession of land uses and demographic change.

Alternative development control mechanisms such as performance based zoning and standards should be explored.

The over-standardization of standards, land use combinations and patterns should be challenged.

Blanket practices should be reviewed in the particular context to ensure the intent of the practice is being addressed or could not be better addressed in other manners.

Trade offs between efficiency and flexibility should be explored.

DIVERSITY SHOULD BE PROMOTED

A diversity of building, uses, design approaches and housing types should be encouraged.

A greater flexibility of standards or a spectrum of standards rather than static figures should be provided.

Adopt an Incremental Approach

An incremental or modular approach to the provision of infrastructure allows more opportunity and adaptability to existing and future contexts.

Opportunities appropriate for an incremental approach should be explored.

UTILIZE THE ECONOMIES OF INTEGRATION

Opportunities for compatible combinations of uses such as parks/community centres and schools or storm water management and open spaces should be explored. Shared facilities can be more efficient and can more easily adapt to an evolution of uses.

Multifunction and flexibility in design of facilities should be sought.

3.3 The Integrated Community

The Integrated Community is a hybrid urban form which adopts successful elements from conventional urban and suburban community form, proposes an integration of physical and cultural elements of the landscape while respecting the natural environment. The Integrated Community is the physical manifestation of an integrated approach to planning and designing community form which is controlled by a flexible framework of regulations and created by an open and iterative process. Analytical drawings of major geographic features, open spaces, schools and parks, transportation and land use patterns have been included for illustrative and comparative purposes.

The structure of the Integrated Community is organized by a number of elements: nodes; edges; connections and distribution of uses and facilities. Principles directing each of these elements are identified and, where appropriate, guidelines for specific standards are provided. A set of preliminary development standards intended to implement these principles is proposed.

3.3.1 Nodes

THE INTEGRATED COMMUNITY IS ORGANIZED AROUND A SERIES OF NODES

Nodes are mixed use centres which are planned to perform a range of differentiated functions. The built form of nodes is attuned to the local neighbourhood, community or regional function they perform.

Mixture of uses and higher densities are concentrated around nodes

Location of nodes builds upon the existing relationships of land use, natural features, regional road connections and infrastructure.

Nodes are located at highly accessible points to all modes of transportation and in particular act as a transit hub.

The livability of nodes stems from attention to internal street and pedestrian connections, availability of goods and services, opportunities to live, work and play, transit and pedestrian friendliness.

In the Greater Toronto Area, the Peel region, Regional Structure Strategy identified an overall regional structure characterized by multi-centre form with a hierarchy of nodes. Nodes such as Queen Street and Dixie Road and Main Street at Queen in Brampton were identified in the strategy[30]

3.3.2 Edges

NATURAL AND CULTURAL LANDSCAPE FEATURES SHOULD BE UTILIZED TO DEFINE LONG- TERM (TWENTY-THIRTY YEAR) BOUNDARIES OF URBAN AREAS

Urban boundaries which mark the outer edges of urban development are defined in municipal policies and physically expressed by the creation of visual edges.

Boundaries should be established which respect and utilize natural features such as woodlots, shorelines and ravines as defining elements.

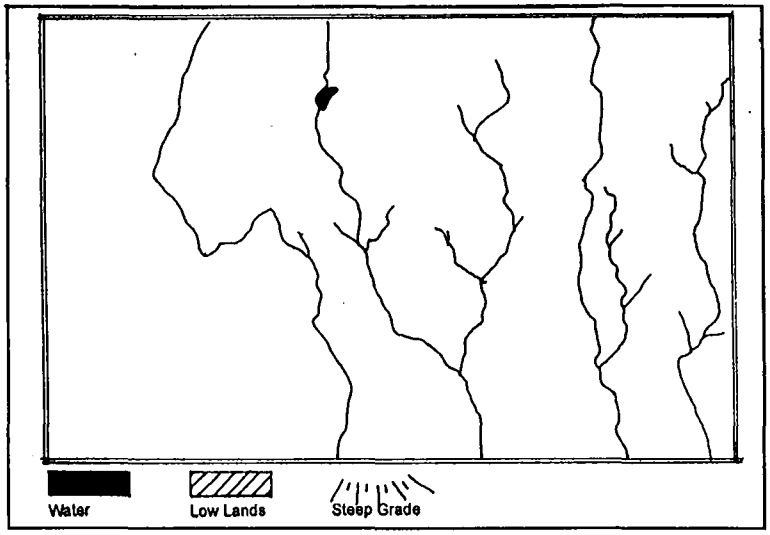
Urban boundaries should be buffered by transitional zones and 'rural' uses such as farmers markets, farming supply services or recreational uses.

Natural and road connections should extend to the boundary of urban areas.

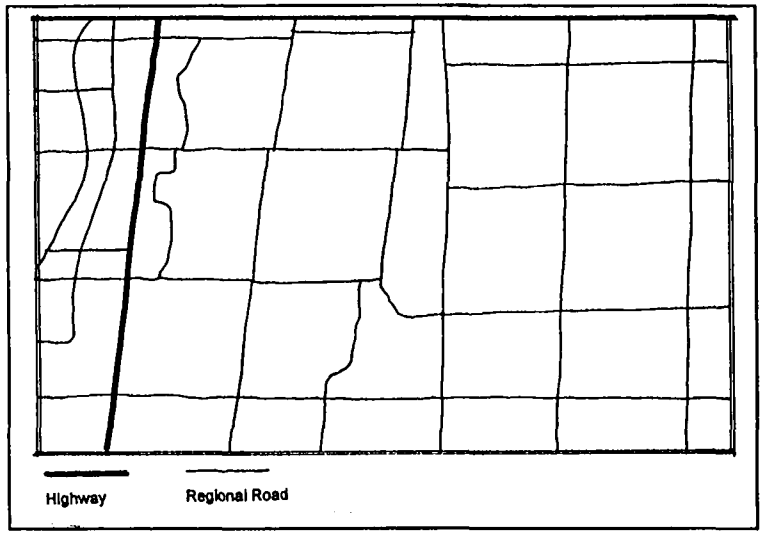
Beyond the urban edge, agricultural and other rural uses are protected, promoted and enhanced.

