

***EAST CLAYTON***

***NEIGHBOURHOOD  
CONCEPT PLAN (NCP)***

***MARCH 2003***

***BUILDING A SUSTAINABLE NEIGHBOURHOOD***



**A. ADOPTION OF MINUTES**

**1. Council-in-Committee - March 3, 2003**

- (b) The recommendations of these minutes were considered and dealt with as follows:

**Item No. C007** East Clayton Neighbourhood Concept Plan (NCP)  
Stage 2 - Engineering Servicing Plan  
File: 6520-20 (EC)

It was Moved by Councillor Higginbotham  
Seconded by Councillor Tymoschuk  
That:

1. Council adopt the engineering servicing and financial strategies as outlined in this report and as specified in East Clayton NCP as the means of managing engineering services for this neighbourhood;
2. Council adopt a staged approach to sustainability by requiring all development in East Clayton to provide the base level of sustainability as described in this report; and
3. all development in East Clayton NCP be required to provide the enhanced level of sustainability as described in this report until grant funding for the on-lot infiltration devices is exhausted.

RES.R03-662

Carried



# Corporate Report

NO: C006

COUNCIL DATE: March 3, 2003

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## COUNCIL-IN-COMMITTEE

TO: Mayor & Council DATE: February 24, 2003  
FROM: General Manager, Planning & Development FILE: 6520-20(EC)  
SUBJECT: East Clayton Neighbourhood Concept Plan Stage 2 – Final Report

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## RECOMMENDATION

The Planning and Development Department recommends that Council:

1. Approve the Neighbourhood Concept Plan (the "NCP") for East Clayton as contained in Appendix I (Appendix I was forwarded in a separate package);
2. Approve the arrangements, performance standards and design guidelines specified in the NCP for managing the development of and for providing services, amenities and facilities for East Clayton;
3. Instruct the Acting City Clerk to introduce the necessary by-law to amend Surrey Zoning By-law, 1993, No. 12000 (the "Zoning By-law"), as documented in Appendix VII, to include amenity contributions for the East Clayton area, based upon the density bonus concept;
4. Instruct staff to bring forward any required amendments to the Official Community Plan (the "OCP") concurrently with applicable rezoning applications in East Clayton;
5. Instruct staff to bring forward an amendment to the Surrey Sign By-law, 1999, No. 13656 (the "Sign By-law") to incorporate restrictions on the heights of signs on 188 Street, Fraser Highway and 64 Avenue, in the commercial and business park areas in East Clayton, in accordance with the provisions of the proposed East Clayton NCP; and
6. Instruct staff to establish a City Project Team to guide implementation of the East Clayton NCP.



## **PURPOSE**

The purpose of this report is to advise Council about and obtain Council approval for:

1. The complete and final NCP for the East Clayton area;
2. The adjustments made to the approved Stage 1 Land Use Plan;
3. The funding mechanisms for amenities proposed for the East Clayton NCP area and the associated Zoning By-law amendment; and
4. A process for subsequent OCP amendments needed to implement the East Clayton NCP.

A report, under separate cover, from the Engineering Department describes the servicing and infrastructure funding arrangements associated with the development concept contained in this report.

## **BACKGROUND**

The East Clayton NCP area is bounded by 64 Avenue and Fraser Highway to the south, 72 Avenue to the north, 196 Street (Surrey/Langley border) to the east and 188 Street to the west. The East Clayton NCP area comprises about 250 hectares (562 acres). East Clayton is part of the larger Clayton area, which consists of about 900 hectares (2,000 acres).

On January 25, 1999 City Council approved the General Land Use Concept, Servicing Strategy and Master Drainage Plan for the entire Clayton area as a basis for preparing a more detailed NCP for East Clayton. The overall "General Plan" approved for Clayton, envisages a strong, unique community structure and identity to be realized through:

- a village and large civic centre (community hall, parks and schools) near 72 Avenue and 188 Street;
- a suburban "fringe" adjacent to the Agricultural Land Reserve;
- higher residential densities near Willowbrook and near the village centre;
- eight future neighbourhoods, two of which comprise East Clayton;
- an employment centre (business park) in the East Clayton area, near Fraser Highway and 192 Street; and
- abundant park areas, greenways and natural areas.

### **Principles of Sustainability**

As part of the approval of the "General Plan", City Council instructed staff to explore the application of sustainable development principles, standards and practices in the detailed planning process for East Clayton. Accordingly, the preparation of the East Clayton NCP has been based upon the seven principles of sustainable development, which were identified through the "Surrey Charrettes" (1996 in South Newton) and the subsequent "Alternative Development Standards Workshop" held in 1998. These principles are as follows:

1. Conserve land and energy by designing compact walkable neighbourhoods. This will encourage pedestrian activities where basic services are within a five to six minute walk of all homes;
2. Provide different dwelling types in the same neighbourhood and even on the same street;
3. Communities are designed for people; therefore, all dwellings should present a friendly face to the street in order to promote social interaction;
4. Ensure that car storage and services are handled at the rear of dwellings;
5. Provide an interconnected street network, in a grid or modified grid pattern, to ensure a variety of itineraries and to disperse traffic congestion and provide convenient public transit to connect East Clayton with the surrounding region;
6. Provide narrow streets shaded by rows of trees in order to save costs and to provide a greener, friendlier environment; and
7. Preserve the natural environment and promote natural drainage systems.

## **DISCUSSION**

### **Development Concept**

On November 8, 1999 City Council approved, in principle, the development concept component (Stage 1 Land Use Plan) of the East Clayton NCP (Appendix II). This plan, developed with assistance from the UBC James Taylor Chair in Landscape and Liveable Environments and with funding from various levels of government, involved a very extensive charrette and public consultation process with citizens, stakeholders and numerous government agencies and utility companies, was premised upon principles of sustainability and received general acceptance from the various stakeholders.

As a result of the first applications processed in East Clayton and a detailed review of the plan from transportation and drainage perspectives, some modifications were made to the November 8, 1999 Land Use Plan (Stage 1). The modified Land Use Plan (Appendix III) was presented to the public at an Open House on September 25, 2002. The purpose of the Open House was as follows:

1. To highlight proposed modifications to the Land Use Plan;
2. To present an overview of the proposed design guidelines and performance standards for the various components of the Land Use Plan, land uses, municipal services, phasing, overall green infrastructure and cost estimates to support the Land Use Plan;
3. To outline the proposed amenity contribution requirements for park development, fire, police and library services in East Clayton;

4. To provide the East Clayton property owners and the general public with an opportunity to comment on the proposed modifications to the Land Use Plan and on the design guidelines, servicing, phasing and funding proposals; and
5. To complete the public participation process before Council adopts the final East Clayton NCP (Stage 2).

Planning and Development staff took into account, in completing the Land Use Plan, the comments received from the public at and after the Open House. The major changes between the Land Use Plan presented at the Open House (Appendix III) and the proposed final Land Use Plan (Appendix IV) are described below. The area identified in the heading on each of the following sections is illustrated in the plan attached as Appendix V.

***Area "A" (as illustrated on Appendix V)***

The Land Use Plan considered by Council as part of the NCP (Stage 1) approval on November 8, 1999 illustrated two primary designations in Area A. These were a **Live/Work (70% Residential and 30% Business) designation** along both sides of 68 Avenue and a **Work/Live (70% Business and 30% Residential) designation** along the north side of 67 Avenue, north of the Business Park designation. The density envisioned in these two designations was medium-high residential density ranging from 15 to 25 units per acre. The intent of these designations was twofold. Firstly, to provide for innovative housing with opportunities for small scale businesses to be operated within a residential area. The businesses in these designations would have more flexibility than the "home-based businesses" currently permitted in some residential zones in the Zoning By-law. Secondly, to create a transition zone between the single family residential areas to the north and the business park land uses to the south.

The owners of the properties that were proposed for these two new designations expressed reservations about this concept. They advised that this land use concept has not been proven viable, to date, in Surrey and they had concerns that there is no market demand, at this time, for this form of land use. They also expressed concerns about its compatibility with the existing residential uses in the area.

Following further discussions with the subject property owners, the Land Use Plan has been adjusted to change the Live/Work and Work/Live designations, including the small portion designated as Neighbourhood Commercial, to a single new designation called "Special Residential". This designation will allow residential developments at a slightly lower density of 10 to 15 units per acre in the form of small single family residential lots, townhouses and row houses as a principal use and will permit work places (such as artist studios, hair salons, business offices, coffee shops, etc.) as an optional additional use, at a small scale within the dwellings or in ancillary buildings and rear garages on the same lot as the dwellings. This new designation addresses the concerns of the property owners and ensures that business and working opportunities are provided within the neighbourhood while allowing for a better fit with the existing and proposed residential uses. As a result of this change in designation, the cul-de-sac off the north side of

67 Avenue, immediately west of 192 Street, as shown in the Stage 1 Land Use Plan, has been reoriented to 68 Avenue to better fit with the boundaries of existing lots.

***Area "B" (as illustrated on Appendix V)***

The Stage 1 Land Use Plan designated this area between 188 Street and the Business Park designation to the east, as Live/Work. To address concerns from the owners of the property in this area about the viability of the Live/Work designation and to reflect and relate better to the proposed commercial rezoning to the west of 188 Street (currently at Third Reading), the front halves of the properties in this area, fronting 188 Street, have been redesignated from Live/Work to Neighbourhood Commercial. The designation on the rear half of these properties has been changed from Live/Work to Business Park to expand and reinforce the opportunities to locate businesses in the East Clayton community. As a result of these land use changes, the westerly north/south street, connecting 67 Avenue and 68 Avenue, has been deleted so as to eliminate potential problems associated with intersection spacing along 68 Avenue.

***Area "C" (as illustrated on Appendix V)***

The Stage 1 Land Use Plan indicated three designations between 188 Street and the north/south pedestrian/bike corridor to the east of 188 Street. These were: Neighbourhood Commercial facing 188 Street; Medium-High Density Residential (15 to 25 units per acre) facing 68A Avenue; and Live/Work facing 68 Avenue. To address the concerns of the owners of properties in this area, regarding the viability of the Live/Work designation and to reflect the changes made in the Area "B", the pedestrian/bike corridor has been reconfigured and the Neighbourhood Commercial designation has been expanded. The expanded Neighbourhood Commercial designation in this area is compatible with the proposed Neighbourhood Commercial designation to the south and will compensate for the area of Neighbourhood Commercial designation that has been deleted from the plan at the intersection of 68 Avenue and 190 Street.

***Area "D" (as illustrated on Appendix V)***

The Stage 1 Land Use Plan did not show any access from Fraser Highway into the Business Park area and it illustrated a pedestrian connection, north from Fraser Highway in line with 189 Street via an open space corridor. Concerns were expressed, through the public consultation process, that the proposed Business Park area should have direct vehicle access from Fraser Highway, a major transportation corridor. The Stage 2 Land Use Plan eliminates the open space corridor and extends 189 Street south to provide a right-in/right-out intersection into the Business Park area from Fraser Highway. This will also help in dispersing the Business Park traffic. There are three access points serving the Business Park area, two on 192 Street and one on Fraser Highway. Additionally, this change will allow the future transit transfer station, that is proposed within the Business Park area, to function more efficiently.

***Area "E" (as illustrated on Appendix V)***

The Stage 1 Land Use Plan (Appendix II) illustrated two detention ponds located on private properties: Pond "D", to the west of the 192 Street Diversion, to service the Business Park and Live/Work and Work/Live areas and Pond "E", to the east at the existing intersection of 192 Street with Fraser Highway, to service the area generally between the 192 Street Diversion and the existing 192 Street. Upon further review by the Engineering Department to address concerns about the maintenance of the private detention ponds and the impact of the detention pond on the development of the property designated for Business Park use, the previous two ponds have been combined into one community pond on the Stage 2 Land Use Plan. The combined pond, shown on Appendix V as Pond "D", is located to the north-east of Fraser Highway and 192 Street Diversion intersection. Also, in this area, a small park located to the north of 65 Avenue and the road connection to 65 Avenue, that were both illustrated on the Stage 1 Land Use Plan, have been deleted. This was done to increase the residential development area and reduce potential traffic impacts.

***Area "F" (as illustrated on Appendix V)***

To allow more area for townhouse development within this area, the large community detention pond, shown on Appendix V as Pond "B", has been reduced in size and relocated to the north to better serve the development of the residential area in comparison to the Stage 1 Land Use Plan. The Medium Density (10-15 units per acre) areas located within the blocks to the east of 192 Street and west of 194 Street, between 65 and 66 Avenues, have been deleted and the Medium-High Density areas (15-25 units per acre) have been expanded within these two blocks, which will allow additional area for townhouses within the Land Use Plan. The High Density (25-45 units per acre) designation on the south side of 65 Avenue has been reduced in size and replaced with the Medium-High Density (15-25 units per acre) designation.

***Area "G" (as illustrated on Appendix V)***

The Stage 1 Land Use Plan envisioned this Medium-High Density area (15 - 25 units per acre) to be developed with small-scale street-oriented row house and town house type developments, within a finer grid of east-west streets, providing connections to the school/park site to the east. However, the owners of properties in this area expressed concerns about the impact of the finer street grid on their properties, wanting to maximize the development potential of each site by allowing for larger scale and more comprehensive townhouse developments. As a result, the Stage 2 Land Use Plan eliminates the finer street grid from this area, but retains the east-west connections by continuing 69 Avenue through the area and showing an open space corridor between two potential townhouse sites.

***Area "H" (as illustrated on Appendix V)***

The Stage 2 Land Use Plan illustrates an increased area for Medium-High Density (15-25 units per acre) residential development by replacing a major portion of the Medium-Density (10-15 units per acre) residential area. This change will provide for increased density next to the school/park site and benefit the East Clayton area, in general, by increasing the efficiency of the utilities and City services. The road pattern has been rationalized in the Stage 2 Land Use Plan as a result of this land use change, which creates larger areas for multiple unit residential developments at 15-25 units per acre.

***Area "I" (as illustrated on Appendix V)***

In this area, one additional block of residential lots has been proposed between the north-south open space corridor and 196 Street, to allow for more efficient use of the land in this area, as requested by the property owners. The area for Medium-Density (10-15 units per acre) residential has been increased, the road pattern has been slightly modified and intermittent lane/walkway connections to 196 Street have been introduced to facilitate traffic circulation and to break up the visual impact of long blocks. Additionally, the Neighbourhood Commercial designation, indicated in the Stage 1 Land Use Plan, on the property at the south-west corner of 72 Avenue and 196 street has been deleted with this property being redesignated as Medium Density Residential (10-15 units per acre). The owner of this property expressed a concern about the lack of demand for local commercial in this area. To achieve the objective of providing for basic commercial services within a five to six minute walking distance of the residences in this sector of East Clayton, a provision will be made to allow limited commercial uses in conjunction with the future medium density dwelling units at the corner of 72 Avenue and 196 Street. In addition to this, the Stage 2 Land Use Plan shows the Special Residential designation (10-15 units per acre) on a portion of the land further to the west on 72 Avenue. This will preserve the option of providing some limited local commercial and small-scale home-based businesses in the area in the future when the surrounding residential area is developed and a demand for basic neighbourhood services is likely to arise.

**Land Use Statistics**

The following summarizes the amount of land allocated within the Stage 2 Land Use Plan for different land uses, the estimated number of dwelling units, the population of the area and potential commercial and business park floor area at build out of the Land Use Plan:

***Residential***

The Stage 2 Land Use Plan provides for 119.8 Ha./296 Ac. of Residentially-designated land. The Land Use Plan anticipates between 3,352 dwelling units at the low end of the prescribed density range in the various residential areas to 6,038 dwelling units at the high end of the density range. Based on an average ratio of 2.8 persons per dwelling unit and 4,370 as the probable number of dwelling units at the base densities (as per Table 2.2 in Section 2 of Appendix I), the built-out population of East Clayton would be approximately 12,200.

### ***Commercial***

The Land Use Plan allocates a total of 8.58 Ha./21.20 Ac. to the various Commercial designations. At the built-out stage, the total amount of the commercial floor area is estimated to be approximately 40,000 sq. m./400,000 sq. ft., based on a floor area ratio varying from 0.3 to 0.5 depending on the specific commercial designation in the Land Use Plan.

### ***Business Park***

The Business Park designation covers a total area of 14.31 Ha./35.36 Ac. If the maximum floor area ratio of 0.75 is achieved, the total floor area on the land in this designation would amount to 107,326 sq. m./1,155,290 sq. ft. at build out.

### ***Institutional Uses, Schools and Open Spaces***

The land designated for institutional uses, such as churches, amounts to 0.6 Ha./1.5 Ac. The schools, parks, greenways and riparian areas occupy 33.7 Ha./83.27 acres and the existing BC Gas right-of-way occupies 12.73 Ha./31.45 acres of land within the plan area.

### **Design Guidelines**

Section 3 of the East Clayton NCP (Appendix I) contains a set of Design Guidelines for the Residential (including Special Residential), Commercial and Business Park areas. The purpose of the Design Guidelines is to achieve a pedestrian-friendly, high quality and co-ordinated neighbourhood that is consistent with the principles and objectives of sustainable development. The Design Guidelines describe the dominant characteristics that will be encouraged in these areas. Issues addressed by the Design Guidelines include the relationship of buildings to streets, built form and character, parking and garages, design response to the climate and design considerations for crime prevention. Appendix VI summarizes the characteristics that are to be encouraged in each of the referenced designations.

### **Amenity Requirements**

In accordance with City Council policy, to address the amenity needs of the proposed new development in East Clayton, all development proposals at the time of rezoning or building permit issuance will be required to make a monetary contribution toward the provision of new police, fire protection and library services and toward the development of the parks, open spaces and pathways.

The monetary contributions toward police, fire and library materials will offset the capital costs of providing these services to the new development and are applied on a standardized basis in all of Surrey's Neighbourhood Concept Plan areas. The monetary contributions toward parks, open spaces and pathway development are based upon an estimate of the capital costs of these improvements for this particular NCP area. The

total cost is divided by the anticipated number of dwelling units and acreages in the case of non-residential development to ensure an equitable contribution arrangement.

The sustainable design of the East Clayton community has resulted in shared development cost contributions for the development of some major parks and open space improvements, due to the dual function of many of these areas for both recreation and storm water management purposes. The natural features of the area (i.e., watercourses) are considered to be important components of both the natural passive recreation system and storm water management strategy.

### ***Parkland Development***

The East Clayton community will contain two neighbourhood school/park sites (one with a storm water pond/bio filtration amenity area), two riparian park areas, one linear park (greenway) and a series of five local parks.

The village and civic centre for the entire Clayton area is located immediately west of East Clayton (west of 188 Street) at 72 Avenue. An elementary school and a secondary school are located in the village centre along with a larger community park. The village centre may also contain civic buildings and other institutional uses such as churches or seniors' facilities. It is envisioned that the public spaces in the village centre will contain street furniture, special decorative light standards, walkways, urban plazas and special landscaped areas.

While the village centre, is in majority, located outside of East Clayton proper, the future development in East Clayton will benefit from the civic features, parks and other amenities in the civic centre. The specific design guidelines and precise types of amenities in the village centre will be determined when the detailed Neighbourhood Concept Plan for this area is prepared. However, it is prudent for the City to set up a development fund for the village centre in conjunction with development in East Clayton. It is estimated that East Clayton's share, (two neighbourhoods out of eight) of the total cost of the village centre amenity costs of \$1,064,000, is \$266,000. This will be collected on an equitable basis from development in East Clayton and will be held by the City to assist with the development of Clayton's village centre in the future.

Two gateway features are to be constructed at the 192 Street entrance into East Clayton from Fraser Highway, one on each side of 192 Street. The easterly feature will be integrated with the storm water detention pond (Pond "D") as an attractive water feature and has an estimated cost of \$10,600.

The estimated cost of developing park and related amenities in the future East Clayton community is approximately \$3,214,000 (2003 dollars). This amount includes \$10,600 as the estimated amount for the construction of the easterly gateway feature and \$266,000 as East Clayton's share towards the cost of the future village centre amenities.



***Library and Library Material***

A study of library requirements in Surrey's new neighbourhoods has established that a contribution of \$122.35 (in 2003 dollars) per dwelling unit (non-residential development is exempt) is necessary to cover the capital costs for library materials and services, which is sensitive to population growth. Consequently, a total of approximately \$535,000 will be collected from East Clayton towards materials such as books, computers and CDs.

***Fire and Police Protection***

Future development in this neighbourhood will drive the need to upgrade existing fire and police protection facilities. A study of fire protection requirements in Surrey's new neighbourhoods has established that a contribution of \$236.09 per dwelling unit and \$944.68 per acre of non-residential development (in 2003 dollars) will cover the capital costs for fire protection. Similar to Library Services, a contribution of \$54.46 per dwelling unit and \$218.65 per acre of non-residential development will cover the capital costs for police protection. This will result in a total capital contribution from East Clayton of approximately \$1,087,000 toward fire protection and \$250,700 toward police protection.

***Summary of Funding Arrangements***

A summary of the applicable amenity contributions (per dwelling unit or hectare/acre) and the estimated revenue the City can expect to receive from the East Clayton NCP area is documented in the following table.

<b>EAST CLAYTON NEIGHBOURHOOD CONCEPT PLAN AMENITY CONTRIBUTIONS</b>			
	<b>Per Unit Contribution All Residential <i>Approx. 4,370 dwelling units (@ base densities as per Table 2.2, Section 2 of the NCP)</i></b>	<b>Per Acre Contribution All Non-Residential <i>Approx. 58.04 acres (23.48 ha.)</i></b>	<b>Anticipated Revenue</b>
<b>Police Protection</b>	\$54.46 per dwelling	\$218.65 per acre	\$250,680.60
<b>Fire Protection</b>	\$236.09 per dwelling	\$944.68 per acre	\$1,086,542.50
<b>Park/Pathways Development</b>	\$735.33 per dwelling	n/a	\$3,213,392.00
<b>Library Materials</b>	\$122.35 per dwelling	n/a	\$543,669.50
<b>Total Contribution (per unit or per acre)</b>	<b>\$1,148.23 per dwelling</b>	<b>\$1,163.33 per acre</b>	
<b>Total Anticipated Revenue</b>			<b>\$5,085,284.60</b>

The above-noted per unit amenity contributions are derived from estimated base densities in the residential designations and the number of dwelling units (excluding any coach houses and secondary suites) anticipated (Table 2.2 in Section 2 of Appendix I). The estimated costs of the various amenities are distributed evenly to each dwelling unit. Therefore, if the number of dwelling units in a proposed development is lower than that anticipated by the NCP, the applicant will be expected to "top up" the amenity fees based on the number of the dwelling units used to calculate the amenity charge to ensure that there is no shortfall in the funding for the proposed amenities.

### **Public Consultation**

An integrated, multi-stakeholder approach to the planning process was used to arrive at the preferred development concept, which formed the basis for the Stage 1 Land Use Plan. Among the various consultative initiatives used, were the following:

#### ***The East Clayton Citizen Advisory Committee***

A Citizen Advisory Committee was established in early 1999 consisting of property owners and residents of the area to bring local knowledge and community concerns to the planning process and participate in addressing the concerns. The Committee held at least ten meetings through to endorsement of the preferred development concept forming the basis of the Stage 1 Land Use Plan.

#### ***Public Meetings***

Two public meetings/open houses were held (in March and July, 1999) to introduce the concept of sustainable development to the general public and provide opportunities for interested parties to comment on the preferred development concept and preliminary sustainable development standards for drainage, utilities and transportation infrastructure. Additionally, a comprehensive display of this material was set up at City Hall for a period of four months to receive further public input.

#### ***Workshops and Design Charrettes***

A number of workshops were held with various stakeholders, which included:

- the East Clayton Citizen Advisory Committee;
- environmental agencies;
- transportation and utility agencies;
- City staff from Planning & Development, Engineering and Parks, Recreation & Culture (both planning and operations staff and Library Services staff) and Fire Departments;
- the RCMP;
- the School District;
- representatives of the development industry; and

- other interested parties, such as representatives from Surrey's Environmental and Agricultural Advisory Committees, the Port Kells and Clayton Community Associations, the GVRD and the Township of Langley.

A Design Team was established to participate in two main design charrettes in April and May 1999 and a series of mini-charrettes focusing on technical matters and innovative design ideas.

In addition to the above-described meetings, workshops and charrettes were held to inform and receive input from the local community and the public at large. In addition, a number of articles on the East Clayton initiative and related sustainability topics were published in the local newspapers.

Following this extensive public consultation process, Council considered a status report on the East Clayton NCP on November 8, 1999 and approved, in principle, the Stage 1 Land Use Plan.

Prior to the preparation of the Stage 2 Land Use Plan, a public Open House was held on September 25, 2002 to receive input on the modified Stage 1 Land Use Plan. The refinements and adjustments to the Land Use Plan resulted from a detailed review by City staff of the Stage 1 Land Use Plan in relation to transportation and servicing objectives and from the review and approval of the first development applications in the East Clayton area. Following the Open House, through to mid-February, 2003, staff continued to receive comments from the public and held several meetings with property owners and developers to discuss specific land use issues related to their properties and the proposed Land Use Plan. The proposed Stage 2 Land Use Plan is the result of this public and stakeholder consultation process.

### **Implementation of the NCP**

#### ***OCP Amendments***

The entire area covered by the East Clayton NCP is currently designated Urban in the OCP. Although the NCP Land Use Plan anticipates changes to the OCP designations in East Clayton, the determination of the precise boundaries of these changes cannot be established until a detailed survey plan is presented. It is, therefore, recommended that any necessary changes to the OCP designations in the East Clayton area proceed concurrently with site specific rezoning applications as has been the process in other Neighbourhood Concept Plans in the City.

#### ***Design Guidelines***

In the case of single family residential developments, the Design Guidelines will be implemented through the process of reviewing and approving subdivision plans and in developing building schemes. In the case of row houses, town houses and other multiple unit residential developments, commercial developments and developments in the business park area, the Design Guidelines will be implemented through the process of reviewing and approving the related Development Permits.

### ***Application of NCP Policies***

It should be recognized that some of the policies in the NCP are "breaking new ground" in the City of Surrey and B.C. It will be necessary for staff to exercise some flexibility and judgement within the general policy framework of the NCP in relation to the application of individual policies to development proposals in the NCP depending on the particulars of the individual development proposals.

### ***City Project Team***

A project team consisting of City staff from the Planning and Development, Engineering and Parks, Recreation and Culture Departments should be established to guide the overall implementation of the East Clayton NCP, so as to ensure consistency and to evaluate and monitor progress toward achieving the various objectives of the NCP.

### ***Zoning By-law Amendment***

Schedule F of the Zoning By-law includes the map of East Clayton, which was incorporated in the Zoning By-law by way of Text Amendment By-law, 2002, No. 14653 that was adopted by Council on May 13, 2002. This was done in conjunction with the approval of the first development application (No. 7901-0198-00) in East Clayton. However, to enact the amenity contribution requirements, the Zoning By-law requires a further amendment to add East Clayton to the list of Neighbourhood Concept Plans within which monetary contributions are required. The proposed amendments to Schedule G of the Zoning By-law, to incorporate the amenity fees for East Clayton, are documented in Appendix VII.

### ***Sign By-law Amendment***

Portions of the East Clayton Land Use Plan along 188 Street, Fraser Highway and 64 Avenue will be developed for commercial and business park uses. These areas are and will be, exposed to a large amount of local and commuter traffic. To ensure that the developments along these frontages have a reasonable opportunity for signage, without detracting from the objective of creating a pedestrian-friendly neighbourhood, East Clayton should be incorporated as a Special Sign Area in the Sign By-law. Provisions need to be included in the Sign By-law to control the height of free-standing signs on 188 Street, Fraser Highway and 64 Avenue. It is recommended that staff be instructed to bring forward appropriate amendments to the Sign By-law, following the approval by Council of the East Clayton NCP to implement the sign provisions of the NCP.

## **CONCLUSION**

A City project team, in consultation with property owners, government agencies, utility companies, representatives of the land development industry and the public, have prepared an NCP, including a land use plan and engineering/funding/phasing strategy, for the East Clayton area.

The NCP is consistent with the policy framework identified in Surrey's OCP. Strategies have been identified for funding various amenities required for the neighbourhood. Subject to Council's concurrence with the related report from the Engineering Department, it is recommended that the final and complete NCP for the East Clayton area, as described and appended to this report, be approved and that the Acting City Clerk be instructed to introduce the necessary by-laws in support of the plan, as described in this report.

Murray Dinwoodie  
General Manager  
Planning and Development

BP:saw

Appendices

- Appendix I Final and Complete East Clayton Neighbourhood Concept Plan (Stage 2)  
(attached as a separate package)
- Appendix II Approved Stage 1 East Clayton Land Use Plan
- Appendix III Revised Stage 1 Land Use Plan presented at September 25, 2002 Open House
- Appendix IV Stage 2 East Clayton Land Use Plan
- Appendix V Major Changes made to the Revised Stage 1 Land Use Plan
- Appendix VI Summary of the Dominant Characteristics envisioned in the Residential,  
Commercial and Business Park Areas
- Appendix VII Proposed Amendment to Schedule G of the Zoning By-law

**Summary of the Dominant Characteristics  
Envisioned in the Residential, Commercial and Business Park  
Areas of East Clayton**

**Residential Areas**

The intent of the design guidelines for the residential areas is to encourage the development of a diversity of housing types, densities and forms to provide a broad variety of housing options within the neighbourhood.

***Half-acre Residential (up to 4 units/acre - Aloha Estates)***

- Single family homes with or without ancillary units or coach houses on half-acre lots.
- Design of the ancillary dwellings and coach houses to reflect the existing "estate" character of the Aloha Estates area.

***Low Density (6-10 units/acre)***

- Detached single family homes on lots ranging from 320 sq. m. to 560 sq. m., with or without ancillary units or coach houses and duplex homes with or without rear lane access.
- Rear lane access is to be achieved for as many lots as possible, but in general should not be less than 60% of the lots in a development.
- Small front yard setbacks to allow more room for private back yard space
- Coach houses are encouraged on corner lots to increase diversity, provide unity to the streetscape and increase "eyes on the street".
- Garages accessed via rear lanes where lanes are provided or, where lanes are not provided, preferably via shared driveways or, alternatively, paired driveways from the fronting street.
- On-street parking to supplement off-street parking and contribute to traffic calming.

***Medium Density (10-15 units/acre)***

- Detached single-family homes, with or without coach houses, on narrow-deep lots ranging from 220 sq. m. to 290 sq. m. and detached single family homes, without coach houses, on wide-shallow lots ranging from 270 sq. m. to 300 sq. m. Semi-detached homes on narrow/deep lots may also be provided.
- Reduced front setbacks to reinforce the human scale of the street and to allow more room in the back yard.
- Garages and coach houses located at the rear of the dwellings and accessed via rear lanes.
- On-street parking to supplement off-street parking and contribute to traffic calming.

***Medium-High Density (15-25 units/acre)***

- A range of housing types including row houses, townhouses, stacked townhouses, semi-detached homes, duplexes and single family homes with coach houses.
- Compatibility of design with adjacent residential areas.
- Reduced front yard setbacks to create a strong street orientation.
- Garages accessed via rear lanes.

### ***High Density (22-45 units/acre)***

- Townhouses, stacked townhouses, row houses and garden apartments.
- Reduced front setbacks to create a strong street orientation.
- Reinforce the East Clayton neighbourhood character by maximizing ground-oriented units with direct pedestrian access to the front of the units from the street.
- Compatibility of the design with adjacent residential areas.
- Parking and garages accessed from the rear or from within the development sites.

### ***Mixed-Use Commercial/Residential (25-45 units/acre)***

- Residential units above ground floor commercial uses.
- Front yard setbacks of up to two metres to reinforce pedestrian oriented streetscape.
- Building heights of up to four storeys.
- Parking accessed from the rear of the buildings.

### ***Special Residential (10-15 units/acre)***

- A residential area containing a mix of townhouses, row houses and single family homes on small lots with the option of a small-scale, low impact retail or service commercial or other businesses as part of the residential units.
- Small-scale businesses/commercial uses located at the ground floor of the residential units with direct access from the street or located at the rear in the ancillary buildings or garages with access from a rear lane.
- Parking for residential units accessed from the rear with on-street parking provided for the businesses and commercial units.
- Compatibility of the design with the character of the East Clayton Neighbourhood

### **Commercial Areas**

The intent of the design guidelines for commercial areas is to encourage street-oriented commercial and mixed-use commercial developments at densities to meet the needs of the residents of the East Clayton and surrounding communities. In the case of Specialty Commercial, due to its location and subdivision pattern, the guidelines encourage the creation of a village-like character that would support pedestrian orientation and activity.

### ***Mixed-use Commercial/Residential***

- The Main Street commercial area is to serve as the heart of the community and connect East Clayton with the larger Clayton community. The smaller mixed-use commercial area, located at the corner of 196 Street and 64 Avenue will serve the local residential population in the immediate vicinity.
- Building and street design is to emphasize and reinforce pedestrian orientation.
- On-street parking for access to ground floor commercial uses; additional parking to be provided underground or at the back of the commercial uses.

### *Neighbourhood Commercial*

- Smaller scale commercial nodes serving residential development within a five-minute walk.
- Residential units may be provided above street-oriented commercial units.
- Parking on-street, where possible and behind buildings away from the street.

### *Specialty Commercial*

- Community-oriented commercial area to serve both the local residents and the wider community accommodating a range of commercial businesses and personal service uses such as restaurants, bistros, specialty shops and services, etc. that require and operate in a centralized location.
- A village-like character with small-scale building footprints, human-scale detailing and parcelized parking lots to emphasize pedestrian orientation.

### **Business Park Area**

The intent of the design guidelines for the Business Park area is to encourage the creation of a well-integrated community of low impact industries and businesses that are generally compatible with one another and with the surrounding residential areas.

- Front setbacks to accommodate landscaped areas to create a positive relationship with the street and to provide for natural infiltration.
- Parking lots to be located behind buildings shielded from sidewalks, divided into small lots and to include generous landscaping and pervious surfaces.



**Proposed Zoning By-law Amendment**

It is recommended that Schedule G Amenity Requirements in Neighbourhood Concept Plan (NCP) and Infill Areas in Surrey Zoning By-law, 1993, No. 12000, as amended, be further amended by adding a new Item 18, after Item 17, as described below:

<b>NCP and Infill Areas</b>		<b>Amenity</b>	<b>Contributions Per Dwelling Unit</b>	<b>Contributions For All Other Land Uses</b>
18.	Area XVIII on Schedule F of this By-law	Parks and Pathways Development	\$735.33	N/A
		Library materials	\$122.35	N/A
		Fire Protection	\$236.09	\$944.68 per acre
		Police Protection	\$54.46	\$218.65 per acre
		<i>Total Amenity Contributions</i>	\$1,148.23	\$1,163.33 per acre



## BACKGROUND

The Proposed Land Use Concept Plan for the East Clayton NCP is being presented for approval in a separate Corporate Report from the General Manager of the Planning & Development Department. This report outlines the engineering servicing issues and financial issues that are included in the East Clayton NCP.

## DISCUSSION

The engineering services discussed in the report relate to major community infrastructure. Only those work, which are presently in or could be added to the 10 Year Plan and funded through Development Cost Charge (DCC) program are discussed in detail. Local site servicing requirements of individual developments are not analysed in the report.

Unlike most other NCP study areas, East Clayton has a number of unique features and challenges:

- Extensive sustainable initiatives throughout the NCP;
- Significant down stream drainage constraints;
- Topography dictates two main servicing catchments areas; and
- Due to the existing rural residential use, limited services are currently available.

### Sanitary Sewer

Currently, septic fields service most of the NCP area. Under the proposed plan two sewer systems will serve the NCP area: the recently constructed Langley By-Pass Trunk will serve the eastern catchment, and the 68 Avenue trunk leading to the pump station at 176 Street will serve the western catchment (as shown in Figure 7.3.1 in Appendix I). Both these systems flow to GVS & DD Cloverdale Interceptor running parallel to 56 Avenue.

As development progresses, three sections of the trunk sewer will require to be upgraded on the eastern system:

1. Sewer on 196 Street from 64 Avenue to Fraser Highway;
2. Sewer on Highway #10 (Langley By-Pass): 196 Street to 56 Avenue; and
3. Sewer on 196 Street from Fraser Highway to Highway #10 (Langley By-Pass).

The upgrades of section 1, 2 and 3 of the sewer will be triggered once a total of approximately 48, 77 and 91 hectares of development respectively are completed within the eastern catchment of the NCP.

Similarly, two sections of the 68 Avenue trunk sewer and the interim pump station at 176 Street will require to be upgraded for the western system as development progresses. A deep Cloverdale Trunk Sewer will potentially replace the pump station at 176 Street when the ultimate 400 L/s flow has been reached. However, developments in this NCP are unlikely to trigger this work as the trunk services the whole Clayton catchment, not just East Clayton.



## **Water**

Water can be supplied to the study area from four main feed points:

- 200 mm diameter water main at 72<sup>nd</sup> Ave and 192<sup>nd</sup> Street
- 150 mm diameter water main at Fraser Highway and 192<sup>nd</sup> Street
- 150 mm diameter water main at 72<sup>nd</sup> Ave and 194A Street
- 200 mm diameter water main at 64<sup>nd</sup> Ave and 194A Street

The existing local water distribution system services only a small area of the neighbourhood and does not have adequate capacity for future development. A network of new feeder and major grid mains of size between 300 mm and 450 mm diameter, connected to the existing Clayton Pump Station and GVWD trunk main, is proposed to extend into the neighbourhood to provide water supply for the ultimate build out (as shown in Figure 7.4.1 in Appendix I).

This new network, together with extensions on new roads, will be adequate to service the proposed land use. Each development will be required to demonstrate that they have adequate water supply for domestic and fire fighting use for their development under interim and ultimate conditions.

The feeder and major grid main and the Clayton pump station upgrade are included in the 10 Year Servicing Plan. The Clayton Pump Station will require major upgrade in order to meet the future peak demand flow conditions. The pump station is near its capacity and an upgrade is expected to be required in the next few years. The timing of the station upgrade and the water network will require coordination with the developments. DCC funding will be available where upsizing beyond the development immediate requirement is needed.

## **Transportation**

All of the roads in East Clayton will require upgrading from the existing rural cross-sections to urban standards. As part of the sustainability principles of East Clayton, the street system has the following features:

- a tight road grid for improved connectivity and pedestrian access;
- minimized pavement and right-of-way widths;
- lane access to facilitate swale drainage infiltration systems within the boulevards of local roads;
- enhanced pathway system for pedestrians/cyclists; and
- extensive traffic calming.

Arterial roads bound East Clayton on three sides, 72 Avenue to the north, Fraser Highway/64 Avenue to the south and 196 Street to the east. 188 Street, a Major Collector, is the west boundary.

192 Street will be the only Arterial road internal to East Clayton and will be built to a parkway standard which includes a grassy swale boulevard with trees and multi-use pathway, while 194 Street and 68 Avenue will be the only internal Major Collector roads. The remainder of the network is comprised of two-way and queuing local road (alternative one-way travel with on street parking), except for the Business Park area, which also includes minor collector road (as shown in Figure 7.2.2., in Appendix I).

The local road system is based on the neo-traditional parking pocket standards with the enhancement of a swale drainage system in the boulevard for enhanced sustainability.

The use of lanes is an important component of the sustainability principles and character for East Clayton. Eliminating driveways from the local roads has the following benefits:

- Increases infiltration with low maintenance swale drainage system;
- Increases number of street trees which provides greater tree canopy coverage and improves the drainage sustainability;
- Doubles (at least) on-street parking supply, important for East Clayton due to lot density, coach houses and secondary suites; and
- Improves urban streetscape.

Pedestrian/cyclist opportunities have been enhanced for this neighbourhood through a combination of next-to-street, off-street and on-street routes. The road network has been established to facilitate future expansion of transit service for the neighbourhood with minimized walking distances to/from the bus stops.

Extensive traffic calming will be built into the neighbourhood. The following measures will be utilized:

- curb extensions (bulging) at virtually all intersections, which “pinches” the street thereby slowing traffic and reduces pedestrian crossing distances;
- raised intersections at key pedestrian crossing locations; and
- coloured pavement at other important pedestrian crossing locations.

### **Drainage**

Stormwater management is a cornerstone of the ecological sustainability strategy of this neighbourhood. One of the original objectives of the NCP was to provide a stormwater management plan that resulted in runoff that was similar to a forested environment and many of the strategies proposed in the NCP should help us achieve this objective. Since the sustainable drainage components such as on site infiltration deal with small frequent rain events but are overwhelmed by large storms, they do not replace the need for a conventional drainage system to protect life and property during the less frequent larger events.

The following paragraphs describe both the conventional drainage servicing requirements for larger storms and sustainable engineering approaches proposed for the East Clayton Neighbourhood for smaller more frequent events.



The East Clayton NCP area currently has a rural residential land use and is serviced mainly by roadside ditches and natural creeks. Surface drainage from the area flows to two major catchment areas:

- South-East catchment that encompasses 190 ha of land sloping to the south east and draining partially into McLellan Creek and partially into the Township of Langley storm sewer system through culverts across 196<sup>th</sup> Street towards the Nicomekl River;
- Western catchment is approximately 85 ha in size and slopes to the west draining into North Cloverdale Creek near 188<sup>th</sup> Street and Fraser Highway and flows into the Serpentine River watershed.

### **Off site constraints**

Of the two drainage catchments described above, the catchment flowing to the Township of Langley storm sewer system has the most constraints, and limited capacity. Consequently the proposed plan has been developed to account for this constraint by providing detention ponds and flow diversions. Downstream of the NCP, portions of McLellan Creek have been enclosed limiting conveyance capacity to existing flow conditions. The plan has been developed in conjunction with the Township of Langley to ensure peak flows into McLellan Creek will not increase as a result of development through the use of ponds and diversions.

### **Detention Ponds**

A total of five community detention ponds have been proposed for the NCP. Four ponds will service the South Eastern catchment and one will service the western catchment. Potential pond locations are shown in the Neighbourhood Land Use plan. The four ponds servicing the South Eastern Catchment will ensure runoff originating from the site does not exceed existing constraints downstream of the Neighbourhood along McLellan Creek and through Langley's sewer system. A storm sewer is also required along 196 Street to ensure runoff constraints in Langley's system are not exceeded. A detention pond constructed immediately to the west of 188 Street will mitigate anticipated increased flows from the Western Catchment into North Cloverdale Creek (as shown in Figure 7.5.1 in Appendix I).

These ponds represent ultimate build-out conditions. Interim ponds may be allowed, but only when lands for the ultimate proposed pond to which the subject area is tributary have been secured by the developer for the City. No DCC rebates will be provided for interim works.

### **On-site servicing**

Due to the development industry's desire to construct homes with finished basements, developers within East Clayton NCP will be required to design storm sewer systems to convey runoff below the basement levels for a 1:100 year rainfall event rather than the 1:5 year rainfall in order to avoid frequent flooding.

Storm sewers that service areas greater than 20 hectares are deemed to be trunk sewers and are eligible for DCC funding and are included in the 10 Year Servicing Plan.



## **Sustainable development objectives and guidelines**

Sustainable development objectives were incorporated into the East Clayton Neighbourhood Concept Plan. The plan contains Green Infrastructure Performance Standards and Guidelines that describe the overall site requirements with respect to sustainable best management practices. The main objectives of this strategy are:

- To protect and enhance the environment;
- To enhance community value, quality, and appeal;
- To increase access to, and variety of, recreational opportunities;
- To protect habitat, especially fish habitat; and
- To maintain stream hydrology and stream water quality.

Infiltration Best Management Practices (BMPs) are most critical to drainage. For building sites the requirement is an effective infiltration capacity of 12 to 24 mm/day over the total impervious area of each lot. This will most likely be achieved through the use of an infiltration chamber or trenches constructed on each site where native soil percolation rates are greater than 0.5 mm/hr.

A similar infiltration target has been set for specific streets as indicated in the NCP. Standard road cross sections provided in the NCP allow for road rainwater to filter through roadside swales and infiltration trenches.

Another significant sustainability measure associated with stormwater is the preservation of soils on building sites. All landscaped areas of a building lot will have a minimum depth of topsoil of 450 mm. This requirement ensures that the thin soils of the Clayton area are re-used to their maximum advantage to increase runoff absorption and that topsoil will not be permanently removed from the site.

Specific urban-forestry standards have also been defined in the NCP. These will help the overall project area meet its stormwater management objectives by providing increased rainwater interception and reducing total runoff.

### **Cost of sustainable initiatives**

The Engineer for the first developer within the NCP area submitted certified cost of \$4200 for implementing on-site infiltration strategies. The cost of soil preservation measures has been estimated in the range of \$300/lot. Roadside swales and perforated drainage systems has been estimated at \$1200 per lot. The total additional cost for all the sustainability initiatives is \$5700 per lot. These costs are significant but in line with previously reported expectations.

In an effort to mitigate these costs the City has applied and received an \$ 862,000 grant from the Canada/BC Infrastructure program and a \$ 200,000 grant from the GVRD to implement and monitor the performance of infiltration BMPs in East Clayton. Under this grant, developers can apply to get up to 75% (to a maximum of \$3,750) of their on-site infiltration Best Management Practice reimbursed. Results from the monitoring program



will provide confirmation on the value of these strategies and provide design criteria that can be applied both city wide and regionally.

**Base level vs. enhanced model of sustainability**

Given the substantial cost to provide all the sustainable initiatives and the uncertainty that the infiltration strategies will provide the anticipated benefits, a staged implementation plan is recommended. Under this plan only the lots for which grant funding is available will be required to implement the full suite of sustainability BMPs including on-site infiltration structures (enhanced level). These structures will be monitored over a number of years to verify their performance. Any new lots beyond the first 200 lots (that receive funding) will be required to provide a base level of sustainability BMPs (i.e. full soil retention, tree coverage, etc., as shown in Table 1) but will not be required to provide on-site infiltration structures. If results from the monitoring program indicate that the infiltration structures do provide appropriate ecological value and are operationally feasible, this will be reported back to Council and the regulatory agencies. This in turn could result in subsequent lots within the NCP being also required to have the full enhanced level of sustainability BMPs including infiltration structures. Ideally the decision to proceed with the requirement for the full level of sustainability BMPs should be taken preferably on a region wide basis. This will avoid one area of the City/Region having a higher cost of drainage servicing than all other areas. This overall decision would have to balance the cost of enhanced sustainability measures against ecological benefit and any reductions in the cost of downstream drainage infrastructure and be explored within a regional context. It is thus possible that this drainage standard could become a region wide requirement.

All other ecological standards associated with the Neighbourhood Concept plan should be implemented as directed in the NCP and indicated in base level in Table 1 in Appendix II. We believe the benefit of the base level will outweigh their reasonable implementation costs.

**Financing**

A financial analysis is included in the engineering servicing report. The cost has been identified for the necessary DCC infrastructure to service this area.

The following table summarizes the projected DCC revenues and construction costs for each engineering service area at full build-out. The DCC revenues in this table are based on the current DCC rates.

Services	Projected DCC Revenues	Projected DCC Expenditures	Surplus/(Deficit) Balance
Sanitary Sewer	\$3,629,000	\$4,687,000	(\$1,058,000)
Drainage	\$8,380,000	\$8,164,000	\$216,000
Water	\$4,166,000	\$2,177,000	\$1,989,000
Collector Road	\$5,756,000	\$5,520,000	(\$236,000)

As illustrated by the above table, the overall minimal deficit or surplus.