The Massachusetts Department of Environmental Management has drafted a Farmland/Open Space Conservation and Development Bylaw to be used by local municipalities to identify and legally protect open space or farmland districts. These districts are defined based on a set of criteria ranging from soil quality, aquifer recharge areas, to historic or cultural interest. The by-law limits uses in these districts and establishes a system for special permits and performance standards for development of over three lots. [31]

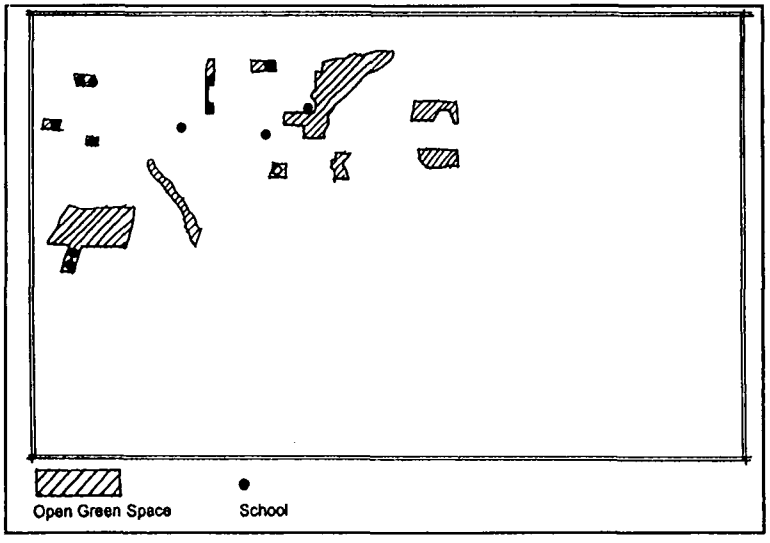
The Liveable Region Strategy for the Greater Vancouver Regional District introduces a Green Zone serving to confirm the limits to urban expansion and protecting the Region's natural assets. The Green Zone includes parks, agricultural lands, 'community health lands' (watersheds, floodplains, and hazard lands), forestry lands, recreational and scenic lands.