## **Development Phasing**

Development will likely proceed from downstream sections of the drainage and sanitary systems to the top of the catchments. Developers progressing ahead of this sequence will be required to design, finance and build the downstream infrastructure required. Ultimately as in other NCP areas the market will determine the actual development patterns and phrasings.

## **CONCLUSION**

The East Clayton NCP servicing plan provides a comprehensive servicing and financial plan for the area. The proposed staged approach is recommended as it achieves a high level of sustainability while still ensuring the developments in East Clayton will be competitive within the regional context.

Paul Ham, P.Eng.  
General Manager, Engineering

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Attachment

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# APPENDIX I

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## East Clayton NCP Proposed Servicing Plan Maps

See figures 7.2.2, 7.3.1, 7.4.1, 7.5.1

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## APPENDIX 2

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### East Clayton NCP Sustainability Components

# TABLE 1

#	COMPONENT	PERFORMANCE ROLE	LEVEL OF SUSTAINABILITY	OBJECTIVE	DESIGN	COST
1	<b>On-Lot Infiltration BMP:</b> Dispersion BMPs such as storage and infiltration of run-off.	To disperse storm water runoff into pervious areas from paved and roofed areas and facilitate infiltration.	Enhanced	<ul style="list-style-type: none"> <li>Effective infiltration of 0.5 to 1mm/hr.</li> <li>Connect the impervious areas to storage and infiltration area.</li> </ul>	<ul style="list-style-type: none"> <li>Each development does percolation test to determine size of storage required.</li> <li>Storage is related to percolation rate and impervious area.</li> </ul>	\$4,200/lot
2	<b>On-Lot Soil Preservation</b>	Preserve and enhance the soils natural absorption ability to decrease run-off.	Base	<ul style="list-style-type: none"> <li>Minimum depth of soil 450 mm of enhanced natural infiltration.</li> </ul>	<ul style="list-style-type: none"> <li>Topsoil retained and deep tillage of sub-base.</li> </ul>	\$300/lot
3	<b>On-Street Measures:</b> Roadside swales and infiltration trenches.	Facilitate collection of runoff generated from lots, roads. Standard road cross sections provided in NCP allow for road rainwater to filter through roadside swales and infiltration trenches.	Base	<ul style="list-style-type: none"> <li>Boulevards sunken in to allow for road water to drain in them through side inlets on curb.</li> <li>Perforated system when practical.</li> <li>Sidewalks graded to boulevards.</li> </ul>	<ul style="list-style-type: none"> <li>Conventional sewer capacity analysis.</li> <li>Perforated pipes when practical.</li> </ul>	\$1,200/lot
4	<b>Tree Canopy</b> Trees/bushes in each lot boulevards, parks, etc.	Facilitate evapo-transpiration (E/T), add trees with high E/T potential in winter and summer.	Base	<ul style="list-style-type: none"> <li>Full canopy cover objective: 40% Lots 60% Streets 30% Parks</li> </ul>	<ul style="list-style-type: none"> <li>Appropriate landscape plan with appropriate species.</li> <li>Minimum size specified for trees.</li> </ul>	Minimal additional cost.
5	<b>Storm Water Ponds</b> Storm Water Detention facilities on a regional basis and within strata developments, commercial, and industrial sites. Specific locations as shown in Figure 7.5.1.	To detain net runoff from upstream areas and then gradually release to the downstream receiving system. These facilities play a critical key role in managing flows into the existing downstream systems.	Base	<ul style="list-style-type: none"> <li>Enough land is secured to ensure ultimate pond can be built, assuming the on-lot measures are ineffective.</li> </ul>	<ul style="list-style-type: none"> <li>Ponds would be constructed, assuming a 50% effectiveness of the on-lot and on-street systems. Ponds could be expanded in the future at a nominal cost.</li> </ul>	Nominal savings.

## ACKNOWLEDGEMENTS

The East Clayton Neighbourhood Concept Plan was prepared in partnership with the James Taylor Chair in Landscape and Liveable Environments (UBC) under the “Headwaters Project”. The City of Surrey acknowledges the participation of the members of the East Clayton Advisory Committee, residents and property owners of East Clayton, Pacific Resources Centre, the Ministry of Community, Aboriginal and Women’s Services, Provincial and Federal government agencies, utility companies and all other participants in the East Clayton Neighbourhood Concept Plan (NCP) planning process.

The East Clayton Neighbourhood Concept Plan was developed over the course of three years between 1999 and 2002, to design a new community based on the seven agreed-upon sustainability principles, which evolved through previous partnership projects involving the City of Surrey, the UBC James Taylor Chair and various government agencies, such as the 1995 Surrey Design Charrette and the 1998 Alternative Development Standards workshop for Sustainable Communities.

This report was adapted from the draft report entitled “East Clayton Neighbourhood Concept Plan, 2000” prepared by UBC James Taylor Chair in Landscape and Liveable Environments. This report has reflected and incorporated the input received from all the participants in the consultation process since May 2000.

**EAST CLAYTON**

**NEIGHBOURHOOD CONCEPT PLAN**

**Stage II**  
**NCP Report**

**March 2003**

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## 1.0 INTRODUCTION

The East Clayton Neighbourhood Concept Plan (NCP) is the result of an integrated planning process involving several constituencies of interest. Based on principles of sustainability and complete communities, the plan includes the application of innovative servicing, storm-water management, road standard, and neighbourhood planning ideas.

The East Clayton NCP will be used as a policy framework to guide the future development of this sustainable community. The report includes a detailed description of the process, land-use designations and densities, and development standards and guidelines. It also includes a discussion of development phasing and cost-sharing arrangements for municipal servicing, infrastructure, and neighbourhood amenities. The Planning Background documents provide general information on the area and the planning process that resulted in the formulation of the East Clayton Neighbourhood Plan.

## **1.1 THE SURREY OFFICIAL COMMUNITY PLAN AND A VISION FOR COMPLETE COMMUNITIES**

The Official Community Plan (OCP) for Surrey (adopted on October 8, 1996 and subsequently updated on January 28, 2002) designates some “Suburban” areas as those having long-term development potential subject to land-use planning with local residents. Within this framework the Clayton area is identified as “Suburban”, and East Clayton as a new “Urban” neighbourhood. The first step in planning for East Clayton’s future is the formulation of a Neighbourhood Concept Plan for East Clayton area.

The Surrey OCP “promotes planned community development – bringing together residents, business and City resources to guide the location and form of growth toward long term City and regional goals for complete and sustainable communities.” Complete and sustainable communities are those that offer a wide range of housing choices, services, and employment opportunities at high enough densities to support convenient access to services and transit, all within a pedestrian-friendly neighbourhood fabric. At the same time, complete communities also protect the quality and integrity of ecosystems by maintaining environmentally sensitive areas (i.e., natural flow-receiving watercourses), and by managing the quantity and quality of storm- water runoff.

## **1.2 THE GENERAL LAND USE PLAN FOR THE CLAYTON AREA**

The preparation of a General Land Use Plan for the Clayton Area, which encompasses approximately 809 hectares (2,000 acres), commenced in June 1996 and involved two stages.

The first stage created a “vision” for the community that would lead to the development of land use concepts, a servicing and phasing strategy, a master drainage plan, and a list of environmental objectives. The second stage involved the preparation of the more detailed NCP for East Clayton and is described in this report.

The public consultation component of the planning process for the Clayton Area Land Use Plan included a formal questionnaire and public meeting, held in June 1996. Internal and external stakeholder meetings were held in November 1996, culminating in a public visioning workshop, held November 13, 1996. Public involvement was enhanced through the involvement of the 15-member Clayton Citizen Advisory Committee (CAC), who brought local knowledge to the planning process and who represented property owners and residents during the preparation of land use alternatives. The final public information meeting for the General Land Use Plan was held by City Council in December 1998.

## 1.2.1 General Land Use Plan and Seven Principles of Sustainable Development

In July, 1998, City Council held a shirtsleeve session to raise discussion and obtain feedback on issues related to sustainable growth, efficient development and livable communities for Surrey. At this session the following seven principles of sustainable development were presented:

***Principle No. 1***

*Conserve land and energy by designing compact walkable neighbourhoods. This will encourage pedestrian activities where basic services (e.g., schools, parks, transit, shops, etc.) are within a five- to six-minute walk of their homes.*

***Principle No. 2***

*Provide different dwelling types (a mix of housing types, including a broad range of densities from single-family homes to apartment buildings) in the same neighbourhood and even on the same street.*

***Principle No. 3***

*Communities are designed for people; therefore, all dwellings should present a friendly face to the street in order to promote social interaction.*

***Principle No. 4***

*Ensure that car storage and services are handled at the rear of dwellings.*

***Principle No. 5***

*Provide an interconnected street network, in a grid or modified grid pattern, to ensure a variety of itineraries and to disperse traffic congestion; and provide public transit to connect East Clayton with the surrounding region.*

***Principle No. 6***

*Provide narrow streets shaded by rows of trees in order to save costs and to provide a greener, friendlier environment.*

***Principle No. 7***

*Preserve the natural environment and promote natural drainage systems (in which storm water is held on the surface and permitted to seep naturally into the ground).*

On December 14, 1998, City Council considered Corporate Report No C-401 from the Planning and Development, which recommended the following:

1. Approve the Clayton General Land Use Plan;
2. Instruct staff to commence the preparation of the NCP for East Clayton (lands currently designated “Urban” in Surrey’s Official Community Plan) and to ensure that it includes the type, size, location and densities of the specific land uses, road hierarchy, and alignments based on the General Land Use Plan;
3. Instruct staff to explore the application of sustainable development principles, standards, and practices during the detailed NCP process for East Clayton;
4. Instruct staff to prepare a comprehensive servicing, phasing and financial strategy for East Clayton that will demonstrate adequate funding for specific amenities, infrastructure, and utilities; and
5. Instruct staff to address issues left outstanding after the completion of the process.

On January 25, 1999, Council approved the General Land Use Plan for Clayton and authorized planning staff to explore the application of the seven principles in the East Clayton NCP planning process.

### **1.3 THE EAST CLAYTON INTEGRATED PLANNING PROCESS**

Planning for a more sustainable East Clayton community required the integration of resources and an integrated planning method. It called for the application of a multi-party approach to building policy and developing acceptable standards of commitment among diverse constituencies. It involved raising awareness, providing time for reflection, and accepting alternative ways of developing a community.

#### **1.3.1 A Planning Partnership**

In 1998, a partnership between the City of Surrey Planning and Engineering Departments, the UBC James Taylor Chair in Landscape and Livable Environments, and the Pacific Resources Centre was arranged for the purpose of implementing a planning process based on sustainability principles for the East Clayton planning area.

The James Taylor Chair provided leadership and technical expertise regarding principles of sustainable urban design and the use of the design charrette method. The Pacific Resources Centre assisted in the design and facilitation of an integrated planning process. The City’s Planning Department carried out its mandate to implement Council’s directives by ensuring that the planning process maintained a standard that was consistent with, or higher than, those of other planning processes and that the East Clayton NCP was compatible with the OCP and the Clayton Area General Land Use Plan. The City’s

Engineering Department ensured compliance with the objectives of the Clayton Master Drainage Plan, the Surrey Transportation Plan, and other engineering servicing mandates.

In February 1999, a meeting was held to confirm the involvement of the East Clayton Citizen Advisory Committee (ECCAC) in the planning process and to introduce the idea of incorporating sustainable development principles and standards into a detailed plan for East Clayton.

ECCAC involvement ensured that:

- 1) a core group of local people developed an understanding and appreciation for the underlying principles of the plan, its features, and how they are linked to form a complete community system;
- 2) an effective two-way communication system conveyed information to constituency members, the design table, and City staff as the plan evolved;
- 3) the outstanding issues stayed on the table until resolved or advanced to its satisfaction;
- 4) local landowner interests were represented;
- 5) planning concepts were practical, achievable, and financially responsible from the perspectives of both landowners and the public;
- 6) despite major concerns over certain proposals for the future of East Clayton (e.g., the arterial designations and realignment), the momentum of the plan and its credibility was maintained; and
- 7) self-interest was placed within the context of the community and City-wide interests.

### 1.3.2 Public Consultation

The East Clayton NCP process incorporated public consultation at three levels: through the ECCAC, through the design team, and through general public sessions. Appendix I provides a list of constituents and issues raised during the design table sessions.

## 1.4 NCP PROCESS OBJECTIVES

The NCP charrette process was guided by the following objectives:

- ***Build capacity for integration through shared awareness and determination to act jointly.*** Throughout the NCP process, the ECCAC, City staff and all other constituencies provided a high level of commitment to acting jointly, as was evidenced by attendance, participation, and joint agreements attained during the charrette event and design workshops.
- ***Involve early on (preferably at the beginning) those people, agencies, and organizations that can influence plan policy and development standards (including their implementation).*** The NCP process was designed to be flexible

so as to expand involvement. The objective was to broaden the opportunities for the constituencies of interest to reach acceptable solutions and to influence the outcome of the plan.

- ***Share information equally.*** The rules of engagement set by the Design Team at the outset and maintained throughout ensured that everyone was operating with the same information.
- ***Share resources and cross mandates for mutual gain.*** Participants involved in creating plans brought to the NCP process a variety of valued resources. These resources included technical skills, policy and regulatory skills, financial skills, negotiating skills, interests, local knowledge, ideas, and common sense.



*Design Table Session*



*Public Open House Presentation*

- ***Build confidence in the process, in planning policies, and in alternative development standards.*** The NCP process was deliberately designed to promote awareness of the principles and concepts of a more sustainable urban community, to reinforce acceptable solutions at each stage, and to generate an acceptable Neighbourhood Concept Plan.
- ***Direct involvement of municipal staff.*** In the NCP process, engineering and planning staff recognized an opportunity to explore ways to apply sustainable development principles. They provided the leadership necessary to promote staff participation and buy-in.
- ***Access necessary technical expertise.*** Urban design experts complemented the participation of city staff and consultants in the design team.
- ***Deal with issues efficiently.*** Efficiently dealing with planning issues means that none are left on the table or unresolved. In this case they were resolved to the point at which all constituencies agreed that the concept plan can be advanced to the presentation and approval stages.

## 1.5 RECOMMENDED FOLLOW-UP

In order for the successful implementation of the NCP and reinforcement of the overall sustainability principles in future developments, the following are some of the programs and additional initiatives that should be considered during the various stages of its evolution:

- education and awareness;
- evaluating the role of building form in achieving overall neighbourhood character;
- evaluating the use of multi-use paths as routes for local trips and recreational purposes;
- monitoring the pedestrian and automobile circulation patterns;
- evaluating pedestrians and drivers response to road pattern and traffic calming measures;
- ensuring safe and convenient access to transit;
- monitoring the use and role of pocket parks in the neighbourhood;
- development of zoning regulations that allow for flexibility in mixing housing types and densities within the same block; and
- stream monitoring.



## 2.0 DESCRIPTION OF THE EAST CLAYTON LAND USE PLAN

Section 2 provides a description of the various land uses proposed in the East Clayton Land Use and Development Concept Plan (*Figure 2*), which comprises approximately 238.6 hectares (589.7 acres). The land uses are based upon the approved General Land Use Plan for Clayton and conform to the seven principles for sustainable development East Clayton, as endorsed by Surrey City Council in December 1998 and outlined in Section 1.2.1.

Sections 3 through 5 provide detailed standards and design guidelines pertaining to four interrelated areas of the NCP: Land Use; Building Development; Ecological Infrastructure; and Engineering and Servicing. It is important to note that these standards and guidelines are mutually supportive. For example, the proposed infiltration drainage system for East Clayton is dependant upon (among other things) the fine-grained grid pattern of development, (which facilitates the dispersal and infiltration of groundwater), as well as ensuring that surface infiltration throughout the site is maximized. Similarly, issues of density, land use integration and street connectivity are expected to influence potential reductions in automobile dependency, while having a positive influence on neighbourhood walkability.

It is anticipated that the standards contained herein will require more detailed refinement as development applications progress through the approval process. However, the performance standards for the land use, building footprint, ecological infrastructure, road engineering, and servicing plans should be achieved. It is expected that this will require increased efforts on the part of the City and developers to coordinate, engineer, and implement the design standards as future development takes place

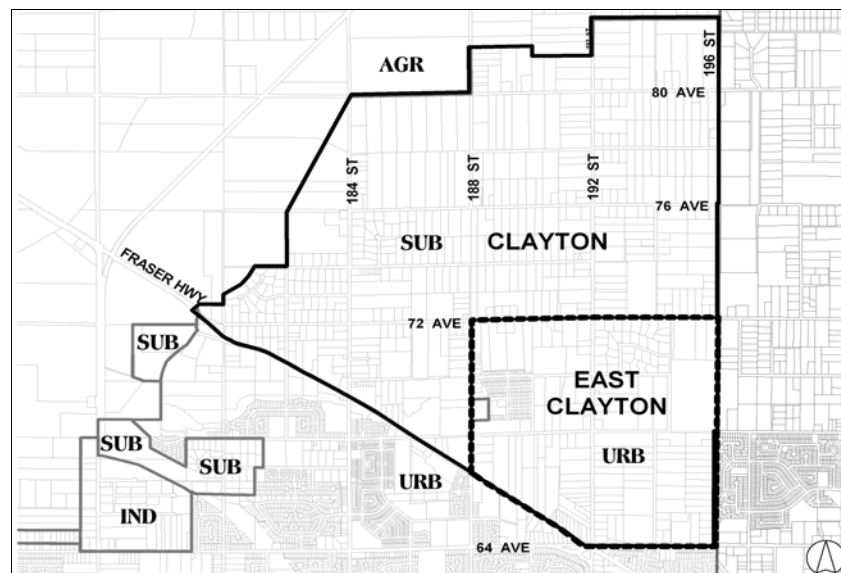
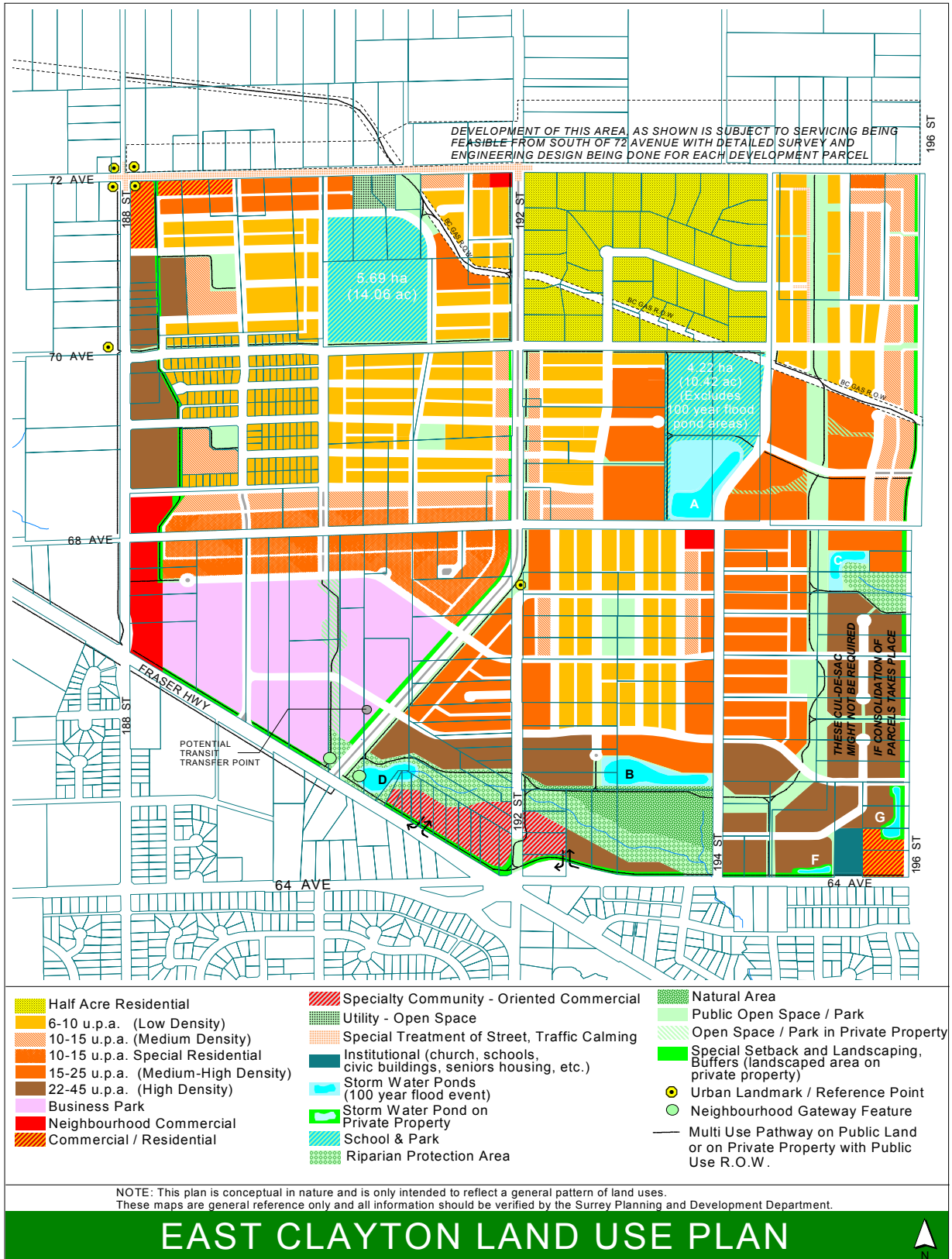


Figure 1 East Clayton Neighbourhood Concept Plan Boundaries

**Figure 2 East Clayton Land Use and Development Concept Plan**



## 2.1 SUSTAINABLE PLANNING PRINCIPLES

This section presents the seven sustainable principles that guided the planning process and describes generally how each is represented in the Land Use Plan. The plan supports enough of a variety of land uses and residential housing types to maximize affordability, sociability, and availability of commercial services within easy walking distance for the estimated 12,200 population. Envisioned as a complete, mixed-use community, East Clayton is designed to promote social cohesion, local economic opportunities, and environmental stewardship while providing equitable access to housing and jobs and reducing dependence on the automobile.

### *Principle No. 1*

*Conserve land and energy by designing compact walkable neighbourhoods. This will encourage pedestrian activities where basic services (e.g., schools, parks, transit, shops, etc.) are within a five- to six- minute walk of their homes*

- Achieving a pedestrian-oriented neighbourhood requires that homes be within a walkable distance of shops and services and that streets be interconnected to provide the widest possible choices of pedestrian routes for reaching nearby destinations.
- Accordingly, residential neighbourhoods are to be structured around a fine-grained modified grid of streets and lanes, with a majority of the blocks averaging 160 metres (525 feet) by 65 metres (210 feet).
- The streets and lanes are to be considered both public corridors and neighbourhood amenities and should accommodate automobile, pedestrian, and bicycle traffic while ensuring easy access to local destinations. Traffic calming devices are to be considered throughout the neighbourhood.
- Two schools/major parks are to be located centrally within the community and among residential uses, and each smaller residential area is to be organized around a central neighbourhood green. Building design and orientation are to reflect the size, location, and configuration of individual parcels.
- The “Main Street” Commercial Area, located at 188<sup>th</sup> Street and 72<sup>nd</sup> Avenue, is intended to be the most important commercial destination for residents of East Clayton. This commercial node will also serve the additional 20,000 to 25,000 new residents expected to reside in the surrounding Clayton community within the following 30 years.
- Additionally, each individual neighbourhood should have a neighbourhood commercial area that provides a working and shopping place for people within walking distance of their residence. Urban landmarks and neighbourhood gateway features will announce entries into different neighbourhoods, create a civic focal point, and enhance a network of visual reference points throughout the community.



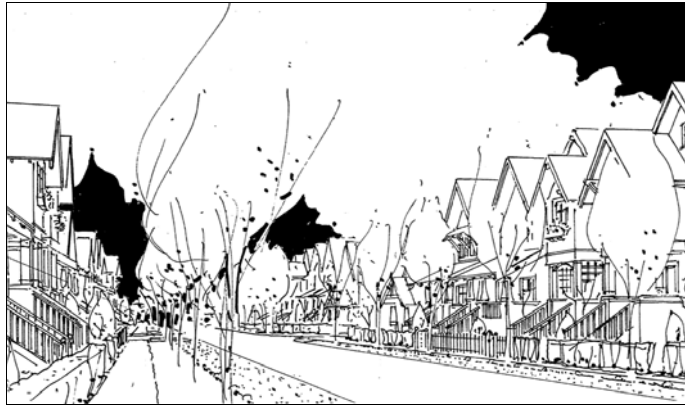
*This image shows a mixed-use commercial core that includes commercial-residential street-oriented town house form buildings. Human-scaled detailing contributes to the creation of pedestrian-friendly and economically vibrant community nodes.*

### ***Principle No. 2***

*Provide different dwelling types (a mix of housing types, including a broad range of densities from single family homes to apartment buildings) in the same neighbourhood and even on the same street.*

The plan accommodates a wide variety of household types and tenures. A diverse and socially cohesive neighbourhood for the community of approximately 11,200 persons is the intended result. The plan promotes integration and symbiosis between different family types and ages as a way of strengthening the larger community.

- Creative and economic housing options will be encouraged, such as single family homes with a second dwelling unit available to provide a “mortgage-aid” to young families, while also serving those individuals and families in need of affordable housing.
- The types of housing offered by the plan include multiple-unit residential in the form of apartments and fee-simple ground-oriented townhouses, single family homes on small- to medium-sized lots, and mixed-use commercial/residential housing.
- The diversity of housing tenures and types that the plan proposes create opportunities for affordable rental suites capable of adequately serving Surrey citizens whose earned income places them in the bottom one-third of earners region-wide.



*This perspective sketch shows a diversity of dwelling types and sizes on the same street, a diversity that is masked by the similarity in massing, height, and quality of detail of all the structures. Common touches (such as covered porches, deep overhangs, front yard fences and hedges, and the amount of window space on the front of buildings) contribute to a powerful sense of unity – a unity that includes a diversity of people within a cohesive community.*

***Principle No. 3***

*Communities are designed for people; therefore, all dwellings should present a friendly face to the street in order to promote social interaction.*

- Blocks are to be proportioned to create a fine-grained, interconnected network of streets; to reduce congestion; and to allow as many homes as possible to front directly onto public streets.
- Dwellings should be situated closer to streets, thereby ensuring more “eyes on the street” and creating a larger back yard area for private outdoor space.
- Front yards should have buffers or be slightly raised from the level of the street to ensure privacy and clearly distinguish between private and public space.
- Street trees, boulevard strips, and on-street parking will create a pleasant environment for pedestrians and provide a buffer from passing traffic.



*Small front setbacks ensure more “eyes on the street” and create a larger back yard area for private outdoor space. Low front yard fences clearly distinguish between private and public space. Street trees, boulevard strips and on-street parking create a pleasant environment for pedestrians and buffer the effects of passing traffic.*

***Principle No. 4***

*Ensure that car storage and services are handled at the rear of dwellings.*

The existing site conditions (i.e., topography, vegetation, road network, and parcel configuration) determined the proposed community structure and lot sizes for East Clayton.

- Narrow lots demand lanes so as to prevent building fronts from being consumed by garages, front yards from being consumed by concrete, and residents from being closed off from contact with activities on the street by the barrier of the garage (as shown in the image that follows).
- Lanes allow cars to gain access to units from behind, resulting in a reduction of the required front yard setback and an increase in useable back yard space.



*This image depicts a residential street dominated by garage doors.*



*This image shows a streetscape of similar-sized lots but with garages located off rear lanes, thereby allowing homes to directly address the street.*

- A portion of the plan includes shallower blocks that have wider lots with no lanes. However, on these wider parcels, the lot dimension will allow garages to be placed beside and behind the principal façade rather than in front of the dwelling, thereby maintaining direct front-door access to the street and reducing the negative effect of garages on streets

***Principle No. 5***

*Provide an interconnected street network, in a grid or modified grid pattern, to ensure a variety of itineraries and to disperse traffic congestion; and provide public transit to connect East Clayton with the surrounding region.*

The organization of roads, blocks, parks, parkways and riparian areas responds to the site's topography and the location of its sub-watersheds, which are found in the southern portion of the site around North Cloverdale Creek, McLellan Creek, and Horner Creek (see *Figure 2.5 Appendix II*).

- The street network is organized around a four-part hierarchy of streets, which includes arterials, collectors, local streets, and lanes. This is unlike conventional developments, wherein traffic is routed along an exclusive and dendritic (i.e., branching like a tree) hierarchy of roads from an arterial, to a collector, to a local, and finally to a cul-de-sac.
- The plan's integrated system proposes that traffic be dispersed across the interconnected and modified grid, thereby reducing demand on arterials roads and the need for large intersections.
- Major and local through-traffic is accommodated on a system of major and minor arterials, which are designed to accommodate the specific requirements for servicing, utilities, drainage, pedestrian amenities, and urban forestry.
- Through-traffic occurs on the north-south routes of 188<sup>th</sup>, 192<sup>nd</sup> and 196<sup>th</sup> Streets, and along the east-west 68<sup>th</sup>, 70<sup>th</sup> and 72<sup>nd</sup> Avenues, with the Main Street mixed-use commercial street occurring along 72<sup>nd</sup> Avenue.

This system, in concert with sufficient provision of mixed-use services and access to transit, can produce major reductions in auto dependence, especially for local trips. Areas similar to East Clayton show up to 40 per cent reduction in trip generation per capita. The plan assumes a 25 per cent reduction as the basis for designing the transportation network that will serve the wider area.

***Principle No. 6***

*Provide narrow streets shaded by rows of trees in order to save costs and to provide a greener, friendlier environment.*

- Paved street widths for local and minor collector streets range from 6 metres (20 feet) to 9.8 metres (32 feet); which includes parking pockets. This width increases to 12.2 metres (40 ft.) (including parking pockets) in major collectors streets.
- Rights-of-way for these streets range from between 17 metres (56 feet) and 22 metres (72 feet), depending on the specific infrastructure and servicing and amenity requirements (i.e., drainage, traffic volume, and urban forestry) of each individual street.

- Street trees are closely spaced (10-12m. / 33-40 ft. apart) to provide ample shade for pedestrians.
- Raised curb streets with wide treed boulevards with swales can also achieve the overall drainage objectives for the area, if infiltration devices on private lots reduce the amount of rain water flowing onto the public boulevards and streets, and the City's requirements for infiltration rates are met.



*This image shows the ultimate desirable narrow, curbless residential street. Its curbless profile would allow water to infiltrate directly into the infiltration zone.*

***Principle No. 7***

*Preserve the natural environment and promote natural drainage systems (in which storm water is held on the surface and permitted to seep naturally into the ground).*

The backbone of the plan's green infrastructure is its linked system of streets and open spaces, which includes local streets, linear parks, schools, riparian protection areas, tree preservation areas, neighbourhood pocket parks, and buffers. This system will have many beneficial functions. It will simultaneously satisfy social, recreational, and educational demands while meeting important ecological goals (such as stream protection, storm-water management, and habitat preservation). As a result of the reduced pavement in roads and requirement for adequate infiltration on private lots, it is anticipated that a substantial percentage of all annual rainfall will be absorbed by the soil in yards and roadway boulevards.

- The plan includes two major park/school sites, which are to function as retention ponds/artificial wetlands during unusually heavy rains and as useable green areas for the surrounding residents and school facilities during normal periods (image below).
- In addition, a series of shallow ponds are to serve as detention/infiltration areas for more frequent major rains, holding it until it too can seep naturally back into the soil; be transpired by aquatic plants; or be released gradually into the streams. Designed as natural components of two of the three major parks, these ponds are to provide a permanent habitat for avian and aquatic species while also making a positive contribution to the aesthetic quality of the landscape.





*Large parks and school grounds are integral components of the site's ecological infrastructure. They provide on-site bioremediation and infiltration for large storms, and they become shallow retention basins during 20 to 100 year storm events.*

### **2.1.1 Performance Objectives**

The above seven principles provide the general parameters for sustainable planning and design in East Clayton. The following are feasible general targets for performance in the areas of the natural and man-made environment. These performance targets informed the design brief for the charrette and are derived from key local, regional and provincial policies relating to sustainable development over the past decade.

#### **Built Environment**

##### **To reinforce a strong single family neighbourhood character**

- Ensure pedestrian priority of pedestrians over vehicles along all local residential streets with minimum driveway interruptions.
- Maximize opportunities for extending the fine grained interconnected pedestrian/bike circulation system to increase options for passive recreational opportunities for all age groups.
- Ensure that semi-private areas (covered or open) space are provided at the interface between buildings and street.
- Ensure that buildings retain a human scale with one or two storey portions of the building being dominant at the interface area with the street.
- Ensure that building designs reinforce street activity and provide opportunities for casual surveillance.
- Ensure variety of open space/park areas that satisfy the recreational needs of the various age groups within close proximity to home.

#### **Ecology**

##### **To improve air quality by reducing auto use:**

- Ensure that commercial and transit services are within a 400-metre (1/4 mile) walk-able radius of all residents.
- Ensure that walking and cycling are viable alternatives to the use of cars to access local facilities and activity nodes.

##### **To maintain stream health and to enhance habitat:**

- Maintain or enhance ecological performance of native aquatic habitats.
- Maximize opportunities for parks, riparian areas, and greenways to retain significant habitat value.
- Maintain existing base flow level in all on-site and off-site streams.
- Eliminate storm surge
- Minimize opportunities for water pollution

## **Equity**

- Maximize opportunities for providing work places in proximity to areas of residence.
- Provide a wide variety of unit types and sizes appropriate to citizens of all ages, family types and income groups.

## **Economy**

- Orient as many residential units as possible so that passive solar heating is maximized.
- Reduce cost of infrastructure.
- Maximize efficiency in use of land.
- Incorporate imaginative financing devices (e.g., mortgage helpers in the form of secondary suites).
- Facilitate opportunities to supplement family income with businesses operated from the place of residence.

## 2.2 LAND USE TYPES

The following section provides a brief description of each land use type and its designated land allocation. The East Clayton Land Use Statistics (Table 2.2) identifies proposed building and population densities for each of the land use types and shows low, high and average estimate density for each land-use.

### 2.2.1 Residential Areas

Approximately 119.8 hectares (296 acres) of East Clayton's land area is proposed for future residential use. The proposed residential land uses offer a wide variety of forms and tenures within walkable neighbourhoods, as per the sustainable planning principles including:

#### *Half-Acre Residential*

Single-family homes (with and without ancillary secondary suite or coach house units) on half-acre lots up to a maximum density of 4 units per acre. This residential land use is proposed for the existing one-acre lot subdivision called Aloha Estates, which is designated Urban on the Official Community Plan and located at 72 Avenue and 192 Street. (Rezoning and subdivision of existing one-acre lots will require a high level of cooperation from residents and hinge upon the timing of road infrastructure and servicing.)

#### *Low Density*

Single-family homes (with and without ancillary secondary suites or coach house units) and duplexes on lots of an approximate area of 320m<sup>2</sup> to 375m<sup>2</sup> (3,445 to 4,037 sq. ft.) up to a maximum of 560m<sup>2</sup> (6,000 sq. ft.) with and without lanes at gross densities between 6 and 10 units per acre.

#### *Medium Density*

Single-family homes (with and without ancillary secondary suites or coach house units) on narrow-deep or wide-shallow lots of an approximate area of 220m<sup>2</sup> to 300m<sup>2</sup> (2,368 to 3,229 sq. ft.) with lanes at gross densities between 10 and 15 units per acre.

#### *Medium-High Density*

Row houses, duplexes, stacked townhouses, or single family houses with a coach house or secondary suite at gross densities between 15 and 25 units per acre.

#### *High Density*

Fee-simple row houses on lots between 165m<sup>2</sup> and 250m<sup>2</sup> (1,776 and 2,691 sq. ft.), stacked townhomes and apartments at gross densities between 22 and 45 units per acre.

#### *Mixed-Use Commercial/Residential*

Residential units above ground floor commercial uses in the mixed-use areas proposed at 72 Avenue and 188 Street and at 64 Avenue and 196 Street (see also *Mixed-Use Commercial/Residential under Section 3.2. a)*)

***Special Residential***

*A special mixed-use residential area allowing certain low impact retail and service commercial as an optional use as part of a residential unit in the form of townhouse, row house, or small lot single family homes at a density between 10 and 15 units per acre.*

## **2.2.2 Commercial Areas**

A total of 8.58 hectares (21.20 acres) of the Plan area is designated for three types of commercial uses.

***Mixed-Use Commercial/Residential***

One of the two mixed-use areas proposed is the Main Street commercial center, located at the corner of 72<sup>nd</sup> Avenue and 188<sup>th</sup> Street. Located at a key entry point to the neighbourhood, the Main Street commercial centre is to serve as the heart of the community and will connect East Clayton to the wider Clayton area. This area is to be pedestrian-oriented in terms of street design as well as building massing and orientation, and is to have a “village-centre” character. A smaller mixed-use commercial/residential area is to be located at the southeast corner of the neighbourhood at the corner of 196<sup>th</sup> Street and 64<sup>th</sup> Avenue (see also. *Mixed-Use Commercial /Residential under Section 3.2. a)*).

***Neighbourhood Commercial***

Smaller-scale commercial nodes (as a single use or as part of Special Residential uses) are proposed at four additional locations, which are situated so that every residential unit is within a five-minute walk of at least one commercial location. These smaller commercial areas may also incorporate residential use above the street-oriented commercial units.

Also, a street-fronting neighbourhood/community-oriented commercial area is proposed on the east side of 188 Street between Fraser Highway and 68 Avenue to complement the commercial uses being considered for development to the west, across from 188 Street. This commercial area would also serve the needs of the Business Park patrons and customers.

### ***Specialty Commercial***

A specialty community-oriented commercial area, geared towards both local residents as well as those from the wider community, is proposed along Fraser Highway. It is imagined that this area could be similar to the commercial area at Panorama Village (No.10 Highway and 152<sup>nd</sup> Street) and would be a particularly good location for restaurants and shops.

Development within the three commercial areas will conform to the relevant commercial zones contained in the Surrey Zoning By-law. However, where allowable uses and regulatory standards contained in the related By-laws are inconsistent with the performance objectives outlined in the NCP (i.e., parking, building coverage, and setbacks), these alternative standards will be considered and facilitated through amendments or variances of the Zoning By-law as necessary.

### **2.2.3 Business Park**

In keeping with the Clayton Land Use Plan, the East Clayton NCP designates approximately 14.31 hectares (35.36 acres) of the south-central portion of the site (between 192<sup>nd</sup> Street and 188<sup>th</sup> Street) as business park area. Uses within this area will be oriented towards industry of a high-tech and/or light manufacturing and service nature. The development of this area will generally conform with the existing IB “Business Park” Zone of the Zoning By-law No 12000.

### **2.2.4 Special Residential Areas**

Adjacent to the Business Park, along 68<sup>th</sup> Avenue between 188<sup>th</sup> and 192<sup>nd</sup> Streets are proposed Special Residential uses. At densities between 10 and 15 units per acre these areas provide for a mixed use development in the form of townhouses, row houses, or single detached dwellings on small lots, and will allow, as an optional use, home-based work and certain types of craft, office, retail, and selected personal services as well as consultant businesses, provided that the business operators are the owners or occupants of the residential units. The mixed housing types in the special residential areas will allow the land owners to retain their existing single family homes while taking advantage of the mixed use provisions and the increased density.

A type of housing unique to Surrey, this special residential land use designation partly fulfills a need for affordable housing. It fills the gap between the more restrictive home based business regulations contained in Surrey’s Zoning By-law under the “home occupation” provisions and the full-scale business which must be located within a commercial or industrial area. While creating an urban ambiance along 68<sup>th</sup> Avenue with its retail and service business component, its mandatory residential component also acts as a land use transition to effect a gradual change in land uses between the Business Park to the south and the residential areas to the north.

The City of Surrey Zoning By-law does not currently include a zone to implement these special residential areas. A zoning category will be created for this purpose when a proposal is submitted to the City in accordance with the concept envisioned above. The development guidelines presented in Section 3.4 provide direction with regard to possible uses, lot coverage, building massing, and architectural character for these areas.

## **2.2.5 Parks, Open Space and Preservation Areas**

A total of 33.7 hectares (83.27 acres) of the site is allocated for an integrated system of public and natural areas consisting of but not limited to: two school/park sites, a system of neighbourhood, and riparian parks, greenways, and landscaped buffers. These components are considered part of the green infrastructure system, and thus will perform multiple functions, including recreation, habitat, and surface drainage. See Section 4 “Green Infrastructure...” and Section 7 “Engineering Servicing” for more detailed performance requirements related to natural drainage, environmental enhancement, and circulation.

### **School/Park Sites**

The size and location of the two school/park sites conforms to the policy “Site Layout and Design Guidelines for the Planning of School/Neighbourhood Park Sites Jointly Operated by the City of Surrey and School District No. 36.” This policy indicates that school/park sites should have an area of between 5.26 and 8.1 hectares (13 and 20 acres) and be located to serve a minimum of 750 and maximum of 1,500 family-oriented housing units. The two sites are centrally located within walking distance of the surrounding residential communities and are both aligned with the 70th Avenue collector street (also designated as a greenway). Section 5.0 of this report provides general performance objectives for the school/park sites within the context of the green infrastructure system. However, in order to achieve compatibility with related City and Provincial policies, in addition to meeting the performance objectives of the NCP, specifically with respect to drainage and urban forestry, more detailed standards and design guidelines will be required as development proceeds.

Table 2.2 East Clayton Land Use Statistics

Land-Use	Area		Total No. Units				Total Net Area	Estimated Population
	Hectares	Acres	Low Density Range	Base Density for Amenity Purposes	High Density Range	# of Units		
Residential								(Average 2.8 persons/unit, based on low/med range)
Future half-acre residential (4 upa maximum)	17.58	43.43	2	2.5	4	174	9.3%	304
Low density (6 - 10 upa)	32.59	80.52	6	8	10	805	17.2%	1804
Medium Density (10 - 15 upa)	12.90	31.87	10	12	15	478	6.8%	1071
Medium-High Density (15 - 25 upa)	22.02	54.41	15	20	25	1360	11.6%	3047
High Density (22 - 45 upa)	23.85	58.93	22	30	45	2652	12.6%	4950
Mixed-Use (25 - 45 upa)	2.24	5.53	25	30	45	249	1.2%	465
Special Residential (10 - 15 upa)	8.62	21.30	10	10	15	320	4.5%	596
<b>Total Residential</b>	<b>119.80</b>	<b>296</b>	<b>3,352</b>	<b>4,370</b>	<b>6,038</b>	<b>6,038</b>	<b>63.1%</b>	<b>12,236</b>
<b>Commercial</b>								
Mixed-Use Commercial	2.24	5.53				11,200		120,557
Neighbourhood Commercial	2.84	7.02				8,520		91,709
Specialty Community-Oriented Commercial	3.50	8.65				17,500		188,370
<b>Total Commercial</b>	<b>8.58</b>	<b>21.20</b>				<b>37,220</b>		<b>400,636</b>
<b>Business Park</b>	<b>14.31</b>	<b>35.36</b>				<b>107,326</b>		<b>1,155,290</b>
<b>Institutional (Except Schools)</b>	<b>0.6</b>	<b>1.48</b>						<b>0.3%</b>
<b>Schools, Parks, Greenways and Riparian Areas</b>								
School/Park Sites	9.9	24.46						5.2%
Storm Water Pond (Public property)	4.11	10.15						2.2%
Riparian Protection Area	5.93	14.65						3.1%
Parks and Linear Open Space	10.21	25.22						5.4%
Natural Area (adjacent to Riparian Greenway)	2.91	7.19						1.5%
Utility Open Space	0.64	1.58						0.3%
<b>Total Schools, Parks, Greenways and Riparian Areas</b>	<b>33.7</b>	<b>83.27</b>						<b>17.8%</b>
<b>Gas Right of way</b>	<b>12.73</b>	<b>31.45</b>						<b>6.7%</b>
<b>Total</b>	<b>190</b>	<b>469</b>						<b>100%</b>



### **3.0 LAND USE AND DEVELOPMENT PERFORMANCE STANDARDS AND DESIGN GUIDELINES**

These guidelines, along with Surrey's Official Community Plan, the Clayton General Land Use Plan and Surrey Zoning By-law, will be used to guide development in East Clayton. The primary intent of these guidelines is to facilitate the co-ordinated development of an identifiable, mixed-use, and pedestrian-oriented community that is consistent with the seven principles for sustainable communities and development objectives outlined in Section 1.2.1 of this report. The development performance standards and guidelines are organized by the following four land use types proposed by the plan, including:

- 1. Residential Areas**
- 2. Commercial Areas**
- 3. Business Park Area**
- 4. Special Residential Areas**

### **3.1 RESIDENTIAL AREAS**

The intent of the residential area design guidelines is to encourage the development of a variety of housing types, densities, and forms that will provide a variety of housing options while still ensuring a strong and unified residential character for East Clayton. These guidelines support the sustainable planning principles previously outlined in this report, with a special emphasis on the following:

***Principle No. 1***

*Conserve land and energy by designing compact walkable neighbourhoods. This will encourage pedestrian activities where basic services (e.g., schools, parks, transit, shops, etc.) are within a five- to six- minute walk of their homes.*

***Principle No. 2***

*Provide different dwelling types (a mix of housing types, including a broad range of densities from single family homes to apartment buildings) in the same neighbourhood and even on the same street.*

***Principle No. 3***

*Communities are designed for people; therefore, all dwellings should present a friendly face to the street in order to promote social interaction.*

***Principle No. 4***

*Ensure that car storage and services are handled at the rear of dwellings.*

#### **Objectives**

- To provide a diversity of housing types (i.e., detached, semi-detached, fee-simple row housing, townhouses, and apartments) and tenures so as to accommodate a wide range of individuals (i.e., single parents, couples, families with children, seniors, people with special needs, and others);
- To increase housing options for people at a variety of income levels and family types;
- To allow as many dwellings as possible to address the street;
- To encourage walking and cycling to local destinations and thereby reduce dependence on cars;
- To include on-street parking, street trees, boulevards, and sidewalks;
- To establish front yard setbacks that will ensure a clear definition between private and public space and that will enhance crime prevention by increasing the number of “eyes on the street”;

- To encourage a design that respects the regional heritage, climate, and landscape while maximizing opportunities for views, natural ventilation, and solar access; and
- To enhance public safety through the application of Crime Prevention Through Environmental Design (CPTED) principles.

### **General Character of Residential Areas**

Residential areas are expected to achieve a strong and cohesive overall single family residential character and reinforce the relationship of the residential units to the street. It is expected that the various residential densities and housing types proposed in the plan can be accommodated in the neighbourhood based on a typical single family residential block as a basic module. Densification could be achieved by developing small single family lots, with or without coach houses or ancillary secondary suites, townhouses, row houses, stacked townhouses, etc. within the basic module.

Diversity could therefore be achieved by a combination of various housing types and densities within the same block or by combining blocks of different densities and housing types within the overall neighbourhood grid system of streets.

### *Half-Acre Residential (Aloha Estates)*

Single family homes (with and without ancillary secondary suites or coach house units) on half-acre lots up to a maximum density of 4 units per acre. Development standards/regulations should generally be in accordance with the RH Zone contained in Surrey Zoning By-law, No 12000.