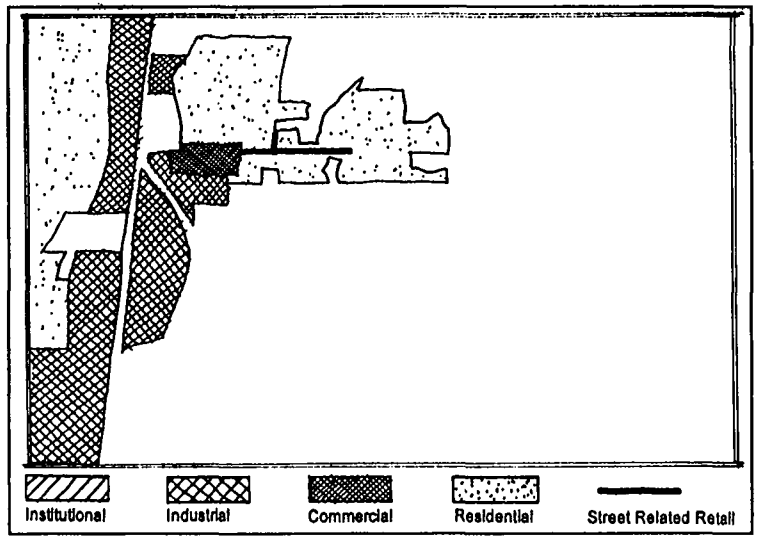
Geographic Features



Road Network

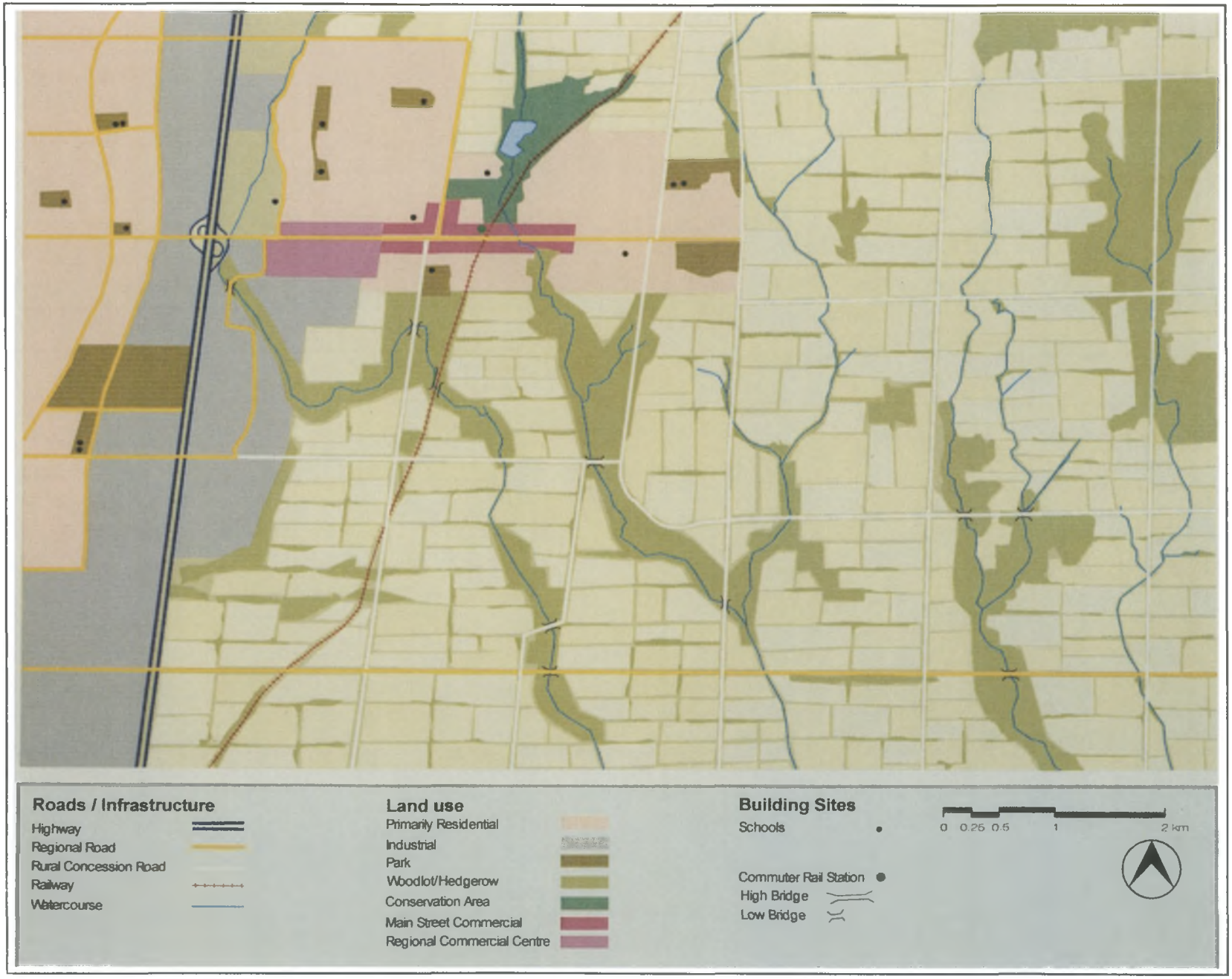


Open space and Schools

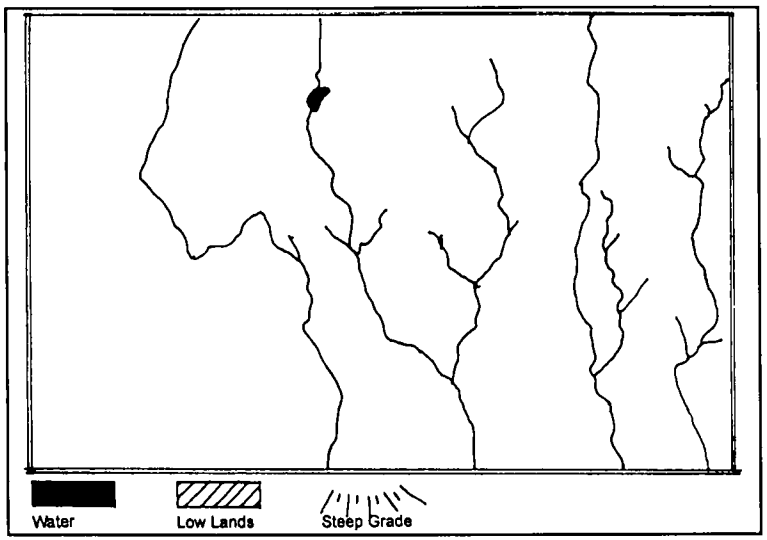


Land Use

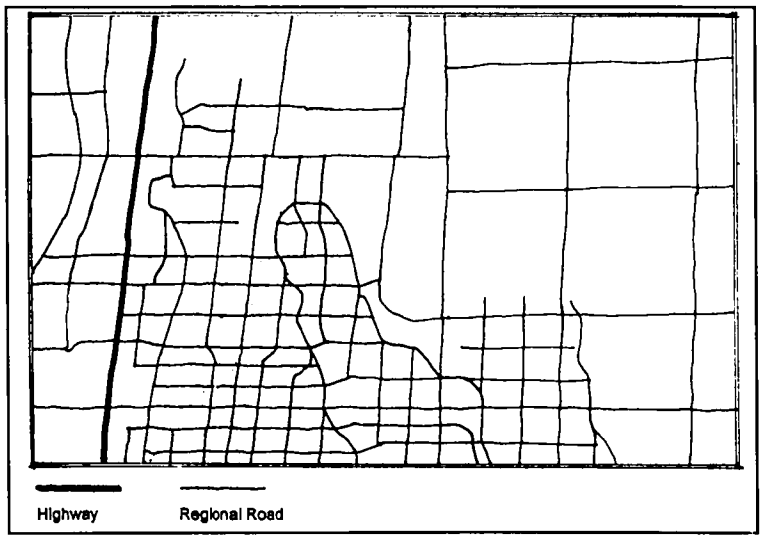
ANALYSIS DRAWINGS



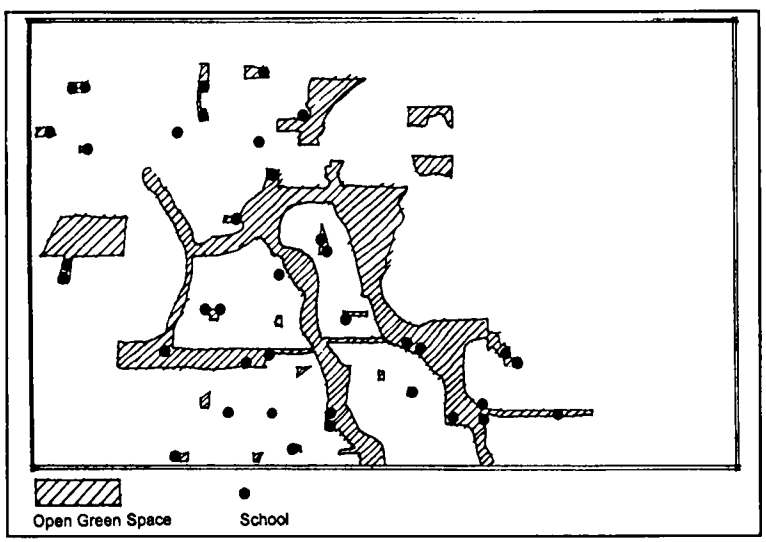
SAMPLE PATCH



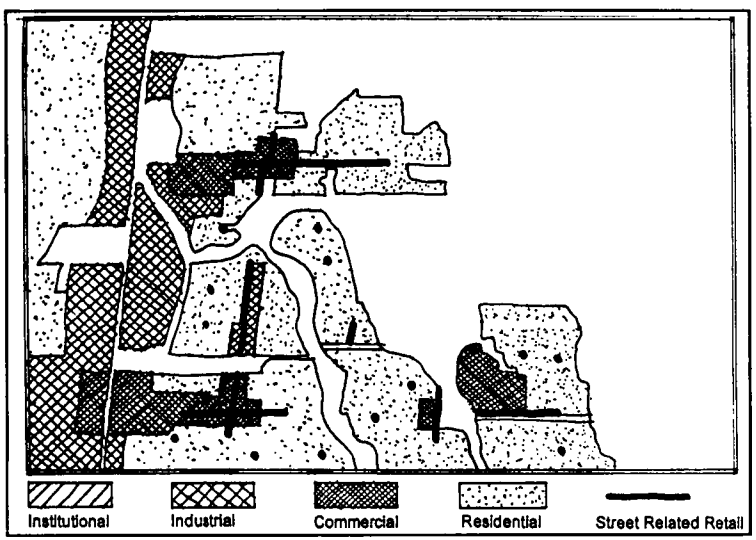
Geographic Features



Road Network

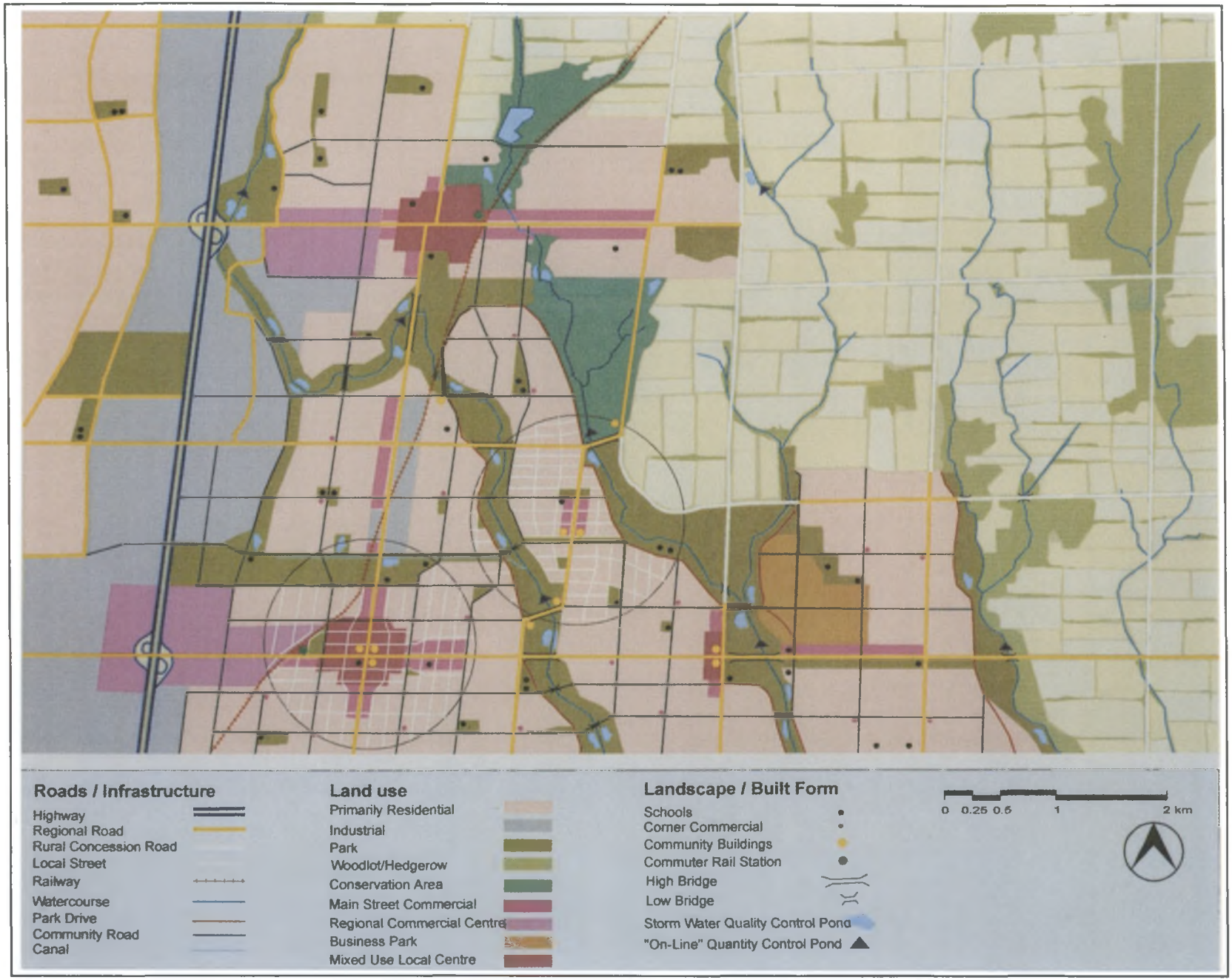


Open space and Schools



Land Use

ANALYSIS DRAWINGS



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3.3.3 Connections

AN INTEGRATED NETWORK OF GREEN AND BUILT CONNECTIONS CONDUCTS ACTIVITY AND MOVEMENT THROUGHOUT THE INTEGRATED COMMUNITY.

This network of connections includes the following modes: roads, transit, parks, streets, passive and active open spaces, sidewalks and trails.

This network of connections permits people to travel by all modes throughout the community.

Connections are designed to be accessible and safe.

Any one connection should be comprised of a combination of modes such roads, bikeways, walkways with transit routes/stops.

The Region of Ottawa-Carleton Plan review process is recommending that the Transportation Master Plan component include new measures to define Quality of Service based on the relationship of demand to available capacity. This capacity would incorporate anticipated modal split and number of persons/vehicle as factors, thus recognizing the potential of transit and car-pooling for increasing the capacity of road networks.[33]

Geary Blvd in San Francisco is a multi-modal street with a 38m ROW, 30m roadway, 5 lanes, sidewalks of 13, landscaped corridors and buildings set at the property line.[32]

Portland's Regional Transportation Strategy proposes multi- modal arterials which incorporate on street parking, 18m travel widths, bicycle and pedestrian pathways.

Figure 6: The Rideau Canal in Ottawa is a water transportation link to the Great Lakes, a setting for some of Canada's most important monuments and a linear park that connects the open spaces in Parliament Hill through to Carleton University and Vincent Massey Park

Figure 7: The careful design of Riverdale Park in Toronto's Don Valley preserves natural green space, provides opportunities for active and passive recreation while integrating some of the City's most important transportation and service networks

Portland, Oregon's Master Park Plan establishes the '40 Mile Loop' which builds upon existing greenways to eventually encircle the city with a network of trails, bicycle routes, parks, the riverfront and major destinations.[34]

Figure 8: Smaller, low level bridges enhance the experience of natural features, calm traffic and can be less expensive to build

GREEN CONNECTIONS

NATURAL AND CULTURAL FEATURES ARE INTEGRATED INTO THE URBAN FABRIC IN A MANNER WHICH ENHANCES THE URBAN FORM AND RESPECTS NATURAL FEATURES.