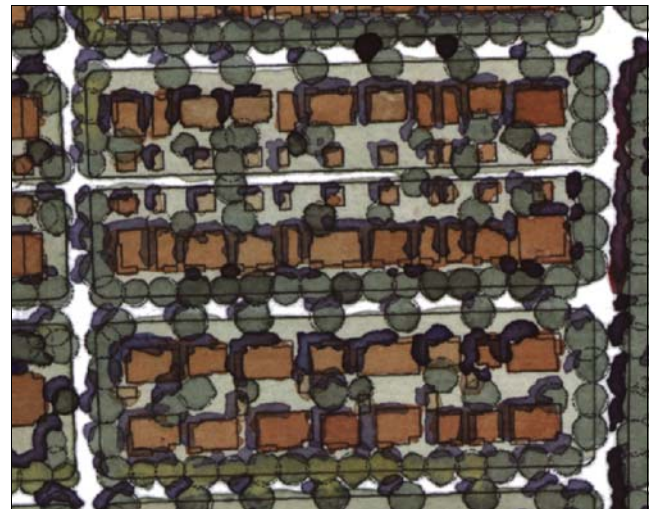
In keeping with the objective of providing a variety of housing types and sizes, the Aloha Estates area south-west of 72 Avenue (currently one-acre lots) may eventually be redeveloped into half-acre lots (with or without coach houses). The subdivision potential and timing will be dependant upon road infrastructure and servicing and will require a high level of cooperation among property owners. The design of coach houses is to reflect the existing “estate” character of the Aloha Estates area.

### ***Low Density Residential***

Single family homes (with and without secondary suites and/or coach house units) and duplexes on standard and shallow/wide lots of approximately 320m<sup>2</sup> to 560m<sup>2</sup> (3,440 to 6,000 sq. ft.) with and without lanes at densities between 6 and 10 units per acre (gross density). Development standards/regulations should generally be in accordance with the RF, RF-12, and RF-12C Single Family Residential Zones contained in Surrey Zoning By-law, No 12000.

Developments in this zone should provide as many lots as possible having rear lane access to a garage. Achieving this objective may not be always feasible in all sites as existing subdivision pattern and terrain conditions change throughout the neighbourhood, however, low density residential areas should not have less than 60% of the lots with rear lane. Access to garages from the rear lane is mandatory for all lots in blocks with lane.

*This plan view of a low-density area shows single family homes on a variety of lots that include lots with lanes and shallow-wide lots in blocks without lanes.*



*Dominant characteristics:*

- *Small front setbacks to allow more room for private backyard space;*
- *Corner lots with coach houses to increase diversity, to provide unity to the streetscape, and to increase “eyes on the street”;*
- *Most garages accessed via rear lanes; in blocks without lanes, access to the garage is via shared front driveways (paired driveways are acceptable in especial situations)*
- *Parking pockets on one, or both sides of the street provide additional parking opportunities.*

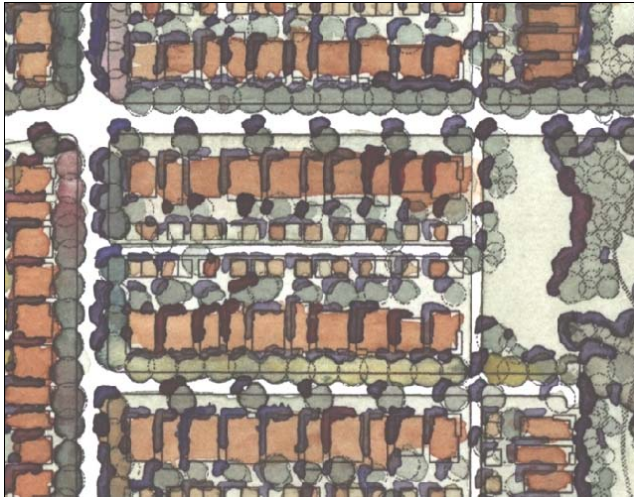
*This single family streetscape illustrates the character of dwelling units on larger lots, with rear lanes, within the low density area.*



- *Entries that retain a human scale (i.e., no higher than one storey) and that relate to the street;*
- *Front porches and verandahs with overhangs that define a semi-private area in front of the unit;*
- *Small front yard setback and clear delineation of public and private space;*
- *Façades articulated with window details and projections;*
- *Steep sloped gable roofs;*
- *High quality materials and finishes (e.g., wood, masonry); and*
- *Garages accessed via the rear lane or (on blocks without rear lanes) garages that are recessed behind the front façade.*
- *Garages at a min. 6.0 m. (20 ft.) front yard setback.*

### *Medium Density Residential*

Primarily single family residential homes in more compact neighbourhoods are permitted while allowing for additional accommodation in the form of two-family dwellings (i.e., duplexes). Developments in this area include single family units on narrow 220m<sup>2</sup> to 250m<sup>2</sup> (2,368 to 2,691 sq. ft.) lots (with or without coach houses) and wide-shallow 270m<sup>2</sup> to 300m<sup>2</sup> (2,906 to 3,229 sq. ft.) lots, with lanes at densities between 10 and 15 units per acre (gross density). Development standards/regulations should generally be in accordance with the proposed new RF-9 and RF-9C Single Family Residential Zones. Access to the garage from the rear lane is mandatory for these lots.



*This plan view of a medium-density area exhibits a range of housing types – single family homes, single family homes with secondary units, and duplex units – all within the same block and all maintaining a strong single family character.*

*Dominant characteristics:*

- *Front setbacks of 2.0 m. to verandahs and 3.5 m. to units (6.5 ft and 11.5 ft respectively) to reinforce the human scale of the street and allow more room for backyard space;*
- *Larger front yard setbacks of 7.5 m. (25 ft.) and landscaping buffer required fronting portions of 192 Street and 196 Street as shown on the Land Use Plan;*
- *Garages and ancillary dwelling units are accessed via the rear lane or, in the case of corner units, via the side street; and*
- *Parking pockets on one, or both sides of the street provide additional parking for visitors*

*Medium density areas retain a single family character while providing a range of housing types.*

- *Strongly defined front entry that relates to the street;*
- *Front porches with overhangs;*
- *Small front-yard setback with clear delineation of public and semi-private space;*
- *Façades articulated with appropriately proportioned windows and roof projections;*



- *Strong and simple gable roof forms to provide interest and rhythm to the streetscape, and permit natural light penetration;*
- *Use of materials that reflect regional context (i.e., wood, cedar shingles, stone) and careful detailing; and*
- *Garage and ancillary units are accessed via rear lanes*



### ***Medium-High Density Residential***

Medium-high density development, comprising semi-detached single family duplexes, fourplexes and fee-simple row houses, and at the higher density range, integrated townhouse developments, are permitted between the ranges of 15 and 25 units per acre (gross density). Development standards/regulations should generally be in accordance with the proposed new RM- Multiple Residential 19 Zone, and the RM-10, RM-15 and RM-30 Multiple Residential Zones contained in Surrey Zoning By-law, No 12000.

Emphasis is on recognizing the single family neighbourhood character of East Clayton, ensuring a good relationship of the units to the street and compatibility of design with other residential areas, and promoting a high number of ground-oriented units. Access to parking is provided via rear lanes or internal driveways; the units front and have direct pedestrian access from the street.

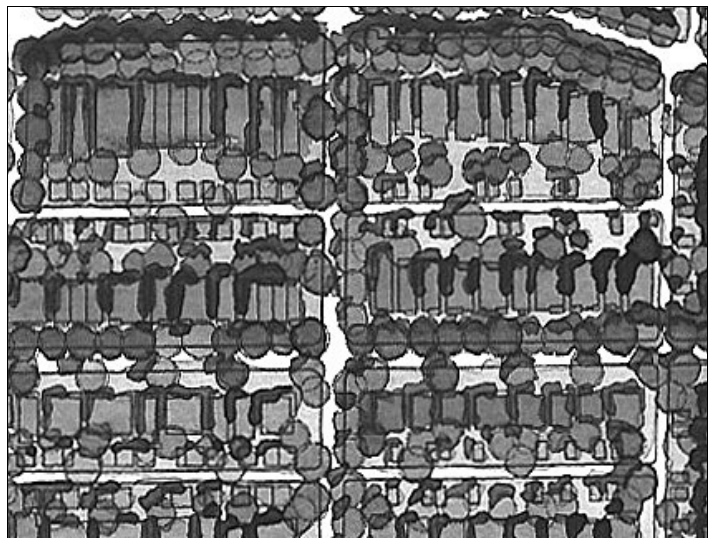
*This plan view shows a variety of lot dimensions and housing types including semi detached single family duplexes and fee-simple row houses.*

*Dominant characteristics:*

- *Front setbacks of 2.0 m. to verandahs and 3.5 m. to units (6.5 ft and 11.5 ft respectively) for single family, semi-detached units and rowhouses.*
- *For buildings higher than 2 storeys, front yard setback of 4.0 m. (13 ft.) for the two first levels and 6.0 m. (20 ft.) above;*
- *Garages accessed via lane and an open parking pad for coach house or secondary suite; and*
- *Parking pockets on one, or both sides of the street provide additional visitor parking.*

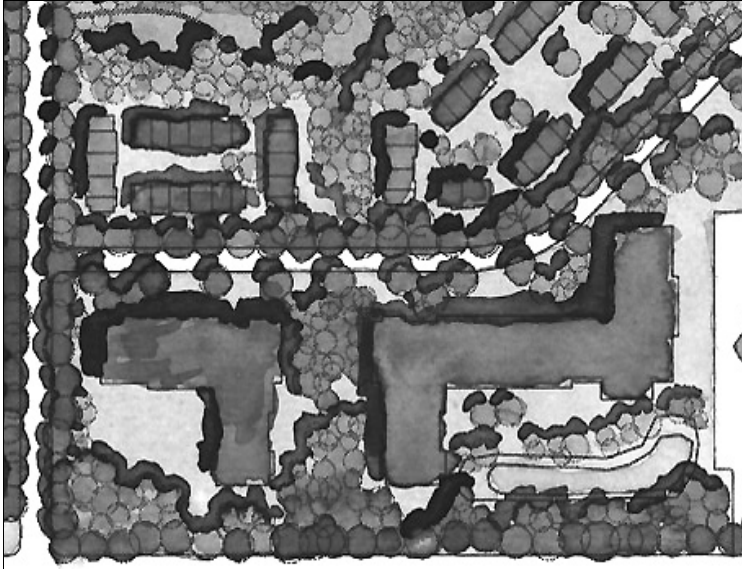
*Row houses are designed to reinforce the character of single family areas and contribute to a unified streetscape.*

- *Ground-oriented units;*
- *Clearly identified front entry and yard that relates to the street;*
- *Extended porches and recessed entries;*
- *Massing and detailing that relates to the surrounding single family context;*
- *Massing based on simple, regular shapes with strong, gabled roof forms; and*
- *Garages are not a part of streetscape*



### *High Density Residential*

High-density residential development between the ranges of 22 and 45 units per acre (gross density) is permitted in this category. Development standards/regulations should generally be in accordance with the RM-30 and RM-45 Multiple Residential Zones contained in Surrey Zoning By-law, No 12000. Emphasis is on recognizing the single family neighbourhood character of East Clayton, ensuring a compatibility of design with other residential areas, and promoting the highest possible number of ground-oriented units with a direct connection to the street.



*High-density areas are comprised of stacked townhouses, row houses, and/or garden apartments at densities between 22 and 45 units per acre. This plan view shows high-density row houses across the street from apartments.*

*Dominant characteristics:*

- *Front setbacks of 4 metres (13 ft.) at street level and 6 metres (20 ft.) in upper levels in order to create a strong street orientation for apartment buildings;*
- *Parking provided in individual garages at the rear, in rear parking areas, or underground; and*
- *The lower level units front and have direct pedestrian access from the street.*



*High-density apartments have ground-oriented access with a strong orientation to the street.*

- *A maximum number of individual entries front onto the street;*
- *Clear delineation between private and public space;*
- *Recessed front entries or porches to articulate façade and reinforce unified residential character;*
- *Upper-floor units have private roofdecks or balconies;*
- *Massing and proportions contribute to human scale of the street; and*
- *High-quality materials and detailing that is compatible with adjacent single family areas.*



### ***Mixed-Use Main Street Residential***

High-density residential units of densities between 25 and 45 units per acre (gross density) are permitted within the context of a mixed-use neighbourhood. Development standards/regulations should generally be in accordance with the RM-30 and RM-45 Multiple Residential Zones, and the CD-Comprehensive Development Zone contained in Surrey Zoning By-law, No 12000. The Main Street district serves as the “heart,” or central locale first for the East Clayton community and ultimately, for the Clayton district as a whole. In the Main Street residential area, residential units are designed to visually and functionally integrate with commercial uses on the main floor. The external design of buildings is oriented to the pedestrian realm, with a direct and close connection to the public sidewalk. All parking is to be provided via rear lanes, underground. Visitor and customer parking is to be provided at the rear of the building (or underground) and on the street.

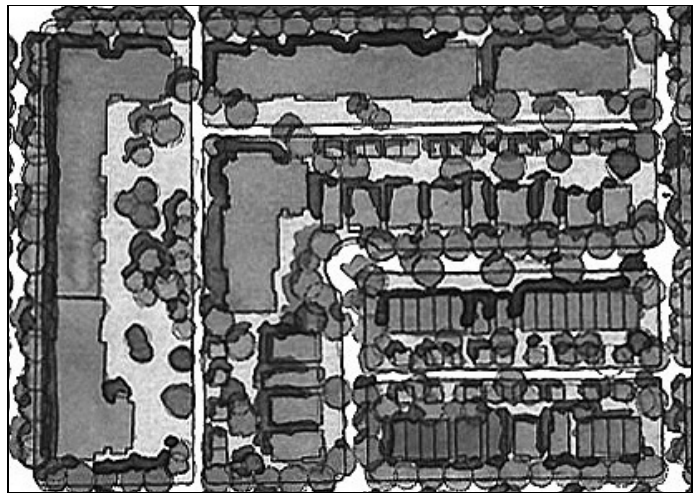
*The Main Street residential area is envisioned as a high-density mixed-use that accommodates apartments or townhouses above ground-floor commercial uses.*

*Dominant characteristics:*

- *The residential density ranges between 25 and 45 units per acre;*
- *Front setbacks between 1 metre (3 ft.) and 2 metres (6.5 feet);*
- *Building heights not to exceed 4 storeys; and*
- *Parking provided at the back with access from the lane.(see also Main Street Mixed-Use Commercial/Residential, Section 3.2. a).*

*The Main Street residential area features commercial uses along the ground floor with residential units above.*

- *Lot coverage up to 70% to ensure street frontage continuity;*
- *Residences accessed via a separate entrance from the commercial uses, integrated into the facade of the building;*  
*and*
- *Awnings and/or canopies, provide pedestrian weather protection and articulate ground-floor retail uses.*



### **3.1.1 Housing Density and Diversity**

#### **Net Density**

Assuming that the average density for each residential zone is reached, the total net residential density (total site area excluding rights-of-way and other undevelopable area) should be 36.47 units per hectare/14.7 units per acre.

#### **Block Diversity**

To reach the overall residential density target in East Clayton and to ensure effective and efficient operation of the services, infrastructure, and the integrated community structure, a mixture and variety of residential types along with the target densities must be achieved.

- The target densities are those at the “Base Density for Amenity Purposes” identified in Section 2 . Table 2.2. East Clayton land Use Statistics.
- Target land use mixes comprise a wide array of different dwelling types in the same neighbourhood and on the same block arranged in compatible building forms.
- Residential development projects will be encouraged to provide a variety of dwelling types and densities.

### **3.1.2 Relation of Buildings to Streets - Building Footprint and Design Standards**

The relationship between density, land use integration, and street connectivity is important in reaching the various objectives of the plan. With this in mind, the interconnected system of streets and lanes should be maintained as per the Land Use Plan.

Achieving a human scale, reinforcing pedestrian priority over vehicles and achieving a close buildings-street relationship are closely linked to the relative continuity of building frontages and sidewalk, therefore, the provision of residential blocks with lanes is critical to meet the neighbourhood character and sustainable objectives.

#### **Building Coverage**

Achieving the various performance objectives related to green infrastructure and drainage requires minimizing the amount of impervious surface area resulting from buildings and other surfaces on each lot.

- If the infiltration performance standards defined by the City for the area are met (via natural soil absorption or an acceptable on-site infiltration device), the total lot coverage of low and medium density lots (including garages/coach houses) could reach a maximum of 60 per cent. In medium-high density areas, site coverage shall also be no greater than 60 per cent for single family lots (including garages/coach houses) and duplex and row house lots. In high density areas, building coverage should not exceed 50 per cent. Mixed-use developments may have a site coverage of up to 70 per cent, while still meeting infiltration performance standards.

## **Building Height**

- The height of principal single family dwellings on low, medium and medium high density lots should not exceed 9.5m (31 ft.). (Note: where applicable, the floor above the second floor [i.e., space within the roof gable] is considered habitable space.)
- The height of coach houses in these areas shall not exceed 6.5m (21 ft.) with a steep pitch roof (e.g. 10:12).
- The height of row houses and townhomes in medium-high and high-density areas shall not exceed 9.5m (31 ft.).
- High-density and mixed-use apartments shall not exceed 15.0 m. (50 ft.).

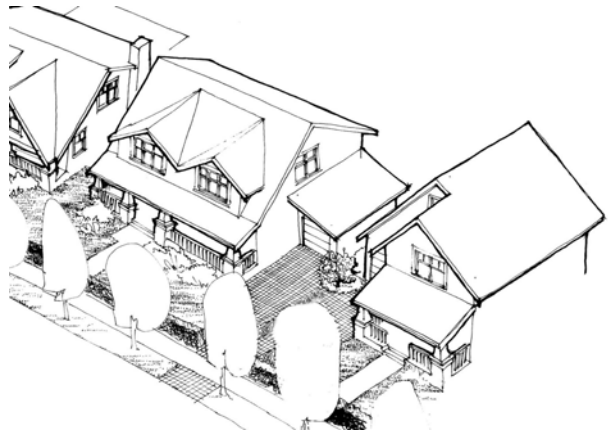
## **Parking and Garages**

For low, medium, medium-high, and portions of high density areas (i.e., row house/townhouse developments), a minimum of 2 parking spaces per unit is required. One additional parking space for a coach house or ancillary unit should be provided on the site; additional visitor parking may be provided on one or both sides of the street. A parking count should confirm that at least one parking space for each two potential ancillary dwelling units on the block/street can be accommodated on the street.

- Parking in the lane right-of-way is not allowed.
- Access to parking is to be provided off the lanes; on those exceptional blocks where this is not feasible, parking should be provided from the street via shared driveways (and in exceptional cases via paired driveways) or shared easements and incorporated in such a way as to enhance the streetscape of the neighbourhood.
- Garages for single family dwellings are to have a maximum of one garage door with a maximum width of 5 metres (16 feet). On blocks without lanes garages should be located at the back of the lot, or be setback a minimum of 6 metres (20 feet) from the front property line and 2.5 m. (8 ft.) from the front wall of the unit.
- On blocks without lanes, entry drives and curb cuts are to be minimized by combining two drives for entry off the street.

- Entry drives to a front garage (within the site) should be a maximum of 5.25 metres (17 ft) in width. Driveways may flare slightly on private property to provide a parking court or storage area next to the garage.
- On blocks without lanes, the massing of garages is to be secondary to the primary form of the home (at least 2.5m (8 ft.) setback from the building face, however, this setback can be reduced to 2.0m. (6 ft. 6 in. ) in low-density in the RF-12 Single Family (12) Residential Zone). The design and detailing of the garage should be consistent with the architectural style of the home.
- Wherever possible, permeable materials (i.e., decorative pavers, permeable asphalt, “grass-crete”, gravel, ribbon-strip treatments) should be provided for driveways, parking pads, and parking courts.
- All garage doors visible from a public street or open space should include transom glass and be of the same quality of detail and craft as the primary building.
- In low density areas, attached garages and garage doors are to be integrated into the building mass. In higher density areas, placement of the parking entrance, (if provided from the street to the rear garage), shall be integrated with, but secondary to, the rest of the building façade. The parking entrance shall be preferably accessed via the side street or lane.
- Lane-accessed garages and coach houses should be set back a minimum of 0.5 metre (2 ft) from the lane right-of-way.

*On blocks without lanes, recessed garages with minimum dimensions are integrated into the home. Shared curb cuts, “ribbon strips” (median planted area), and decorative pavers increase the permeable surface area of the driveway.*



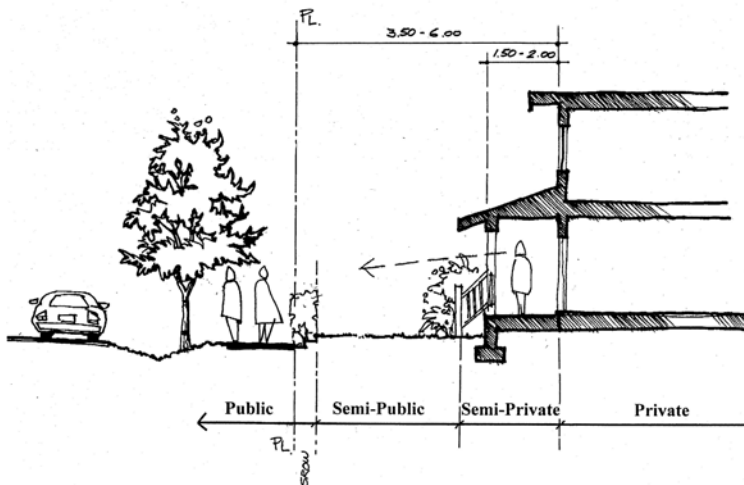
## Front Setbacks

- Front setbacks should reinforce the human scale of the street and neighbourhood. In low, medium, and medium-high density areas, front setbacks for primary dwelling units on single family lots should be a minimum of 3.5 metres (11.5 feet) and 6.0 metres (11.5 feet) for a street fronting garage, where rear lane access to garage is not possible. Front porches and verandahs may project up to 1.5 metres (5 feet) into the front yard setback.

- Special front setbacks of 7.5 metres (25 feet) are required for lots facing portions of 192<sup>nd</sup>, 196<sup>th</sup> Street, and portions of 64<sup>th</sup> Avenue (see Land Use Plan) to provide for a landscaped buffer, on private property, along these arterial roads.
- Coach houses on a flanking street should have a front setback that is compatible to the sideyard setback of the primary dwelling unit.
- Front setbacks for row houses and townhouses in medium-high and high-density areas should also be a minimum of 3.5 metres (11.5 feet) from the front property line. Where townhouses, row houses abut low-density single family lots, the front setback should be the same as the single family dwellings.
- Mixed-use residential/commercial buildings should have a front setback that range between 1.0 metre (3.3 feet) and 2.0 metres (6.6 feet.) at ground level. Upper floors should have additional setback.

## Building Orientation

- All residential buildings are to have their primary façades facing public streets, parks, and greenways. In the case of corner lots, where buildings are fronting two streets,



*An appropriate relationship between private single family residence and public street. The front porch is allowed to extend a maximum of 2 metres (6.6 feet) into the front setback. Low shrubs along the property line make a clear distinction between the private front yard and the public street.*

## Entries, Porches and Front Yards

Where appropriate, fencing and hedging should be provided in order to help delineate public and semi-private space. Hedging or fences should be kept low, and the latter should be designed to be in keeping with the architectural character of the dwelling. The maximum recommended height of any front-yard fencing is 1 metre (3.3 feet).



*A small home facing two streets. Note the porch addresses both streets, provides a generous amount of outdoor space and incorporates the front entry door.*

- Wood, metal or stone fencing, or a combination, is acceptable while chainlink metal fencing without continuous hedging on the street side is not. Picket, lattice, three board fence, or other similar wood fencing is acceptable while solid fences are not.
- Gates; if proposed, should be consistent with the style of the fence.
- Front doors, or individual entries, on ground-oriented units are to be emphasized through the use of entry porches (or recessed front doors).
- The addition of large porches and verandahs facing the street is encouraged. These promote neighbourhood interaction and provide semi-private outdoor space. They should have a clear minimum depth of 1.5 metre (5 feet), although 2.0 metres (6.5 feet) is most desirable.
- Porches and entrances to the dwelling unit should not be higher than 1 storey above the verandah level or the stoop.
- Porches and verandahs are to be raised a minimum of 0.5 metre (18 inches) and no more than 1.2 metre (4 feet) above the public sidewalk level. Main floor level should not be higher than 1.2 metres (4 ft.) above the sidewalk level.



*On this row-house street, all units access the street from a recessed front entry and a small front porch. Low fences (1 metre/3.3 feet) and landscaping distinguish public from private space and contribute to a neighbourly character.*

- In high-density residential areas, as many units as possible should face the street and are to be provided with individual access to the street. The disposition and orientation of the units/clusters should provide frontage continuity and define the street edge.
- “Gated Communities” are not consistent with the planning principles and are therefore not appropriate.

## Coach Houses

- Coach houses are strongly encouraged on all corner lots in low and medium-density residential areas.
- The principal entry for all corner coach house units is to face the flanking street.
- The design of coach houses is to be compatible in scale and character with that of the primary residence.

*This corner duplex also incorporates a small coach house in the rear yard.*

*Note the side yard setback on the primary unit is consistent with the front yard setback of the coach house. Massing, roof forms and porch elements are complementary to the primary dwelling and contribute to a unified streetscape.*





- Developments on lots less than 9.0 metres (30 ft.) wide or shallow/wide lots should not include coach houses.
- On lots other than corner lots, entries to coach houses should connect to streets via side yards.
- Steep gable roofs and dormers are encouraged in all coach houses.
- Most of the habitable space of the coach house should be contained within the roof gable to minimize building mass.
- The number and size of windows should be maximized in facades that abut the side street and lanes.
- A minimum separation of 6.0 m. (20 ft.) should be provided between the garage or coach house and the principal unit.

### **3.1.3 Built Form and Materials**

Consideration is to be given to massing and materials of all buildings in order to create a rich overall neighbourhood character with rhythm and variety, while keeping within a cohesive design framework.

#### **Built Form Diversity**

- In addition to the diversity of building forms between the different residential density areas, diversity of building forms is encouraged within the same area and on the same street.
- A variety of unit types (e.g., single family, duplex and row houses) are encouraged within each block in order to provide a variety of tenures and add variation to the streetscape.
- Variation in individual housing types results in different “models.” Each model may have the same lot size and basic floor plan but must be differentiated by varied exterior treatments and materials.
- No street block should have more than two consecutive single family homes with the identical house model; the same models should have variations on its expression toward the street. Variations in the expression of the building towards the street, through the location of porches, roof form, façade articulation and front elevation design details (i.e., window proportions, trim, and materials) is encouraged.

## Building Massing

- The massing of individual houses or buildings should express a strong and clear hierarchy of forms.
- Building massing should reflect the character of homes found in traditional West Coast urban neighbourhoods (especially in the low, medium and medium-high density areas). This massing should incorporate strong, pitched roof forms, porches and/or recessed entries.
- The scale of adjacent buildings should minimize overlook and shadowing between buildings.

## Roof Forms

- Buildings in low, medium and medium-high density areas should have simple and strong primary gabled roof forms. If necessary to provide roof articulation, secondary roofs gables, sheds, or integrated skirt roofs may be incorporated to express a clear formal hierarchy and to visually support the primary roof form.
- The incorporation of living spaces within the roof form should be considered and is strongly encouraged. Dormers are encouraged to add detail to roof lines.
- Roof slopes of a minimum of 8:12, with steeper roofs preferred on dominant and primary roofs. Gable roof forms are most desirable to provide articulation and interest to facades along the street.

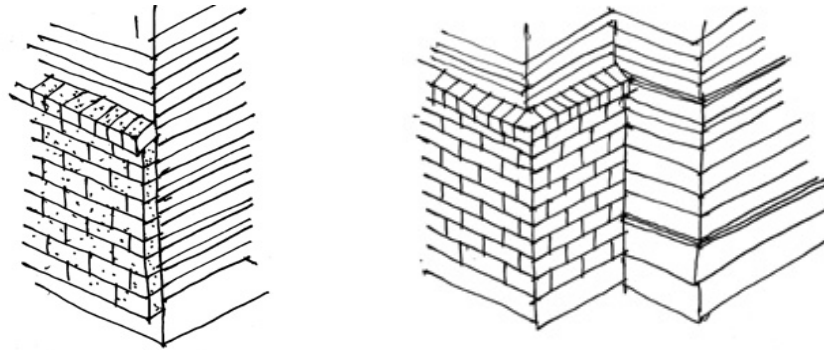


Examples of appropriate roof forms

- Garage roofs are to complement the roof form of the house
- Consideration should be given to the roofing materials so as to achieve an appropriate fit with the building's structural massing, articulation, and roof forms.

## Building Finishes

- Building and roofing materials are to reflect the regional heritage and climate as well as to express a high level of craftsmanship.
- Recommended exterior finishes include wood and vinyl siding, shingle siding, brick, stone, and stucco if combined with another material. A maximum of two material finishes is encouraged on any elevation, with a third material being permitted above the upper storey on gable ends or dormers. On three- or four-storey buildings there should be a layering of cladding materials in order to create a base, middle, and top wherever appropriate.
- Siding treatments should continue around corners for at least 1.5 m. (5 ft.) in order to avoid a “pasted on” appearance.
- Flashings and gutters should be integrated into the design through colour or other methods.
- White or light colours for façade details in contrast with strong building colours are encouraged.



*Recommended treatment for changes in cladding. Image on the left shows an abrupt change from brick to wood cladding that is unacceptable. Image on the right shows the change occurring an acceptable distance around the corner of the principal elevation and at an appropriate junction.*

## Windows

- Windows are to be visually prominent and are to be articulated with colour and/or trim. The largest group of windows, or those belonging to the primary living spaces within the building, should be of a scale that is compatible with the massing and roof forms of the building and be clearly visible from the street.
- Windows are to be of a simple configuration, carefully composed to support the massing of the buildings. Groupings in bays are encouraged. Large horizontal picture windows are discouraged.
- Vertical or square windows (individual or in groups) are strongly encouraged to be dominant in the front facade.
- The use of muntins and mullions is encouraged.



*The image to the left shows an appropriate treatment for windows. Windows are of a rectangular shape, positioned vertically and with wide trim. Wood trim is used around windows and doors in a manner*

### 3.1.4 Environmental Design Considerations

#### Climatic Response

- All residences should be oriented so that a maximum amount of primary living space receives direct sunlight. The residences should also incorporate overhangs, awnings, or trellises that will allow the low winter sun, but not the high summer sun, to penetrate the unit.

#### Views

- Views from the larger Clayton district, featuring the agricultural lowlands, Mount Baker, and other visually significant amenities should be preserved wherever possible. Residential development within East Clayton should ensure that existing views are not unduly compromised by insensitive siting, massing or orientation and that potential views are protected.

#### Topography

- Planning and building designs should be responsive to the contours and natural features of the site. Specific slope conditions are to be considered in building

layout, and designs should ensure that the functional and visual integrity of the site's grade, as well as its relationship to adjoining sites, is maintained.

### **Useable Outdoor Space**

- Provide a generous amount of usable private ground-oriented outdoor space for each residential unit. A minimum separation of 6.0 metres (11.5 feet) should be maintained between the garage and the dwelling unit in all narrow single family residential lots with a detached garage/coach house.
- Provide a minimum of 36 m<sup>2</sup> landscaped, unpaved yard area in all lots in medium and medium-high density residential areas
- Upper-storey terraces, patios, and/or rooftop gardens for upper-storey units in high-density residential areas would be an acceptable alternative to ground-oriented outdoor space only when it is impossible to provide direct ground access.

### **Crime Prevention Through Environmental Design (CPTED)**

- Developers and designers are to consider appropriate safety and natural surveillance measures (such as lighting design, visual access/surveillance) as per CPTED principles.
- The maximum number of units are to face onto greenways and neighbourhood parks.
- Homes are to be designed so that primary living areas have a clear view of the street, park, and/or greenway.
- Garages are to be oriented so that they do not block the view of the street or lane.
- It is desirable that all single family residential blocks with lanes have coach house units in the corner lots, at the lane entry.
- The largest group of windows, or those belonging to primary living areas (e.g., kitchens, family rooms, or bedrooms) should directly overlook rear yards and lanes.
- Adequate lighting at the front and back of the dwelling unit is to be provided towards streets and lanes.
- In order to increase surveillance onto the lane, where possible, the design for coach houses should incorporate one room on the ground floor and have windows facing the lane and the street on a corner lot.
- Functional porches should be provided on the street-facing elevation of residences.
- For principal residences, the first-floor elevation is to be set high enough to provide a commanding view of the street, but no more than 1.2 metres (4 ft) above the public sidewalk level.

## 3.2 COMMERCIAL AREAS

The intent of the commercial area guidelines is to encourage street-oriented commercial, and mixed-use commercial development of appropriate densities and forms so as to meet the needs of the residents of East Clayton and surrounding communities. In the case of specialty commercial, due to its location and subdivision pattern, street-oriented development is not possible. However, the guidelines provide direction for the development of specialty commercial buildings that convey a village-like character and that support pedestrian activity. The guidelines conform to the seven sustainable planning principles outlined in Section 1.2.1 of this report, with a special emphasis on the following two principles.

### ***Principle No. 1***

*Conserve land and energy by designing compact walkable neighbourhoods. This will encourage pedestrian activities where basic services (e.g., schools, parks, transit, shops, etc.) are within a five- to six- minute walk of their homes.*

### ***Principle No. 2***

*Provide different dwelling types (a mix of housing types, including a broad range of densities from single-family homes to apartment buildings) in the same neighbourhood and even on the same street.*

### **Objectives**

- To encourage development that is compatible with and serves adjacent residential uses;
- To increase housing options for a variety of income levels and family types by providing residential units over main floor commercial areas;
- To use lanes to provide access to parking and to create a continuous building frontage;
- To encourage walking and cycling to local destinations and, thereby, reduce dependence on the automobile;
- To include on-street parking, street trees, infiltration devices, and sidewalks;
- To encourage building design that emphasizes the pedestrian realm through the use of compressed front setbacks, pedestrian weather protection, and human-scale detailing;
- To accommodate economic development and to increase the number of local jobs for people who live in East Clayton;
- To provide basic commercial services within walking distance of all homes; and
- To enhance public safety through the application of Crime Prevention Through Environmental Design (CPTED) principles.

### ***Main Street Mixed-Use Commercial /Residential***

The intent of this area is to encourage the development of street-oriented commercial uses that are compatible with upper-storey residential units. Mixed-use commercial areas are intended to accentuate nodes of activity where high levels of pedestrian traffic are expected to occur and where the most intense development is expected to take place. At-grade retail/commercial uses with residential units on upper levels are to be designed to create an appealing, pedestrian-friendly streetscape that is compatible with surrounding residential uses.

The primary mixed-use commercial area (Main Street) is proposed at the intersection of 188<sup>th</sup> Street and 72<sup>nd</sup> Avenue and serves as a central commercial locale for the entire Clayton community. The commercial frontage to extend along the 188<sup>th</sup> Street and 72<sup>nd</sup> Avenue frontages.

A second mixed-use area is proposed at the corner of 196<sup>th</sup> Street and 64<sup>th</sup> Avenue.

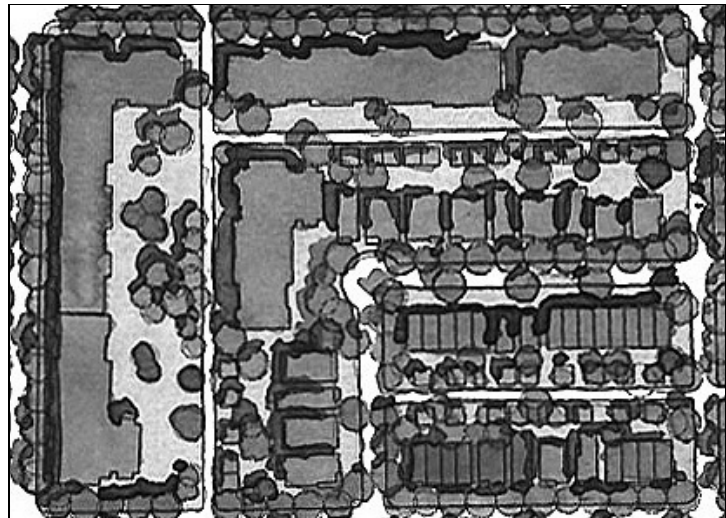
*The Main Street mixed-use commercial/ residential area is proposed at the corner of 72<sup>nd</sup> Avenue and 188<sup>th</sup> Street.*

*Dominant characteristics:*

- *Mixed-use commercial buildings of a maximum height of four storeys and a lot coverage of up to 70 per cent to ensure a near continuous street frontage;*
- *Parking areas are located behind the buildings, not exposed to direct view from the street*
- *Large surface parking lots are not permitted; and*
- *Short-term parking for patrons to be provided by on-street angled parking and at the back of the building;*
- *Commercial tenants parking is at the back or in underground structures accessed via the rear lane.*

*Image of a mixed-use commercial / residential street.*

- *Similarly scaled buildings*
- *Street trees, canopy covered sidewalks; and*
- *Short-term on street parking to supplement off street parking either underground or behind buildings*

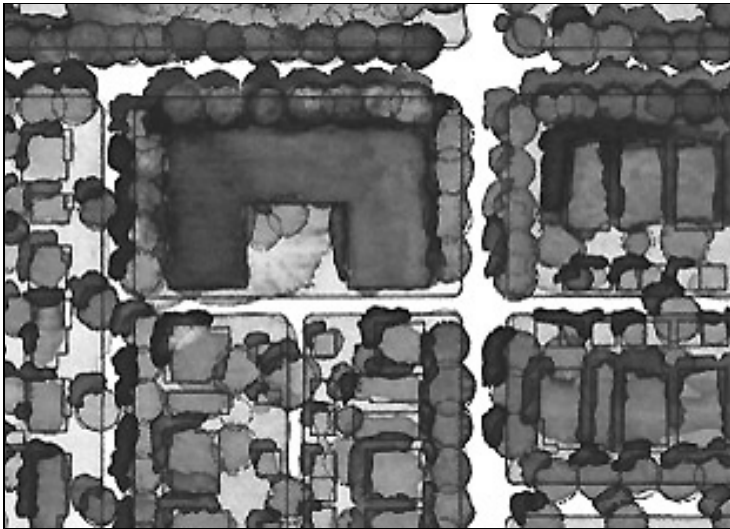




### *Neighbourhood Commercial*

The intent of this area is to provide for retail and service development that features small-scale commercial enterprises and services (such as neighbourhood grocery or convenience stores) that cater to the everyday needs of local residents. Proposed at four locations throughout the community, as a single use or forming part of the Special Residential uses, neighbourhood commercial areas are to be situated so that residents of East Clayton are within at least a 400-metre (5-minute) walking distance from one of them.

A small, street fronting, community/neighbourhood commercial area on the east side of 1188<sup>th</sup> Street between Fraser Highway and 68<sup>th</sup> Avenue; complements the commercial node proposed for development on the west side of 188<sup>th</sup> Street. This community/neighbourhood commercial area will serve the needs of both the East Clayton residents and the patrons and tenants of the Business Park area.



*A total of approximately 2.84 hectares (7.02 acres) of neighbourhood commercial (including the 188 St. community commercial area) is proposed in five locations throughout East Clayton.*

*Dominant characteristics  
Front setbacks between 1 metre (3 feet) and 2 metres (6.6 feet) to ensure a strong pedestrian orientation; Parking lots along building fronts are not permitted; and  
Parking accommodated on the street, in underground structures, or in parking areas accessed via the rear lane or side street.*



*Image of a neighbourhood commercial node.*

*Small-scale, street-oriented commercial uses (e.g., a local grocery store, cafe, or office) that respond to residents' daily needs. The massing and form of these buildings incorporates elements of the surrounding residential character*

### *Specialty Community-Oriented Commercial*

This use will accommodate a range of goods and services, commercial activities, and personal services (such as restaurants, specialty shops and services, bistros and cafes) that require a centralized location. Unlike other commercial zones that support residential uses, the specialty commercial area is envisioned as a centre of commercial activity for the larger neighbourhood and surrounding communities. The nature of its location and parcel configuration precludes direct street orientation, as is seen in neighbourhood commercial and mixed-use Main Street commercial uses; however, small-scale building footprints, human-scale detailing, and parcelized parking areas ensure a pedestrian-oriented environment that is compatible with surrounding residential uses and is easy to access from the residential areas by bike or on foot.

*A total of 3.5 hectares (8.65 acres) along the north side of Fraser Highway and 64 Avenue is allocated for specialty commercial use. The area will serve both the local and surrounding communities with a mix of commercial uses.*

#### *Dominant characteristics*

- *The built form should reflect the scale and character of surrounding residential buildings;*
- *Large parking surfaces, which are exposed to direct views from adjacent streets should not be permitted;*
- *Small clusters of parking should be provided and distributed among each building; and*
- *A 15-metre (50 feet) wide landscaped buffer is required along Fraser Highway.*

#### *Image of a specialty commercial area*

- *Arcaded buildings provide weather protection for pedestrians and create a “village-centre” atmosphere; and*
- *Small parking areas are grouped between buildings and are planted generously with trees.*



### **3.2.1 Relation of Buildings to Streets – Building Footprint and Design Standards**

#### **Building Coverage**

Achieving the various performance objectives related to green infrastructure and drainage requires minimizing the amount of impervious surface area resulting from buildings and other built surfaces on each lot. At the same time, creating pedestrian-friendly streets (in the case of Neighbourhood Commercial and Mixed-Use Commercial areas) requires minimizing front setbacks and maximizing the street frontage of buildings.

The building coverage to be permitted is subject to satisfying the infiltration standards that the City prescribe. The following standards apply:

- The total maximum building coverage for Main Street mixed-use commercial lots is 70 per cent.
- The total maximum building coverage for Neighbourhood Commercial is 60 per cent.
- The total maximum building coverage for the Specialty Commercial area is 50 per cent.

#### **Building Height**

- Buildings in Main Street Mixed-Use Commercial areas shall not exceed a height of 15 metres (50 feet).
- Buildings in Neighbourhood Commercial areas shall not exceed a height of 9.5 metres (31 feet) with the majority of the area above 2 storeys to be contained within a steep pitched roof.
- Buildings in the Specialty Commercial area shall not exceed a height of 9.5 metres (31 feet).

#### **Parking and Garages**

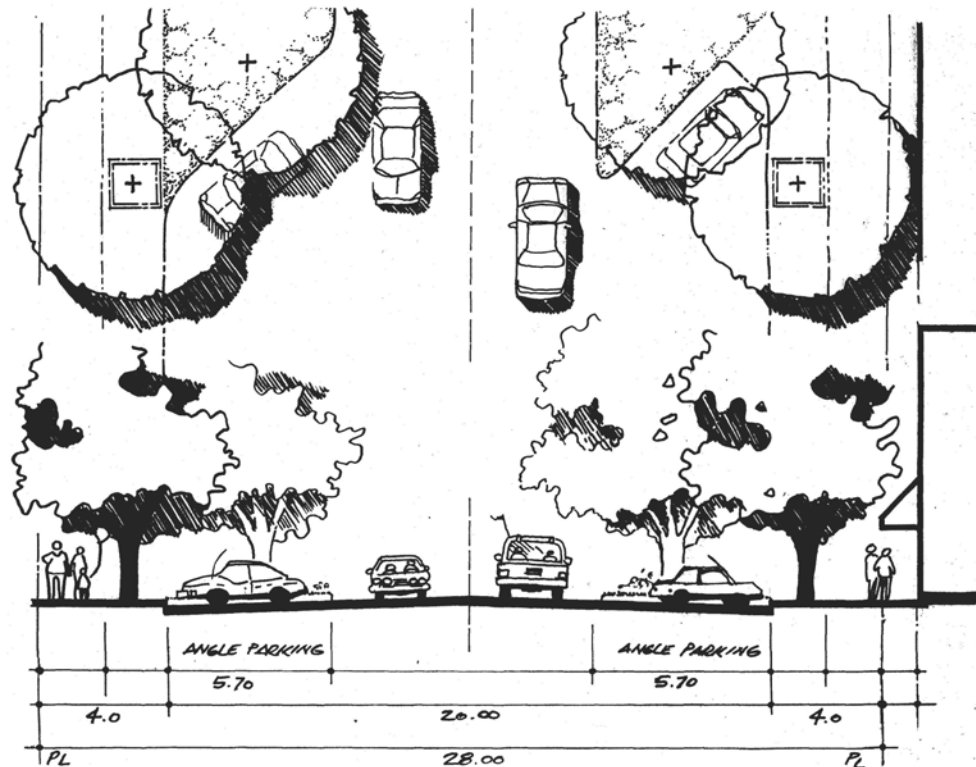
- On-street parking is a convenience for people visiting commercial establishments for a short time. It can also improve the pedestrian realm at the street edge by providing a buffer to moving traffic. In Neighbourhood Commercial, Mixed-Use Commercial areas and in front of Special Residential areas the amount of adjacent on-street parking shall be maximized and, depending on the specific location, considered as part of the required parking. Angled parking will be allowed in front of the Mixed-Use Commercial area on 72<sup>nd</sup> Avenue only.

- Off-street parking in large open parking lots can detract from the flow of pedestrian activity and can jeopardize the level of architectural continuity along a mixed-use commercial street. This being the case, other than street parking, all surface parking in Neighbourhood Commercial and Mixed-Use areas is to be accessed from rear lanes or side streets, screened by a combination of transparent fence and landscaping and be designed in such a way as to avoid potential conflict with pedestrian activity.



*Landscaped medians, planters, street trees on grates, and awnings create a pleasant envelope for pedestrians. Parking is provided on the street and in lane accessed parking areas.*

- The visual impact of service areas and vehicular parking ramps is to be minimized through proper treatment (such as enclosure, screening, high quality finishes, sensitive lighting, trellises and landscaping).
- Where it can be demonstrated that a mix of uses creates staggered peak periods of parking demand, parking areas can be shared among adjacent uses.
- In the Specialty Commercial area, surface parking areas are to be separated from pedestrian walkways and sidewalks by landscaped medians and planted with shade trees at an approximate ratio of one tree per six spaces.
- Tree species with a canopy large enough to cover, at tree maturity, approximately 35 per cent of the parking surface should be provided.
- Trees should be set into permeable areas and protected by bollards or tree guards.
- The use of permeable surfaces, or other equally effective means of treating storm-water on all parking areas should be incorporated in order to reduce surface runoff.



*Cross-section and plan view of the proposed 72nd Avenue Main Street. The cross section features a two-way travel lane angled on-street parking, street trees, wide sidewalks and pedestrian weather protection. Rear and underground parking areas, service areas, and vehicular parking ramps are accessed via lanes on all blocks*

### **Building Orientation and Front Setbacks**

- With the exception of specialty commercial buildings, all commercial buildings shall have front setbacks that range between 1.0 metre (3 feet) and 2 metres (6.6 feet) and should incorporate sufficient retail continuity to maintain a viable pedestrian-oriented commercial street.
- With the exception of specialty commercial buildings, all commercial buildings are to have their primary façades address public streets. Shop windows, awnings, canopies, and signage are to enliven the public realm and create an engaging walking environment.
- Commercial buildings on corner lots should include architectural detailing that addresses both streets.
- Outdoor extensions of cafes and restaurants are encouraged where the context is appropriate.

## Primary Entries

- The entrances of all mixed-use and neighbourhood commercial buildings should be visible and immediately accessible from the public street.
- The entrances of specialty commercial buildings, if they cannot be made visible and accessible from the public streets, should be visible and directly accessible from an outdoor space such as a plaza/square or parking area next to the building.
- Pedestrian entries should be clearly expressed and recessed or framed by a sheltering element such as an awning, arcade or portico. In order to provide a continuous walking path, arcades should be a minimum of 1.8 metres (6 feet) in width and high enough to ensure light penetration. They should also be well lit at night.
- Commercial building entries should be recessed no more than 2 metres (6 ft. 6 in.) into the principal façade.
- When the commercial unit is at ground level, individual commercial unit entries should be located on the street (and not in a common vestibule).