These features are actively incorporated into the plan from the start to create an integrated green system.

Natural features, by their nature, are an existing condition that should be integrated into a community. They should be treated as elements which structure urban form.

The preservation of linear open space systems without sufficient transportation crossings can fragment community form. A critical review of the function of natural corridors and community connectivity is needed to strike an appropriate balance.

The construction of bridges (ranging from pedestrian to 'low' and 'high' multi-modal bridges) enhances the experience of natural features and the quality of life in the community.

The impact of future land use on habitat populations must be recognized (i.e. preserving a corridor for deer movement may not make sense when the reason for their current presence and movement is to feed on corn grown on future residential areas).

There are numerous crossings of 'natural' preserves by community roads in the Integrated Community. 'Critter-friendly' road design could balance road needs against recreation and habitat preservation, to the mutual benefit of all stakeholders.

BUILT CONNECTIONS

BUILT CONNECTIONS ACCOMMODATE AND INTEGRATE A FULL RANGE OF TRANSPORTATION OPTIONS

ROADS

THE CONVENTIONAL SPECTRUM OF ROAD TYPES IS EXPANDED

A highly connected grid of 'community' roads is introduced as an infrastructure element prior to subdivision and development of the land. This is essential to obtaining a road fabric that transcends the arterial grid and facilitates connections for local trips by providing an alternative to regional arterials.

The designated community roads traverse individual neighbourhoods and therefore dictate the location of a through road within a given site.

A finer grid of local streets is essential, and should be specified in development control policy and regulations, once a comprehensive network of community roads is assured.

Performance standards can assure adequate weaving of local streets into the community road network.

The local street hierarchy consists of a fully developed family of 3-4 small streets or lane types of 2 way traffic in which flow is restricted by design measures such as traffic calming mechanisms

Roads of all types border most of the appealing topographical features in order to: bring the benefits of these features to the public; put the frontage firmly in the public realm; and create the opportunity for the

The community road network is spaced at 400-800 metre intervals between major streets, within which there are 6-12 blocks.

In denser commercial areas this grain should be smaller, ie +/- 200 metres.

Major streets should generally not exceed 4 lanes plus one turning lane, transit or HOV lane

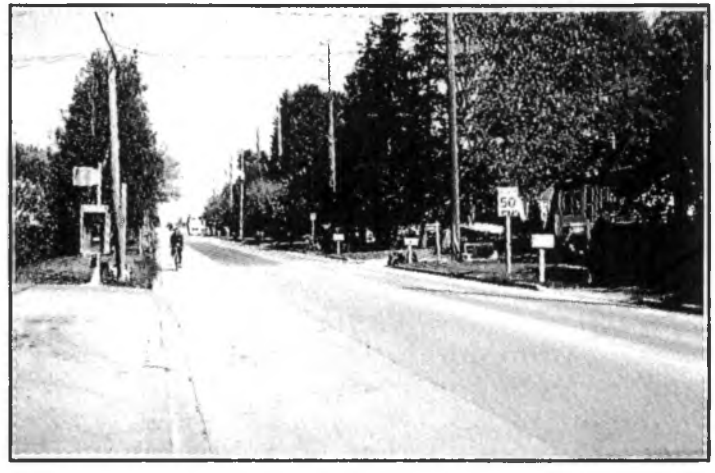

Figure 9: A finer grid of community arterials could take several forms, one of which could be like Ninth Line in the Town of Box Grove, Region of York

The Four Mile Creek development in Boulder Colorado used an annexation ordinance to vary city standards and to broaden the residential street guidelines to include the entire movement network and urban design guidelines[35]

Figure 10: A drive down Rosedale Valley Road in Toronto introduces a few minutes of nature into the day's commute to

value of the natural amenity to be carried "inland" into the community for many blocks.

The art and science of parkway design, having almost passed into extinction, should be reconsidered especially for roads along natural features such as rivers.

All streets should have fronting uses that 'turn toward' the street. This is an integral part of vital and safe streetscapes.

Landscaping features should be specified in order to formalize the relationship between forestry and road engineering.

BICYCLES

PLANNING FOR BICYCLE TRANSPORT SHOULD PARALLEL EFFORTS FOR VEHICULAR ROADWAY PLANNING

These tools include a reproducible, consistent way to measure the bicycle 'Level of Service' (counterpart to highway Level of Service) and a simple menu of facilities with a standardized nomenclature. Bicycle planning should develop a process similar to that for highway planning, in which a long range plan is regularly and predictably 'taken down' into next year's annual work program of standardized steps, such as design, right-of-way purchase, etc.

The provision of a dense and highly connected local street system assures bicyclists of a continuous and connected system exclusively on low-volume, low speed roads.

The roads bordering appealing topographical features are high- priority locations for integrated bicycle facilities, such as lane and off-street paths.

The same tools long enjoyed by vehicular roadway planning should be used for planning bicycle transportation.

TRANSIT

A VIABLE TRANSIT NETWORK IS ENSURED THROUGH PLANNING DENSITIES, CONNECTIONS AND INCREMENTS OF SERVICE

Arterial streets are the logical candidates for transit routes, whether bus or Light Rail Transit (LRT). The concentration of retail activity along

arterial streets could prove to be a 'transit friendly' feature, similar to the original 'streetcar strips'. The challenge lies in site development guidelines that produce a transit friendly environment along the arterials, while initially catering to almost exclusive automobile access.

Arterial streets, with the addition of service and provision for parking at the rear of buildings, allowing buildings to front onto the street, can evolve into attractive spines of development.

A tiered transit system would provide a community service on major roads and would connect with a series of smaller local routes servicing neighbourhoods.

3.3.4 Distribution of Uses and Facilities

A FLEXIBLE FRAMEWORK SUPPORTS AN INTEGRATION OF USES AND FUNCTIONS, ENCOURAGES DIVERSITY AND EFFICIENCY OF SERVICES.

LAND USE

A FINE GRAIN OF USES AND INTEGRATION OF THOSE USES SHOULD BE PROMOTED

A mixture of uses is encouraged throughout the community. The degree of mixture peaks in nodes and diminishes as one radiates from the nodes.

A community should offer opportunities to have work and play for all ages. Uses are generally organized to complement natural features and the capacity of infrastructure elements. Areas with the greatest access to multi-media transport perform a regional function and permit such functions as regional mall, regional employment centre, and industry.