*Note the separate entry court and stairways to residential units on upper floor units.*

- Internal public circulation systems, such as shopping malls, are discouraged.
- Residential entries and lobbies are to be separate from commercial entries. The former should have a residential character that distinguishes them from the latter.
- Residential lobbies are to be visible from the street, and their main entries should front onto the street.

## **Pedestrian Access and Bicycle Circulation**

- The orientation of the Main Street Commercial Mixed-Use area is distinct from that of other commercial areas. Elements such as angled on-street parking, wide sidewalks, and landscaped boulevards, will contribute to a pedestrian-oriented, village-centre character that favours pedestrian and bicycle movement.
- Adequate bicycle parking facilities should be provided and, in the case of mixed-use and neighbourhood commercial buildings, they should be accessible from the sidewalk.

### **3.2.2 Built Form and Materials**

#### **Massing and Roof Form**

Mixed-use and neighbourhood commercial buildings are to be compatible in form and scale with surrounding lower-density residential buildings, especially on lots adjacent to residential areas.

Changes in massing should relate to the building's structural systems and reflect its interior arrangement of spaces.

Building configuration and massing should maximize sun access, for example by terracing the upper levels on the south side.

Neighbourhood commercial buildings are to use residential roof forms, including gables and dormers.

#### **Building Finishes**

- Building materials are to reflect the regional heritage, climate, and landscape, and their construction should display a high level of craft. Cladding, particularly on the lower levels, is to be sturdy and appropriate to commercial establishments.
- Materials associated with residential buildings should be used in neighbourhood commercial buildings to reinforce their local service role.

#### **Windows**

- On upper-storey residential portions in mixed-use and neighbourhood commercial areas, the largest group of windows (or those belonging to the primary living spaces within the building) should be of appropriate residential scale.
- The relationship between the street and ground-floor commercial uses is to be emphasized with display windows, awnings, and/or canopies.



## Canopies and Signage

- Street-level commercial, office, and retail activities should feature pedestrian weather protection (in the form of awnings or architectural overhangs extending a minimum width of 1.8 metres [6 feet]).
- All weather protection elements are to be designed to facilitate a continuous, architecturally integrated building frontage.



*Angled awnings provide weather protection and identify individual storefronts. Signage should be consistent with a “village centre” character. The image on the left shows signage incorporated under the awning. The image on the right shows wooden fascia signs above each commercial entry.*

- It is recommended that canopies have a minimum slope of 30 degrees (35 to 45 degree is preferred).
- Fascia signs and window signs are encouraged.
- Sign size, location and information thereon is to be designed and oriented to pedestrians and is to relate to the scale and character of the commercial area.
- Materials used for signs should reflect the surrounding character and be compatible with materials used in adjacent buildings.



### 3.2.3 Environmental Design

#### Noise

- Noise disturbance to residential units as a result of mixed-use commercial components (such as parking, loading, exhaust fans, and restaurant entertainment) is to be minimized. Methods to help reduce the level of noise disturbance include: orienting bedrooms away from noise sources; allowing windows to be closed by choice; enclosing balconies; and using sound deadening construction materials and techniques.

#### Crime Prevention Through Environmental Design

- A high level of safety and a sense of security are important aspects of liveability. Commercial developments should provide appropriate safety and natural surveillance measures (such as proper lighting, visual access and security), as per CPTED Design Guidelines contained in the Surrey Official Community Plan.
- The design of the residential units above commercial ground-floor units should instill a feeling of security by maximizing the amount of windows facing the street to provide “eyes on the street.”
- Public, private, and semi-private areas should be clearly defined.
- Public and semi-private spaces should be designed so as to maximize surveillance.
- Building design should provide maximum opportunity for surveillance of sidewalks, entries, circulation routes, semi-private areas, children’s play areas and parking entrances.
- Any recessed entries and/or blind corners should be avoided. The design of the stairwells and halls should maximize visibility of the interior from outside. Servicing, amenity, and storage rooms should be grouped together in a visible locale for easy surveillance.
- Residential lighting in mixed-use commercial areas should ensure the clear visibility (day and night) of access routes and landscaped areas without excessive lighting levels or glare.
- Adequate, pedestrian-oriented lighting should be provided on all streets and in lanes.

### **3.3 BUSINESS PARK AREA**

The intent of the Business Park area is to help to achieve the long term objective of creating complete communities that include places to live, work and play by providing employment opportunities located close to the place of residence while also taking advantage of the location of East Clayton in relationship to the Fraser Highway; a major transportation corridor in the region.

The Business Park layout provides for smaller parcels and depths than similar developments in other locations in the city, these parcels lend to a type of business and scale of operations that are very much compatible and easily integrated to residential uses. The Business park performance standards encourage the development of light industrial, advanced technology, research and development industries, office, and similar uses that are generally compatible with one another and with adjoining residential and/or commercial areas. The standards for the Business Park area should conform to those found in the IB Zone of Surrey Zoning By-law No 12000.

#### **Objectives**

- To encourage the creation of a complete, mixed-use community through the integration of industry and commercial business in the business park with other land uses in East Clayton;
- To encourage healthy, safe, and clean business and industry while addressing area character and environmental concerns; and
- To accommodate on-site infiltration of the “six-month storm”, through the incorporation of detention and infiltration systems (see Section 4.0 and Section 7.0 for detailed performance standards regarding on-site infiltration/detention measures).

### ***Business Park***

The plan designates approximately 14.31 hectares (35.36 acres) of the south-central portion of the site (between 192<sup>nd</sup> Street and 188<sup>th</sup> Street) as a Business Park area. This designation will provide for advanced technology, research and development industries, and compatible commercial uses that complement these light industrial activities.

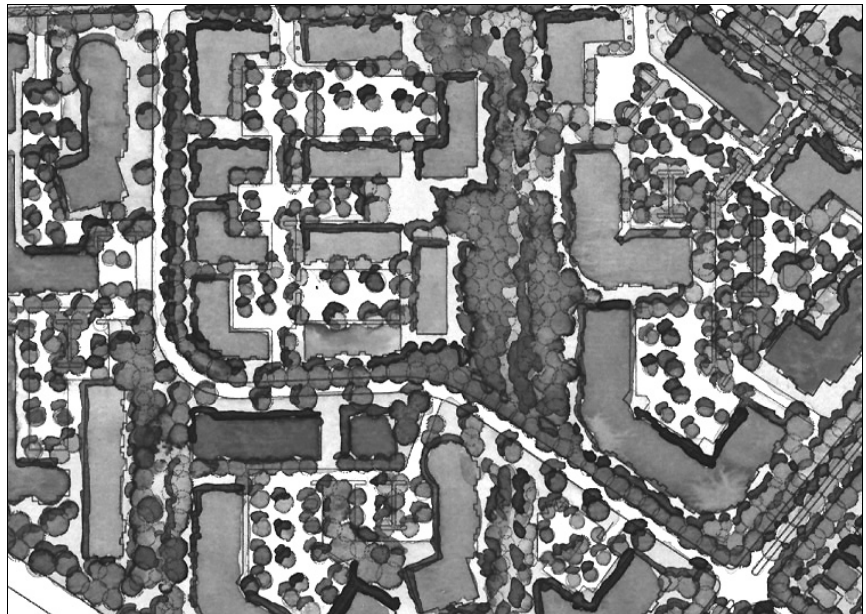
*Plan view of Business Park area in the southwest quadrant of the site.*

#### *Dominant characteristics*

*Front building setbacks of 9 metres (30 feet) provide a landscape buffer area for infiltration and maintain a positive relationship between the building and the street;*

*Rear and small side parking lots are divided into parcels big enough to serve each individual building and to allow adjacent buildings to share space; and*

*Each parking area features pervious surface treatment (i.e., porous pavement, pavers) and is generously planted with trees.*



*Image of a building in a Business park area*

*This high-tech building features generous glazing, massing that relates to its interior functions, and human-scaled detailing elements that contribute to a strong street presence. Parking is provided to the side and is shielded from the sidewalk.*



## **Land Use Compatibility**

To ensure compatibility between the business park and the adjacent special residential area, all new development may be asked to demonstrate, through a report from a qualified acoustical and/or environmental engineer, either that there are no negative impacts on residential liveability or that they can be mitigated through appropriate design.

### **3.3.1 Relation of Buildings to Streets**

#### **Building Orientation**

- The massing, setback, and orientation of the building should create a positive relationship between industrial buildings and the streets onto which they face, both in order to reinforce the character of the surrounding special residential area, and to enliven the surrounding streets. Examples of ways of achieving this include to:
  - provide primary entrances of the buildings on the street-facing facades;
  - face ground-floor offices and commercial services toward the street and sidewalk with maximum areas of clear glass;
  - achieve a maximum front setback of 9 metres (30 feet);
  - orient corner buildings so that the façades address both streets with an appropriate architectural expression at the corner;
  - maintain a continuous street frontage to the maximum extent possible;
  - provide minimum areas for parking on the side of the buildings and closing the separation between buildings with colonnades, arcades, trellises or similar structures along the street side of the parking; and
  - screen parking areas from direct views from the street.

#### **Entries and Courtyards**

- These should be located and designed to provide direct pedestrian access, at the fronting street, to the building or ground-level individual rental or strata units.
- Upper-floor units may be entered through a central entry lobby off the public street or through individual suite doors provided at grade.

#### **Parking, Loading, and Storage**

- Parking entries off public streets should be a maximum of 8 metres (26 feet) wide in order to reduce visual impact. The entries to the parking and loading areas should also be located so as to reduce the visual impact on the street.

- Loading areas, service areas, and overhead doors should be located at the back of the building or on the side if not visible from the street. No overhead doors should be visible from the street.
- The use of large, impermeable parking surfaces should be avoided. Surface parking lots should be planted with shade trees at an approximate ratio of one tree for every six spaces. (Tree species should have a canopy large enough to cover approximately 35 to 40 per cent of the parking surface, at tree maturity.)
- Tree planting islands should be large enough to sustain the growth of medium and large size trees to maturity.
- Trees planted in parking areas should be protected by bollards or other barriers.
- In surface parking areas, the use of permeable paving surfaces should be incorporated in order to reduce surface runoff.
- Garbage containers enclosures should be built and be finished of the same materials used in the building.
- Garbage enclosures to be provided with gates and covered with a roof if not an integral part of the building structure.
- Storage areas as well as heating and mechanical equipment should be enclosed, located behind the building, or screened so as not to be visible from the street.

### **3.3.2 Built Form and Materials**

#### **Massing and Articulation**

- A single dominant building mass should be avoided. Variations in massing are to include changes in height and horizontal plane. Changes in massing should relate to the building's structural systems and to reflect the interior arrangement of space.
- Glazing should be provided on all street-facing façades so as to create visual connections between street/open spaces and building users and to reduce the visual impact of blank walls toward the street or visible from the street.
- All sidewalks adjacent to retail and office uses should be provided with rain protection in the form of canopies, colonnades, or similar features.

#### **Exterior finishes**

- Building materials should reflect the regional climate and landscape and express an urban industrial aesthetic while being cognizant of the character of the surrounding residential neighbourhoods.
- Recommended exterior finishes include masonry, concrete, stucco, glass, and steel.

### 3.3.3 Environmental Design

#### Rain Protection and Signage

- Building entries should include canopies or rain protection that is approximately 3 metres (10 feet) above grade and that protrude no more than 2.5 metres (8 feet) from the building.
- Building entrances should be articulated with recesses, awnings and/or canopies, and signs that are appropriate to the architecture and material expression of the building. Clear glass and metal are considered appropriate materials.



*Landscaped setbacks and unit pavers maximize infiltration and define the building entry. The glass awning provides weather protection and allows light into the foyer.*



*Light shelves provide shade to south facing offices and animate the facade.*

- Entries of buildings should be highly visible, clear glazed, and easily recognized from the street.
- Only fascia signs and/or backlit channel letters should be used to identify the development and businesses.
- Individual free-standing signs are not appropriate to the character of the Business Park, however, feature structures should identify the Business Park at the main entrances from major perimeter transportation routes.

#### Climatic Response, Light and Ventilation

- As much as possible, offices should be oriented so that a maximum amount of workspace receives direct sunlight, and they are to incorporate terracing, overhangs, awnings or trellises that allow the low winter sun, but not the high summer sun, to penetrate the space.
- Landscaped courtyards are encouraged in order to provide sufficient light and ventilation into large floor plates. All courtyards should include trees.

- The material for outdoor surfaces should allow for natural infiltration of the rainwater into the ground (e.g. unit pavers spaced 2.5 cm (1 inch) or more apart from each other).
- Solar shading and light shelves are recommended, especially on south facing facades, as part of an energy-efficient design and as a means of animating façades.

### **Crime Prevention Through Environmental Design**

- Consider appropriate safety and natural surveillance measures (such as lighting design and visual access/surveillance) as per CPTED principles.
- Sidewalks/walkways between parking areas and building entries should be provided with the appropriate lighting and low landscaping.
- Any recessed entries and/or blind corners should be avoided. The design of stairwells and halls should maximize visibility of the interior from outside.
- Servicing, amenity, and storage rooms are to be grouped together in a visible locale for easy surveillance.
- Building designs should allow maximum opportunity for surveillance of sidewalks, entries, circulation routes, and parking areas.

### 3.4 SPECIAL RESIDENTIAL AREAS

The intent of the Special Residential areas is to provide a transition from the Business Park area into residential areas. This designation permits and encourages the development of a medium-density dual use (residential/business) neighbourhood with a wide array of compatible businesses such as artists' workshops, craft stores, gift shops, and similar limited retail businesses, personal service uses, consultants' offices, etc.

The land uses allowed in the Special Residential areas will help to fill the gap between the restrictive home-based business regulations contained in the Zoning by-law that allow a very restrictive range of businesses to operate in a single family dwelling and the full-scale businesses which must be located within a commercial or industrial zone. This area also resolves the transition; in terms uses, density and building mass, between the single family residential areas at the core of the neighbourhood and the business park areas toward the highway.

The following objectives support the development of a functional, liveable Special Residential area.

#### Objectives

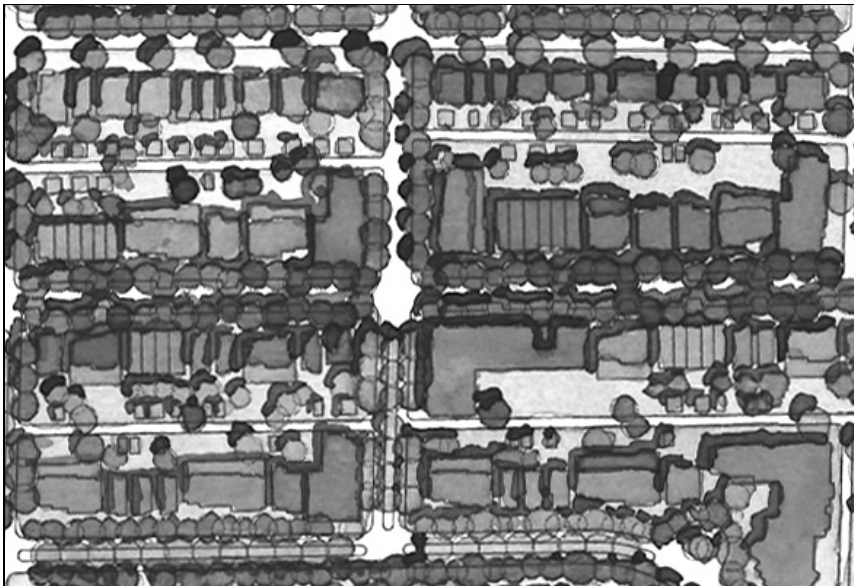
- To provide a diversity of housing types and tenures in order to accommodate a wide range of households and family types;
- To provide business locations directly attached or associated to residential accommodation in order to foster the development of small businesses and artisans in Surrey;
- To provide more job opportunities in Surrey, thus reducing work trips outside of the community and reducing automobile usage;
- To provide an innovative form of affordable housing by allowing home owners to live and work at home;
- To provide the opportunity for homeowners to increase their quality of life by eliminating commuting times and, possibly reducing the need for child care;
- To facilitate a transition between residential land-uses and business/office uses;
- To encourage walking and cycling to local destinations and neighbourhood services, thereby, reducing automobile dependency; and
- To encourage building design that emphasizes the pedestrian realm and street through compressed front setbacks, pedestrian weather protection, and human-scale detailing.



### *Special Residential Areas*

The intent of the Special Residential area is to provide a place where individuals have an option of working or running their small business from their homes. At densities between 10 and 15 units per acre, the Special Residential area will provide a transition between the residential areas north of 68<sup>th</sup> Avenue and the predominantly business/office uses to the south. Flexibility of use will be encouraged at the ground level which will accommodate either residential or business uses associated with a residence.

The area is organized along a fine-grained grid of streets and lanes ensuring easy accessibility from and to local destinations, rear access to the units and storage, on-street parking, and maximum street frontage of buildings. Ultimately, a vibrant business atmosphere is envisioned along 68<sup>th</sup> Avenue, with residential uses occupying mainly the upper levels of the building. The Special Residential area is basically a residential area with a businesses component as an optional use. The difference between Special Residential and Mixed-Use Commercial/Residential uses is that in the Special Residential area, the residential use can be a single use within the property but it is tied in tenure to the business use.



*Densities between 10 and 15 units per acre is proposed for the Special Residential area, shown in this plan view of 68<sup>th</sup> Avenue.*

*Dominant characteristics:*

- Residential units may allocate up to 30 per cent of the area to allow opportunities for home-based businesses and ground floor office/studio/retail uses.
- Residential uses take place either behind or above the associated groundfloor retail/ commercial uses
- The fronting street is envisioned as a pedestrian-oriented street with on-street parking pockets, street trees, and business on the ground floor.



*Images of Special Residential streetscape*

*Limited retail and offices occupy ground-floor units with associated residential units above or behind these spaces. The massing, roof forms, and window proportions reflect a residential character. At the ground level, recessed entries, generous glazing, awnings, and signage animate the streetscape and identify ground-floor uses. Parking on-street is available.*

### 3.4.1 Density, Land Use and Diversity

The Special Residential areas should accommodate between 10 and 15 units per acre. Approximately 30 per cent of the floor area may be permitted for work-related uses; the remaining 70 per cent of floor space should be used for residential purposes.

The Special Residential developments should be comprehensively designed, including the unit's design, that should facilitate the easy conversion of part of the dwelling unit to business/commercial uses and meet the appropriate Building Code requirements.

Allowable business uses may include the following:

- Artists' studios, craft shops/studios, sign makers, etc. which may include a retail component.
  - Small-scale retail stores such as grocery stores, bookstores, gift shops, convenience stores, candy stores, florists, etc.
  - Personal service uses as hair- salons, custom tailors, etc.
  - General services such as tutorial services, cafes, restaurants, mail delivery services, printing and photocopying services, desk-top publishing services, travel and insurance agencies, day care centers, etc.
  - Professional offices such as computer programmers, internet service providers, home designers, interior designers, law offices, accounting offices, etc.
  - Small cafes, deli shops, small bakeries, etc.
- 
- Within a Special Residential unit, the residential use component is mandatory and the business use is optional. The business uses should be of small scale and should not generate undue impacts to the residential use above, behind, or in the adjacent areas.
  - Employees may be allowed in the business, commercial component of the units, however, it is anticipated that the number of employees within the Special Residential areas would not be significant due to the scale of the business operation and the nature of the home-base occupations.
  - Within the Special Residential areas a variety of housing forms is possible, even in the same block.
  - Housing forms in this area may include single family detached homes, duplexes, row houses and townhouses in strata title or fee simple ownership. However, careful interfacing consideration should be given where distinctive housing types or densities, for example single family homes and row houses, are developed side by side.
  - Although the Special Residential areas are not intended primarily for families with children, it is inevitable that children of all ages may occupy some of the residential

units. Therefore, consideration should be given in the design stage to incorporate appropriate amenities within the development. Such amenities may be open spaces and play areas in the back yards or on terraced rooftops.

### **Land-Use Compatibility**

The compatibility of Special Residential units is of concern when adjacent uses generate noise, vibration, or odours that could affect liveability in the residential portions of the units. All new development within and abutting Special Residential areas may be required to demonstrate, through a report from a qualified acoustical and/or environmental engineer, either that there are no negative impacts on residential liveability or that they can be mitigated through appropriate design. On the other hand, all projects in the Special Residential areas must be designed comprehensively and the permitted uses must be defined to avoid conflict and to promote symbiotic land use compatibility.

### **3.4.2 Relation of Buildings to Streets – Building Footprint and Design Standards**

#### **Building Coverage**

- Provided that the on-site infiltration standards defined by the City are met, building coverage in Special Residential areas may be a maximum that ranges between 50 per cent and 60 per cent of the lot, depending on the housing type (e.g. single family development on small lots with or without coach houses, or row house type of development).
- Wherever possible, the building coverage should be maximized to achieve as continuous a street frontage as possible, especially for development that fronts onto 68<sup>th</sup> Avenue.

#### **Building Height**

- Buildings in Special Residential areas should not exceed 9.5 metres (31 feet) in height. It is desirable that buildings contain a minimum of two storeys.

#### **Orientation**

- The massing, setbacks, and orientation of buildings should reinforce a pedestrian street character
- Where a business component is included in the Special Residential unit, it is anticipated that residential units will only be provided above the main floor; however, if properly designed to mitigate conflicts concerning liveability and privacy, ground-floor or partial ground-floor residential uses would be also considered.
- As physical connection between working and living units may at some point be closed, aspects related to fire separation should be considered at the design stage to facilitate this conversion, and to provide a wider range of business opportunities from the unit.

#### **Entries and Private Outdoor Space**

- Each residential unit should provide some useable outdoor space, in the form of a garden patio or deck, of at least 10 m<sup>2</sup> (108 sq. ft.) with a minimum depth of 1.8 metres (6 feet).
- There should be direct pedestrian access at the fronting street, at or near grade level to each individual business occupancy and/or a residential unit that abuts the fronting street of the development.
- Upper-floors, i.e. the residential component of the units, can be accessed through a central entry off the public street or through a separate entry.



*Special Residential units are to be accessed from individual entries or through central entries or courtyards off the street as shown in the image on the left. Parking is accessed via the rear lane, either underground or attached to each unit, as shown in the image on the right*

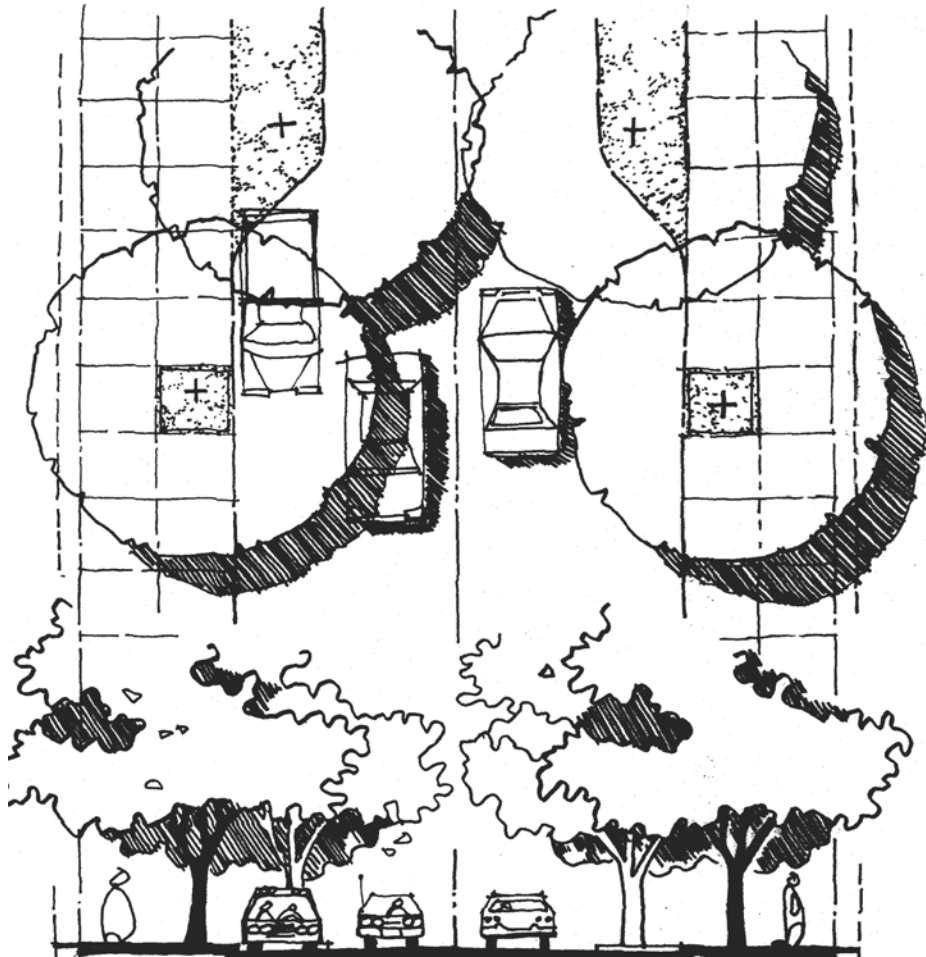
## Parking and Storage

- On-street parking is a convenience and can improve the pedestrian realm at the street edge by providing a buffer to moving traffic. The amount of adjacent on-street parking should be maximized (especially along 68th Avenue).
- Parking access to units should be provided in individual garages at the rear of units. Access to garages is mandatory via lanes or side streets. Short-term visitor/patron parking will be made available on the street.
- Garbage container storage areas, heating and mechanical equipment, and off-street parking and eventual loading areas should be enclosed or screened so as not to be visible from the street.

### 3.4.3 Built Form and Materials

#### Massing

- Changes in massing should relate to the building's structural systems and to reflect the interior arrangement of space.
- A strong residential character for Special Residential units is recommended in order to achieve a strong character relationship to adjacent residential areas.



*Conceptual plan and section of the proposed Special Residential collector along 68th Avenue. Elements include two travel lanes, on-street parking in parking pockets, street trees, and 2.0 metre (6.6 feet) wide sidewalks.*

## Roof Forms

- Roof forms of Special Residential buildings should reinforce the overall residential character of the area.
- For sloping roof forms, slopes of a minimum of 8:12 are strongly encouraged, with steeper gable roofs preferred on dominant and primary roofs toward the street.
- Consideration should be given to the roofing materials so as to achieve an appropriate fit with the building's structural massing and roof forms.



*These Special Residential units incorporate massing and roof elements characteristic of residential architecture. Ground levels are used for offices, studios and shops with associated living spaces either recessed behind or on upper floors.*

## Weather Protection and Signage

- Street frontages in row housing types of development should include small canopies or awnings protruding a minimum of 1.5 metres (5 feet) from the building face. The height of these features should be such as to avoid damage by users of the street.
- Canopies should have a minimum slope of 30 degrees (35 to 45 degree is preferred), unless it is demonstrated that flat canopies are architecturally more suitable.
- Fascia signs, projecting and window signs are encouraged.
- Sign size, location and information thereon should be designed and oriented to pedestrians and should relate to the scale and character of the Special Residential area.
- Signage should be integrated into the detailing of the building (and not applied as an afterthought).



## **Windows**

- Windows on all ground street-facing façades should cover at least 60 per cent of the façade area. Glazing, with high transparency, should be used to encourage visual connections between street/open spaces and building users.
- The treatment of windows should be consistent with the architecture of the building. The scale, placement and trim of windows should reinforce a residential character while allowing visibility and light into street front business and office spaces.

## **Building Finishes**

- Building material should reflect the regional climate and landscape and be compatible with surrounding land uses, and especially responsive to the surrounding residential character of the area.
- Appropriate materials include wood and vinyl siding, brick masonry, concrete, and stucco.

### **3.4.4 Environmental Design**

#### **Climatic response**

- Units should be so oriented that most of the primary living space receives direct sunlight, and they should incorporate terracing, overhangs, and awnings or trellises that allow the low winter sun, but not the high summer sun, to penetrate the unit.

#### **Light and Ventilation**

- Adequate lighting and ventilation is required for all Special Residential units.
- Solar shading, trellises and light shelves are recommended, especially on south facing façades, as part of an energy-efficient design that also animates façades.

#### **Crime Prevention Through Environmental Design**

A high level of safety and a sense of security are important aspects of liveability. Special Residential developments are required to consider the following CPTED principles:

- Units should be designed so that areas of the highest daily use address the public street.
- Adequate pedestrian-oriented lighting should be provided on the side of the units toward the street and the lanes.

- In addition to providing a generous amount of windows on facades abutting streets and lanes, functional upper-storey terraces and balconies are also encouraged on both the street and lane-facing elevations in order to increase opportunities for casual surveillance.
- Public, private, and semi-private areas should be clearly defined. Public and semi-private spaces should be designed to maximize surveillance.
- Building designs should provide maximum opportunity for surveillance of sidewalks, entries, circulation routes, semi-private areas and parking entrances.
- Any recessed entries in the rear of buildings and/or blind corners should be avoided.
- The design of the stairwells and halls potentially used by patrons should maximize visibility of the interior from outside.

## 4.0 GREEN INFRASTRUCTURE PERFORMANCE STANDARDS AND GUIDELINES

The green infrastructure performance standards and guidelines suggest the necessary minimum levels of performance for maintaining and potentially enhancing natural drainage systems in East Clayton. This section describes how the principles of infiltration best management practices (BMPs), urban forestry, and soil preservation should be applied to building sites, streets, and public green spaces.

The backbone of the plan's green infrastructure is its linked system of streets and open spaces, which includes local streets, linear parks, schools, riparian protection areas, tree preservation areas, neighbourhood pocket parks, and buffers. This system will have many beneficial functions. It will simultaneously satisfy social, recreational, and educational demands while meeting important ecological goals (such as stream protection, storm-water management, and habitat preservation). As a result of the reduced pavement in roads and requirement for adequate infiltration on private lots, it is anticipated that a substantial percentage of all annual rainfall will be absorbed by the soil in yards and roadway boulevards.

### **Principle No. 7**

*Preserve the natural environment and promote natural drainage systems (in which storm water is held on the surface and permitted to seep naturally into the ground).*

### **Objectives**

- To reduce immediate as well as life cycle costs of the storm drainage system;
- To protect and enhance the environment;
- To increase access to, and variety of, recreational opportunities;
- To protect habitat, especially fish habitat;
- To maintain stream hydrology and stream water quality;
- To eliminate the need for removing any soil from the site; and
- To enhance community value, quality, and appeal.

## 4.1 BUILDING SITES – PERFORMANCE OBJECTIVES

The paved areas comprising of the planned buildings, driveways, and patio areas will generate significantly higher levels of surface runoff. In addition, traditional landscaping of grassed/treed areas does not encourage percolation of rainwater into the ground. Furthermore, during wet winter season the percolation capacity of soil is reduced due to antecedent rainfall induced wet soil conditions. As well, the evapotranspiration losses through tree canopy are much less due to cold temperature and reduced leaf cover.

Reducing the total paved surface area and routing the drainage from these impervious areas through grassed and other pervious areas/infiltration facilities will reduce net storm-water runoff. Similarly, by maximizing pervious soils in the topsoil when landscaping the grassed areas, and by using below ground enclosed infiltration trenches/rock pits etc, runoff can be reduced. In order to minimize impervious surfaces, the following criteria shall apply:

- Areas with gross residential densities equal to or less than 20 dwelling units per acre, will be allowed a maximum of 60% (building coverage including coach houses) impervious surface. All runoff from impervious areas will be directed to pervious areas that include devices capable of enhancing the infiltration capacity of the site so it will function as though it were vegetated and not compacted.
- The objective is to have the hydrologic behavior of the developed lots mimic the predevelopment conditions for volume and peak flows.

### 4.1.1 Infiltration Best Management Practices (BMP's) for Building Sites

Dispersion Best Management Practice (BMP) facilities and shallow infiltration facilities, applied on a distributed manner, could handle up to 0.5 to 1.0 inch depth rainfall events, which constitute about 90% of the total annual rainfall events. To achieve this level of control, these measures have to be implemented in each lot, as follows:

#### Urban Forestry on Building Sites

- Residential yards are an important element in the urban forestry strategy for East Clayton. In the permeable areas of the lot, locations should be found for shade trees so that, when mature, their canopy will cover at least 40 per cent of the lot. Trees will generally be of the “medium-sized” variety, capable of achieving approximately 10 metres (33 ft.) in height, and a comparable breadth, at maturity. A list of suggested native species is available from the Surrey Parks, Recreation and Culture Department.

- Trees (at least one tree every two lots in small lot subdivisions) are to be located at least 3 metres (10 ft.) from the outside edge of infiltration devices (1.5 m / 5 ft.) if tree root barriers are installed.) Trees should be at least 50 mm diameter at breast height (d.b.h.) when installed, and they should be thriving one year after planting.

### **Soil Preservation on Building Sites**

- Site topsoil is to be carefully stockpiled for later redistribution on the site. In no cases should topsoil be removed from the site. Topsoil from the building footprint will be redistributed to the remainder of the site. Consequently, topsoil depths in the finished site will be up to twice what they were originally.
- The first 0.5 metres (1.6 ft) of topsoil will be stockpiled for later distribution over the areas intended for permeable surfaces. This requirement ensures that the thin soils of the Clayton area are re-used to their maximum advantage and that topsoil will not be permanently removed from the site. In short, yards and boulevards must absorb more water and provide a better medium for tree growth when development projects are completed than they do at present.
- All pervious areas of a building lot will have a minimum depth of topsoil of 600 mm. (2 ft.)
- Care must be exercised in grading the site and setting finished floor elevations. This site development method will make it difficult (and in many cases impossible) to retain existing trees. In these cases the need to ensure the adequate hydrological and urban forestry performance of the site after development will take priority.
- Proper aeration of returned topsoil is crucial and will be maintained by the developers and the builders. Topsoil areas are to be checked for depth and aeration prior to the granting of an occupancy permit. Soil amendments may also be required. Pre-existing vegetation may need to be ground up and added to the soil to improve its aeration and humus content. If this process leaves soil that is still too thin for healthy tree growth and water infiltration, then additional soil amendments will be required.

### **Infiltration Devices**

- Infiltration enhancements will be accomplished via infiltration devices of various designs and configuration.
- The target is an infiltration rate of 12 to 24 mm/day (or about 120 to 240 cubic meters per ha. per day) over the total area of each lot without adversely affecting pervious areas.
- Eliminate direct connections from lots to street drainage system
- Infiltration devices should be located at the front or rear of the lot and as far from building foundations as is practical so that there is at least one metre (3 ft.)

of undisturbed parent material between the infiltration device and foundation excavation.

- Infiltration devices will be placed on private property and will be maintained by the property owner.
- Observation pipes must be installed in each device.
- Roof drains are to discharge into lawn or planted areas rather than directly into infiltration devices to allow silts and organic matter emanating from the roof to be absorbed by surface vegetation.
- Infiltration devices are to be designed for 30 years of operation under normal use. Siltation is the most common reason for infiltration device failure; consequently extreme care is to be exercised in designing and installing systems.
- Percolation tests will be conducted by a geotechnical consultant in accordance with the methods outlined in the “Ministry of Health and Ministry Responsible for Seniors” PERCOLATION TEST PROCEDURE document in order to design the system and estimate its performance.
- Where soils have percolation rates greater than 1 mm/hr infiltration devices as listed below will be installed.
- Alternative sustainability measures will be identified by the developers for areas with soils having percolation rates less than 1 mm/hr.
- The design and installation methods for the infiltration device must be approved by the Engineering Department.

## **Residential Sites**

- Percolation tests will be performed for every 10 residential lots with a minimum of two tests per development.
- Infiltration devices with the following minimum characteristics will be installed for every 100 square metres (1,075 sq. ft.) of development.

### ***Single Family infiltration device***

Minimum contact area  $4.7\text{m}^2$  (50 sq.ft.)

Minimum storage volume  $1.6\text{m}^3$  (56 cu.ft.)

### ***Multi - Family***

Minimum contact area  $6.3\text{m}^2$  (68 sq.ft.)

Minimum storage volume  $2\text{m}^3$  (70 cu.ft)

Devices with the above characteristics have been found to meet the infiltration targets for soils with percolation rates of 1 mm/hr. The City will consider alternate designs if the developer can demonstrate that the alternate designs meet or exceed the criteria of 12 to 24 mm/day.

## Commercial Sites

- All surface parking areas (e.g. Specialty Commercial and Business Park), shall be planted with a minimum of one tree every six (6) spaces as required by the OCP.
- Parking stall rows will be separated by vegetated curbless islands set below pavement grade, landscaped to provide bio-retention and conveyance of parking lot runoff.
- Pavement edges must allow free flow of water from grass areas or filtration swales. Soil must be between two and three inches below pavement level in order to prevent water damming by the turf.
- The islands will drain to widening at the ends of each row where landscaped islands with tree clusters will be provided.
- Tree species will be selected from those approved by the Parks, Recreation and Culture Department such that at maturity the tree canopy will cover a minimum of 35% of the parking lot area.
- Commercial sites will complete percolation tests for every 5000 m<sup>2</sup> (53,800 sq. ft.) of development or a minimum of two percolation tests for each site to determine the soil infiltration capacity.
- Infiltration devices with the following minimum characteristics will be installed for every 100 square metres (1.075 sq. ft.) of development.

### *Commercial*

Minimum contact area 6.3m<sup>2</sup> (68 sq.ft.)

Minimum storage volume 2.0m<sup>3</sup> (70 cu.ft.)

## 4.2 STREETS – PERFORMANCE OBJECTIVES

The sustainable development approach provides an opportunity to direct street runoff into grassed swales on either side. For small rainfall events, these swales can be used to treat runoff and infiltrate the runoff by making the soil base pervious / porous.

The roadway swales and perforated storm sewer system will supplement infiltration capacity of the preceding components. These two components play the vital role of safe conveyance of all runoff, including those from heavy and infrequent events such as the once in 100-year events. Thus, they form the backbone of a good drainage servicing scheme. By this function, they are able to convey all residual flows to the community detention ponds and the receiving watercourses.

- Street rights-of-way, not including lanes must have a minimum of 30% permeable areas.
- Streets will effectively manage excess runoff resulting from all rainfall events.
- Provide a continuous overland flow path and a sub-surface storm sewer system as an integrated continuous conveyance system to minimize public inconvenience to an acceptable level

### 4.2.1 Infiltration Best Management Practices (BMP's) for Streets

#### Infiltration Devices

- Permeable areas are to accept runoff from impermeable areas and are to be equipped with infiltration devices capable of enhancing the infiltration capacity, so that, under average precipitation conditions, the site will perform as though it had no impermeable surfaces and as though it were vegetated and not compacted
- Infiltration devices may be located on one or both sides of local streets. Infiltration devices must be located on both sides of collector streets and arterials. (*Refer to the Section 7.2 for detailed street design information.*)
- Infiltration devices will be located in roadside swales where applicable.
- Target Infiltration rates of 0.5 to 1.0 mm/hr.
- Provide a continuous system to convey storm runoff, eventually through SWM ponds to the receiving watercourses.
- Street boulevards/swales are to maintain continuity of permeable surfaces by avoiding interruption by front garage entry driveways.
- Grass filter strips and elevated drain inlets, or other similar devices approved by the Surrey Engineering Department, must be used to prevent siltation. Observation pipes must be installed in each device.



- Infiltration devices are to be designed for 30 years of operation under normal use. Siltation is the most common reason for infiltration device failure; consequently, extreme care should be exercised in designing these systems. Approved filter fabric must be used to line rock-filled trenches. The Surrey Engineering Department must approve all construction specifications for infiltration devices.
- Subsurface conveyance systems are required to deliver water in excess of the system exfiltration capacity up to the five-year storm amount (*Refer to Section 7.0 for Storm Servicing requirements*). A typical device is a shallow perforated pipe located near the top of street-side infiltration devices. Such pipes connect all infiltration devices on the street and deliver water to the storm sewer system. Storms in excess of the five-year event are conveyed over the surface, via the swales in the right-of-way to a safe outlet.
- Road edges must allow free flow of water from paved surfaces to grass boulevards or filtration swales. Soil must be between two and three inches below pavement level in order to prevent water damming by the turf.
- Curbs will include side inlet grates to allow the discharge of roadway runoff to the continuous road infiltration swales.
- Continuous infiltration swales will be provided on front roads for all developments with lanes, which will be maximized through the neighbourhood.

### **Urban Forestry on Street Rights-of-ways**

- Streets are an important element in the urban forestry strategy for East Clayton.
- Shade trees to be located in the permeable areas of the right-of-way. When mature, the canopy of these trees will cover at least 60 per cent of the street right-of-way. Trees will generally be of the “medium-sized” variety, capable of achieving a height of approximately 12 metres (40 ft.), and a comparable breadth, at maturity. (A list of suggested species is available from the City of Surrey Parks, Recreation and Culture Department.)
- The Surrey Parks, Recreation and Culture Department should be consulted with regard to tree spacing and species variety. Trees are to be located such that the infiltration device does not cause detrimental impact to the tree roots. Paved sidewalks within 3 metres (10 ft.) of a tree trunk should be underlaid with structural soil to avoid sidewalk heaving. Trees should be at least 7.6 centimetres diameter at breast height when installed and should be thriving as per Parks, Recreation and Culture Department specifications one year after planting (*See Figures 4.2 a, 4.2 b and 4.2.c*).

## Soil Preservation on Street Rights-of-way

- Site topsoil must be carefully stockpiled for later redistribution on the right-of-way. In no cases should topsoil be removed from the site. Generally, the area available in street rights-of-way for re-spreading this topsoil will be approximately 30 per cent of the area of the right of way prior to development. Consequently, topsoil depths in the finished site should be up to twice what they were originally.
- Topsoil depth in East Clayton is generally thin, often less than 0.5 metre (1.6 feet). Topsoil excavated for replacement by structural gravel is to be stockpiled on the site for later distribution over the areas of the right-of-way intended for permeable surfaces (i.e., boulevards/swales).
- Proper aeration of returned topsoil is crucial. Topsoil areas will be checked for depth and aeration prior to the granting of an occupancy permit by Surrey Engineering/Building Department. Pre-existing vegetation on the site may need to be ground up and added to the soil to improve aeration and humus content. If this process still leaves soil unsuitable, then additional soil amendments will be required. The Surrey Parks, Recreation and Culture Department will review soil tests and proposed amendment strategies.

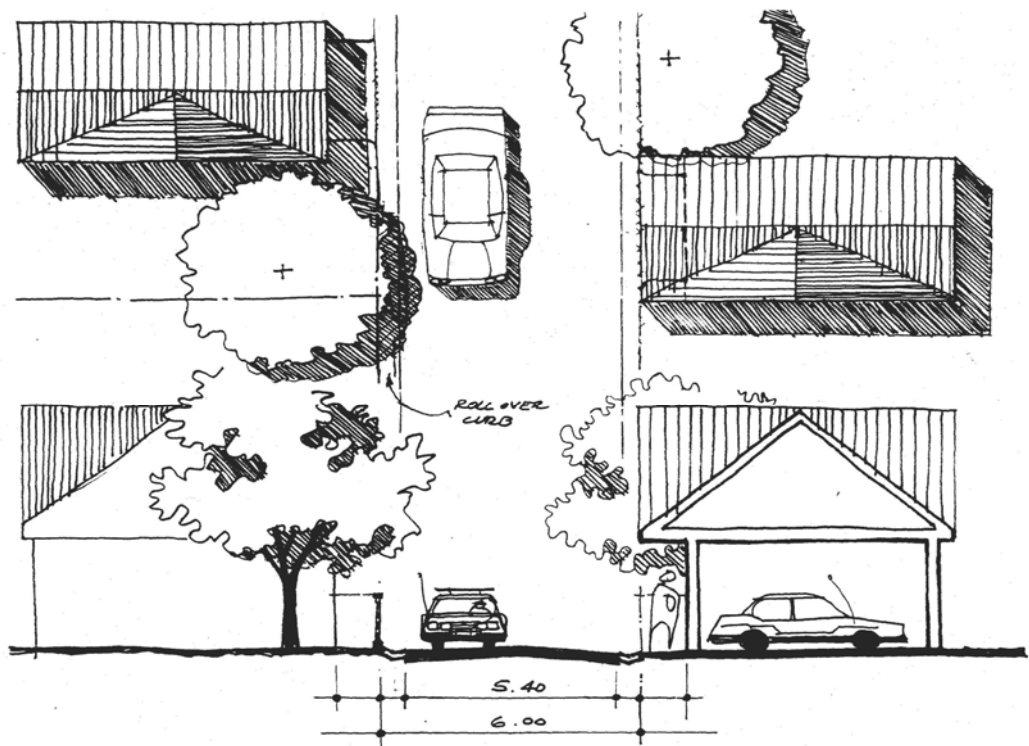


Figure 4.2.a Residential Lane

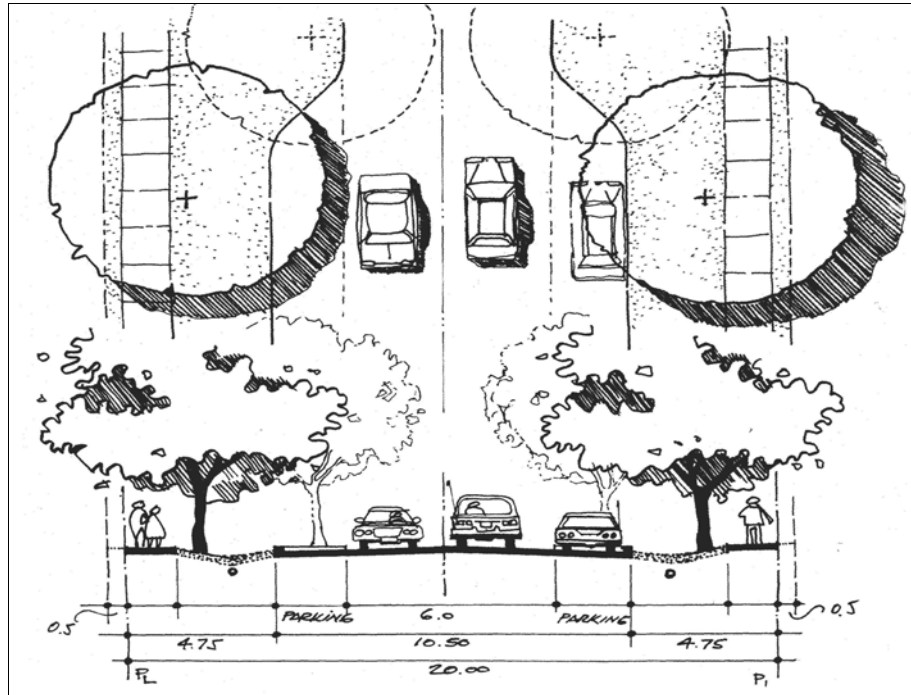


Figure 4.2.b Two-way Residential Street

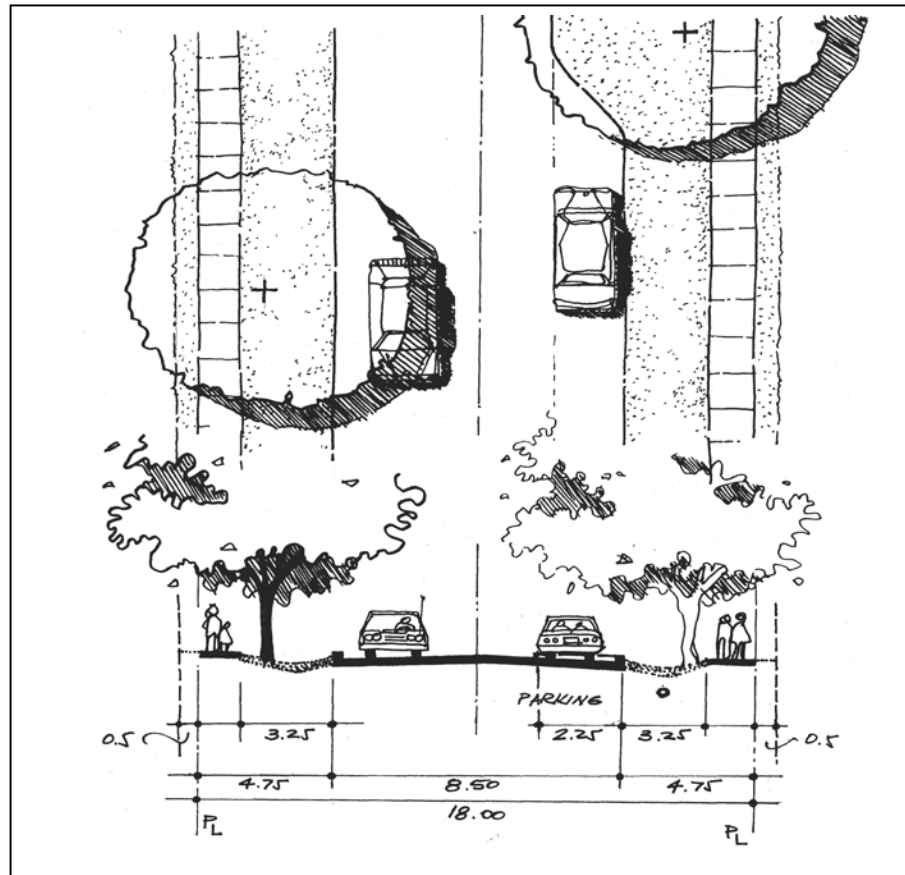


Figure 4.2.c Queuing Residential Street

## 4.3 PUBLIC AND NATURAL AREAS

These guidelines are applicable to the various components of the public green space network that extends throughout East Clayton. Table 4.3 indicates the areas allocated, and Figure 4.1 shows the location of various components of the network. The network serves both ecological and social purposes by supporting the surface drainage system, providing sufficient avian and aquatic habitat, maintaining base flows in streams, and providing areas for both passive and active recreation.

**Table 4.3 Public and Natural Areas**

	<b>Hectares</b>	<b>Acres</b>
School/Park Sites (not including pond)	9.9	24.46
Parks and Linear Open Space	10.21	25.22
Riparian Protection Areas	5.93	14.65
Natural Areas (Preservation)	2.91	7.19
Storm Water Ponds (Public Property)	4.11	10.15
Utility Open Space	0.64	1.58
<b>Total</b>	<b>33.70</b>	<b>83.27</b>

### 4.3.1 School/Park Sites

The plan proposes 9.90 hectares (24.46 acres) of combined park and school sites. Each of the two sites is to serve the recreation and primary educational needs of the community. Areas of forest cover, combined with a naturalized wetland/retention pond on the eastern school/park site, are to provide infiltration for surface water and bird habitat. The Surrey Parks, Recreation and Culture Department will manage and oversee construction and maintenance of the school/park sites.

### Infiltration Best Management Practices (BMPs) and Wetlands

- All impervious surfaces (i.e., multi-use paths, streets, parking lots) are to drain into permeable areas and/or on-site infiltration devices.
- The wetland proposed for the school ground in the northeastern quadrant of the site is intended as a retention and bio-filtration area for surface water. The wetland is to incorporate a naturalized edge with native wetland plants and to provide small islands and protected areas for bird habitat.
- The design of the pond and wetland areas will meet the requirements of the current design criteria for parks and drainage.
- All such work is to comply with existing Surrey Parks, Recreation, and Culture Department construction and maintenance standards and guidelines and be

inspected by the Surrey Engineering Department and Ministry of Environment, Lands and Parks staff. All detained water is to be discharged into streams only as per Department of Fisheries and Oceans and Ministry of Environment, Lands and Parks regulations.

### **Urban Forestry**

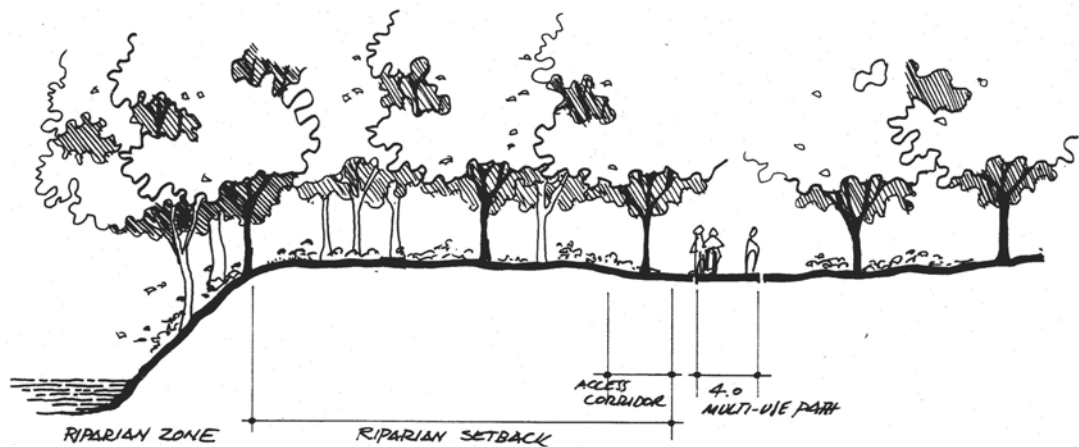
- At least 40 per cent of school/park sites are to be covered by canopy at tree maturity.
- Areas that are not required for playfields shall provide natural habitat area in order to replace habitat lost to construction. There is to be a particular emphasis on avian habitat.

### **4.3.2 Riparian Parks**

Riparian parks have considerable ecological and recreational value. Their use is to be restricted to passive recreation and is to incorporate multi-use pathways outside the prescribed leave areas. As per the Ministry responsible for environmental protection guidelines, and the Department of Fisheries and Oceans. This leave area provides for a number of biophysical and geotechnical features and functions, including: providing continuous tree canopy for shade and leaf litter; preventing understory vegetation removal in order to ensure soil binding and, thus, preventing soil erosion and stream sedimentation; and maximizing smaller understory species, which provide leaf litter and insect drop/drift to the stream, which are preferred fish food. In addition, snags or dead trees within the leave area can become large organic debris in streams, thereby providing the instream complexity needed by juvenile salmon as well as critical habitat for cavity-nesting birds and many small mammals.

### **Performance Objectives**

- The leave areas are “leave-alone areas,” and the objective is conservation rather than multiple-use.
- No vegetation is to be removed from leave areas. This includes understory and ground cover, which provide many important geotechnical as well as biological functions.
- Access corridors should not to be aligned within leave areas that are 30 metres (100 feet) or less in width.
- Any access corridors that would necessitate removal of vegetation or soil disturbance for trail construction in a leave area are either to be discouraged or to be limited to the outer 5 meters (16 ft.) of the leave area.



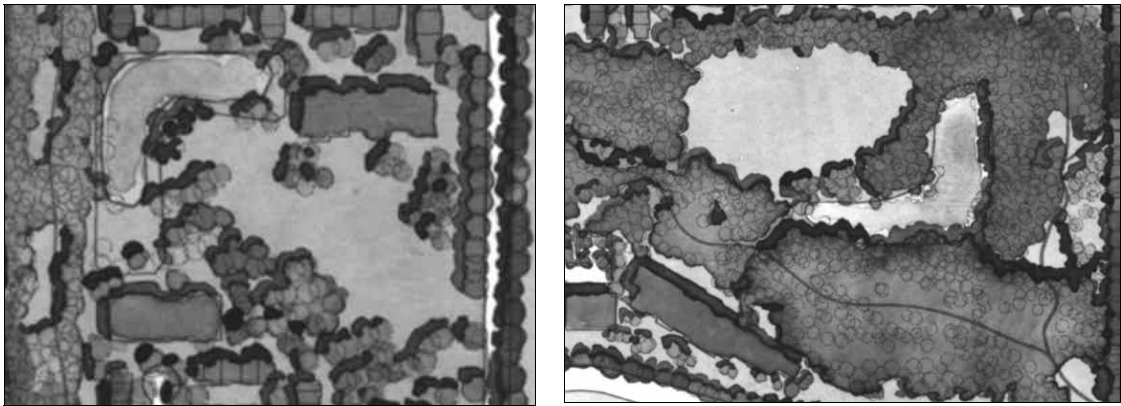
*Riparian Park Greenway. Note that 25-30 m (82-98 ft.) setback is required from top of bank.*

- Access corridors within the leave areas will require Provincial Ministry, and possibly Fisheries and Oceans Canada approvals.
- Access corridors in or around sensitive aquatic areas are to be designed as narrow, low-impact walkways (width of 1.5 metres / 5 ft. with natural substrate or crushed gravel surfaces to encourage infiltration. Asphalt; compacted clay, or bark mulch are not permitted). Access corridors within the leave areas are not to be designed to accommodate vehicles (including wheelchairs and bicycles). Hard surface multi-use paths outside the leave area can accommodate vehicles (e.g., wheelchairs and bicycles) and are to be 4 metres (13 ft.) wide.
- Where it can be accommodated by meandering through existing vegetation or by removing limited vegetation and disturbing very little of the surface soils a narrow 1.5 metre / 5 ft. footpath could be used either to connect the corridor on one side of the leave area to a particular site of interest within the leave area or to transect the leave area altogether. Such footpaths should be aligned at right angles to the stream so that it limits the length of the incursion within the leave area. So as to avoid wetted or erodible areas or areas supporting unique or sensitive vegetation, the locations for these penetrating footpaths are to be developed following a thorough assessment of the area. Alternatively, these narrow access footpaths should be elevated above the forest floor (i.e., on boardwalks), with associated signage explaining the biological values of these areas.

## Detention Ponds

The Land Use Plan proposes situating two detention ponds adjacent to riparian park areas: the first is to be located near the headwaters of McClellan Creek; and the second is to be located just north of the North Cloverdale Stream riparian zone.

- All work is to comply with existing construction and maintenance standards and guidelines, and it is to be approved by the Surrey Engineering Department and the appropriate Environmental agency.
- Ponds should be designed for maximum practical water retention to further improve water quality. The design must also reduce possible temperature impact.
- The wetlands are to incorporate a naturalized edge with native wetland plants.



*Constructed wetlands along the Dedicated and Riparian Greenways. Designed with a naturalized edge and native riparian plants, these ponds will be natural filters for runoff, provide habitat for birds, and enhance the aesthetic quality of the landscape.*

## Urban Forestry

- All existing forested areas are to be preserved for infiltration (i.e., the understory and natural mulching of the forest is to be preserved).
- All riparian setbacks shall preserve the existing vegetation.
- Riparian areas may accommodate open clearings for recreation outside the prescribed leave area. These areas may be available for holding flood waters for the 100-year storm up to a maximum depth of 1 metre (3 ft.).
- The Surrey Parks, Recreation and Culture Department, in co-operation with the Surrey Engineering Department, is to manage and oversee the construction and maintenance of riparian parks.

### 4.3.3 Neighbourhood Parks

#### Infiltration

- All impermeable surfaces (i.e., multi-use paths, streets) are to drain into permeable areas and/or on-site infiltration devices in order to maintain the existing total infiltration as if the site were no developed.
- All impermeable areas will drain to permeable surfaces in order to maintain the existing total infiltration as if the site were undeveloped.
- Where required, infiltration BMPs and soil preservation measures, as per Sections 4.1.1 and 4.2.1, are to be applied in order to achieve prescribed infiltration rates.
- Neighbourhood parks are to accept and to manage drainage from surrounding street surfaces, with approval from the Parks, Recreation and Culture Department.
- Pathways and sidewalks around the periphery of parks are to drain into permeable areas and or into infiltration devices.

#### Urban Forestry

- At least 30 per cent of neighbourhood parks are to be covered by the canopy at tree maturity, thus ensuring that a strong vegetated edge surrounds an open interior space.
- The Surrey Parks, Recreation and Culture Department is to manage and oversee the construction and maintenance of all public parks.

### 4.3.4 Pedestrian Corridors and Bicycle Routes

The East Clayton pedestrian and bicycle network is a series of multi-use corridors that are to connect areas of public and natural interest with mixed-use and residential neighbourhoods. A key component of green infrastructure is that the proposed pedestrian/bicycle circulation system is designed to encourage alternatives to automobile travel and to provide opportunities for passive recreational use throughout East Clayton. Ultimately, this system will link the community to the Greater Surrey Greenway System (*See Figure 4.3.1*). The local pedestrian/bicycle circulation network (including greenways) has been classified with regard to local function and appears in Figure 4.3.2.

(Note: The terms “greenway” and “multi-use corridors” refer to recreational and travel corridors [for pedestrians, wheelchair users, cyclists, etc.] that links natural and urban areas. “Path”, or “Pathways”, refers to the paved or gravel surface that is located within the greenway or multi-use corridor, that is used for walking and/or biking.)



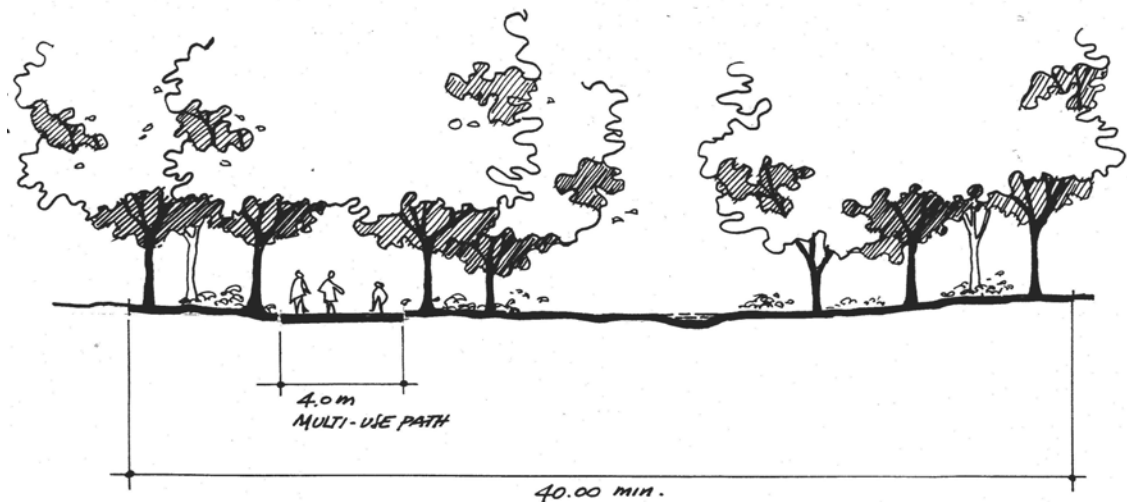
## Pedestrian and Bicycle Routes

Pedestrian and bicycle routes are to be integrated within the north-south Greenway system. This pertains to areas within the dedicated greenway, as well as within appropriate distances of riparian areas, as defined by the environmental protection agencies as the case may be. Figure 4.3.1 shows the alignment of core and secondary bike routes as well as multi-use pathways.

- The width of all multi-use pathways within the dedicated north-south Greenway corridor and the riparian corridors are to be no less 4 metres (13 ft.). This width is required to accommodate various potential users (walkers, wheelchairs, cyclists, joggers), and will allow emergency and maintenance vehicle access. Multi-use pathways may meander within the total width of the multi-use corridor without compromising safety and function.
- Multi-use paths will be minimum of 3 metres (10 ft.) wide where provided in replacement of a standard city sidewalk.
- All roadway intersections along greenways are to be designed to accommodate pedestrian and bicycle traffic and may include controlled signal lights; curb bulges to calm traffic and ensure safe crossings; trees, landscaping and pavement treatment to enhance appeal; and to assist in groundwater infiltration.

## Dedicated Greenway

The dedicated north-south Greenway runs parallel to 194<sup>th</sup> and 196<sup>th</sup> Streets. It will have a 40-metre (130-ft.) minimum design width and will be designed in a “park-like” way appropriate to its condition as the “front door” for any of new dwelling units. Notwithstanding the above, the greenway will have habitat value and will be designed to hold, and infiltrate rain water into the ground.



*Dedicated North-South Linear Park*

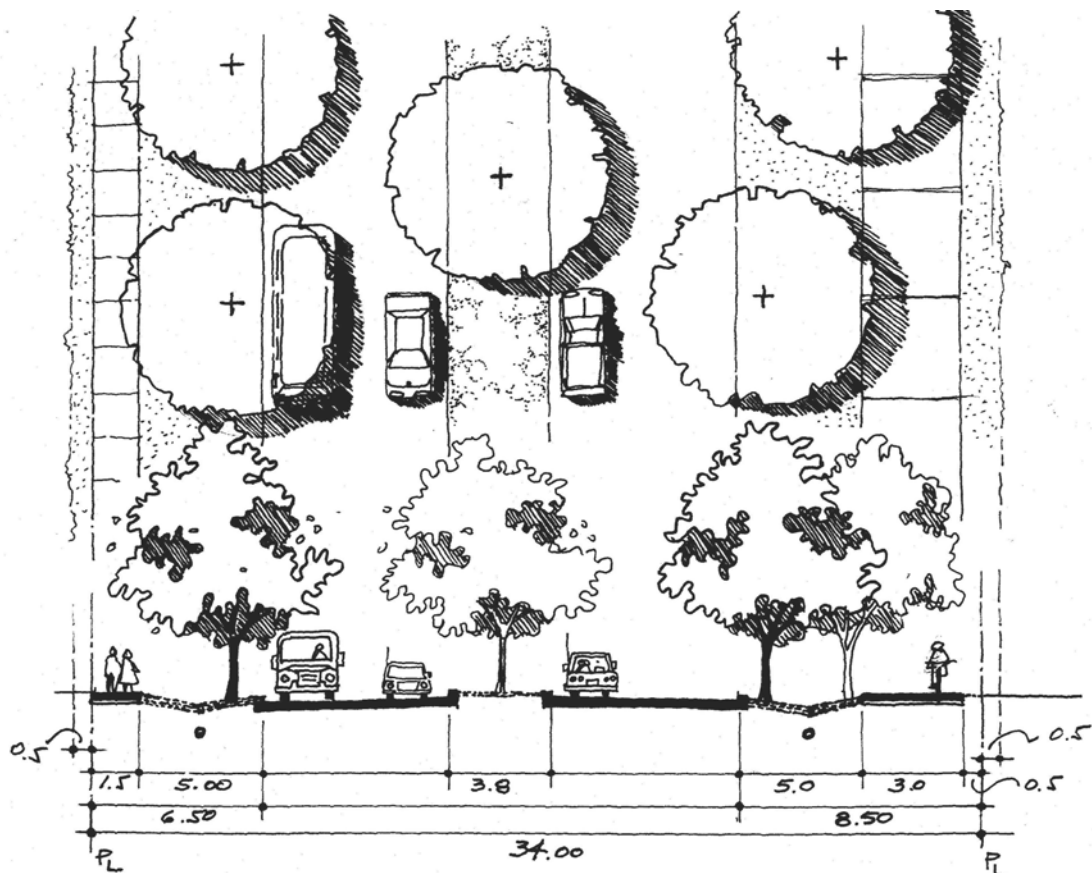
## Urban Forestry

- At least 60 per cent of the dedicated greenway is to be covered by tree canopy at tree maturity, with areas of clearing available in order to allow direct winter sunlight to penetrate and to provide year round areas of use for all residents.
- Dramatic views down and across the corridor are to be protected wherever possible and are to be a consideration when it comes to tree selection and spacing.

## Infiltration

- The greenway system is to be designed principally to manage ordinary storms for the purposes cited above, but it must also be designed to safely convey the 100-year storm amounts to retention ponds (which are located within Riparian Park areas).
- Artificial, intermittent, and possibly, semi-permanent streams are to be incorporated and constructed as part of the greenway.

## 192 Street Green Arterial Parkway



192 Street Green Arterial Parkway. Swales located in the boulevard, provide biofiltration of surface water

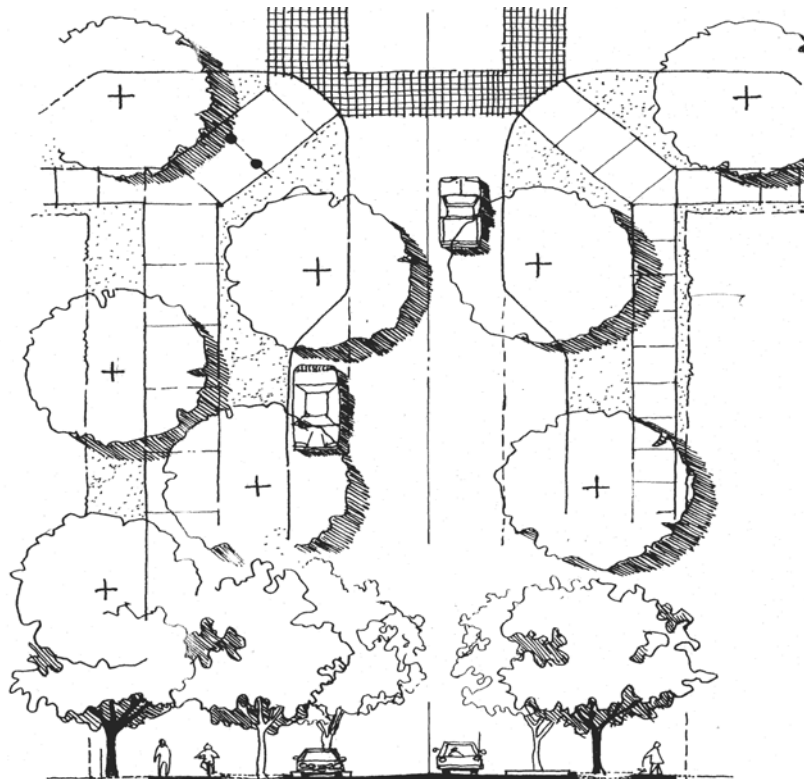
Located along 192<sup>nd</sup> Street, the multi-use corridor is to be designed in a “park-like” way appropriate to its condition as the “front door” for hundreds of new dwelling units.

- The parkway drainage system will provide biofiltration and infiltration for runoff from the road.
- The parkway system is to be designed principally to manage storms of less than the five-year level (for the purposes cited above); it is also to be designed to safely convey the 100-year storm amounts to detention ponds.

## 70<sup>th</sup> Avenue Boulevard

The 70<sup>th</sup> Avenue boulevard contains an off-street multi-use corridor designed for bikes and pedestrians. Its design is to contribute to neighbourhood character, to connect schools to neighbourhood centres, to connect the centre of the community to adjacent communities, and to provide a safe and identifiable biking and walking route.

- A double row of trees along the multi-use corridor will provide 60% canopy cover of the street right-of-way.
- Traffic-calming measures, such as pedestrian- and bicycle-controlled signals, curb bulges, traffic circles, and planted medians, are to take into account the location of infiltration devices and street trees.



*Design features include, traffic calming bulges, bollards, and a double row of trees with a minimum 3.0 metre (10 ft.) pedestrian path on the north side of the street (south side of the street east of 192 Street).*

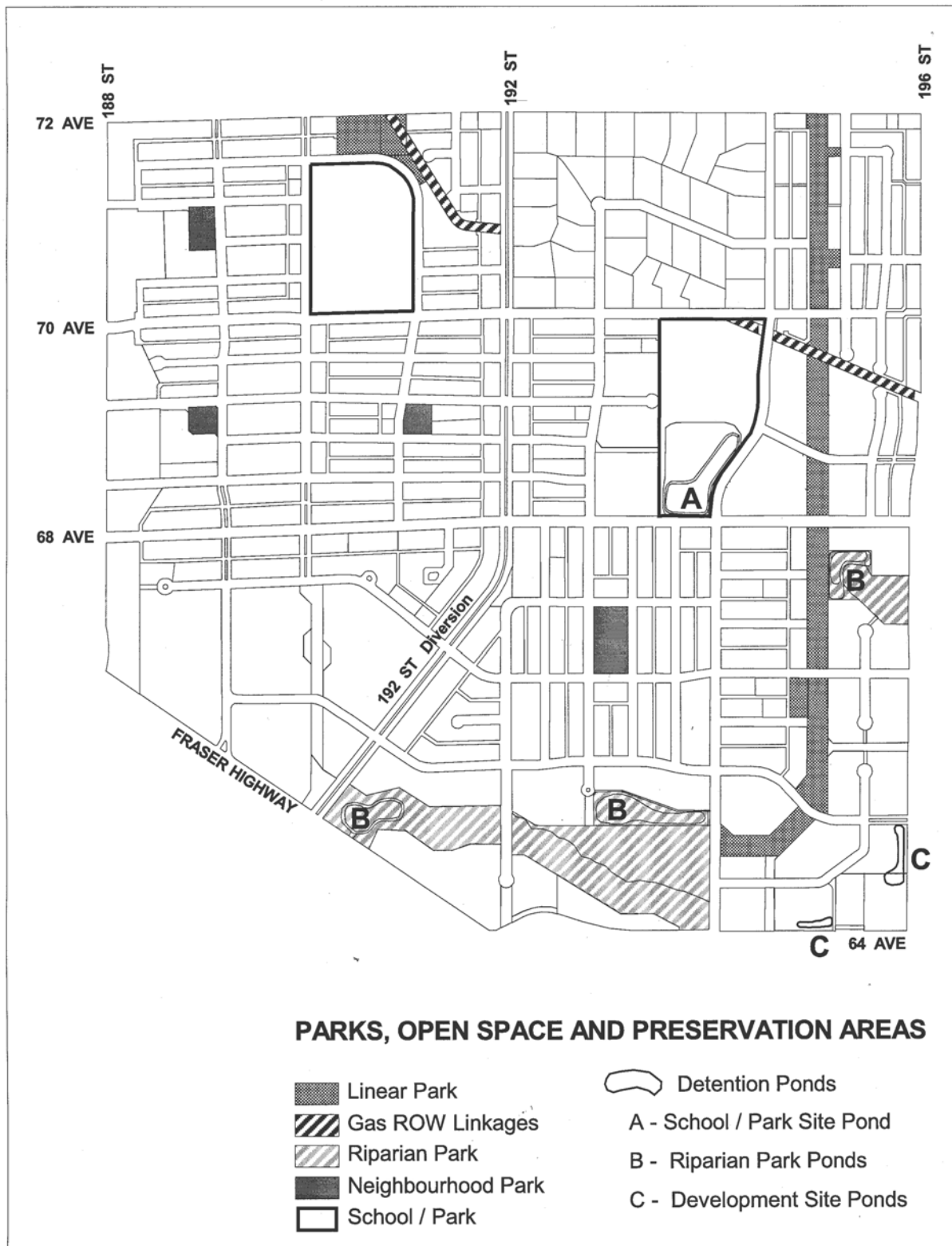


Figure 4.3 Parks and Open Space

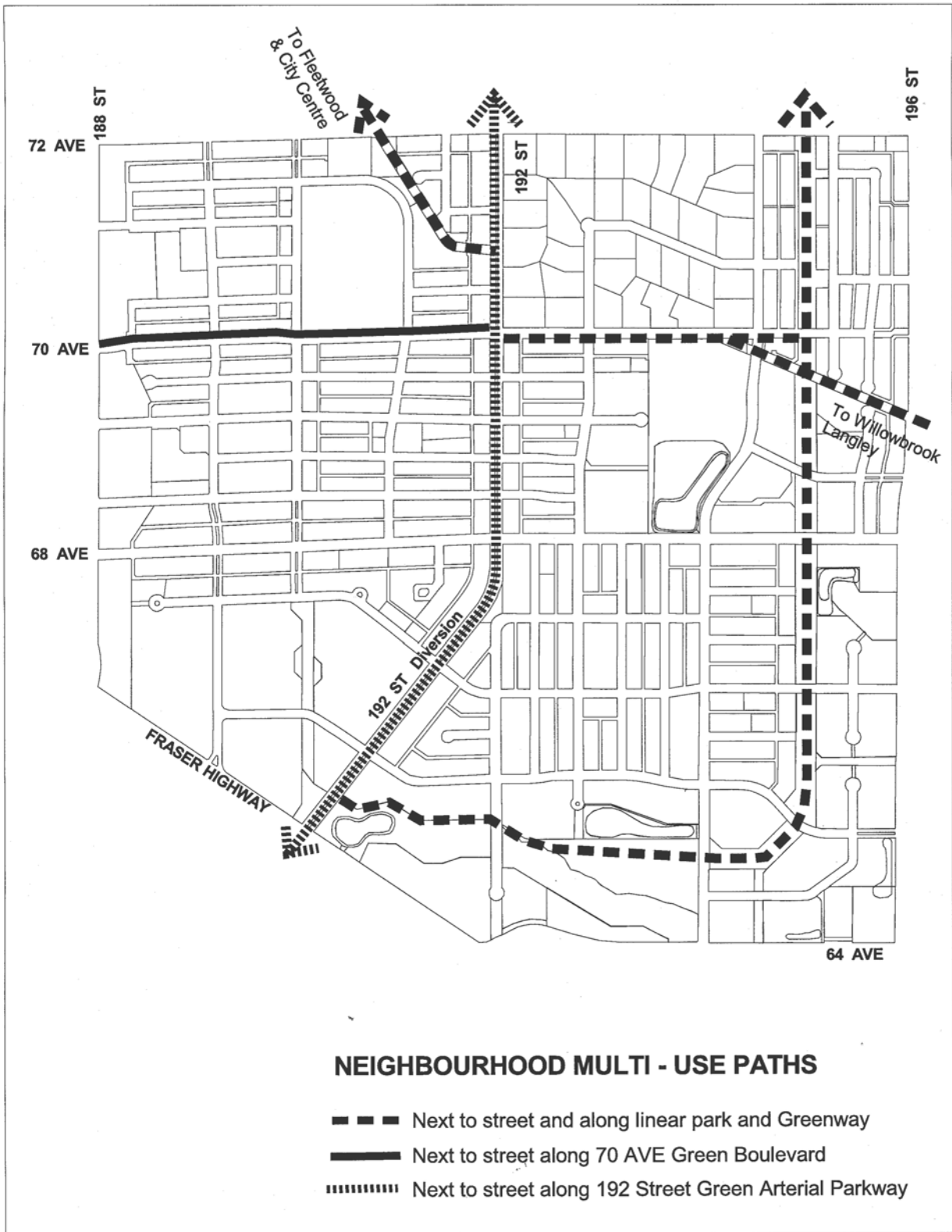


Figure 4.3.1 Greenway and Off-street Multi-use Corridors

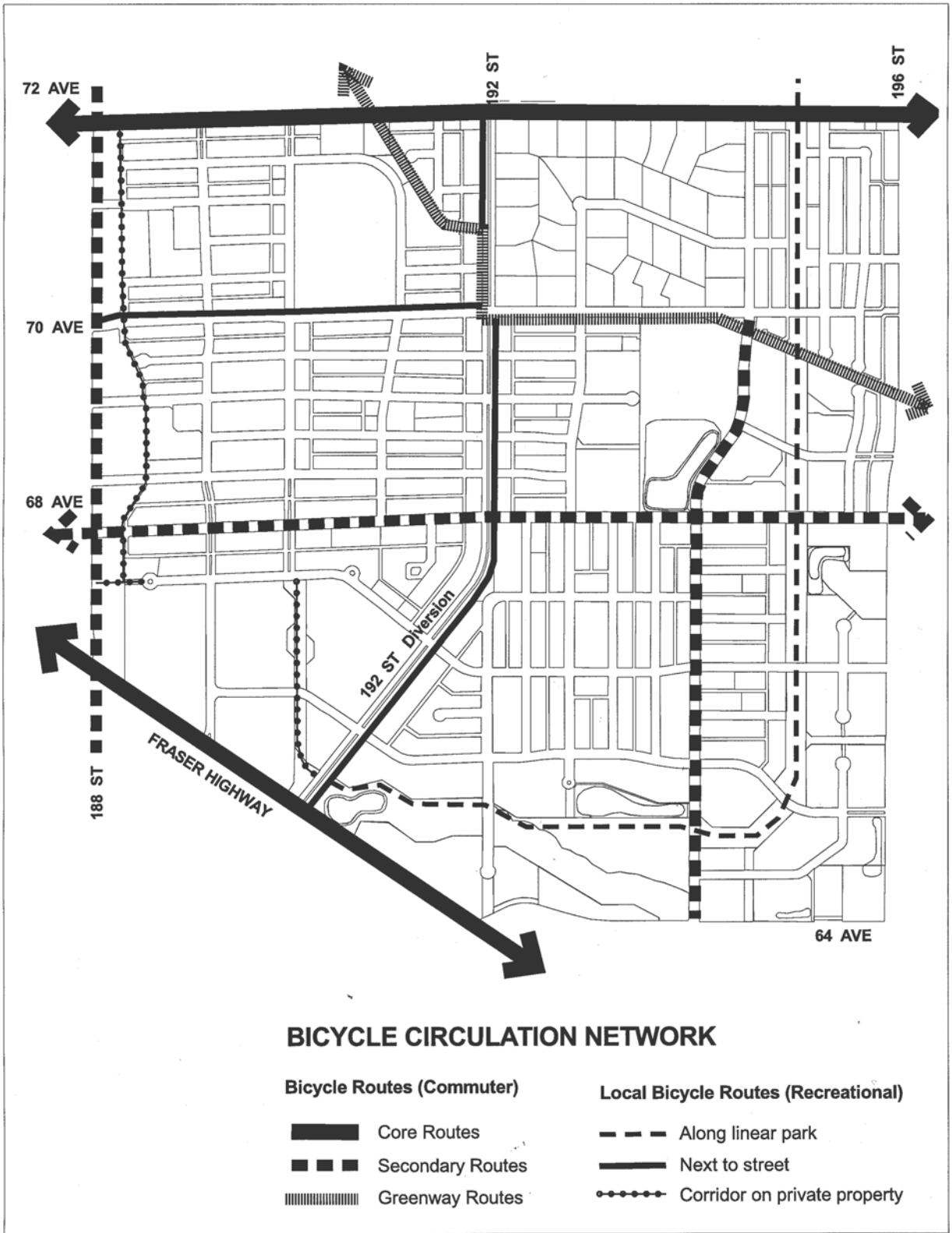


Figure 4.3.2 Bicycle Network

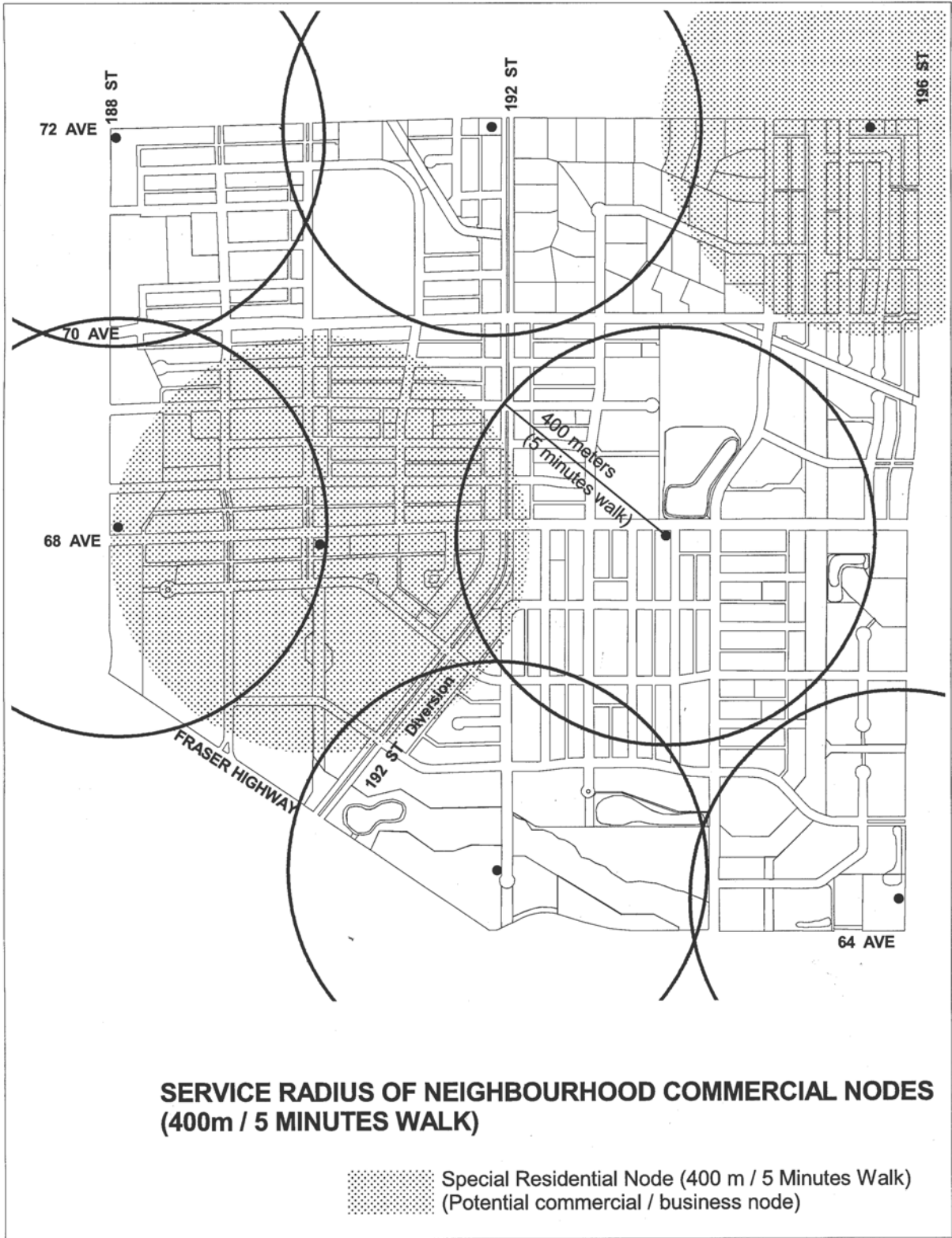


Figure 4.3.4 Walkable Radius from Neighbourhood Commercial Nodes

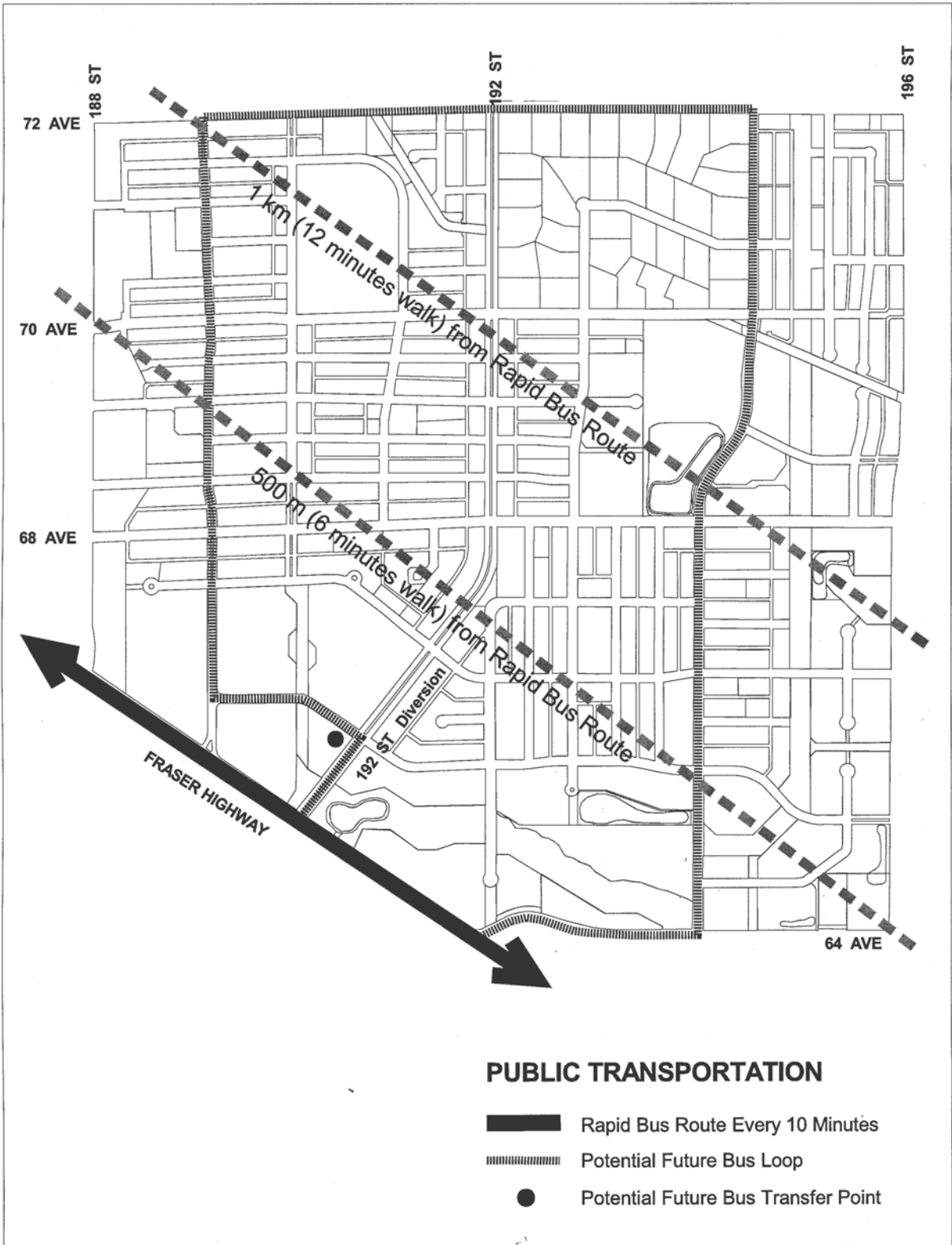


Figure 4.3.5. Bus Routes



## **5.0 COMMUNITY SERVICES AND AMENITIES**

In accordance with City Council's policy, in order to address the amenity needs of the proposed new development in East Clayton, at the time of rezoning or building permit issuance, development proposals will be required to make a monetary contribution toward the provision of new police, fire protection and library services and toward the development of the parks, open space and pathways.

The monetary contributions toward police, fire and library materials will offset the capital costs of providing these services to the new development and are applied on a standardized basis in all of Surrey's Neighbourhood Concept Plan areas. The monetary contributions toward park, open space and pathway development are based upon an estimate of the capital costs of these improvements for this particular Neighbourhood Concept Plan area. The total cost is divided among the anticipated number of dwelling units and acreages (for non-residential) to ensure an equitable contribution arrangement.

The sustainable design of the East Clayton community has resulted in shared development cost contributions for the development of some major parks and open spaces due to the dual function of many of these areas for both recreation and storm-water management purposes. The natural features of the area (i.e., watercourses) are considered to be important components of both the natural passive recreation system and storm-water management strategy.

## **5.1 PARKLAND DEVELOPMENT**

The East Clayton community will contain two neighbourhood school/park sites (one with a storm water pond/ biofiltration amenity area), two riparian park areas, a major linear park (greenway) and a series of five neighbourhood parks.

The village and civic centre for the entire Clayton area is located immediately west of East Clayton (west of 188 Street). An elementary and secondary school are located in the village centre along with a larger community park. The village centre may also contain civic buildings and other institutional uses such as churches or senior's facilities. It is envisioned that the public spaces in the village centre will contain street furniture, light standards, walkways, urban plazas and special landscaped areas.

While the village centre is mostly located outside of East Clayton proper, the future development in East Clayton will benefit from the civic features, parks and other amenities. The specific design guidelines and precise types of amenities in the village centre will be determined when the detailed Neighbourhood Concept Plan for this area is prepared. However, it is prudent for the City to set up a development fund for the village centre in conjunction with initial development in East Clayton. A contribution of \$266,000 is based upon East Clayton's share (2 neighbourhoods out of 8) of a total of \$1,064,000 to assist with the development of Clayton's village centre.

Two gateway features will be constructed at the 192 Street entrance into East Clayton. The easterly one will be constructed and be integrated with the storm water detention pond as an attractive addition to this water feature; at an estimated cost of \$ 10,600. The westerly gateway or landmark will be developed through the Development Permit process, as part of the required landscaped buffer area within private property.

The estimated cost of developing the park and related amenities in the East Clayton community is approximately \$3,214,000, which includes \$10,600 as the estimated amount for the construction of the easterly gateway feature and \$266,000 as the East Clayton's share of the future village center amenities.

Public art should be incorporated into both gateway features and/or at other locations in the village centre area. The cost of public art however, is not included in the estimated cost of the park and related amenities. It should therefore, be provided either through the City's capital construction program or through private sector sponsorship.

## **5.2 LIBRARY AND LIBRARY MATERIALS**

A study of library requirements in Surrey's new neighbourhoods has determined that a contribution of \$122.35 per dwelling unit (non-residential development is exempt) would be appropriate to cover the capital costs for library materials and services. Consequently, a total of approximately \$535,000 will be contributed from this neighbourhood towards materials such as books, computers and CD's.

### 5.3 FIRE AND POLICE PROTECTION

Future development in this neighbourhood will require upgrading of existing fire and police protection facilities. A study of fire protection requirements in Surrey’s new neighbourhoods has determined that a contribution of \$236.09 per dwelling unit and \$944.68 per acre non-residential would be appropriate to cover the capital costs for fire protection. Similarly, a contribution of \$54.46 per dwelling unit and \$218.65 per acre non-residential would be appropriate to cover the capital costs for police protection. This results in a total contribution of approximately \$1,087,000 toward fire protection and approximately \$250,700 toward police protection.

### 5.4 SUMMARY OF FUNDING ARRANGEMENTS

A summary of the applicable amenity contributions (per dwelling unit or hectare/acre) and the estimated revenue the City can expect to receive from the East Clayton Neighbourhood Concept Plan area is illustrated in Table 5.4. The amounts are in 2003 dollars.

**Table 5.4 East Clayton Neighbourhood Concept Plan Amenity Contributions**

	<i>Per unit contribution (As per base density in Table 2.2 (Sect.2). (approx. 4 370 d.u.)</i>	<b>Per Acre Contribution</b> All non-residential (app. 58.04 acres) (approx. 23.48 Ha)	<b>Anticipated Revenue</b>
Police Protection	\$ 54.46	\$ 218.65	\$ 250,680.60
Fire Protection	\$ 236.09	\$ 944.68	\$ 1,086,542.50
Parks–Pathway Development	\$ 735.33	n/a	\$ 3,213,392.00
Library Materials	\$ 122.35	n/a	\$ 534,669.50
<b>Total Contribution (per unit or acre)</b>	<b>\$ 1,148.23</b>	<b>\$ 1,163.33</b>	
<b>Total Anticipated Revenue</b>			<b>\$ 5,085,284.60</b>

The above-noted per unit amenity contributions are derived from estimated base densities in the residential designations and the number of dwelling units (excluding any coach houses and secondary suites) anticipated (table 2.2 in section 2.0). The estimated costs of the various amenities are distributed evenly to each dwelling unit. Therefore, if the number of dwelling units in a proposed development is lower than anticipated, the applicant will be expected to pay the amenity fees based on the number of the dwelling units anticipated to ensure that there is no shortfall in the funding for the proposed amenities.