A variety of scales of shopping and employment uses are provided which range from corner store to big box retail types or from home office to study space to office space to studio space to the home office.

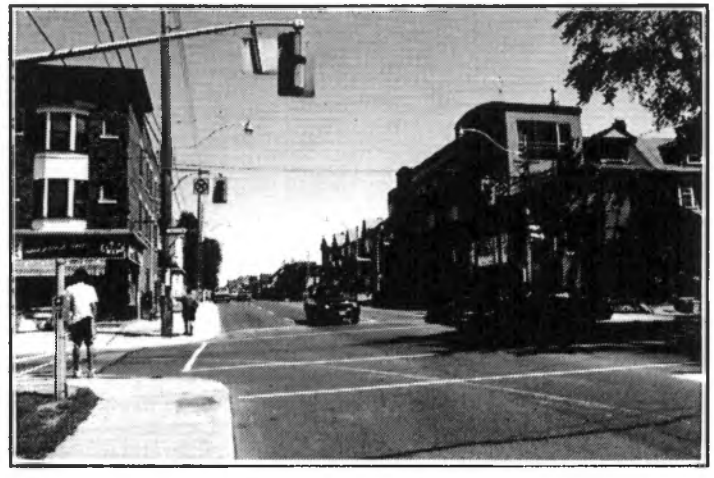

Figure 11: Harbord Street, Toronto: Arterials can support many different uses

Promote a ratio of 1:1 jobs per member of labour force resident in community

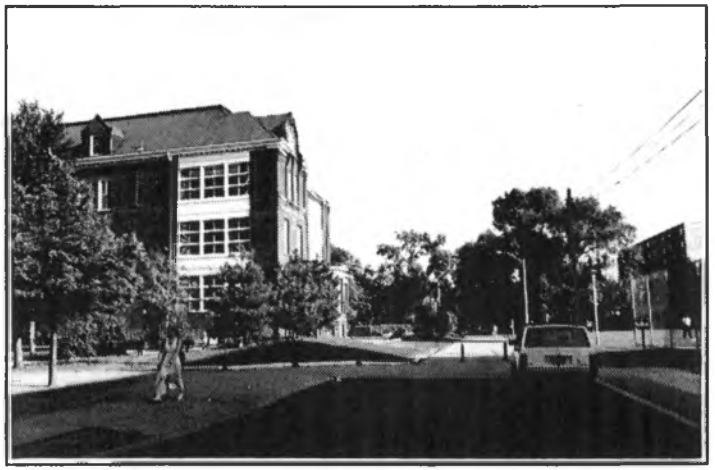

Figure 12: Winchester School, Toronto: The school and playground (left), public street and pedestrian connection (centre) and public park are visually and spatially integrated creating a safe environment and intensive use of neighborhood amenities

Figure 13: Complicated changes in grade separate the entrance from the street and playground, so that any potential for shared amenities or 'eyes on the street' is lost

COMMUNITY SERVICES

COMMUNITY SERVICES ARE ASSEMBLED AND DESIGNED TO EFFECTIVELY MEET PROJECTED NEEDS OF THE COMMUNITY AND ENHANCE URBAN FORM

Efficiency of services is achieved where possible through combining facilities.

Multi-functional design of buildings recognizes an evolution of uses and builds flexibility into capital infrastructure.

Planning regulations and permissions should allow for the evolution of buildings and uses and promote multi-functional buildings.

Relationships between schools sites, parks and the surrounding neighbourhood should be enhanced by means of higher densities, orientation f housing to the civic sites and promotion of a compatible mixture of adjacent land uses.

School buildings, community centres and parks should be seen as civic buildings and celebrated in the surrounding context.

Standardization of school/park/community centre packages should be dismantled and a greater variety of combined facilities should be developed.

Opportunities to integrate schools and parks directly into the urban fabric (ie. schools in main street buildings) should be explored.

School and parks should use on-street parking, where feasible.

The McNabb complex in Ottawa is a multiple use facility built in 1966 on a small site in central Ottawa. The site incorporates a public school, a community centre with indoor gyms and meeting rooms and a hockey arena. More recently, two Ottawa-Carleton School Boards were partners in a joint venture complex called Ray Friel Recreation Centre/Sir Wilfred Laurier High School which combines the school and a shared comprehensive community recreation facility on less land than the stand alone facilities would have required. [36]

INFRASTRUCTURE

DESIGN OF STORM WATER MANAGEMENT AND FLOOD CONTROL FACILITIES SHOULD BE INTEGRATED WITH NATURAL FEATURES AND INTO NEIGHBOURHOOD DEVELOPMENT PATTERNS

Stormwater for the community should be based on watershed/subwatershed studies which should be completed as comprehensive appraisals of environmental, flood erosion and cost factors specific to the area of study. This approach would allow stakeholders to create cost effective and balanced stormwater strategies.

Flexibility in floodplain management should be provided to permit modifications to floodline/development limits where environmentally acceptable technical solutions exist.

Decisions to preserve upper reaches of watercourses would be integrated with land use decisions.

The placement of appropriate park functions in floodplain areas should be recognized and credited.

A greater acceptance of stormwater facilities as 'natural community features' and not as a segregated land use should prevail.

Reviewing agencies should consider for cost consequences generated by blanket policies when looking at alternative solutions.

Figure 14 Dual Land Use Facility Park/Major System Pond, Markham, Ontario

Figure 15 Parkland located in floodplain during extreme flood event, Aurora, Ontario

Figure 16 Stormwater Pond in Ajax, Ontario - pond site located in valley adjacent to ESA - during construction

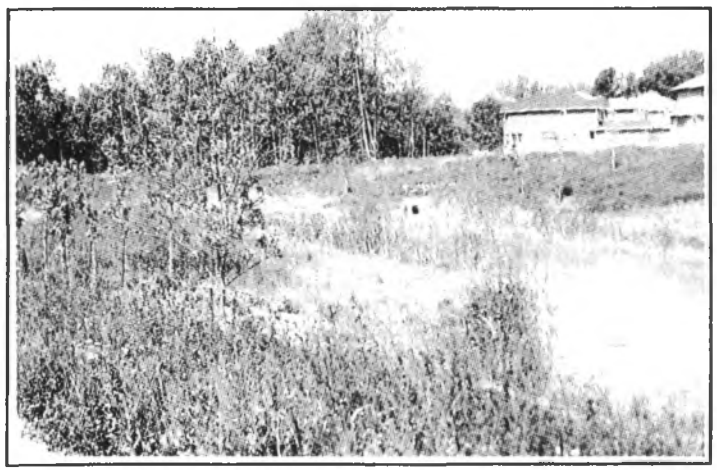

Figure 17 Stormwater Pond in Ajax, Ontario - after construction

The Town of Markham for the past ten years has been using parkland to provide for major system stormwater quantity control. This is considered a compatible use and is given a park credit when the design of the block fully supports its recreational function. Typically parks can be designed to provide 4000 m³ of storage per gross hectare. Maximum depth of ponding can usually be maintained at less than 1.5 metres during the 100 year return storm.[37]

Several parks have been constructed to serve this dual function and in their ten years of service the Town of Markham has experienced no downtime on active use facilities as a consequence of the shared stormwater function. Figure 14 illustrates a park that serves this dual function. Note in Figure 14 that the park grading is set lower than the roadway to receive overland flows that will occur during extreme flood events.

Many examples exist of park facilities that have been built in floodplain lands. Passive uses in such a park can, for all practical purposes, be considered as unconstrained while most active use facilities can be provided with only modest constraints. Figure 15 illustrates a park in Aurora, Ontario undergoing flooding following a severe storm event. During most years only passive areas of the park are affected under spring runoff conditions.

While cases do exist where environmental impacts of valley sitings of stormwater ponds are inappropriate, many cases do exist where valley pond sites work very well and can add diversity to the valley environment. Figures 16 & 17 show a valley pond site that was located adjacent to an environmentally sensitive area in Ajax, Ontario. Figure 16 was taken during the construction period (Nov. 1993) and Figure 17 was taken about 1.5 years later (June 1995) after restoration plantings had been established. Its easy to see that within a five year period following construction that the disturbed area will be well on its way to completely blending into the valley environment.

ELEMENT	URBAN		CONVENTIONAL SUBURBAN		INNOVATIVE NEW DEVELOPMENT	
	Typical Development Standards	Resultant Urban Form	Typical Development Standards	Resultant Urban Form	Typical Development Standards	Resultant Urban Form
Open Space *Parks* *Hazard lands* *Storm water*	Parks ▸%dedication or per capita standard ▸0.6-2.0 hectares/1000 pop ▸5-10% dedication Hazard Lands ▸traditionally no standards ▸currently ecological restoration efforts underway Storm Water Management ▸hard engineering approach	Parks ▸large singular parkland ▸open space systems along major geographical features ▸many small and irregular parcels of parkland Hazard Lands ▸obliterated by development Storm Water Management ▸channelization of storm water ▸No quality control	Parks ▸1-4 hectares ▸integrated with storm water features Hazard Lands ▸ESA and Environmental Reserves Storm Water Management ▸100 year standard ▸quality standards established	Parks ▸larger, more standardized parcels of parkland ▸parkland linked with open space systems ▸privatization of access: reverse lotting Hazard Lands ▸access is privatized: reverse lotting Storm Water Management ▸isolated from other open space uses	Parks ▸standards related to access and walking distance to the park ▸introduction of small and informal parks Hazard Lands ▸protection of significant natural features Storm Water Management ▸combined uses ▸exploration of alternative to 100 year standard	Parks •greater range of park types ▸greenlands 'system' Hazard Lands ▸protection of significant natural features Storm Water Management ▸integrated as part of community plan
Schools	•traditionally no standards •average site size of 1-3 hectares	•many, small sites •range of typologies •interact with surrounding urban form	Elementary school: 2.5+ hectare sites Secondary school: 6-8 hectare •shared use sites are encouraged	•larger sites •located adjacent to or in relation to green open spaces •one storey buildings	•sites are negotiated as part of community design •shared uses are encouraged by funding constraints	•schools share sites with other facilities; open space and dry ponds, creating a public realm
Transportation *Roads* Thoroughfare Placement	800 - 1500m	Urban Grid	Section (1600m) or Existing Rural	Sparse, dendritic	400 - 800m	Small, internal connected cell in isolated context
Local Street Placement	75-100m, specified block size	Dense rectilinear grid	None or "minimum" indicated by lot layout	Curvilinear dendritic	Small block size, 75-100m	Small highly connected; contrived configuration
Throughfare Design Speed	Defacto, less than 40kph	Business-friendly arterials	Maximum affordable 75-90kph	Strip Development	Constrained to 50ph	Residence/Business friendly
Local Street Design	Defacto	Fronting resident, business and institutional	Maximum affordable	fronting residential only	Constrained to 35kph	Fronting residential and local business/institutions
Throughfare Faverment Width	15-25m	Traditional neighborhood	10-15m	Free-flow local streets	5-8m	Queued streets
Transit						
Level of Service (LOS) Standard	Inherited from past transit	Dense transit service	no LOS standards	Meager transit service	No LS standards	Meager transit service
Cycling						
On Street Routes/Lanes Throughfare	None	Cycling generally difficult	None	Cycling generally impossible	Marked lanes on streets	Superior bicycle mobility
On-street Routes, Local Streets	None	Cycling attractive on local streets	None	Cycling acceptable	None	Cycling attractive
Land Use *Density* *Mixture*	•existing densities are dependent on urban context •proposed densities based on combination of employment/residential	•Finely grained mixture of uses •densities higher than surrounding suburban areas •intensity around mixed use areas such as main streets	•mixture of use targets as a ratio or a number	•lower densities (2-2.5 uph) •coarse mixture of uses	•Density of 2 - 2.5 uph •residential and employment targets •neighborhoods defined by walkable distances of 450 m radius	•greater mixture of uses •intensity of mix concentrated at nodes •residential densities similar to conventional development •more compact use of public spaces; sharing of facilities