## **6.0 IMPLEMENTATION**

Following the approval of the East Clayton Neighbourhood Concept Plan, a number of implementation initiatives should be undertaken to ensure that development in East Clayton proceeds in accordance with the approved land use policies, guidelines and servicing strategies. The following initiatives will help determine the nature of development in East Clayton through Surrey's development application process that may apply to individual developments.

### **6.1 IMPLEMENTATION GUIDELINES TO ACHIEVE RESIDENTIAL DENSITY AND DIVERSITY**

Each residential land use designation in the East Clayton Neighbourhood Concept Plan (NCP) contains a density range. The lower range is the minimum density allowed in the land use designation. To achieve the higher range densities, the use of a variety of dwelling unit types and/or lot sizes will be encouraged in a compatible arrangement within a block and/or development site to implement sustainable development principles. A development site is typically defined as the area included within individual development applications.

### **6.2 AMENDMENTS TO SURREY'S ZONING BY-LAW NO.12000 AND SIGN BY-LAW NO.13823**

#### **Bonus Densities and Amenity Contributions**

Pursuant to Sections 496 and 904 of the Local Government Act, most zones in Surrey Zoning By-law No. 12000 stipulate a maximum density, which may be increased to a higher density prescribed in each zone only if amenity contributions, identified in the approved Neighbourhood Concept Plans and incorporated in the Zoning By-law, are made by the applicant/developer. Accordingly, an amendment by-law will be prepared for consideration by City Council to incorporate the amenity contributions determined to be appropriate for developments in East Clayton.

#### **Zoning Regulations and Achieving Sustainable Development in East Clayton**

The East Clayton Neighbourhood Concept Plan identifies a number of performance standards that should be achieved in order for development to meet the sustainable principles premised in the plan. In some cases, there may be discrepancies between the current zoning regulations (e.g., prescribed setbacks or parking requirements) and the recommendations in the Neighbourhood Concept Plan pertaining to specific types of development proposed for East Clayton. Based on the initial development applications in

East Clayton, variances to the existing zoning regulations that may be appropriate for wider application could be considered by City staff for Zoning By-law amendments and forwarded to City Council for consideration.

### **Signage Regulations and Achieving Pedestrian-friendly Developments in East Clayton**

One of the objectives of the East Clayton Neighbourhood Concept Plan is to create a pedestrian-friendly community, which means that the various elements that constitute the streetscapes and physical environment will need to be designed to respect the pedestrian scale. These elements include free-standing signs desired by businesses for advertising purposes. These signs should not, however, overwhelm the streetscapes and physical environment. They will need to be designed and scaled so as not to detract from the objective of creating pedestrian-friendly environment while reasonably accommodating the needs of the businesses to advertise to the street traffic. It is recommended that City staff review Surrey's current Sign By-law to propose amendments to the by-law to regulate the free-standing signs specifically in the East Clayton area.

### **6.3 DEVELOPMENT APPLICATIONS FOR LANDS NORTH OF 72 AVENUE**

Certain lands immediately north of 72 Avenue and east of 188 Street have been identified as possibly being serviceable in conjunction with lands on the south side of 72 Avenue. The serviceability of these lands will depend upon site surveys and detailed engineering infrastructure design criteria at the time of application for each development parcel.

The serviceable lands on the north side of 72 Avenue will need to be redesignated from Suburban to Urban in Surrey's Official Community Plan in order to accommodate urban development. Therefore, an application to amend the Official Community Plan will need to accompany any rezoning application.

### **6.4 CITY PROJECT TEAM**

A project team consisting of City staff from the Planning, Engineering (Planning, Land Development and Operations) and Parks, Recreation and Culture Departments will be established to guide the overall implementation of the Neighbourhood Concept Plan, to educate City staff and other stakeholders, to ensure consistent practice and operation and to evaluate and monitor the various aspects of neighbourhood and infrastructure performance as development proceeds.

## **6.5 DESIGN GUIDELINES - NEIGHBOURHOOD CHARACTER STUDIES AND REGISTERED BUILDING SCHEMES**

The Neighbourhood Concept Plan contains design guidelines for land uses that are intended to provide general direction to achieve the desired neighbourhood character, preserve and enhance natural spaces, encourage pedestrian access to destination areas, facilitate social interaction, and achieve the overall development objectives defined in the final Neighbourhood Concept Plan.

The design guidelines make recommendations regarding the interface between residential areas and public spaces, landscaping and lighting of boulevards and multi-use corridors, as well as architectural elements appropriate for residential and commercial buildings. These guidelines will be used by City staff to guide the developers in coordinating the design among individual development applications and to ensure that the desired neighbourhood character is achieved in East Clayton.

The Design Guidelines will be implemented through Building Schemes for single family developments, which will be registered on the lots and administered by design consultants hired by the developers and approved by the City. For row housing, town housing and other multiple unit residential developments, commercial and business park developments, the Design Guidelines will be implemented through Development Permits.

## **6.6 DEVELOPMENTS IN SPECIAL RESIDENTIAL AREAS**

The concept of designing and building new Special Residential developments, particularly in the Surrey context, is yet untried, although market research suggests that there is a pent up demand for this unique and innovative housing/business accommodation. The benefits of this type of development would include more choice and affordability in the housing/business market and could serve as an incubator for small businesses in Surrey.

To provide consistency in implementing these types of developments, it is recommended that a new Special Residential Zone be created, which would accommodate a range of residential developments and permit a range of small-scale businesses in association with the residential developments. The new zone could be drafted concurrently with a rezoning application proposing such a land use.

## **6.7 COACH HOUSES AND OTHER ANCILLARY DWELLING UNITS**

As of May 2002 the City of Surrey has adopted a Single Family Residential Coach House Zone (RF-12C) allowing for the development of affordable secondary dwelling units (coach houses or secondary suites) to encourage the efficient use of housing stock and infrastructure and to provide alternative housing options. Also, in addition to the RF-9, Single Family Residential (9) Zone, for smaller lots (i.e. 9-metre/30-ft. wide lots), which is awaiting Final Adoption by City Council, a Single Family Residential (9) Coach House Zone (RF-9C) has been drafted, which will allow coach houses or secondary suites on smaller lots.

## **6.8 MIXED-USE COMMERCIAL/RESIDENTIAL**

Two mixed use areas are proposed on the East Clayton Land Use Plan: the Main Street commercial centre at the intersection of 72 Avenue and 188 Street; and a smaller centre at the intersection of 64 Avenue and 196 Street. These mixed-use areas are envisioned to allow developments having small-scale, pedestrian-oriented commercial uses (primarily retail) on the ground floors of the buildings and 2 to 3 storeys of residential uses above the commercial uses.

The current Surrey Zoning By-law includes mixed-use zones (C-15 and C-35). However, these zones are for mixed-use developments in Town Centres and Surrey City Centre. Therefore, the densities, scale and range of the uses permitted in these zones are of a higher order and more intense than what is envisioned in the East Clayton Land Use Plan. It is recommended that a new mixed-use zone should be created that would permit neighbourhood-scale mixed commercial/residential developments. This new zone could be drafted concurrently with a rezoning application proposing such a development.

## **6.9 COMMUNITY INFRASTRUCTURE MAINTENANCE PLAN AND COMMUNITY STEWARDSHIP**

The unique streetscapes, including the swales, infiltration devices on lots and urban forestry profile in East Clayton will require a different maintenance program than typical developments in Surrey. Consequently, the property owners may need to take on the responsibility of maintaining the boulevards and ensuring that boulevard swales and infiltration devices do not become blocked. There will also need to be some community co-operation to ensure that the individual lots retain porous surface materials to allow infiltration of rainwater into the ground.

## 7.0 ENGINEERING SERVICING

Servicing the development of the East Clayton Neighborhood Concept Plan area has been a challenge for the developers and the engineers, to establish an infrastructure system that balances the need for a sustainable, economical, livable and desirable community.

The servicing plan is a result of an extensive interactive effort of a multi-disciplinary design team for incorporating principles of sustainability and complete communities in East Clayton. As a result, the servicing plan includes innovative concepts for the roadways, and drainage management within the lots and along roadways. All of the proposed design elements in this plan are inter-related. Consequently, changes in one element will affect the other elements. Many of the concepts are being implemented for the first time in Canada.

The implementation of the proposed development plan depends on the ability of developers to finance the required infrastructure to service their particular area, as well as the status of off-site sanitary system capacity. All servicing components impose different levels of constraints to various parts of the NCP area.

The following sections list the infrastructure requirements for the East Clayton Neighborhood Concept Plan.



## 7.1 INTRODUCTION

The East Clayton Neighbourhood comprises the southeastern sector of the Clayton Generalized Neighbourhood and is approximately 250 ha in land coverage. The area is bounded by 196<sup>th</sup> Street to the east (the east/west boundary between the City of Surrey and Township of Langley); to the north by 72<sup>nd</sup> Avenue; to the west by 188<sup>th</sup> St.; and to the south by Fraser Highway and 64<sup>th</sup> Avenue.

The East Clayton Engineering Servicing Plan has been developed to support the land use proposed in the East Clayton Neighbourhood Concept Plan (NCP). The East Clayton NCP describes the planned land use and design guidelines for this neighbourhood. The following section describes the engineering servicing plan.

This servicing plan includes innovative servicing standards resulting from an extensive interactive effort to implement a more environmentally sustainable development concept in East Clayton.

The servicing concept requires detailed design and refinement of standards as the development applications progress through the approval process.

## 7.2 TRANSPORTATION

### 7.2.1 Background

The final East Clayton Road Network Plan was developed through the multi-stakeholder Charrette process and refined through meetings between City staff, local property owners and members of the development community. It has been based upon the following key principles:

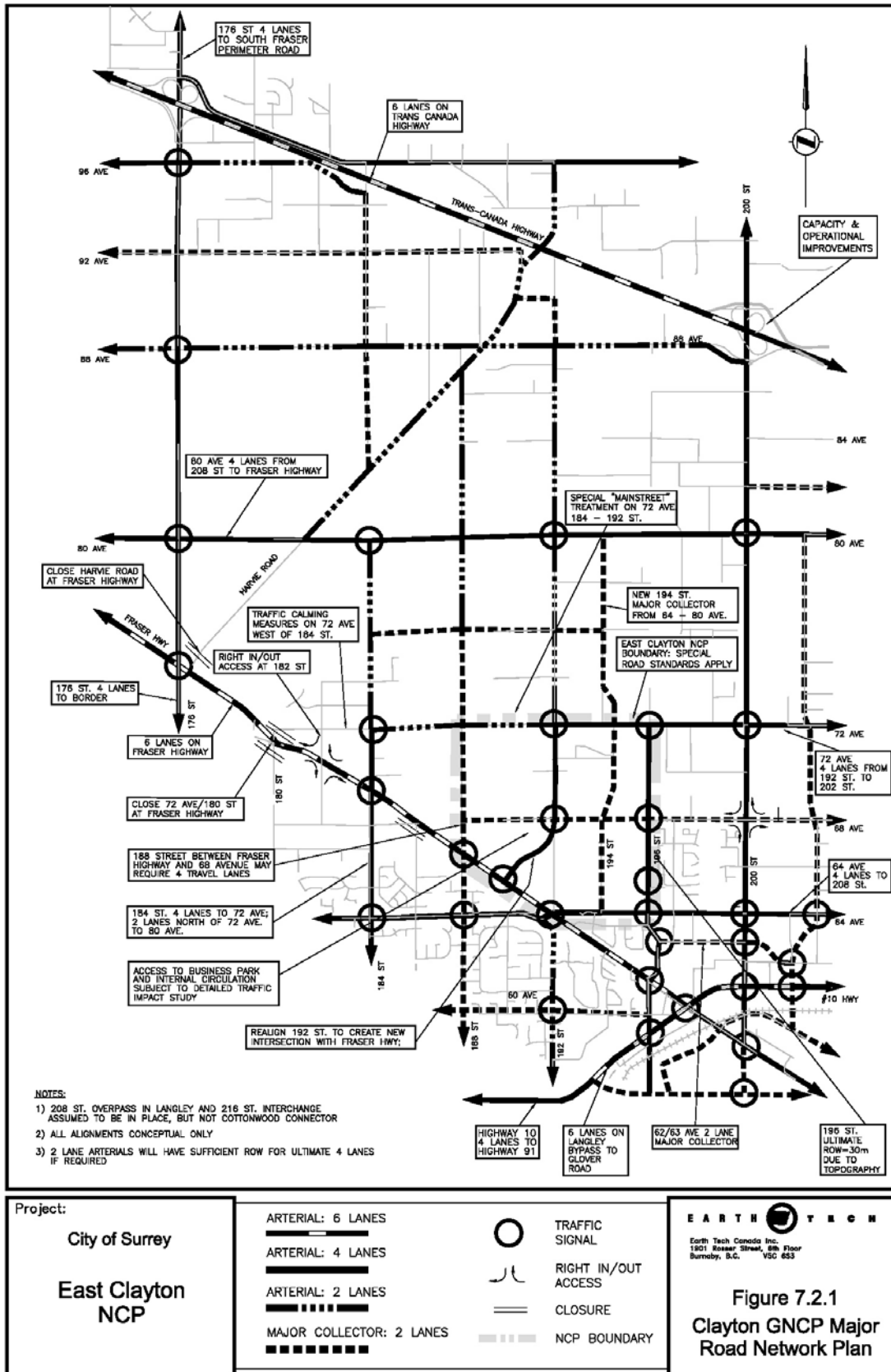
- Maintain the Arterial and Major Collector road network as defined in the Clayton GNCP, as much as possible;
- Use a modified “grid” system (interconnected network) of local and minor collector streets, with short blocks and rear lanes, to provide multiple route choices, and a more refined pedestrian/cyclist network;
- Provide a richer “menu” of street cross sections to respond to different land uses and functions intended for various streets;
- Respect the continuity of green space, drainage requirements and land use/topography conflicts, as well as existing property boundaries;
- Incorporate alternative street drainage systems to reduce environmental impacts of urban development through stormwater infiltration;
- Emphasize street trees as a key component of the City’s “urban forest” policies; and
- Tailor the local street design and establish a tight network of streets to reinforce the pedestrian priority within the neighbourhood.

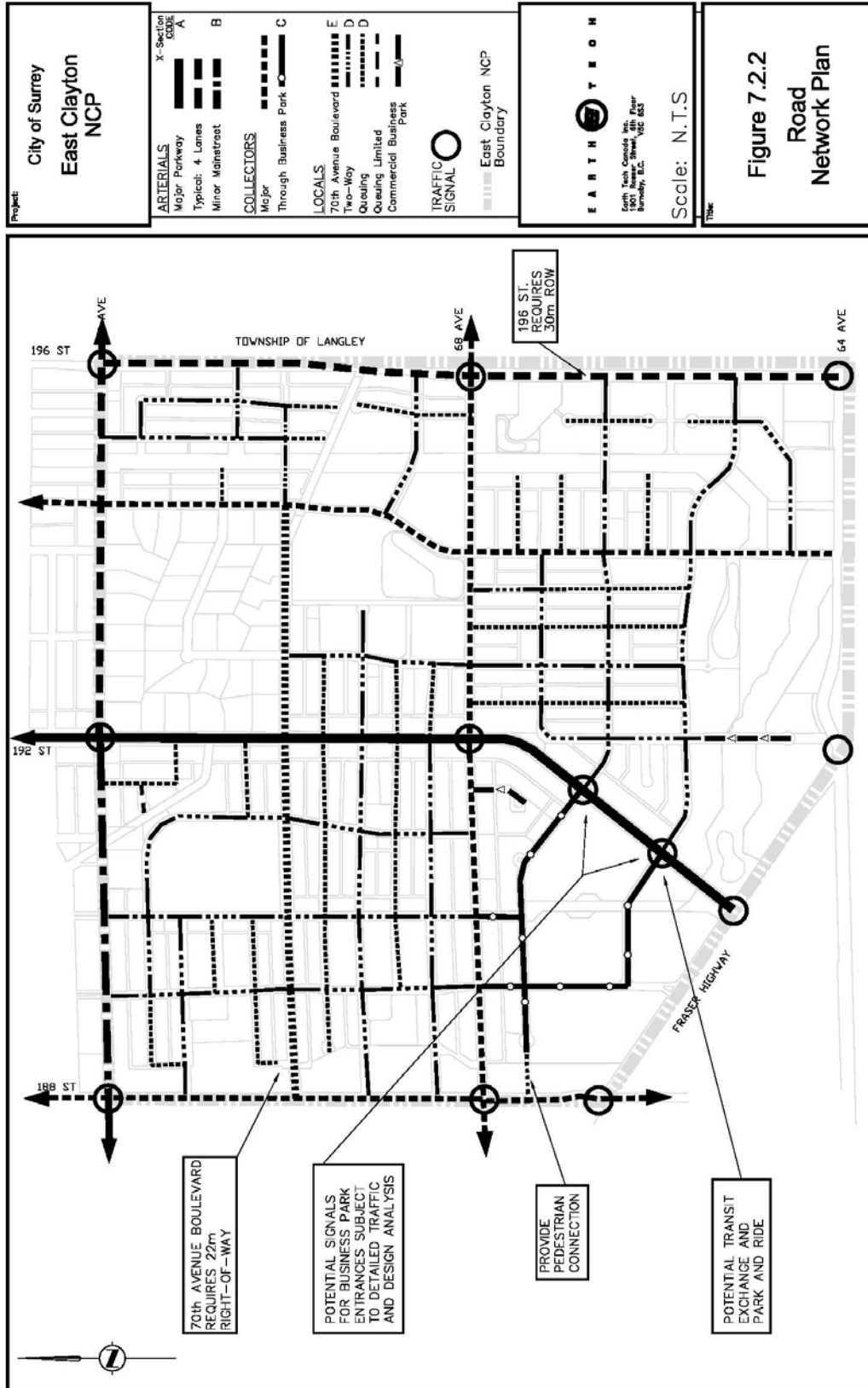
### 7.2.2 Road Network & Hierarchy

The basis for the development of the detailed East Clayton Road Network Plan was the May, 1999 version of the GNCP Major Road Network Plan and the December 1999 East Clayton Land Use Plan approved by City Council. **Figure 7.2.1** represents the refined plan of the “ultimate” road network at full build-out of Clayton as well as the Willoughby area in the Township of Langley.

**Figure 7.2.2** illustrates the proposed road network plan for East Clayton. The “Cross Section Codes” refer to the various street cross section types included in **Appendix IV**. Street types without a cross Section Code are included in the City of Surrey Supplemental Standard Document.

Proposed Local road access to Arterials and Major Collectors is more frequent in the East Clayton NCP than that typically found in other more conventional suburban neighbourhoods in Surrey. This feature of the plan is intended to support the “open” grid network concept by dispersing traffic among multiple routes.





While the Arterial and Collector designations and alignments are well defined, refinements to the Local street system shown on this figure would be considered.

### **7.2.3 Traffic Control Plan**

*Figure 7.2.3* identifies the intersection control, left turn lanes and parking restrictions. The following sections provide additional detail on these elements, as well as road access/driveways and traffic calming.

#### **7.2.3.1 Intersection Control**

##### **Signals/Stop Signs**

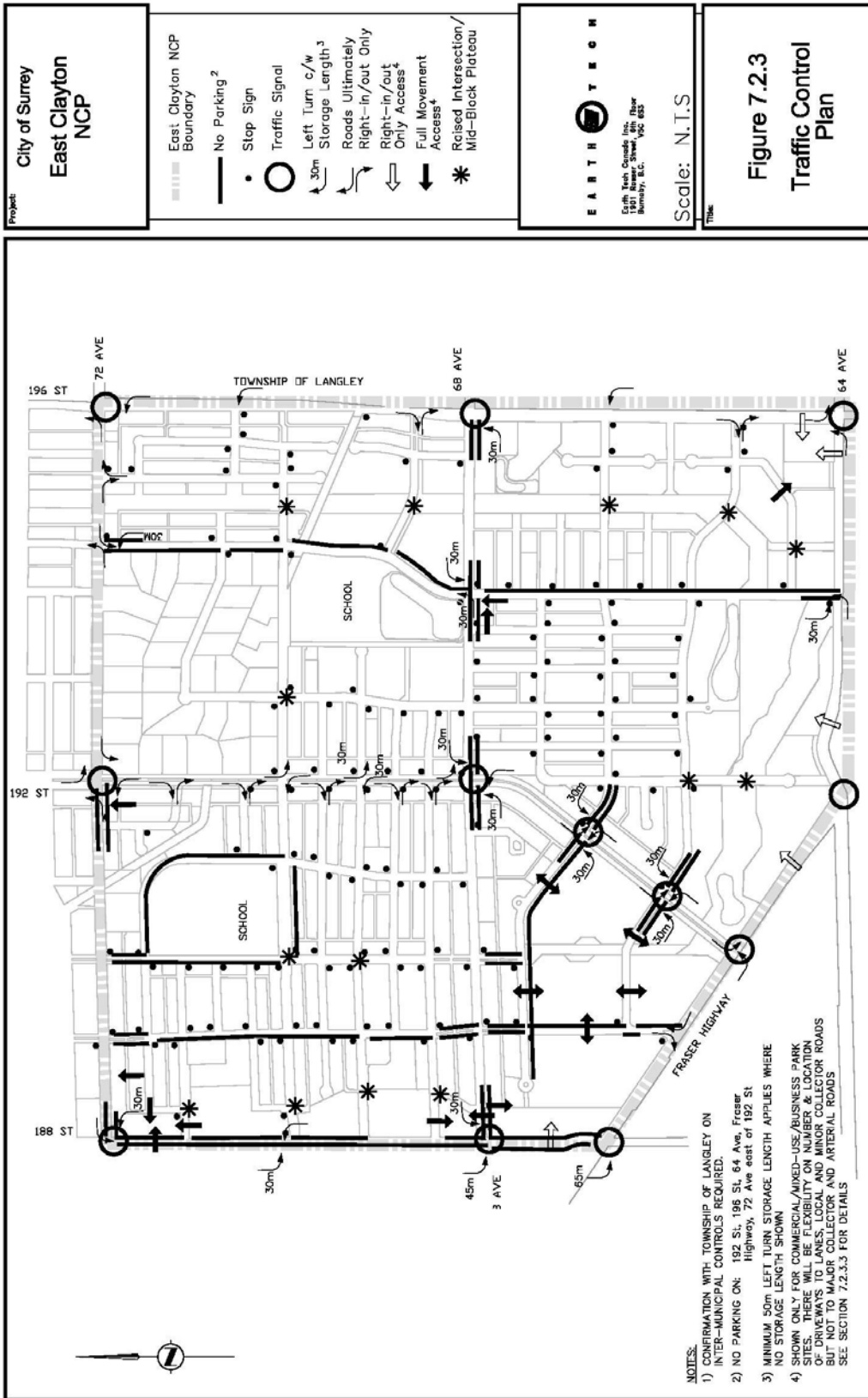
*Figure 7.2.3* shows the locations of existing and potential future traffic signals and stop signs. These recommendations have the following caveats.

- Proposed traffic signal locations are based upon engineering judgment, not detailed traffic impact/signal warrant analysis, and thus are subject to future analysis based on actual demand.
- It is expected that most Arterial/Collector intersections will ultimately require traffic signals.
- Some Arterial/Local intersections may also ultimately require traffic signals. However, based on the proposed density of East Clayton an initial review indicates that these intersections should function acceptably without signals.
- East Clayton is being established with only two-way stop control at intersections. Intersections will be evaluated as necessary in the future to determine if any warrant four-way stop control.
- As East Clayton builds out, traffic demand may vary from what is anticipated, so it may be necessary at some intersections to switch the stop control from one direction to the other. For this reason it is important that all intersection approaches be designed to suit the design speed.

##### **Turn Restrictions / Left Turn Lanes**

###### *Arterials*

- Specific intersections will be restricted to right-in/right-out as identified in *Figure 7.2.3*.
- Left turn lanes will ultimately be required at all other intersections except the “Mainstreet” section of 72 Avenue. The storage length will typically be 40 m to 50 m long.



### ***Collectors***

- No turn restrictions.
- Left turn lane required at key intersections as identified in ***Figure 7.2.3***.

### ***Locals***

- Most intersections will ultimately be restricted to right-in/right-out at Arterial Roads (through the use of raised medians) as identified in ***Figure 7.2.3***. Selected Local Roads will have full movement access to Arterial roads. However, left-turn movements may be restricted if safety problems arise at these locations.
- Left turn lanes will be provided only on 65 Ave and 66 Ave at 192 Street Diversion, due to the potential for signalization of these intersections. This will require pavement widening to 12.2 m at the intersection approaches and 22 m of right-of-way to accommodate all the services.

### ***Lanes***

- Right-in/right-out only at all arterials.
- No left turn lanes.
- Curb returns will be utilized at connections to arterial and major collector roads
- Sidewalk letdowns will be utilized at connections to local and minor collector roads.

### ***7.2.3.2 Parking***

The encouragement of on-street parking is an important concept for East Clayton streets; it narrows the effective width of street pavements and contributes to the traffic calming effect. On-street parking would be prohibited on “Ultimate Arterial” streets where 4 travel lanes are provided, and at specific other locations as identified in ***Figure 7.2.3***. Parking restrictions/rationale include:

- the opposite side of the road from elementary schools - to avoid school children running across the road after being dropped off,
- both sides of some local and collector roads to facilitate left turn lanes at key intersections,

- both sides of some local and collector roads to facilitate special median treatment at specific neighbourhood entry points,
- the opposite side from the Special Residential area on Business Park streets -to provide suitable travel lane widths for the higher number of trucks expected on these streets, and
- along one side of 188 Street and 194 Street as per the standard major collector treatment in order to provide bicycle lanes.

### **7.2.3.3 Driveways / Access**

#### **Single Family Residential**

##### ***Lane Access***

Where lane access is available, driveways must be to the lane, as they will not be permitted to the street.

##### ***Street Access***

Where rear lanes are not possible due to topography or existing subdivision constraints, driveways to non-arterial roads will be permitted.

To reduce the impact of driveways on the overall “sustainability” concept, single-family (all zones) driveway requirements are:

- paired with adjacent properties, offset 2.0 m from the side property line,
- 4.5 m width plus letdown flare between the sidewalk and curb, and
- may be widened to 5.25 m within private property to suit garage widths and facilitate parking on driveways.

#### **Multi Family Residential**

Multi-family driveways must be between 6 m and 7.3 m wide and must be curb letdown style.

##### ***Arterial Road Access***

Driveway access to the arterial roads is not permitted for safety and operational considerations, and in order to avoid impact to multi-use pathways and drainage/landscape corridors.

The only location where arterial access is deemed necessary is between the riparian area and 64 Ave east of 192 Street. This multi-family area will be permitted a



shared right-in/right out to 64 Ave with the adjacent Specialty Commercial site. Alternate access to 192 Street for this multi family site will be required through the Specialty Commercial site.

### ***Collector Road Access***

Access to 188 Street south of 70 Avenue will not be permitted due to the high school across the street, the street parking and the streetscape/housing character planned for this area.

One access will be considered on 188 Street north of 70 Avenue due to the multi-use pathway along the east and south sides of this multi family area.

68 Avenue is the only road extending from 188 Street to 196 Street between 64 Ave and 72 Ave. For this reason it will be an important link with higher than typical traffic volumes. To facilitate the anticipated traffic volumes, driveway access will be limited. Where alternate access is not possible, driveways with spacing in the order of 100 m will be permitted to 68 Avenue.

Driveway spacing for all other collector roads is governed by the City of Surrey Design Criteria Manual.

### ***Local Road / Lane Access***

Driveways must be a minimum of 25 m from the near side of an intersection and other driveways.

### **Commercial/Mixed-Use/Business Park/Institutional Driveway Requirements**

Driveway widths are governed by the City of Surrey Design Criteria Manual. Permissible access locations discussed below are illustrated on ***Figure 7.2.3***.

#### ***Neighbourhood Commercial Site at SW Corner of 72 Ave / 192 St***

Access will only be permitted from the lane as this site has short frontages along both arterial roads.

#### ***Mixed-Use Residential/Commercial Area at SE Corner of 72 Ave / 188 St***

To achieve the desired streetscape and maximize on-street parking, access is to be limited to the local roads and lanes and one shared access to 188 Street.

#### ***Neighbourhood Commercial Area on 188 Street Between 68 Ave and 68A Ave***

Due to relatively high traffic volumes anticipated on 188 Street in this area, and to achieve the desired streetscape, access will be limited to 68 Ave and 68A Ave.

### ***Commercial Area on 188 Street South of 68 Ave***

Due to high traffic volumes anticipated on 188 Street in this area, and to achieve the desired streetscape, only one shared right-in/right-out access will be permitted to 188 Street at mid-block.

One temporary right-in/right-out access to 188 Street would be permitted until access via the ultimate driveway to the north is achieved.

One temporary right-in/right-out shared driveway would be permitted to the Fraser Hwy at the east end of Plan RP6030 Rem A (18861 Fraser Highway), which is approximately mid-block between 188 Street and 189 Street. This access would be shared with the business park.

Statutory right-of-ways or access easement agreements will be required between the commercial sites as well as the business park sites to improve traffic circulation and access.

One access would be permitted from 68 Ave. It is envisaged that the driveway will be combined with the lane from 68 Ave and will continue south as a driveway into the commercial area. However, this is subject to review upon applications for these sites.

### ***Business Park Area***

No direct access will be permitted from the Fraser Highway to improve safety and traffic operations on this route.

Access will not be permitted to the 192 Street Diversion to improve safety and traffic operations along the 192 Street Diversion, to avoid impact to the greenway, and because very good access is available via the local and collector roads.

Full movement access will be available from 189 Street, 65 Avenue and 66 Avenue.

If the area is not developed as a single comprehensive site, then statutory right-of-ways or access easement agreements will be required between the business park sites as well as the commercial sites to improve traffic circulation and access.

### ***Commercial Area at Fraser Hwy / 192 Street / 64 Ave***

One right-in/right-out access will be permitted along the Fraser Highway mid-way between 64 Avenue and the 192 Street Diversion.

One access will be permitted to 64 Avenue as far as possible from the Fraser Highway intersection. This access must be shared with the townhouse site to the east.

Access must be provided through the commercial site to 192 Street for the townhouse site.

### ***Neighbourhood Commercial Area at 194 Street / 68 Ave***

Driveway access is permitted to 193B Street and/or the lane. A driveway to 193B Street must be a minimum of 25 m from the intersections with 68 Avenue and 9 m from the lane. Driveway access is not permitted to 68 Ave or 184 Street due to higher traffic volumes, planned streetscape and the maximization of on-street parking.

### ***Mixed-Use Residential/Commercial and Institutional Areas at 196 St / 64 Ave***

One right-in/right-out driveway to 64 Avenue will be permitted for the commercial/residential site, but an access easement agreement must be registered for the institutional site.

One right-in/right-out driveway to 196 Street will be permitted for the commercial/residential site.

One driveway to 64A Ave is required to the institutional site with an access easement agreement registered for the commercial/residential site.

## ***7.2.3.4 Traffic Calming***

Traffic calming is an important component of creating a livable community. *Appendix V* identifies traffic calming measures that could be considered for each of the street types in East Clayton.

However, Surrey does not currently have a neighbourhood where comprehensive curb extensions and plateaus/raised intersections have been used for traffic calming. When used comprehensively, these measures should be effective without any additional measures. East Clayton is intentionally planned to only utilize these two measures, as described below. This will also enable evaluation of the effectiveness of these measures.

### **Curb Extensions (Bulging)/Parking Pockets**

#### ***Usage***

Curb extensions will be utilized on:

- one side of all 8.5 m wide (queuing) local roads,
- both sides of all 10.5 m wide (two-way) local roads, and
- one side of all collector roads (both sides for 68 Avenue), except where left turn lanes are required.

Mid-block curb extensions must be included where blocks are greater than 120 m long. This limits the length of parking pockets to the recommended 8-10 stalls or

55 m to 70 m, which significantly enhances the traffic calming benefit of parking pockets.

### ***Design***

The design of the curb extensions/parking pockets must meet the following criteria:

- 2.25 m deep parking pockets,
- 9 m radius curb return at the intersections,
- 3m radius reverse curb returns for the start/end of the parking pocket, and
- typically 6 m long (min 3 m long) tangent narrowed road section between the curb returns for intersection and mid-block locations. Where driveway access has to be from the street, the tangent length must be adjusted to avoid a transition across a driveway.

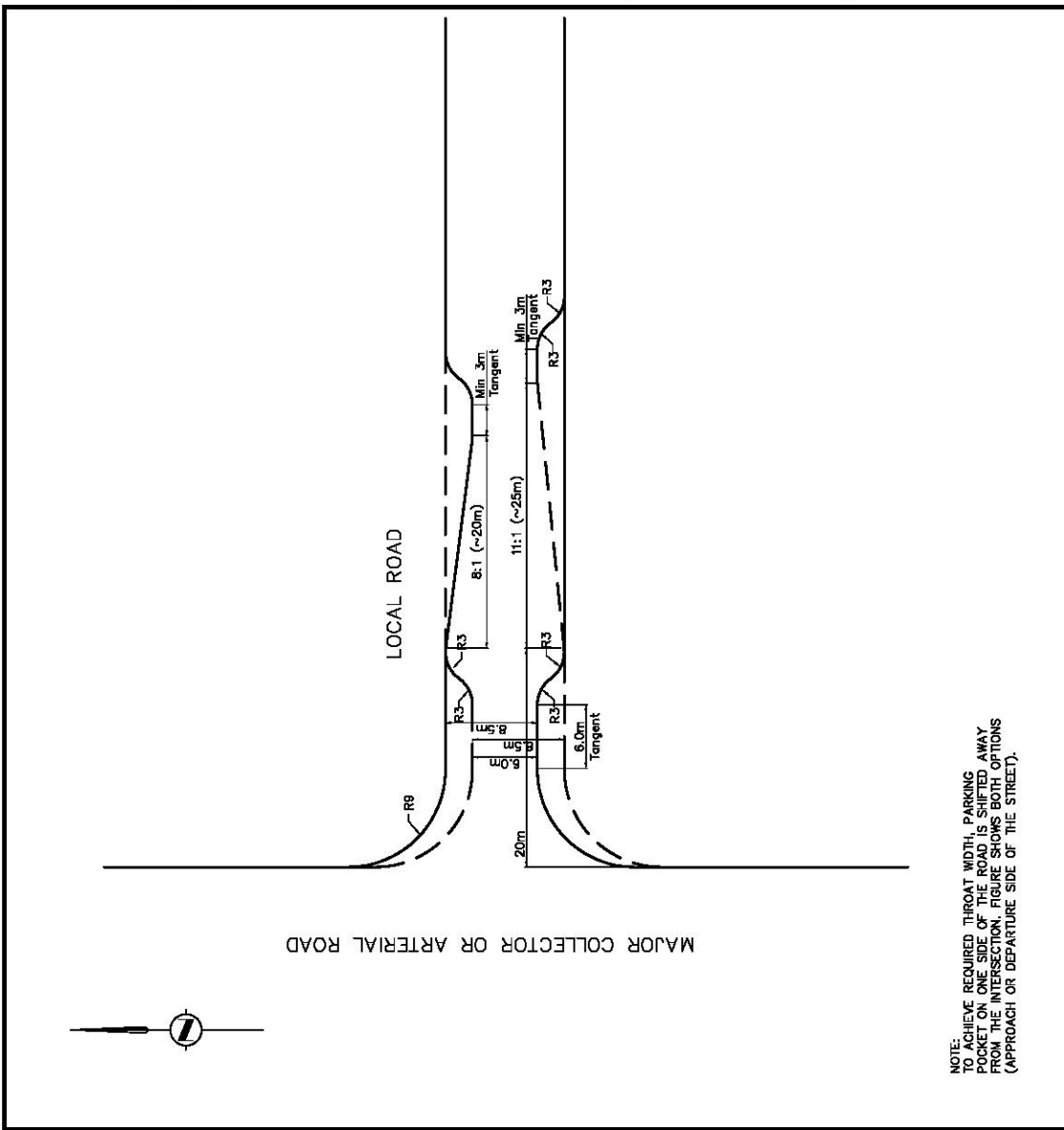
Local Roads must have 8.5 m clear width for a length of 20 m from the curb face of an intersecting Major Collector or Arterial Road. This is necessary to accommodate the turning movement of single unit trucks from Major Collector or Arterial Roads when a vehicle is waiting at the Local Road stop sign. This must be achieved based on the following criteria (illustrated in ***Figure 7.2.4***):

- curb extension/parking pocket on one side of the Local Road must be shifted back from the intersection,
- if shifted parking pocket is on the intersection approach side of the road, taper out the curb extension at 8:1 (approximately 20 m long taper),
- if shifted parking pocket is on the intersection departure side of the road, the pavement should be narrowed with a curb taper of 11:1 (approximately 25 m long taper), and
- minimum 3.0 m tangent required between end/start of taper and parking pocket introduction/termination.

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Scale: N.T.S.  
 Figure 7.2.4  
 Local Road at Major  
 Collector/Arterial  
 Intersection  
 Treatment



## **Plateaus / Raised Intersections**

### ***Usage (locations identified on Figure 7.2.3)***

Plateaus will be utilized for the mid-block local road crossings of the multi-use pathways, namely:

- the multi-use pathway just east of 188 Street between 69 Ave and 71 Ave,
- the north-south linear park/multi-use pathway between 70 Ave and 64A Ave, and
- the east-west parkland/multi-use pathway crossing of 192 St just north of 64 Ave.

Raised intersections will be utilized at key intersections typically near schools or parks. Intersection locations will include:

- 70 Ave at 190 St,
- 70 Ave at 193 St,
- 69 Ave at 190 St, and
- 65 Ave at 192 St.

Additional locations may be identified as development of East Clayton proceeds.

### ***Design***

The design of the plateaus/raised intersections must meet the Transportation Association of Canada's Canadian Guide to Neighbourhood Traffic Calming Specifications. This includes the 80 mm rise, pavement markings and signage. However, the following modifications/additional criteria govern:

- approach and departure ramp length to be reduced to 1.0 m,
- minimum raised plateau length of 4 m,
- if adjacent to an intersection (lane or road), the raised plateau must be extended through the intersection, and
- asphalt surface must be stamped in the herringbone pattern.

## **7.2.4 Street Cross Section Elements**

From the outset of the East Clayton NCP process, alternative and more environmentally sustainable street designs were identified as a critical component of the NCP.

*Appendix IV* contains figures that illustrate the unique Arterial, Collector, and Local Road cross-sections for East Clayton. The letters in the upper-right hand corners of these figures represent the "Cross Section Codes" noted in *Figure 7.2.2* and *Table 7.2.1*.

**Table 7.2.1: East Clayton Cross-Section Elements**

No.	Classification	Type		Dedicated RoW Width	Paved Width <sup>(2)</sup>	Cross Section Code <sup>(3)</sup>
1	ARTERIALS	MAJOR	PARKWAY (192 Street)	34.0m <sup>(4)</sup>	19.0m	A
2			TYPICAL (Ultimate)	27.0m <sup>(5)</sup>	19.0m	
3		MINOR	MAIN STREET	28.0m <sup>(6)</sup>	20m	B
4	COLLECTORS	MAJOR		22.0m	12.2m <sup>(7)</sup>	
5		MINOR	BUSINESS PARK	22.0m	12.2m	C
6	LOCALS	RESIDENTIAL <sup>(8)</sup>	TWO-WAY, parking both sides	20.0m <sup>(9)</sup>	10.5m	D / E
7			TWO-WAY, parking one side, or QUEUING, parking both sides	18.0m	8.5m	D
8			QUEUING LIMITED, parking both sides	17.0m	8.0m	D
9		COMMERCIAL/ BUSINESS PARK	TWO-WAY, parking one side	20.0m	11.0m	
10	LANES	RESIDENTIAL		6.0m	5.4m	
11		COMMERCIAL		8.0m	7.4m	

Table 7.2.1 Notes:

- (1) Road Development Cost Charges (Road DCC's) are based upon street types No. 1-4 only. Minor Collectors, Local Roads and Lanes are not DCC eligible.
- (2) Paved width includes parking pockets, where applicable.
- (3) "Cross Section Code" refers to the street standard cross sections (See **Figures A2.1 to A2.5**). Street types without a code are typical and are shown in the Surrey Supplementary Standard Drawings (SSD). Table 7.2.1 shows their current RoW and pavement width requirements, but the dimensions specified in the SSD shall govern.
- (4) Parkway (192 Street) cross-section requires an additional 0.5 m Statutory right-of-way (SRW) each side.
- (5) 196 Street will require 30m right-of-way from 64 Avenue to 68 Avenue, due to topographical constraints.
- (6) The Mainstreet (72 Ave) will require 28.0 m wide right-of-way in order to provide for angled parking on both sides of the street, which improves accessibility to the planned streetfront commercial development.
- (7) 68 Avenue pavement is widened to 14.0m for parking both sides (and bicycle lanes). An additional 0.5 m SRW is required each side.
- (8) Additional 0.5m SRW required each side where sidewalk is present.
- (9) The 70 Avenue "Boulevard" requires 22.0m wide right-of-way to accommodate a 3.0m multi-use pathway, and an additional row of street trees.

#### 7.2.4.1 Cross-Section Issues

The following issues will require careful attention and/or additional analysis during development and detailed road design.

### **188 Street South of 68 Ave**

Although designated a two-lane Major Collector road, two travel lanes may be required in each direction plus left turn lanes between 68 Ave and the Fraser Highway.

A traffic study was completed for the Triangle Holdings Commercial rezoning at the northwest corner of the 188 Street / Fraser Highway intersection. The study concluded that a southbound right turn lane was required at the Fraser Highway intersection but did not need to extend all the way to 68 Avenue. Dedication was provided for this additional lane and is planned for construction in conjunction with the development.

The first commercial/business park application fronting 188 Street to the east will be required to undertake additional traffic analysis to determine whether a second northbound lane will be required on 188 Street and whether the proposed extent of the southbound right turn lane is sufficient. These issues cannot be resolved at this time as they are highly dependent upon the type of development proposed on the east side of 188 Street.

### **Local & Minor Collector Median/Left Turn Lane Treatments**

The following locations will have medians:

- 189 Street at 68 Avenue and 72 Avenue,
- 190 Street at 68 Avenue and 72 Avenue,
- 68A Avenue at 196 Street, and
- 65 Avenue at 196 Street.

The following locations will have left turn lanes:

- 65 Avenue at 192 Street Diversion, and
- 66 Avenue at 192 Street Diversion.

Parking is banned on both sides of the road in these locations in order to achieve a 3.0 m wide landscaped median or left turn lane. The following criteria apply (example sketch shown in *Figure 7.2.5*):

- The 10.5 m wide pavement for the local roads will have to be widened to 11.0 m to achieve 4.0 m wide lanes either side of the median/left turn lane (pavement width is already 12.2 m for 189 St and 190 St south of 68 Ave, and 65 Ave and 66 Ave west of 192 St Diversion);



- Median/left turn stop bar setback from intersections to be established to suit fire truck turning movements;
- full medians to extend from the main cross street (68 Ave, 72 Ave, and 196 St) to the adjacent lane or a minimum of 25 m (except 190 St south of 68 Ave where it will break at the lane but continue to 67 Ave);
- left turn lanes to be 30 m long;
- medians/left turn lanes to taper out at approximately 20:1. For medians, curb extensions are to be achieved by the next cross street (not applicable to 190 St south of 68 Ave); and
- minimum 3.0 m tangent required between end/start of taper and parking pocket introduction/termination.

The medians on 189 Street and 190 Street at 68 Avenue are intended as both a gateway feature and to discourage truck traffic from entering the residential neighbourhood. The truck traffic is intended to access the area via 65 Ave and 66 Ave from 192 Street Diversion, and via 190 Street from the Fraser Highway.

### **188 St, 194 St & 68 Ave Transitions from Parking Pockets to Left Turn Lane**

Each of these Major Collector roads has areas of parking on one or both sides of the street. The following criteria apply for the transition areas (example sketch shown in *Figure 7.2.6*):

- minimum 20:1 lane/curb tapers, and
- minimum 3.0 m tangent required between end/start of taper and parking pocket introduction/termination.

### **194 St at 70 Ave Parking Pocket Transition from West to East Side**

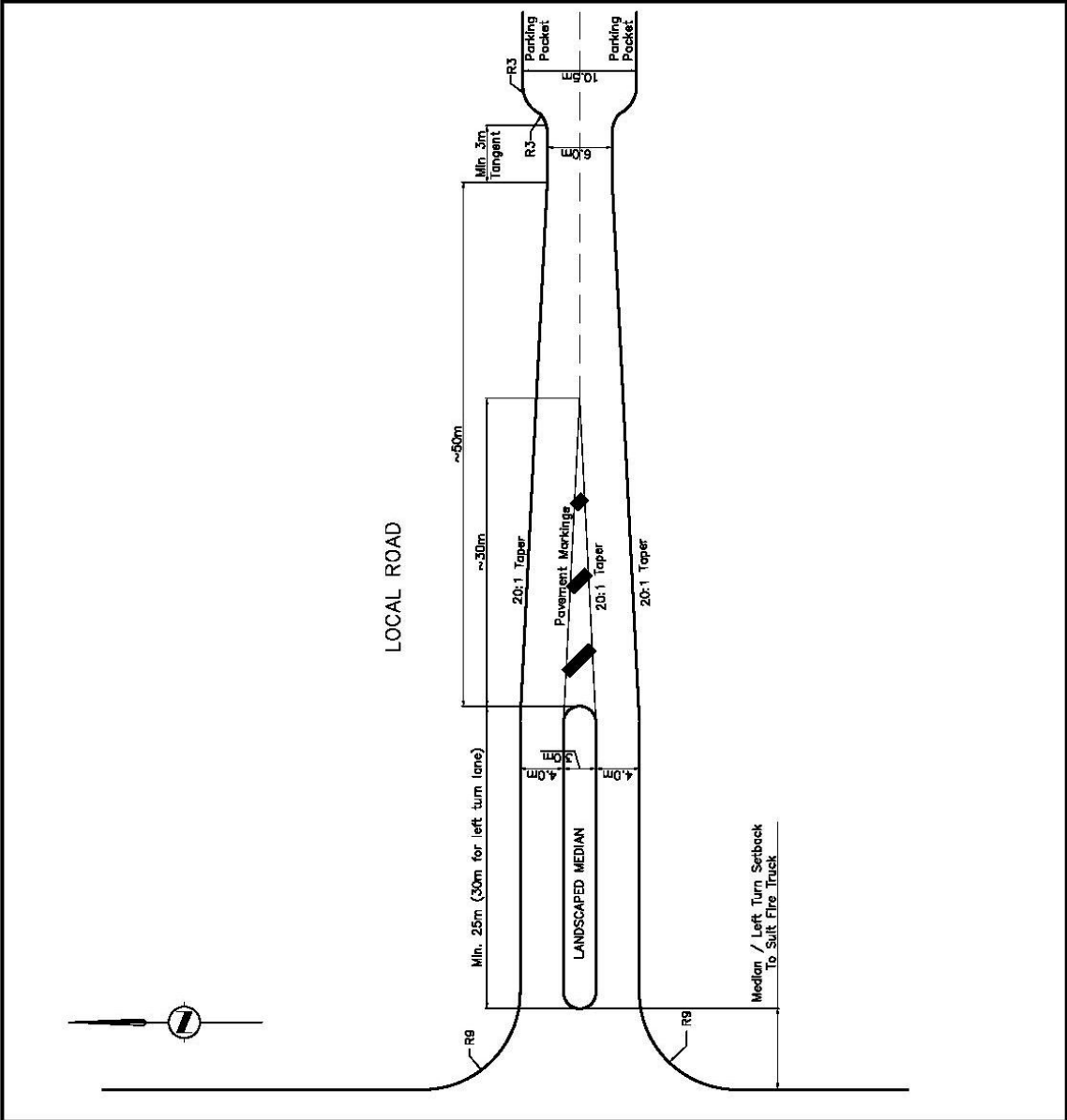
To accomplish a shift in the parking pocket from the west side to east side, the travel way must be shifted. The following criteria applies to this transition (sketch shown in *Figure 7.2.7*):

- transition taper is to start 20 m north of the 70 Ave curb face,
- minimum 20:1 lane/curb taper,
- parking pocket to the north to be introduced a minimum of 15 m beyond the start of the taper, and
- parking pocket to the south to start 20 m south of 70 Ave curb face.