INTEGRATED COMMUNITY	
Typical Development Standard	Resultant Urban Form
Parks ▸local parks within a 250 m radius of residents and employment ▸Regional parks within a 5 minute transit trip or drive Hazard Lands ▸protection of significant natural features Storm Water Management ▸integrated with other open space uses ▸on-line ponds	▸Integration of open space, hazard lands and storm water control as an integral part of greenway connections throughout the community
•Sites combine a spectrum of activities (2-3uses) •on-street parking, where feasible •transit accessible •buildings are multistoried	•greater variety in types of school facilities •schools located within both urban settings (main streets) and greenway settings
400-800 m intervals	Highly connected, in natural context Dense, highly connected; configuration driven by natural features Friendly to all uses
6-12 blocks between major streets; maximum block size, around 100m	All land uses fronting Superior bicycle mobility
Constrained to 50 kph	Superior bicycle mobility
Constrained to 25 - 35 kph	Multi-use street
10 - 15m	Queued streets
5 - 8m	
15 - 30 minute LOS	Superior bicycle mobility
Marked lanes on streets	Cycling attractive
None	
•Ratio of 1:1 jobs per member of labor force resident in community •density dependent on context	•mixture of uses throughout the community •a variety of scales for all uses: local to community

3.3.5 A Proposed Direction for Development Standards

This study has explored the current status of development standards and identified current innovative approaches. Table [1] summarizes the existing status of regional development standards, current innovations and translates the principles developed for the Integrated Community into a proposed direction for development standards.

These are general directions which must be adapted and refined to the local context but are intended to provide an alternative framework from which to approach regional development standards. Built within this framework are opportunities for an integration of functions and an encouragement of variety, diversity and complexity.

3.4 Addressing Obstacles

At present, there are a number of obstacles which impede the implementation of alternative approaches to regional development standards.

Bureaucratic fragmentation

The division of responsibilities for regional urban development amongst many specialised departments inhibits an integrated approach. Overcoming this problem would involve the redesign of regional governments and other responsible agencies to integrate the different functions, but particularly transportation, planning, and natural systems functions into a single, comprehensive decision-making process. Alternatively, within individual organisations planners could take on the role of coordinators and synthesizers, serving to integrate the various disciplines and departments. As many relevant agencies and departments as possible that currently lie outside the development process, must be brought into it and made part of a comprehensive process.

Bureaucratic culture

At present, the culture of local and regional governments does not reward innovation. A major problem stems from the fact that government employees are cast in the role of discipline-specific regulators and reviewers, not as problem

solvers. They are frequently positioned outside the development process, and do not feel responsibility or 'ownership' for a project.

Governance rationalisation and increasing local autonomy over local infrastructure may alleviate some of these issues. There remains, however, a need to rethink bureaucratic culture and to provide incentives to staff to initiate improvements in which broad financial, environmental or other benefits are evident.

Upper tier and professional association guidelines

Upper tier governments and professional associations typically sanction standards and practice within a given field. Members of the transportation profession, for example, rely heavily on the Institute of Transportation Engineers standards, and the Transportation Association of Canada. In Canada, upper tier governments publish road and other standards which must be met in order to receive funding for construction or replacement. Such standards are slow to be revised. As practising professionals look to these agencies, they must provide some leadership and initiative, and form a proactive part in the movement toward new, integrated standards.

Funding policies and practices

Current infrastructure funding practices often encourage expensive or over-capitalised solutions, and do not encourage the search for more efficient use of infrastructure. Upper tier governments do not typically require, prior to funding infrastructure, a demonstration that the need for the investment has been minimised through demand management measures such as pricing mechanisms or land use. Local funding mechanisms such as development charges or property taxes often provide a hidden subsidy to inefficient development. These practices must be reviewed if the benefits of alternative regional development standards are to be made clear, and new standards implemented. This should include moving toward a more comprehensive, full-cost accounting methodology for assessing the costs and benefits associated with infrastructure, which include external costs such as emissions, congestion, publicly-borne accident-related policing and medical costs, etc.

Planning for Infrastructure

Greater flexibility in land use is often prevented because of claims that such flexibility makes it impossible to plan for infrastructure and other facility needs. For example, arguments against allowing accessory apartments in residential areas suggest that they would make it impossible to predict the number of school places required. This problem can be partly overcome by designing for more heterogeneous neighbourhoods that are not subject to 'boom and bust' cycles of conventional suburbia. Establishing a condition of diversity in communities encourages adaptability and enhances the ability of communities to evolve. Also actual use of services such as roads, water, and sewer leads to more effective use of infrastructure and provides a built-in monitoring mechanism regarding usage.

Operational obstacles

New standards are often opposed on the basis that proper maintenance and servicing cannot be undertaken because existing equipment does not suit different types of roads, sizes of parks, etc. Appropriate equipment exists (ie., fire trucks, snow plows and floor polishers) and its purchase can easily be phased in conjunction with the adoption of alternative development standards.

3.5 Areas of future research

This report has pointed to a number of key areas in which future research in the area of regional development standards would be useful.

Obstacles to alternative standards.

In general, the bureaucratic and regulatory obstacles are well known, and of course vary from place to place. What is perhaps universal is the need to find means of promoting and rewarding innovation in local, regional and provincial government settings - to 'reinvent' local government in a similar manner to that undertaken at higher levels. In addition, the question of professional education and the role of professional associations in promoting cross-disciplinary understanding needs to be addressed.

Practical experience.
One of the main obstacles to implementing alternative development standards at the regional level is the lack of existing contemporary examples that can be pointed to, where alternative standards can be shown to be effective and functional. As new standards start to be implemented, they should be monitored, and their performance, cost and maintenance evaluated in comparison to infrastructure constructed according to conventional standards.

Accounting methodologies
The costing methodology for infrastructure is often extremely narrow, and does not usually reflect the 'full costs' associated with infrastructure. The high degree to which local development patterns govern the costs of regional infrastructure such as roads, sewer and water networks, and transit; measurable costs related to regional infrastructure such as publicly-borne health care costs associated with traffic accidents or road policing; and less easily quantifiable costs such as emissions and congestion must be factored into decision-making. A consistent and widely accepted methodology needs to be developed for this to happen.

Retrofitting Non-viable Areas
Despite the obstacles outlined in this report, dealing with yet-to-be-developed areas is likely to be substantially easier than addressing infrastructure issues in the already-built, conventional auto-dominated, post-war suburb. Specific strategies will have to be developed to address the long-term retrofitting of the suburbs toward more efficient use of infrastructure, in order that when opportunities arise they can be exploited.

Other elements of regional infrastructure
There are other elements of regional infrastructure which have not been considered in this report, which nonetheless represent significant investments and should be considered in further rounds of research. Such elements might include: water and sewage treatment facilities, waste management, hydro corridors, local power and/or heat generation, and environmentally sensitive areas and bridges.

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