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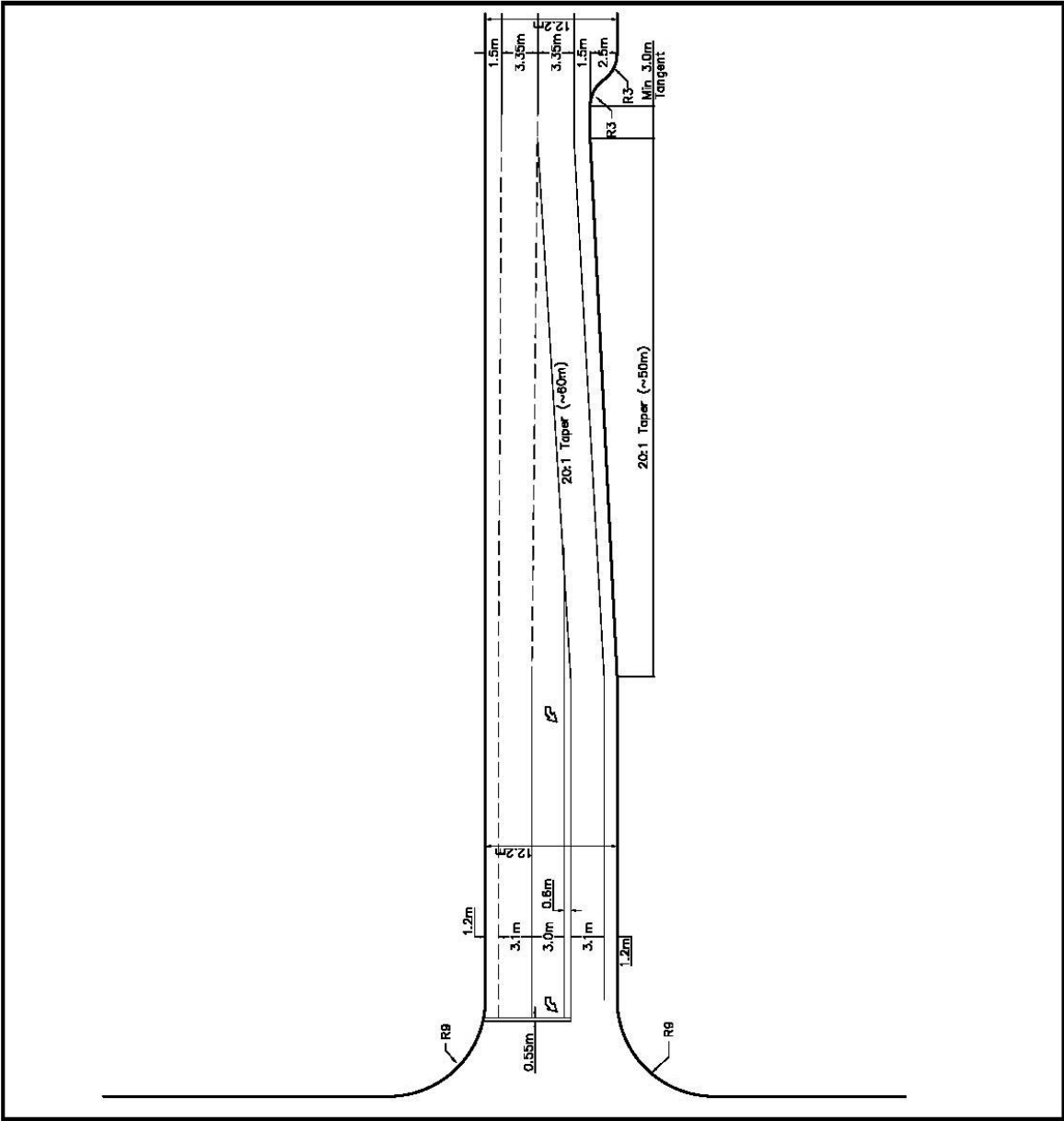
Title:  
**Figure 7.2.5  
 Local Road  
 Median/Left Turn  
 Treatment**



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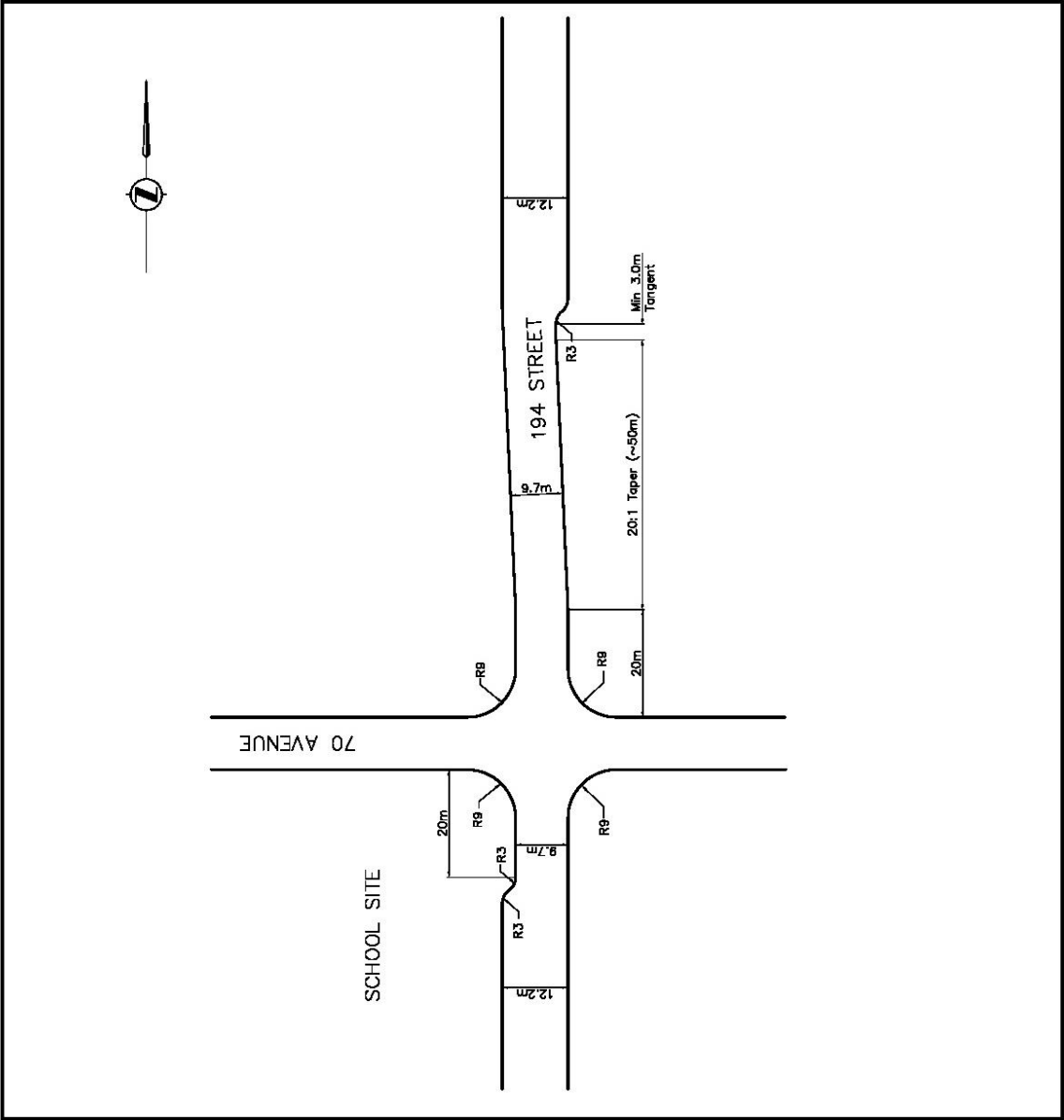
**Figure 7.2.6**  
**Major Collector**  
**Intersection**  
**Transition**



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 Scale: N.T.S

Title  
**Figure 7.2.7  
 194 ST. Parking  
 Pocket Transition  
 From West to East**



## **Mainstreet (72 Ave) Cross-Section Transitions**

### ***Left turn lane Introduction at 188 Street***

Mainstreet (72 Ave west of 192 Street) has been designed to have one through lane in each direction with angled parking. However, a left turn lane is required at 188 Street.

This left turn lane will be introduced entirely on the north side of the road. This will maximize the total number of angled parking stalls, particularly on the south side of 72 Avenue. It also allows the stalls to be introduced closer to 188 Street, which enhances access to the adjacent proposed commercial/residential area.

The following criteria apply:

- 30:1 lane/curb tapers,
- minimum 30 m between 188 Street curb face and angled parking introduction on the south side of 72 Ave. This will allow for a potential bus stop at this location,
- minimum 5 m tangent between the curb taper and angled parking introduction on the north side of 72 Ave.

A sketch of how this transition will be accomplished and the applicable dimensions and tapers is shown in **Figure 7.2.8**.

This concept will require a small alignment shift of 72 Ave west of 188 Street to tie back to the existing road centreline.

### ***Two-Lane Section to 5-Lane Section at 192 Street***

While west of 192 Street 72 Ave is planned as a 2-lane cross-section, it is ultimately planned for 5-lanes (2 through each direction plus left) east of 192 Street.

To optimize traffic operations and create a smooth transition, the following would apply (as shown in **Figure 7.2.9**):

- westbound curb lane to be a drop right turn lane at 192 Street,
- left turn lane centred on the right-of-way to be introduced on the west side of the intersection with 30:1 median and north curb taper, and
- second eastbound lane to be introduced on the west side of 192 Street with an 11:1 curb taper.

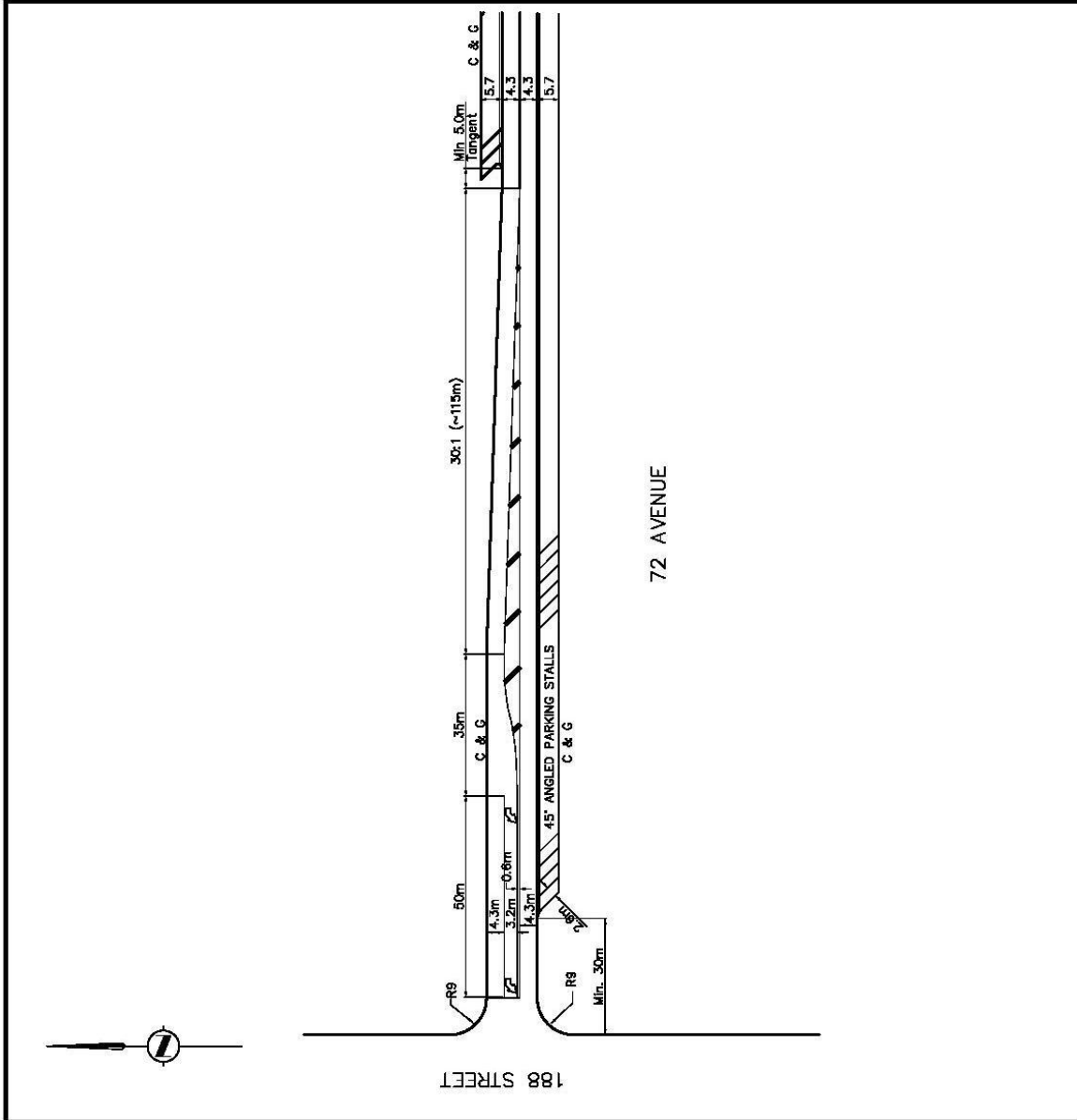
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**EARTH T E C H N I C O M**

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 10000 152nd Street, Floor 200  
 Surrey, B.C. V3R 5S2

Scale: N.T.S

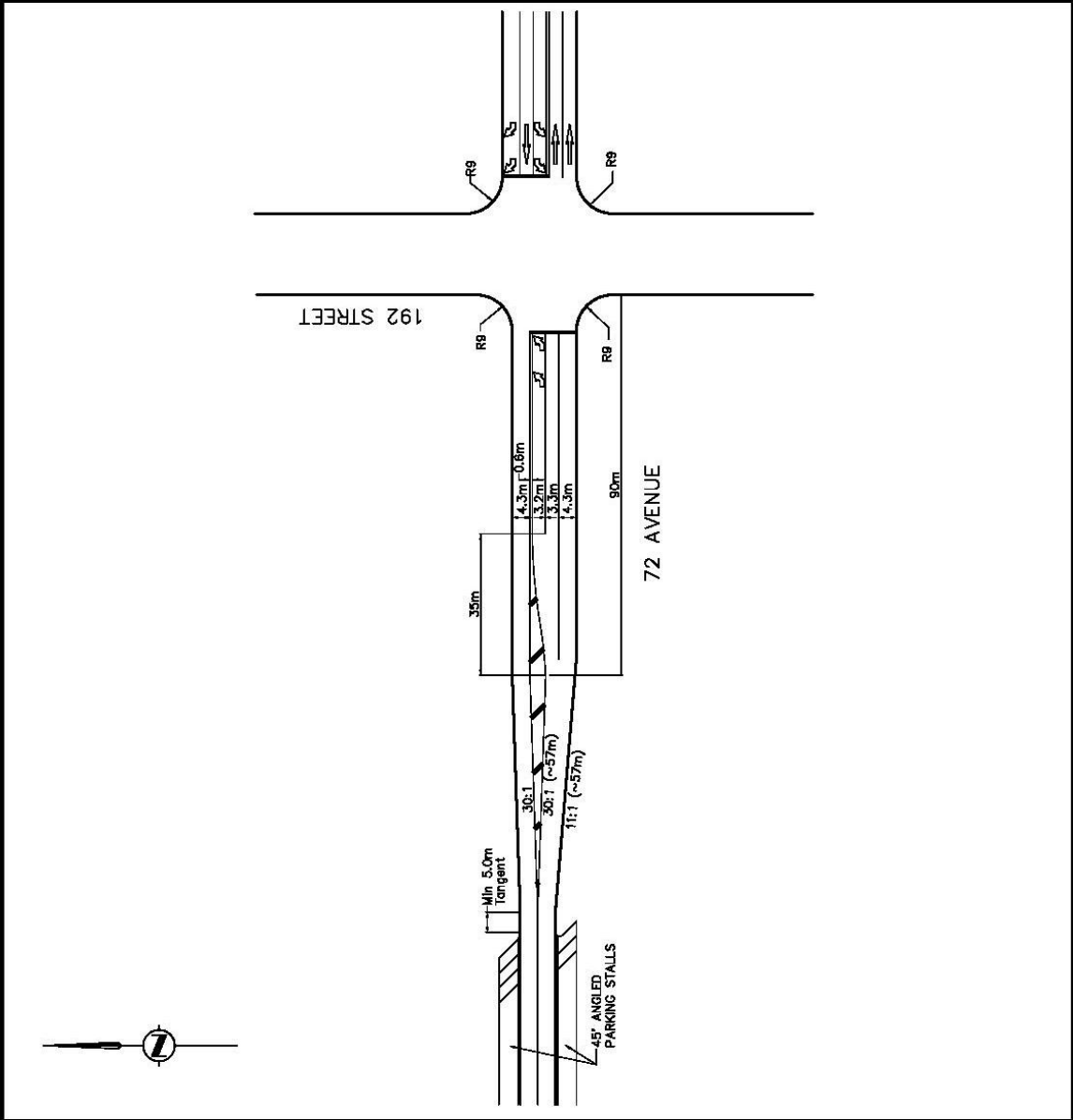
**Figure 7.2.8  
 Mainstreet  
 Intersection  
 Transition**



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Figure 7.2.9  
**72 Ave. Laning  
 Transition at 192 St.**



### **7.2.4.2 Drainage**

Barrier curb and gutter will be used on all roads; however, 192 Street and all local roads with lane access will direct runoff to grass swales via side inlet grates rather than using conventional storm sewer systems. General layout of the swales can be seen in the applicable cross-sections in *Appendix IV*.

To meet the NCP objectives for infiltration and streetscape, at a minimum, all of the swales identified in *Figure 7.2.10* must be continuous between streets/lanes and constructed in accordance with the criteria specified in *Section 4*.

Details for the conventional street storm sewer systems are included in the City of Surrey Supplemental Standard Drawings and Design Criteria Manual.

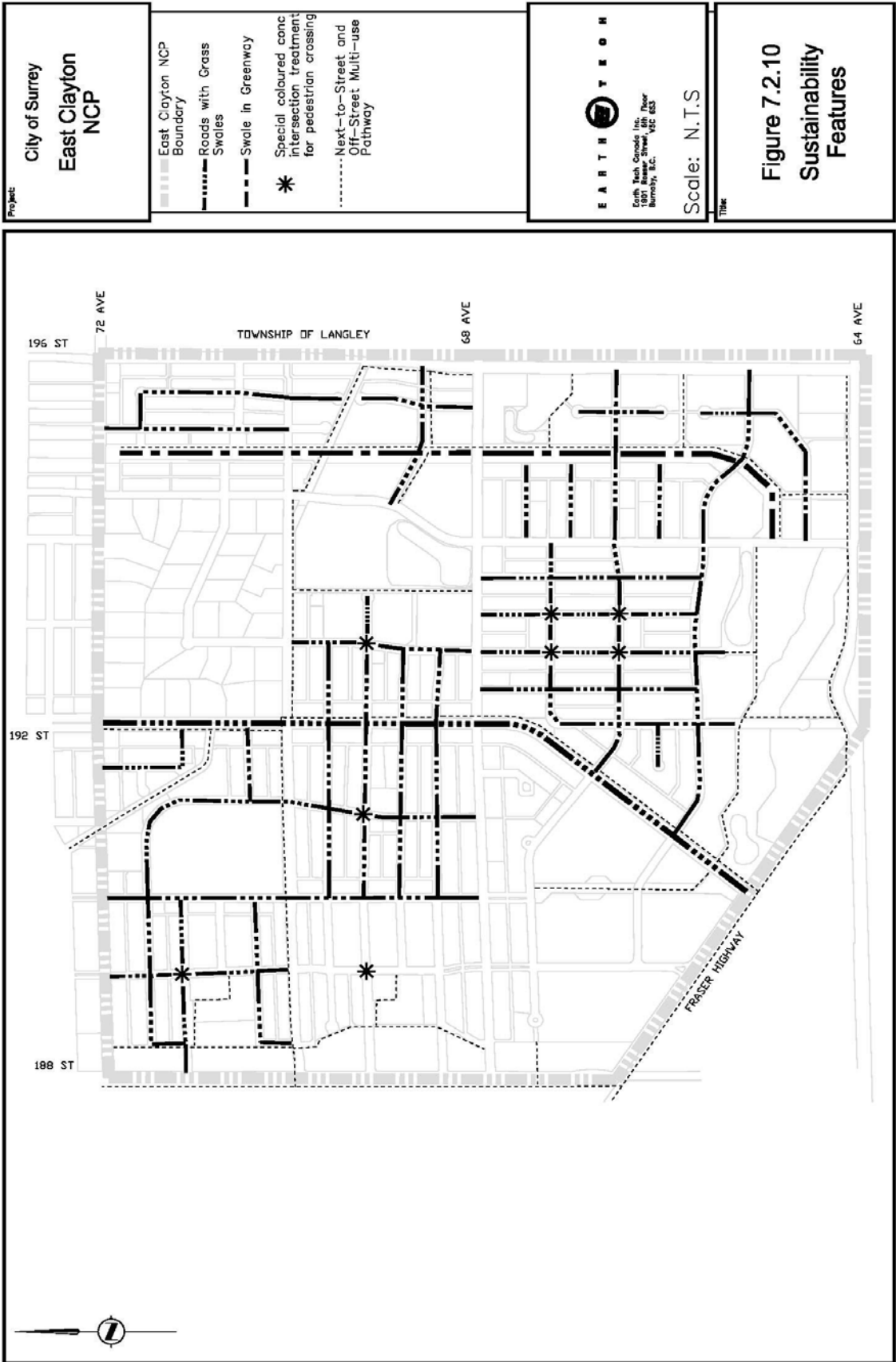
### **7.2.4.3 Lanes**

Rear lanes are important for achieving the sustainability principles and character for East Clayton. The benefits include:

- ability to achieve infiltration with a low maintenance swale drainage system that enhances the urban streetscape;
- enables planting of a greater number of street trees along the streets which improves the drainage sustainability;
- substantial increase in (at least double) the on-street parking supply, which is critical in East Clayton due to lot density, coach houses and secondary suites; and
- ability for narrower lots that are not dominated by front garages.

Lanes will be constructed to the width and standards specified in the City of Surrey Supplementary Standard Drawings and Design Criteria Manual.





#### 7.2.4.4 Street Lighting

Street lighting shall be the standard Cobra style but with flat lenses. Pole types are described in **Table 7.2.2**. Type 2 is required for 70 Ave, and Type 1 is required for all other roads.

**Table 7.2.2: Required Street Light Pole Types**

Pole Type	Height	Options and Comments	Suggested Pole Spacing for required uniformity ratio
Octagonal Tapered	9.1m (30ft)	One piece pole	35 to 40 m (roadway)
Octagonal Tapered	9.1m (30ft)	Two piece pole with mounting plate for secondary pedestrian lighting arm (3-4m height)	35 to 40 m (roadway) and 20 to 25 m (multi-use pathway)

Pole colour for all of East Clayton shall be:

- Tiger Brand RAL 6016 Dark Green Powder Coating Finish or equivalent.

Roadway lighting levels are determined by zoning and road classification, as detailed in the City of Surrey Design Criteria Manual. Pedestrian/multi-use pathway lighting levels are based on IESNA Criteria.

#### 7.2.5 Alternative Modes

##### 7.2.5.1 Bicycle and Pedestrian Network

In keeping with the sustainability principles of East Clayton, the network of cyclist and pedestrian routes is much more extensive than is typically found elsewhere in Surrey.

Three types of routes will be used in East Clayton: on-street, next-to-street and off-street. These are defined as follows.

- Off-street routes are asphalt multi-use pathways used by cyclists, pedestrians, wheelchairs and other modes, such as rollerblades. These routes are typically used for recreational purposes, as they do not follow road alignments. They typically occur along Power or Gas Right-of-way Corridors and greenways and are 4.0 m wide. This width also facilitates emergency and maintenance vehicle access. The pathways may meander (subject to TAC bicycle guidelines for 30

km/h design speed) within the total width of the multi-use corridor without compromising safety and function.

- Next-to-street routes are also multi-use pathways that replace or augment sidewalks and are used for recreational purposes and for commuting by users not comfortable with on-street routes. These routes follow street alignments and can be fully asphalt or a combination of asphalt and concrete sidewalk. Routes designated as part of the commuter network must have a total width of 4.0 m. Other routes typically have a total width of 4.0 m, but where this is not feasible, the width can be reduced to a minimum of 3.0 m.
- On-street routes are oriented towards “commuter” cyclists. These routes can take the form of 1.5 m wide painted bicycle lanes or 4.3 m wide shared use lanes on Major Collector and Arterial Roads.

### **Bicycle Facilities**

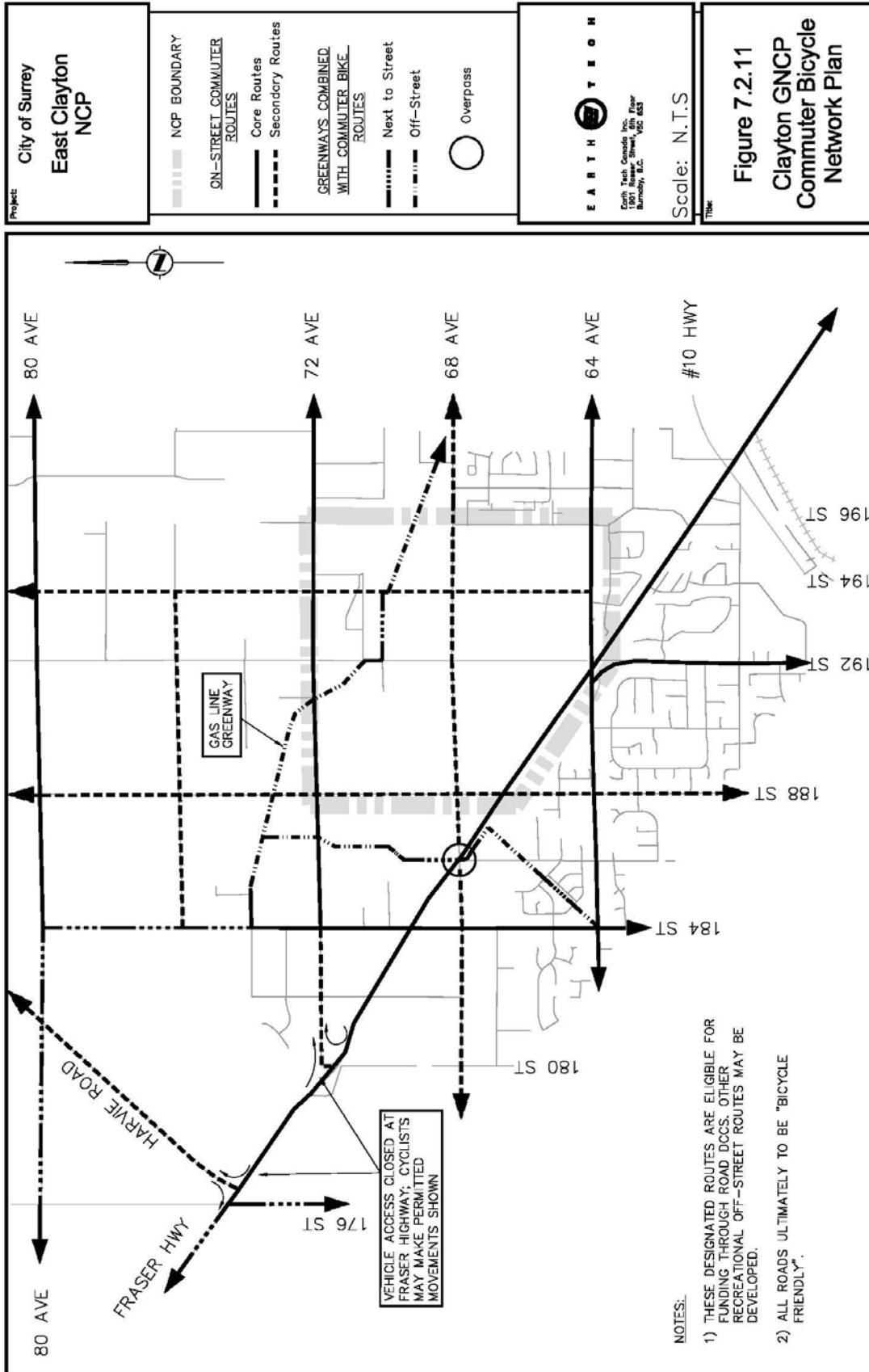
*Figure 7.2.11* shows the Clayton GNCP Commuter Bicycle Network Plan. Based on this plan, the East Clayton NCP Commuter Bicycle Network Plan was developed, as illustrated in *Figure 7.2.12*. The off-street and next-to-street routes shown on *Figure 7.2.12* would be eligible for funding

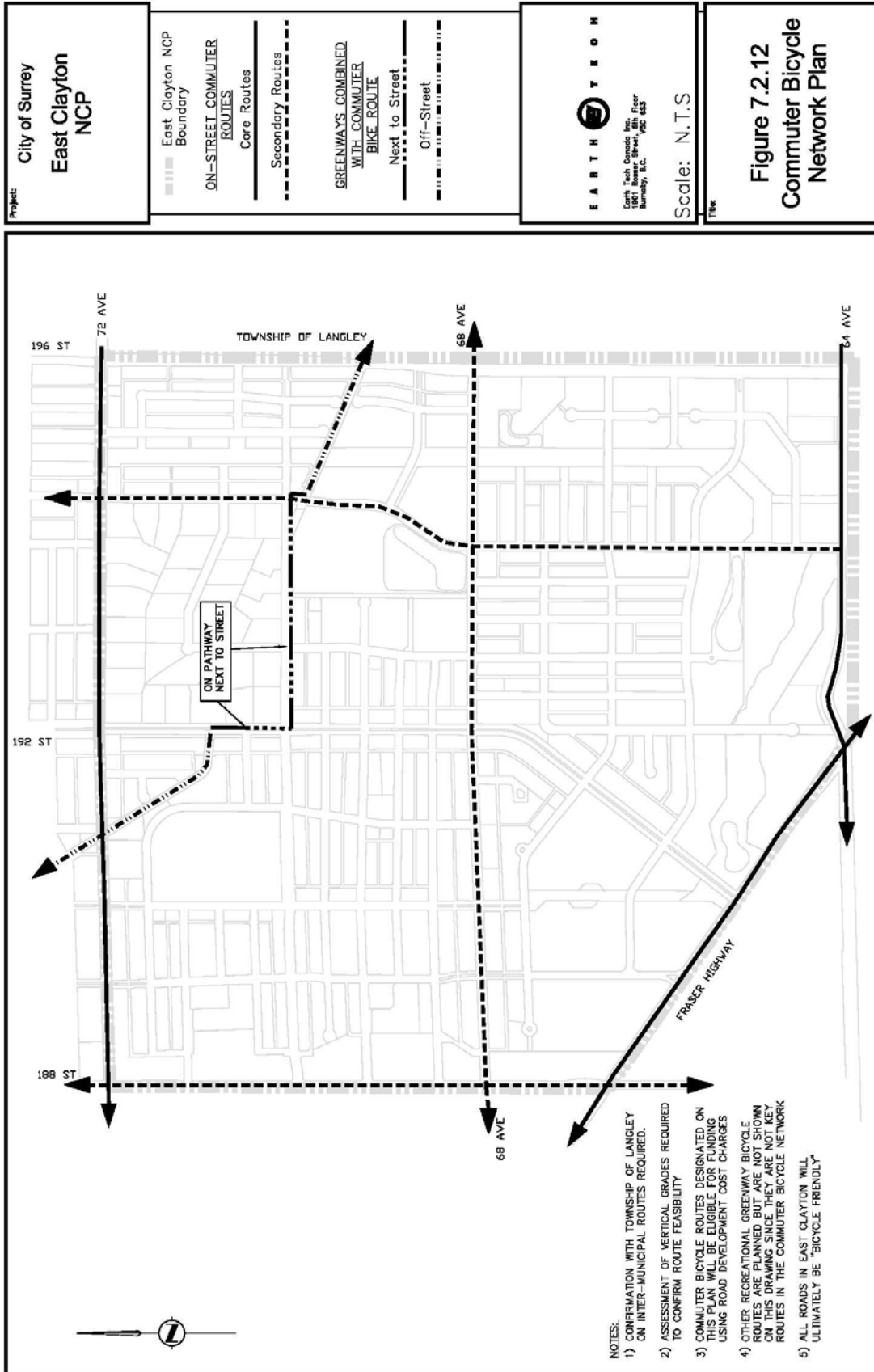
through Road Development Cost Charges (DCC's). The other recreational and/or Greenway routes planned for East Clayton are shown in *Figure 7.2.10*, but, as these are not considered major commuter routes, they are not eligible for DCC rebates.

Special facilities for cyclists on Minor Collectors and Local Roads are not required, since the traffic speeds and volumes of vehicular traffic are expected to be low.

Bollards must be utilized at all pathway connections to roads and lanes to prevent vehicle access. Log rail fencing is required wherever the pathway is immediately adjacent to roads or lanes.

Bicycle racks, lockers and change rooms will be required of the developers as per the guidelines in the Bicycle Blueprint.





**Figure 7.2.12  
Commuter Bicycle  
Network Plan**

## **Pedestrian Facilities**

The pedestrian network in East Clayton will be comprised of 1.5m wide sidewalks on each side of all roads and the multi-use pathway system shown in *Figure 7.2.10*.

The road sections for East Clayton provide wide landscaped boulevards between the sidewalks and the curbs to maximize pedestrian level of service.

Curb extensions are required at virtually all intersections to minimize pedestrian crossing distances.

To further improve key pedestrian crossing locations, raised intersections and mid-block plateaus will be installed as previously identified in *Figure 7.2.3*.

Red brick coloured concrete will be used to define other important pedestrian intersection crossings where identified in *Figure 7.2.10*. Coloured asphalt is not acceptable as the City of Surrey has found that it wears too quickly.

To provide safe pedestrian/cyclist crossing of lanes from multi-use pathways, the following provisions are required:

- a 1.0 m (along pathway) x 15.0 m (along lane) corner cut dedication, as measured from the edge of the asphalt pathway. This is to provide safe stopping sight distance. Where a pathway corridor is wider than the asphalt pathway, the additional corner cut dedication would be reduced accordingly,
- baffle gates are required to ensure cyclists stop at the lane, and
- speed humps located 5 m to 10 m each side of the crossing.

### ***7.2.5.2 Potential Transit Routes and Facilities***

Although TransLink does not currently have any plans for bus routes within East Clayton, it is expected that with the urbanization of the Clayton area, additional internal transit services will be viable either with traditional bus service or a community bus service.

## **Existing and Future Transit Routes**

There are only two routes currently in the East Clayton area:

- Fraser Highway, and
- 64 Avenue.

The Fraser Highway and 200 Street have been identified as future Rapid Bus routes. The City of Surrey has been protecting right-of-way and restricting access to facilitate this plan.

### **Future Transit Route Opportunities**

The higher residential densities and employment opportunities within East Clayton would support reasonably frequent transit service on its internal road network. These services could be logical extensions of transit routes already provided for the City/Township of Langley.

The proposed modified grid system (interconnected network) offers more direct and convenient pedestrian routings to bus stops and more direct and flexible transit routings.

A possible transit bus loop through East Clayton was identified by TransLink along 194 Street, 72 Avenue, 189 Street and 65 Avenue, as shown in *Figure 4.3.5*.

It should be noted that traffic circles preclude bus service under current Coast Mountain Bus Link policy. This is one of the reasons traffic circles have not been recommended as traffic calming measures in East Clayton.

### **Future Transit Exchange / Park-n-Ride Plans and Opportunities**

While TransLink has identified a future transit exchange/park and ride for the Willowbrook Mall area, there may be a need for a small transit exchange facility within Clayton to support the increased transit service to this area required to achieve the principles of “sustainability”.

A small Transit Exchange combined with a local park and ride facility could be incorporated within the Business Park at the corner of 65 Avenue and 192 Street Diversion. This should be reviewed with TransLink prior to redevelopment of these lands.

This location has excellent pedestrian and cyclist connectivity to the rest of East Clayton via multi-use pathways and street sidewalks. It would also provide convenient pedestrian connections to a possible future Rapid Bus station on Fraser Highway.

This location would also have excellent automobile and bus access via the future signal at 192 Street Diversion and 65 Avenue.

Bicycle lockers should be provided at this facility to encourage commuting by bicycle/transit.

## 7.2.6 Proposed Infrastructure

As the area develops, the existing rural road network will need to be upgraded and expanded to meet both access and circulation requirements. This includes the re-alignment of 192 Street at Fraser Highway and the provision of the 196 Street arterial corridor.

All Major Collector and Arterial road elements in East Clayton will be eligible for DCC funding in accordance with the City practice and policy. The costs of Local and Minor Collector road elements will be borne by the developers.

### 7.2.6.1 DCC Infrastructure Financing

For new arterial roads, if a development requires access via this new road then they will be required to fund the design and construction to the City's half road standard (City of Surrey Supplemental Specifications Document, Drawing SSD-R9). If possible at that time, the City will fund additional widening to an interim standard.

The arterial and Major Collector road DCC elements are illustrated in *Figure 7.2.13*.

The associated total and DCC component costs are summarized in *Table 7.2.3* for arterial roads and *Table 7.2.4* for Major Collector roads. . A detailed breakdown of the costs is shown in *Appendix V*.

Road right-of-way will be acquired in accordance with the City of Surrey Acquisition Policy.



**Table 7.2.3  
Arterial Road DCC Items**

<b>Trunk Item No.</b>	<b>Location</b>	<b>Scope (Type &amp; Size of Works)</b>	<b>Notes</b>	<b>Total Cost</b>	<b>DCC Component Cost (Through upsizing contribution by City)</b>
A1	72nd Avenue: 188 to 196 Street	Upgrade to Ultimate Arterial	(50% to East Clayton)	\$4,025,000	\$2,013,000
A2	196 Street: 72 to 64 Avenue	Upgrade to Ultimate Arterial	(50% to East Clayton)	\$4,025,000	\$2,013,000
A3	192 Street: 72 to 68 Avenue	Upgrade to Ultimate Arterial	(100% to East Clayton)	\$2,025,000	\$2,025,000
A4	192 Street: 68 Ave to Fraser Hwy	New Arterial	(100% to East Clayton)	\$1,980,000	\$1,980,000
A5	64 Avenue: Fraser Hwy to 196 St	Upgrade to Ultimate Arterial	(50% to East Clayton)	\$2,050,000	\$1,025,000
A6	Fraser Hwy: 64 Ave to 188 St	Upgrade to Ultimate Arterial	(50% to East Clayton)	\$2,400,000	\$1,200,000
A7	Traffic Signals (External)		(50% to East Clayton)	\$700,000	\$350,000
A8	Traffic Signals (Internal)		(100% to East Clayton)	\$300,000	\$300,000
A9	Off and Next-to Street Bike Network		(100% to East Clayton)	\$200,000	\$200,000
<b>TOTALS</b>				<b>\$17,705,000</b>	<b>\$11,106,000</b>

Notes: 1) Off and Next-to Street bike network cost estimates are for commuter routes only, as identified in Figure 7.2.12  
2) Arterial DCC's fund 50% of off-street commuter routes only, remainder funded by parks and recreation.

**Table 7.2.4  
Major Collector Road DCC Items**

<b>Trunk Item No.</b>	<b>Location</b>	<b>Scope (Type &amp; Size of Works)</b>	<b>Notes</b>	<b>Total Cost</b>	<b>DCC Component Cost (Through upsizing contribution by City)</b>
C1	188 Street : 72 Ave to Fraser Hwy	Upgrade to 2 Major Collector	(50% to East Clayton)	\$1,461,000	\$731,000
C2	68 Avenue : 188 to 190 Street	New 2 Lane Collector	(100% to East Clayton)	\$670,000	\$670,000
C3	68 Avenue : 190 to 192 Street	Upgrade to 2 Lane Collector	(100% to East Clayton)	\$548,000	\$548,000
C4	68 Avenue : 192 to 196 Street	New 2 Lane Collector	(100% to East Clayton)	\$987,000	\$987,000
C5	194 Street: 72 to 70 Avenue	Upgrade to 2 Lane Collector	(100% to East Clayton)	\$555,000	\$555,000
C6	194 Street: 70 to 68 Avenue	New 2 Lane Collector	(100% to East Clayton)	\$711,000	\$711,000
C7	194 Street: 68 to 64 Avenue	Upgrade to 2 Lane Collector	(100% to East Clayton)	\$1,018,000	\$1,018,000
C8	Traffic Signals (Internal)		(50% to East Clayton)	\$100,000	\$50,000
			<b>TOTALS</b>	<b>\$6,050,000</b>	<b>\$5,270,000</b>

### **7.2.7.2 Implementation**

**Section 7.6** describes the phasing planned based on the infrastructure required to service East Clayton.

All Collector and Local Roads would be constructed in conjunction with development. Arterial Road upgrading would be assessed on a needs priority basis. However, 196 Street and the 192 Street Diversion are unique in that they are unconstructed arterial roads with insufficient (or no) dedicated right-of-way. Therefore, timing for fully opening these roads will be subject to development and the availability of the full right-of-way.

The existing 192 Street will remain open through to 64 Avenue until the 192 Street Diversion is fully opened to at least an interim standard. It is anticipated that as development proceeds, portions of the 192 Street Diversion will be opened with a minimum pavement width of 6.0 m. The City may widen to an interim standard in conjunction with this development or may wait until right-of-way has been obtained for a full block or even the full length of the Diversion. This will be assessed at the time on a needs priority basis and available budget.

A similar strategy would be employed for 196 Street.

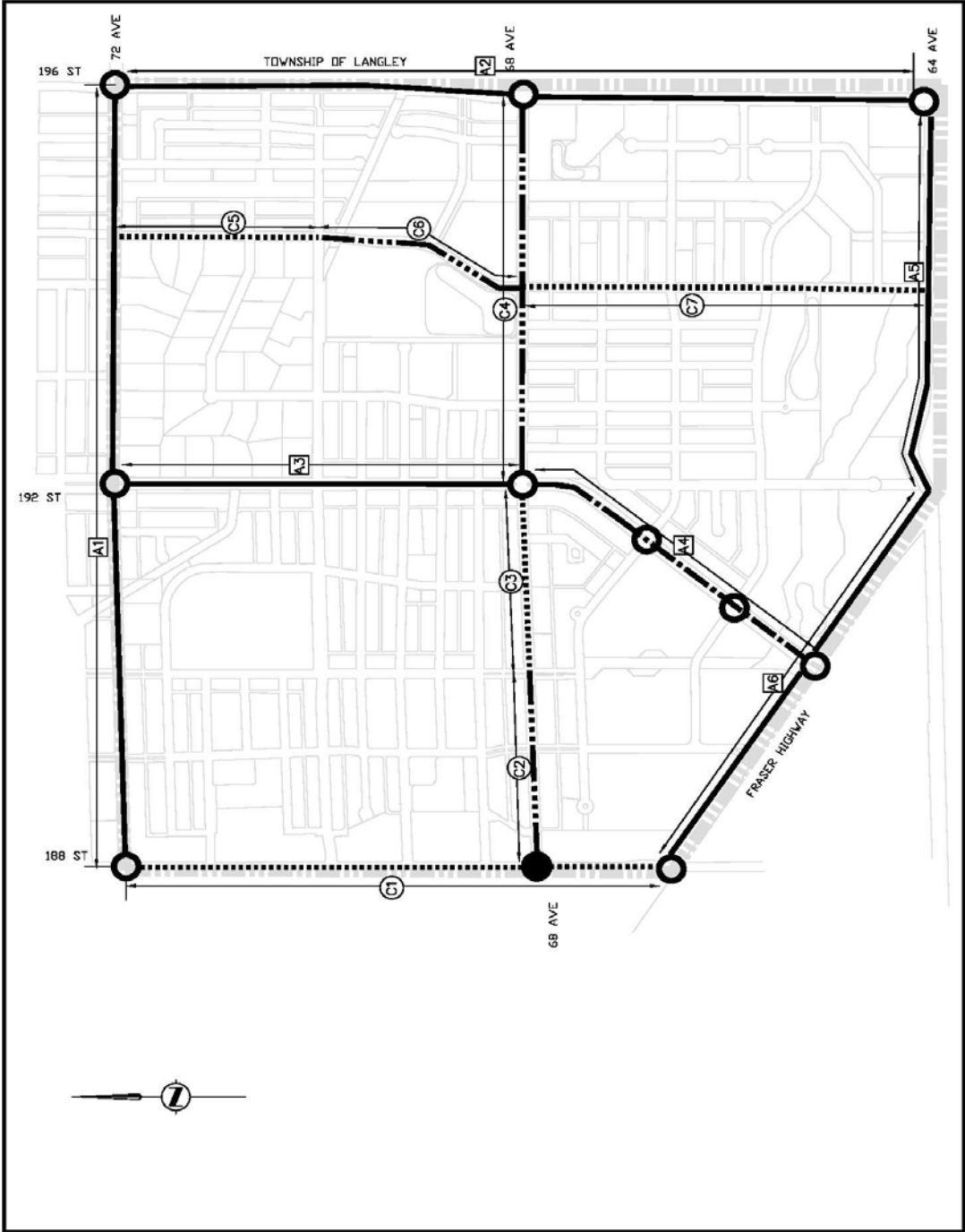
Project: **City of Surrey  
East Clayton NCP**

East Clayton NCP  
 Boundary  
 Upgrade to Ultimate Arterial  
 New Arterial  
 New 2 Lane Major Collector  
 Upgrade to 2 Lane Major Collector  
 Arterial Signalized Intersection  
 Major Collector Signalized Intersection  
 ID Numbers as in Table 7.2.3  
 ID Numbers as in Table 7.2.4

Scale: N.T.S

**EARTH SYSTEM**  
 Earth Tech Canada Inc.  
 1801 Inverness Street, 4th Floor  
 Surrey, B.C.

**Figure 7.2.13  
 Arterial and Major Collector Road  
 DCC Elements**



## 7.3 SANITARY SEWER SERVICING

### 7.3.1 Background

Currently, most of the East Clayton area is serviced by septic fields. When the NCP develops, it can be serviced through two existing sanitary sewer systems, and eventually discharge into the westward flowing GVS & DD regional trunk sewer located along 52<sup>nd</sup> Avenue and 56<sup>th</sup> Avenue (See **Figure 7.3.1**).

The eastern portions of the NCP, Catchment A (187.0 Ha), can drain south via the 196<sup>th</sup> Street sewer; which flows from the intersection of 64<sup>th</sup> Avenue and 196<sup>th</sup> Street south along 196<sup>th</sup> Street to the GVRD Langley Pump Station at 52<sup>nd</sup> Avenue.

Similarly, the western region of the NCP, Catchment B (114 ha) can drain into the 68<sup>th</sup> Avenue trunk sewer. This trunk sewer starts at the intersection of 68<sup>th</sup> Avenue and 188<sup>th</sup> Street, and flows west along 68<sup>th</sup> Avenue to the interim pump station at 176<sup>th</sup> Street. From this pump station, a forcemain drains south to the GVS & DD regional trunk sewer at 56 Avenue.

**Table 7.3.1** summarizes the capacity of both existing sanitary sewer systems, in addition to the estimated peak flows, in both, as a result of the NCP being developed. The ultimate flows include the recent completion of the Langley By-Pass Trunk Sewer, Phase 1.

**Table 7.3.1 - Existing Sewer Capacity**

Catchment	Sewer Section	Max. Capacity* (L/s)	Existing Flows (L/s)	Ultimate Flows (L/s)
<b>East</b>	196 St (from 64 to Fraser Hwy)	43	2	170
	196 St (Fraser Hwy to Langley By-Pass)	109	31	199
	196 St (from Langley By-Pass to 54 Ave)	95	35	203
	196 St (from 54 Ave to 52 Ave)	155	89	257
<b>West</b>	188 St (from 70 Ave to 68 Ave)	48	2	69
	68 Ave (from 188 St to 184 St)	122	6	138
	68 Ave (from 184 St to 176 St P/S)	250***	100	250
	176 St Pump Station (to be upgraded to 400 L/s capacity)	100 (future 400)	196**	400

\*Pipe capacity based on 70% pipe depth

\*\* This figure includes flows from other catchments that are currently not yet saturated.

\*\*\* Capacity shown here is 1 manhole west of 184 street

As shown in this table, the 68<sup>th</sup> avenue sewer can accommodate additional flows from the NCP; providing areas west of 188<sup>th</sup> Street (contributing to the 68<sup>th</sup> Avenue main) develop

after the NCP. The existing interim pump station at 176<sup>th</sup> Street has a capacity of 100 L/s and will be upgraded, in the future, to an ultimate capacity of 400 L/s.

The sewer on 196<sup>th</sup> Street, between 54<sup>th</sup> and 52<sup>nd</sup> Avenue, is currently flowing at full capacity and will not accommodate additional flows from the NCP. A diversion sewer, along the Langley By-Pass, is required to service the NCP and alleviate downstream surcharging. This section of sewer was completed and commissioned January, 2003. As illustrated in **Figure 7.3.1**, the future Langley By-Pass trunk sewer is to extend from 56<sup>th</sup> to 60<sup>th</sup> Avenue. The existing sewer on 196<sup>th</sup> Street, between 64<sup>th</sup> and the Langley By-Pass just south of 60<sup>th</sup> Ave., can accommodate some additional flows but requires upsizing to service the ultimate development of the NCP.

Development of the NCP will build required local services and trunk sewers inside the boundaries of the NCP. Developers will confirm that offsite capacity is available to service additional flows from the NCP. DCC funding is required to build all off-site improvement works.

### 7.3.2 Design

The proposed layout and sizing of the system is based on the City of Surrey 2002 Design Criteria. The detailed design of the system will follow the applicable design criteria at the time of development. The land use design populations for the East Clayton analysis are listed in **Tables 7.3.2 and 7.3.3** below.

**Table 7.3.2 – Design Populations by Land Use Designation**

Land Use	Maximum Units (per acre)	Design Population (Capita per unit)	Design Population (Capita per ha)
Work / Live	25	2.8	173.0
Live / Work	25	2.8	173.0
100' Frontage Lots	7	3.2	55.3
6-10 u.p.a. (Units/Acre)	10	3.2	79.1
10-15 u.p.a.	15	3.2	118.6
15-25 u.p.a.	25	2.8	173.0
25-45 u.p.a.	45	2	222.4
Special Community	15	2	74.1
Commercial/Residential	15	2	74.1
Neighbourhood Commer.	15	2	74.1
Techno / Business Park	18	2	89.0
Institutional	10	2	49.4

**Table 7.3.3 – Equivalent Land Use by Type of School**

Type of School	Population (pupils/school)	Approximate Area (ha)	Equiv. Land Use (based Population/ ha)
Elementary	500	4.3	45
Secondary	1,200	8.0	45

The servicing concept was developed taking into consideration the key constraints and opportunities shown in **Table 7.3.4**. Services will be designed to accommodate basements. Basements will be serviced through gravity sewers as per the design criteria.

**Table 7.3.4 – Key Constraints and Opportunities**

Opportunity and/or Constraint	How the Servicing Scheme Addresses It
<ul style="list-style-type: none"> <li>The topography of the area</li> </ul>	<ul style="list-style-type: none"> <li>Maximize the gravity driven servicing function of the sewer system</li> </ul>
<ul style="list-style-type: none"> <li>The watercourses and creeks traversing the area</li> </ul>	<ul style="list-style-type: none"> <li>Minimize the number of watercourse crossings which interfere with continuous gravity driven flow grades of sewer lines</li> </ul>
<ul style="list-style-type: none"> <li>Receiving capacity of the off-site trunk system</li> </ul>	<ul style="list-style-type: none"> <li>Maximize conformity of capacities and connections with planned as well as implemented plans</li> </ul>
<ul style="list-style-type: none"> <li>Least distances to off-site trunk system</li> </ul>	<ul style="list-style-type: none"> <li>Within the capacity limits, orient the on-site sewer system to minimize lengths, while meeting the other constraints and opportunities.</li> </ul>

The recommended sanitary trunk sewers and a layout plan of the local collector sewers are shown on **Figure 7.3.2**. In order to estimate sanitary flows, the NCP was discretized into 28 subcatchments. Average Day and Peak Wet Weather Flows (PWWF) were then estimated for each catchment, depending on the land-use, density and equivalent population. **Table 7.3.5** summarizes the estimated peak flows for each subcatchment, as well as the overall peak flow from both Catchments A and B.

Detailed sanitary sewer design calculations for all the trunk sewers are provided in **Table 7.3.6**.

### 7.3.2.1 Local Sewers

Development will be serviced by local sewer systems draining to local trunks. Where the local sewers drain eastward toward Langley, the flows are intercepted at 196 Street and directed south to the intersection of 64<sup>th</sup> Avenue and 196<sup>th</sup> Street.

**Table 7.3.5**

**East Clayton Planned Population & Peak Sanitary Flows by Catchment Area**

Aver. Wastewater Flow/ Person      350 l/capita/day  
 Allowable Infiltration Rate          0.1 l/s/ha

Catchment ID #	Total Area (ha)	Population Equiv. # of People	Average QWastewater		Qinfiltrn (l/s)	Total Qaverage (l/s)	Harman Peaking Factor(HPF)	Total Flow (PWWF) (l/s)
			l/day	l/s				
A-1	13.8	1,629	570,150	6.60	1.38	7.98	3.65	25.49
A-2	5.5	454	158,886	1.84	0.55	2.39	4.00	7.90
A-3	15.1	406	141,941	1.64	1.51	3.15	4.02	8.11
A-4	9.6	745	260,736	3.02	0.96	3.98	3.88	12.67
A-5	8.4	570	199,626	2.31	0.84	3.15	3.94	9.95
A-6	2.4	582	203,700	2.36	0.24	2.60	3.94	9.53
A-7	4.0	466	162,960	1.89	0.40	2.29	3.99	7.93
A-8	13.1	889	311,322	3.60	1.31	4.91	3.83	15.12
A-9	6.7	455	159,226	1.84	0.67	2.51	3.99	8.03
A-10	11.6	1,103	385,944	4.47	1.16	5.63	3.77	18.01
A-11	1.8	122	42,777	0.50	0.18	0.68	4.22	2.27
A-12	4.6	495	173,349	2.01	0.46	2.47	3.98	8.44
A-13	10.1	1,048	366,898	4.25	1.01	5.26	3.79	17.09
A-14	12.1	1,045	365,608	4.23	1.21	5.44	3.79	17.24
A-15	10.3	1,179	412,628	4.78	1.03	5.81	3.75	18.95
A-16	10.9	941	329,349	3.81	1.09	4.90	3.82	15.64
A-17	10.8	922	322,661	3.73	1.08	4.81	3.82	15.36
A-18	4.9	29	9,981	0.12	0.49	0.61	4.36	0.99
A-19	19.1	222	77,813	0.90	1.91	2.81	4.13	5.63
A-20	7.2	705	246,884	2.86	0.72	3.58	3.89	11.84
A-21	5.0	446	156,170	1.81	0.50	2.31	4.00	7.73
<b>TOTAL A</b>	<b>187.0</b>	<b>14453.2</b>	<b>5,058,607</b>	<b>58.55</b>	<b>18.70</b>	<b>77.25</b>	<b>2.79</b>	<b>182.32</b>

B-1	11.8	1,328	464,708	5.38	1.34	6.71	3.72	21.33
B-2	9.2	1,053	368,561	4.27	1.04	5.31	3.79	17.19
B-3	12.3	704	246,375	2.85	1.00	3.86	3.89	12.11
B-4	5.9	320	112,171	1.30	1.56	2.86	4.07	6.84
B-5	8.2	787	275,606	3.19	0.52	3.71	3.86	12.84
B-6	12.1	1,174	410,795	4.75	0.72	5.48	3.75	18.57
B-7	11.3	767	268,545	3.11	0.72	3.83	3.87	12.76
B1-1	4.7	70	24,328	0.28	0.47	0.75	4.28	1.68
B1-2	4.2	820	286,901	3.32	0.42	3.74	3.85	13.22
B1-3	6.3	1,035	362,402	4.19	0.63	4.82	3.79	16.53
B1-4	7.2	1,164	407,400	4.72	0.72	5.44	3.76	18.44
B1-5	2.4	253	88,587	1.03	0.24	1.26	4.11	4.45
B1-6	14.2	1,125	393,818	4.56	1.42	5.98	3.77	18.59
B1-7	4.5	63	21,895	0.25	0.45	0.70	4.29	1.54
<b>TOTAL B</b>	<b>114.3</b>	<b>10663.1</b>	<b>3,732,092</b>	<b>43.20</b>	<b>11.43</b>	<b>54.63</b>	<b>2.93</b>	<b>137.86</b>

A temporary dedicated sewer drains the existing development between 192<sup>nd</sup> and 194<sup>th</sup> Street and north of 70<sup>th</sup> Avenue (Aloha Estates) to the Township of Langley. The flows from this area will be diverted to the new sanitary system when the Trunk sewer is extended to the intersection of 192<sup>nd</sup> Street and 70<sup>th</sup> Avenue.

The sub-catchments A27 and B7 north of 72<sup>nd</sup> Avenue are located outside the East Clayton NCP area. Developers will include the flows from these areas in their calculations.

### **7.3.2.2 Trunk Sewers**

#### **(a) Internal Trunks**

Five gravity sub-systems located inside the NCP boundaries are classified as Trunk Sewers see figure 5.3.2.

1. 68<sup>th</sup> Avenue from 193<sup>rd</sup> Street to 194<sup>th</sup> Street;
2. 194<sup>th</sup> Street from 68<sup>th</sup> to 64<sup>th</sup> Avenue, then east to 196<sup>th</sup> Street;
3. 65<sup>th</sup> Avenue from 192<sup>nd</sup> Street to 194<sup>th</sup> Street;
4. 196<sup>th</sup> Street from 65<sup>th</sup> Avenue to 64<sup>th</sup> Avenue;
5. 188<sup>th</sup> Street from 70<sup>th</sup> Avenue to 68<sup>th</sup> Avenue, then west to 187 Street.

Parts of the recently constructed 188 Street trunk sewer are marginally undersized for the maximum peak flows. These are the sewer sections from MH # B27 to B26 (between 68<sup>th</sup> and 69<sup>th</sup> Avenue) and from MH # B23 to B22 (68<sup>th</sup> Ave west of 188<sup>th</sup> St.), with the peak flows highlighted in **Table 7.3.6**. These sections will require upsizing by the developer as the existing capacity limit is exceeded. Upsizing is required when 92 Ha. of the contributing catchment is developed, or when construction of the ultimate road cross-section along these sections is completed. As trunk items, these improvements are DCC eligible.

The first four trunks above drain to the east offsite trunk sewer on 196<sup>th</sup> Street, and the fifth drains to the west. Constraints in the offsite trunk systems will need to be addressed to accommodate the buildout of the NCP.



**Table 7.3.6  
Existing & Proposed Clayton Sanitary Sewer Trunks**

Average Wastewater Flow Per Person 350 l/capita/day  
Allowable Infiltration Rate 0.1 l/s/ha

**Existing Sanitary Sewer Trunks**

Pipe ID #	U/S Node ID #	D/S Node ID #	Tributary Population	Tributary Area (ha)	Sanitary peak (l/s)	Qinfiltrn (l/s)	Qtotal (l/s)	U/S Ground (m)	U/S Invert (m)	D/S Ground (m)	D/S Invert (m)	Length (m)	Slope	Diam. (mm)	Vel. (m/s)	Qdesign (70% full) (l/s)	Qtotal/Qdesign
B1-12e	B29	B28	3,049	38	42	4	46	69.4	66.3	67.5	64.5	130.6	0.014	300	2.07	95.0	0.49
B1-14e	B28	B27	3,753	50	51	5	56	67.5	64.4	66.7	63.7	156.15	0.005	300	1.24	57.0	0.98
B1-15e	B27	B26	4,806	59	64	6	69	66.7	63.7	66.1	63.0	134.65	0.005	300	1.24	57.0	1.22
B1-16e	B26	B25	6,134	71	79	7	86	66.1	63.0	64.4	62.2	150.9	0.005	375	1.44	103.0	0.83
B1-17e	B25	B24	8,649	91	106	9	115	64.4	62.1	64.5	61.3	149.4	0.006	375	2.00	110.0	1.04
B1-18e	B24	B23	9,538	100	115	10	125	64.5	61.3	64.2	60.8	97.75	0.006	375	2.00	110.0	1.14
B1-19e	B23	B22	10,663	114	126	11	138	64.2	60.7	64.0	59.6	105.6	0.008	375	2.00	130.0	1.06

Existing pipe requires upsizing

**Proposed Sanitary Sewer Trunks**

Conduit ID #	U/S Node ID #	D/S Node ID #	Tributary Population	Tributary Area (ha)	Sanitary peak (l/s)	Qinfiltrn (l/s)	Qtotal (l/s)	U/S Ground (m)	U/S Invert (m)	D/S Ground (m)	D/S Invert (m)	Length (m)	Slope	Diam. (mm)	Vel. (m/s)	Qdesign (70% full) (l/s)	Qtotal/Qdesign
A1	A40	A35	3,042	32	42	3	46	79.00	74.50	75.00	70.50	240	0.017	250	1.9	64.0	0.71
A2	A35	A20	4,337	68	58	7	65	75.00	70.50	55.00	53.50	492	0.035	300	2.7	104.0	0.62
A3	A30	A25	2,838	29	40	3	43	61.00	59.50	56.50	54.50	200	0.025	250	2.2	77.0	0.56
A4	A25	A20	3,748	42	51	4	55	56.50	54.50	55.00	53.50	195	0.005	250	1.1	77.0	0.72
A5	A20	A15	8,662	119	106	12	118	55.00	53.50	40.00	40.50	320	0.040	375	3.3	290.0	0.41
A6	A15	A05	9,068	134	110	13	123	40.00	38.50	31.70	30.20	400	0.021	375	2.5	200.0	0.62
A7	A10	A05	4,932	48	65	5	70	36.00	31.50	31.70	30.20	220	0.006	375	1.4	112.0	0.62
A8	A05	A01	14,453	187	164	19	182	31.70	30.2	29.00	27.50	190	0.014	450	2.44	273	0.67

**(b) Offsite Trunks**

**(i) East**

Servicing of the NCP to the east requires the construction of the Langley Bypass sanitary sewer diversion trunk. The Langley By-pass sewer includes two sections as follows:

- (1) Along 196<sup>th</sup> Street, from the Fraser Highway to 64 Avenue.
- (2) Along 196<sup>th</sup> Street, from Langley By-Pass(Highway #10) to Fraser Highway
- (3) Langley By-Pass from 56<sup>th</sup> Avenue to 60<sup>th</sup> Avenue,

The ultimate peak design flow from the NCP into the east offsite trunk sewer is 182 L/s.. The above sections 1, 2 and 3 of the By-pass will be required once a total of 49, 77 and 91 HA respectively, of development are completed within the NCP. Completion of item 2 will allow servicing of the remaining catchment area of 182 Ha.

As each section of the Langley By-pass sewer is constructed it will relieve flows from the existing trunk sewer. The available capacity in the trunk sewer can be used to service new development.

It is anticipated that the City will complete construction of the Langley By-Pass diversion and 196<sup>th</sup> Street upgrade in the current 10 Year Capital Works Plan.

**(ii) West**

Offsite servicing for the NCP is limited by the available capacity of the existing 300mm trunk sewer on 188th Street (from 68th to 69th Avenue), portions of the 375mm sewer on 68th Avenue (from 188th to 184th Street), and the existing 176th Street / 68th Avenue interim pump station.

Upsizing of the existing 375mm trunk sewer on 68th Avenue will be required once the western catchments reach approximately 90% of full build-out.

Ultimate servicing of the NCP Catchment B1 will require the addition of capacity to the pump station or completion of the Clayton Area Interceptor trunk sewer. Servicing of the ultimate NCP will require an increase in the pump capacity by approximately 138 L/s. Also, approximately 135m of the 300mm sewer on 68<sup>th</sup> Avenue should be upsized to a 375mm diameter pipe, with the same inverts.

### 7.3.3 Phasing

Development will proceed from the downstream sections of the sanitary system to the top as indicated in **Figure 7.6.1**. Development progressing ahead of sequence is required to complete the detailed design and construction of all required downstream sections in accordance with the proposed alignment shown on **Figure 7.3.2**.

### 7.3.4 Financing

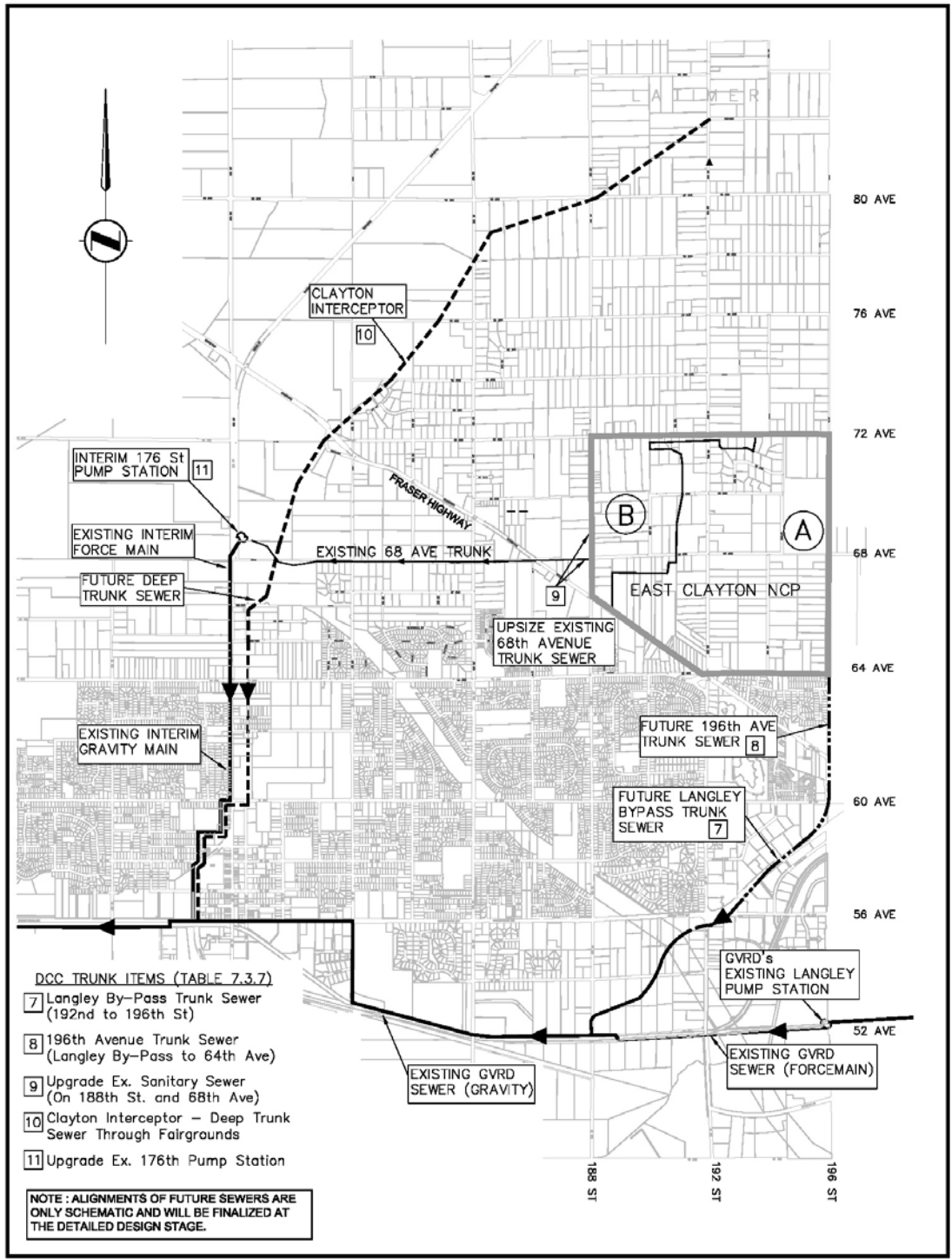
Developers will be eligible for DCC contributions for upsizing of the sanitary sewers as listed in **Table 7.3.7** as detailed in the City's Subdivision and Servicing Bylaw.

**Table 7.3.7  
Trunk Sewer DCC Items**

Trunk Item No.	Location	Scope (Type & Size of Works)	Notes	Total Cost	DCC Component Cost (Through upsizing contribution by City)	Developers Extension of base size requirements (Can be later covered)
<b><u>INTERNAL</u></b>						
1	68th Ave, from 193rd - 194th Street	240m - 250mm main		\$ 55,000	\$ 22,000	\$ 33,000
2	194th Street, from 68th - 65th Avenue	500m - 300mm main		\$ 138,000	\$ 55,000	\$ 83,000
3	194th Street, from 65th - 64th Avenue	320m - 375mm main		\$ 104,000	\$ 42,000	\$ 62,000
4	65th Avenue, from 192nd - 194th Street	400m - 250mm main		\$ 92,000	\$ 37,000	\$ 55,000
5	64th Avenue, from 194th - 196th Street	400m - 375mm main		\$ 130,000	\$ 52,000	\$ 78,000
6	196th Street, from 65th - 64th Avenue	220m - 375mm main		\$ 72,000	\$ 29,000	\$ 43,000
<b><u>OFF SITE</u></b>						
7	Langley ByPass Sewer (from 56th Ave - 196th St)		Clayton prorated share of \$3.3M	\$ 3,300,000	\$ 2,244,000	\$ -
8	196th Ave, from By-Pass to 64th Ave			\$ 280,000	\$ 112,000	\$ 168,000
9	188th St and 68th Ave Upgrades	460m - 450mm main		\$ 230,000	\$ 230,000	\$ -
10	Deep Trunk Sewer through Fairgrounds		Clayton prorated share of \$12M	\$ 12,000,000	\$ 1,800,000	\$ -
11	Interm 176th St Pump Station Upgrade	Additional 138 L/s capacity		\$ 250,000	\$ 250,000	\$ -
<b>TOTALS</b>				\$ 16,651,000	\$ 4,873,000	\$ 522,000

**Notes**

- The City will contribute upsizing costs, according to the set rates of the Sub-division bylaw. These are estimated to approximately by 40% of the total cost.
- The Developer will have the option to seek upsizing contributions from the City or to seek DCC rebates if installing the full required size, which ever is preferable / advantageous to the developer.
- East Clayton's Prorated Share of the Langley Bypass was developed by prorating the total cost of the trunk against the contributing area (East Clayton's contributing area is 187ha and the total contributing area is 275ha).
- East Clayton's Prorated Share of the Deep Trunk was developed by prorating the total cost of the trunk against the contributing area (East Clayton's contributing area is 114ha and the total contributing area is 750ha).



Project:  
**City of Surrey**  
**East Clayton**  
**NCP**

— EAST CLAYTON NCP AREA

(B2) CATCHMENT ID

— EXISTING OFFSITE SEWER

- - - PROPOSED OFFSITE SEWER (REQ'D BY NCP)

- · - · - FUTURE OFFSITE SEWER (NOT REQ'D FOR NCP)

**EARTH TYPON**

Earth Tech Canada Inc.  
 1901 Rossar Street, 8th Floor  
 Burnaby, B.C. V0C 0S3

Scale: 1:25,000

Title:  
**Figure 7.3.1**  
**Off-Site Sanitary**  
**Sewers and**  
**Constraints**

**Project:** City of Surrey  
East Clayton NCP

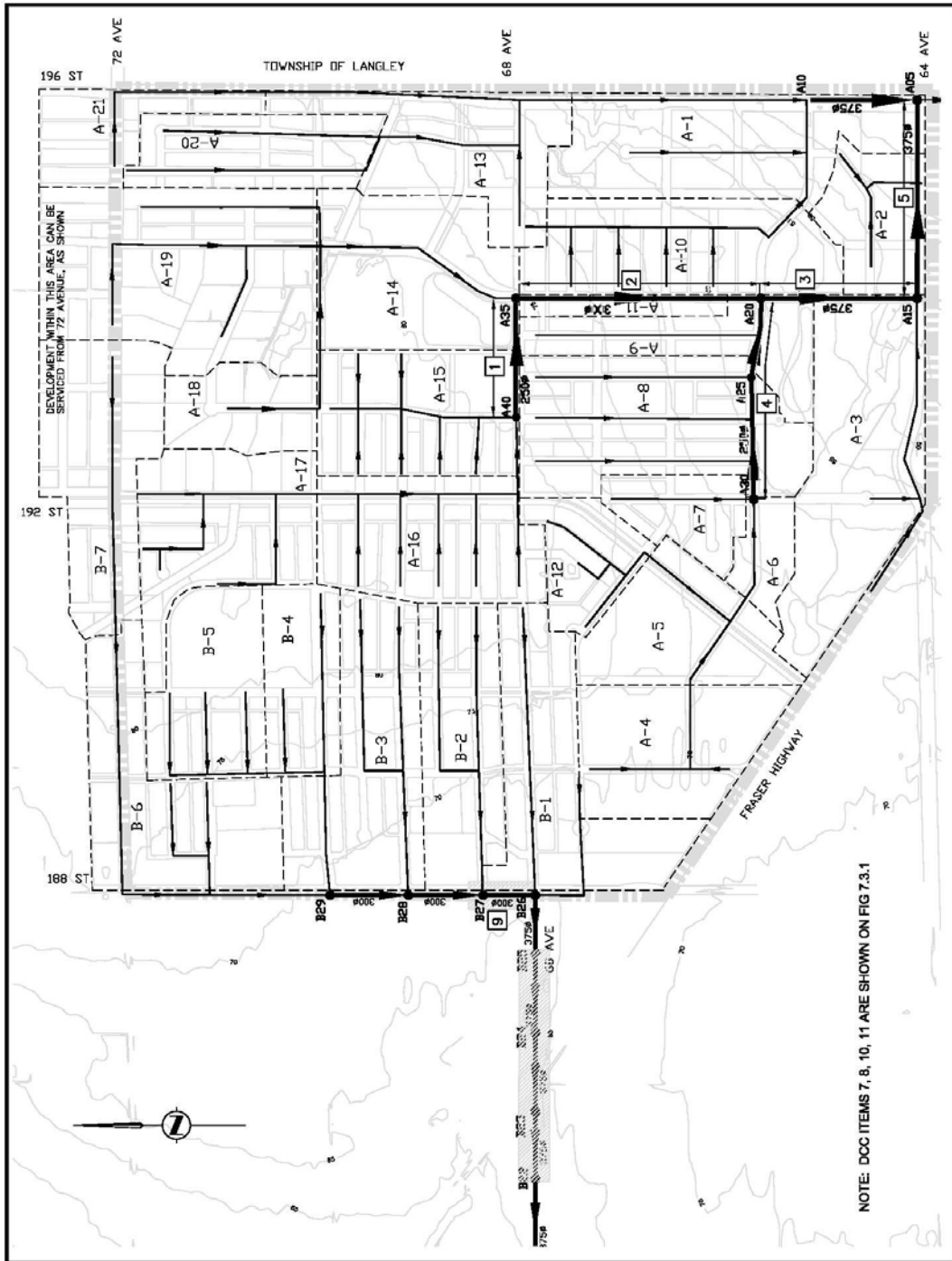
**Title:** Figure 7.3.2  
Sanitary Servicing Plan

**Legend:**

- 5m Contour
- East Clayton NCP Boundary
- Sanitary SubCatchment Boundary
- A-10 San. SubCatchment ID
- Future Local Sanitary Sewer
- Trunk Sanitary Sewer
- 210 Sanitary Node ID
- 3750 Trunk Diameter (mm)
- 3000 Ex. Trunk Diam. (mm)
- Undersized
- ID Numbers as in Table 7.3.7

**Scale:** N.T.S

**ARTHURSON**  
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1801 Rosslyn Street, 8th Floor  
Burnaby, B.C.



## 7.4 WATER DISTRIBUTION

### 7.4.1 Background

The existing water supply system near the NCP is currently separated into two pressure zones; with the zone boundary approximately along the 50m geodetic contour. Most of the NCP is located within the “Clayton Pressure Zone”, which operates at a head of 115m geodetic. A small portion (approximately 6%), located near 64<sup>th</sup> Avenue and 196<sup>th</sup> Street, is located in the “Cloverdale Pressure Zone”, which operates at 90m geodetic static head.

Water supply sources for the NCP are the GVWD’s 900mm diameter watermain and the City’s 450mm main, both located along 72<sup>nd</sup> Avenue from 184<sup>th</sup> Street to 190<sup>th</sup> Street. The upper 115m pressure zone is primarily fed by the GVWD watermain, directly through a PRV located at 72<sup>nd</sup> Avenue and 190<sup>th</sup> Street. Water is supplied to the lower 90m pressure zone by the existing Clayton Reservoir (HGL 90m), also located at 72<sup>nd</sup> Avenue and 190<sup>th</sup> Street. During peak demand conditions, the Clayton Reservoir also supplies water to the upper pressure zone, through a booster station. *Figure 7.4.1* illustrates the location of the existing distribution system and its major components in the area.

As of 1996, the existing distribution system in the area was evaluated as part of the City’s Water Supply Study which assessed its’ ability to meet the existing servicing needs. Key findings included:

- a. The Clayton reservoir is categorized as an unlimited source;
- b. Ultimately, the City is going to modify the PRV set points to increase the HGL of the “Clayton Pressure Zone” from 115m to 125m geodetic;
- c. The City plans to upgrade the booster station to match the future HGL of 125m. This upgrade is required when the demand exceeds the existing pumping capacity of 321 L/s. To allow interim servicing at the lower HGL, the proposed feeder main loop has been upsized in the East Clayton NCP area (south of 72 Avenue and east of 188 Street).

### 7.4.2 Design

The proposed layout and sizing of the system is based on the City of Surrey 2002 Design Criteria. The detailed design of the system will follow the applicable design criteria at the time of development.

Based on City’s equivalent population factors, by zoning or land use designation, the total equivalent design population of the Clayton Area is estimated to be approximately

44,950. This design population for the total area was used to evaluate the water supply requirements for the East Clayton NCP area, as part of the total area.

For residential areas, water demand was calculated based on an average daily allowance of 500 L/capita/day, a maximum day allowance of 1,000 L/capita/day and a peak hour demand of 2,000 L/capita/day, in accordance with the City's design criteria.

For all other areas (i.e. commercial, institutional, etc.) the City's Design Criteria Manual was used as a guideline.

A water network model of all of the pipes in the existing distribution system was developed using EPANET computational software program. The input data for the existing distribution system was obtained from the input data of the City's CYBERNET program based water model. The ultimate system was analyzed for both maximum day plus fire flow and for peak hourly flows. Detailed analysis results confirm that the proposed grid and feeder system will meet the City's design criteria for maximum day plus fire flow, and peak hour demands. **Figure 7.4.1** shows the major grid mains (greater than 300mm diameter) for the ultimate system.

All development within the NCP should be serviced from the upper pressure zone. Lots within the NCP range in elevation from 35m to 83m, geodetic. Based on an ultimate HGL of 125m, the static service pressure will range from 42m (60 psi) to 90m (128 psi). Lots in the southeastern corner of the NCP will experience high static pressures (i.e. above 70m). These lots, shaded on **Figure 7.4.1**, should have household pressure reducing valves installed on their service lines; in accordance with Building Code requirements.

Development within East Clayton is required to complete the following:

1. Design the total distribution system for an ultimate buildout equivalent population, based on the zoning of the preferred land use concept for the East Clayton NCP.
2. As development progresses and requires upgrading of existing inadequate system, have the existing 150mm mains replaced with minimum 200mm mains, in coordination with the developers
3. Provide a grid and feeder main network for the ultimate development, as shown on **Figure 7.4.1**. Thus, the indicated pipe sizes represent the network for the full built-out condition. Therefore, individual developers, who will develop before the ultimate looped distribution system is completed, may have to upsize individual pipes to provide fire-protection to their developments, in the interim.
4. No direct service connections should be allowed to the Feeder mains (mains with 450mm or greater diameter).



The City of Surrey will upgrade the Clayton pump station when development requires an increase of peak flows to 1400 L/s at 40m Total Dynamic Head (TDH). A portion of the DCC's collected from development of the NCP will be allocated for the completion of the pump station upgrades. Developers will not be required to address the pump station upgrades as part of their development but should inform the City of limitations resulting from existing system deficiencies.

Upsizing of the pipe network as shown in *Figure 7.4.1* will be a DCC rebatable item. Developers are responsible for providing adequate flows. DCC rebates only apply to upsizing beyond the development immediate requirements.

### **7.4.3 Phasing**

The layout and sizing concept has been developed to reliably meet the ultimate water consumption demands and also provide projected fire flows from the existing Clayton PRV, Reservoir and Booster Station located south of 72 Avenue and west of 192 Street.

As identified in the servicing plan, the existing grid of trunk water mains feeding the 115m geodetic pressure zone must be improved and extended into new areas, as developments proceed. Development must confirm that the water system has sufficient capacity to service the proposed site for both interim and ultimate conditions.

DCC funding as shown in the next section will be available for upsizing of mains where the required pipe size is smaller than the ultimate requirement for the system.

If the upgrades to the East Clayton Pump Station are required to meet the NCP servicing, developers will be required to co-ordinate the timing construction and the upgrades with the City if advancement of the works as scheduled in the ten year plan is required.

### **7.4.4 Financing**

The DCC eligible Infrastructure elements for the East Clayton area, their projected capital costs of construction and DCC eligible items are summarized in *Table 7.4.1* and shown in *Figure 7.4.1*.

Table 7.4.1 – DCC Eligible Items

Trunk Item No.	I.D. No. 10-Year Plan	Location	Scope (Type & Size of Works)	Notes	Total Cost	DCC Component Cost	Non DCC Component Costs	Required by Year	Projected Phasing Stage	New DCC Item (Y/N)	Funding Type	Part City Funded (Y/N)	Other
1		70 Ave - 191 St - 194A St	690mm - 400mm main		\$ 242,000	\$ 69,000	\$ 173,000						
2		68 Ave - 188 St - 190 St	690mm - 350mm main		\$ 189,000	\$ 44,000	\$ 145,000						
3		190 St, 68 Ave - 194 St, 66 Ave	1260mm - 350mm main		\$ 319,000	\$ 74,000	\$ 245,000						
4		189 St, 68 Ave - 194 St, 65 Ave	1245mm - 300mm main		\$ 393,000	\$ 65,000	\$ 328,000						
5		192 St - 67 Ave - 65 Ave	225mm - 300mm main		\$ 69,000	\$ 11,000	\$ 58,000						
6		191 St, 72 Ave - 190 St, 68 Ave	1170mm - 300mm main		\$ 240,000	\$ 40,000	\$ 200,000						
7		191 St, 72 Ave - 191 St, 70 Ave	420mm - 450mm main		\$ 206,000	\$ 206,000	\$ -						
8		195, 72 Ave - 194 St, 70 Ave	615mm - 300mm main		\$ 168,000	\$ 28,000	\$ 140,000						
9		194 St - 70 Ave - 66 Ave	705mm - 400mm main		\$ 256,000	\$ 73,000	\$ 183,000						
10		194 St, 66 Ave - 195A/194 St, 64A Ave	660mm - 300mm main		\$ 285,000	\$ 47,000	\$ 238,000						
11		194A St - 66 Ave - 64 Ave	660mm - 300mm main		\$ 123,000	\$ 20,000	\$ 103,000						
12	13811	Clayton Pump Station	New Pump Station	1st phase - 50% cost	\$ 1,500,000	\$ 1,500,000	\$ -	2006					
<b>TOTALS</b>					\$ 3,990,000	\$ 2,177,000	\$ 1,813,000						

- Notes:
- 1) Developer to provide watermains to meet requirements for fire protection
  - 2) Feeder mains (greater or equal to 450mm) are 100% DCC eligible
  - 3) New local watermains (200mm for residential, 300mm for commercial) are developers cost
  - 4) Oversizing for new local watermains are DCC eligible
  - 5) Existing watermains requiring oversizing are 100% DCC eligible
  - 6) Pump station upgrades are 100% DCC eligible

Project:  
**City of Surrey**  
**East Clayton**  
**NCP**

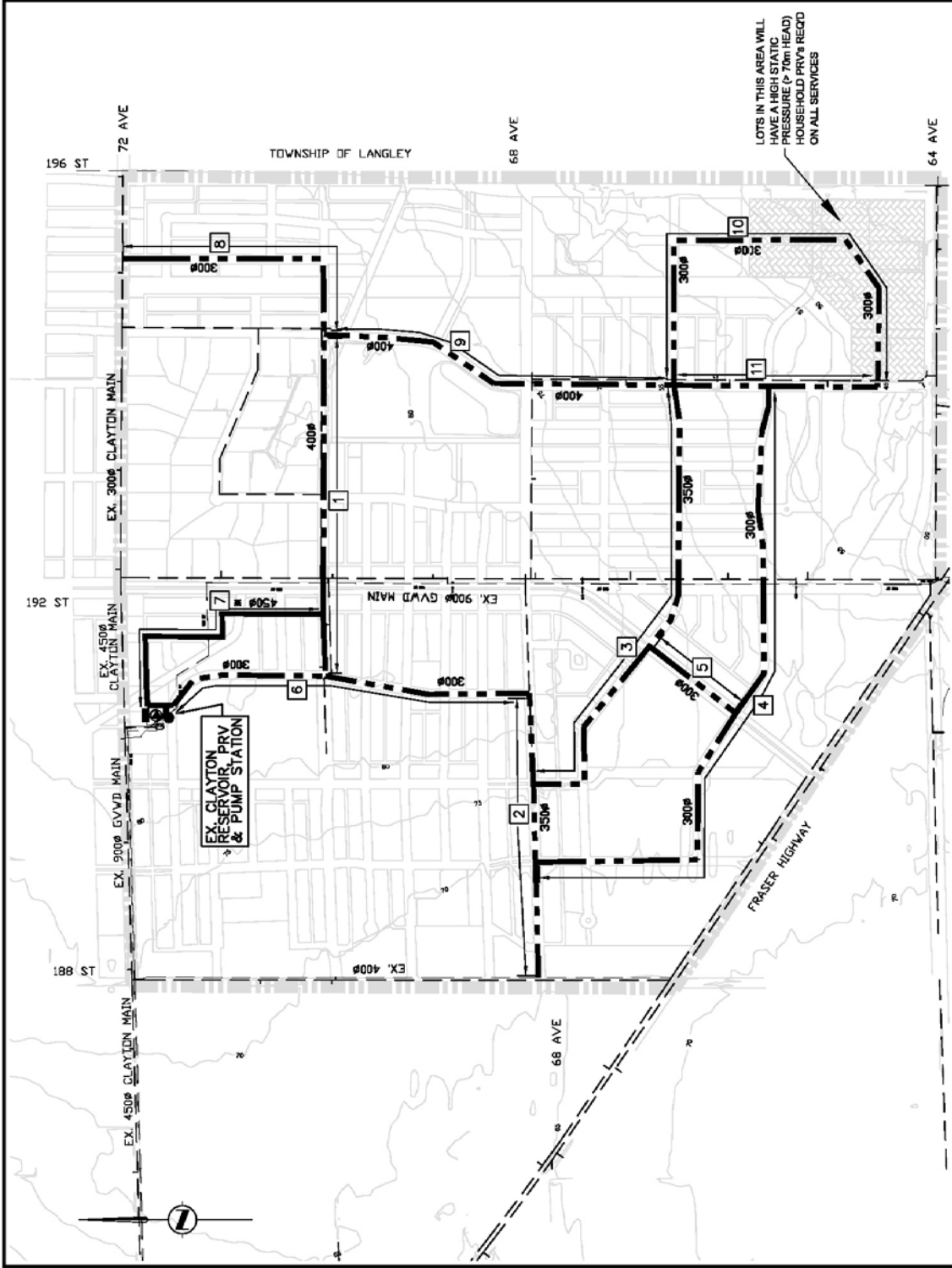
- 5m Contour
- East Clayton NCP Boundary
- Existing Distribution Mains
- New Grid Mains (Approx. 40% DCC Component)
- Proposed Feeder Mains
- 300# Main Diameter (mm)
- ID Numbers as in Table 7.4.1

Scale: N.T.S.

**EARTH T E C H**

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 Burnaby, B.C.

Figure 7.4.1  
**Water Supply**  
**Servicing Plan**



## 7.5 STORMWATER DRAINAGE SERVICING

### 7.5.1 Background

The East Clayton NCP area currently has a rural residential and agricultural land use and is serviced mainly by roadside ditches and natural drainage channels.

Surface drainage from East Clayton area flows to two major catchment areas.

- Catchment A is the eastern and southern area and encompasses 190 hectares (ha) of land. The catchment slopes southeasterly, while partially draining into McLellan Creek (with an outfall across 64<sup>th</sup> Avenue) and partially to the east into the Township of Langley storm sewer system (through culverts across 196<sup>th</sup> Street).
- Catchment B is the western area and is about 85 ha in size. It slopes to the west and drains into North Cloverdale Creek, that outfalls west across 188<sup>th</sup> Street.

Both of the above catchments are part of the Nicomekl-Serpentine river system. Flows from the East Clayton NCP will affect the lowland flooding conditions. The development of the NCP must address the concerns for the protection of existing property and fish habitat from the detrimental effects of flooding and erosion.

The Clayton NCP area is located at the top of the two catchment areas and has a flat topography between 190<sup>th</sup> and 196<sup>th</sup> Streets, and 68<sup>th</sup> to 72<sup>nd</sup> Avenue. Outside and along the north boundary of the NCP, there is land that will be tributary to the services provided within the NCP.

The Township of Langley storm sewers have limited capacity to receive flows from the NCP. As a result, development is required to address capacity issues in the Langley system or provide means to control increase in flows.

Summarized in *Table 7.5.1* are the approximate locations and allowable post development peak discharge rates from East Clayton into the Township of Langley, as per a letter agreement between the municipalities.

**Table 7.5.1 – Maximum Post Development Discharges**

Location	Peak Discharge Rate (m3/s)	
	5-Year	100-Year
Outfall along 68 Ave, East of 196 St. to Langley	0.0	0.0
Outfall South of 68 Ave, East of 196 St. to Langley	0.8	1.7
Outfall at 65 Ave, East of 196 St. to Langley	0.2	0.4
Outfall Along 64 Ave, East of 196 St. to Langley	0.0	0.0
<b>Total</b>	<b>1.0</b>	<b>2.1</b>

Portions of McLellan Creek have been enclosed downstream of the NCP. The 100-year flow conveyance system is unable to accommodate increases in flows. Development tributary to McLellan Creek will need to control the 100-year return period runoff.

Means of effectively managing stormwater runoff in an environmentally sustainable and economical manner is one of the key objectives of the East Clayton NCP. Infiltration is a component of the sustainable development concept and is a means to reduce total runoff volumes resulting from new development. The infiltration devices do not replace the need for conventional drainage servicing systems such as storm sewers for flow conveyance and detention ponds for peak flow attenuation. A consideration in the development of infiltration systems is soil type.

About 80% of the area is covered to a depth of about one metre of moderate to well draining soils. In much of the area, this upper layer of moderately well leached soils overlies a relatively extensive clayey silt unit. This silt unit generally inhibits vertical percolation of water and encourages lateral movement. The Bose soil unit, which comprises moderately coarse textured glacial outwash, is the thickest and most extensive of the better drained units in the area. Much of the Latimer-Langley drainage area is underlain by poorly drained Scat and Boosey fine grained soils, which typically have a high perched water table.

The requirements for infiltration systems for the NCP are outlined in the “*Green Infrastructure Performance Standards and Guidelines*” (see section 4.0) of this Concept Plan.

The build out of the NCP will require the construction of local services and trunk sewers inside the boundaries of the NCP.

## 7.5.2 Design

The proposed layout and sizing of the system is based on the City of Surrey 2002 Design Criteria. The detailed design of the system will follow the applicable design criteria at the time of development.

As per the proposed land use and street layout plan, the East Clayton service area has been discretized into a number of drainage sub-catchment areas and these are shown in **Figure 7.5.1** and are summarized in **Table 7.5.2**. Based on the proposed land use and lot coverage in terms of paved and unpaved areas, the total impervious area (TIA) percentage varies from 46%, to 90%.

**Table 7.5.2 - Catchment Area Characteristics**

Catchment Area*	Area	Future % Imperviousness
A-1	11.0	90.0
A-2	11.1	55.0
A-3	9.3	70.0
A-4	9.9	46.0
A-5	8.0	46.0
A-6	7.7	46.0
A-7	12.0	46.0
A-8	16.9	90.0
A-9	18.6	67.0
A-10	28.1	46.0
A-11	16.6	46.0
A-12	40.4	46.0
B-1	11.3	90.0
B-2	9.6	52.0
B-3	11.8	52.0
B-4	17.7	52.0
B-5	13.3	52.0
B-6	10.4	52.0
B-7	11.4	52.0
<b>TOTAL</b>	<b>275.1</b>	<b>56.5</b>

*\* Note: Figure 7.5.1 shows area locations*

The NCP drainage servicing strategy is to convey the minor (1:5 year) stormwater runoff via storm sewers to a series of 5 detention ponds that discharge to three existing watercourses. As noted above the 100-year flows are a concern for areas downstream of the NCP. The detention ponds will also provide detention to control the increase in flows for the major runoff events (1:100 year events).

The southeast section of the NCP will be serviced by the available capacity in the Langley system and excess flows will be diverted to an off-site trunk sewer on 196 Street south of 64<sup>th</sup> Avenue. Interim stormwater detention practices will be required for development in this area until construction of the trunk sewer is complete.

### 7.5.3 Storm Sewer Network

The City design criteria require the provision of a minor storm system to convey the 1:5 year runoff. Safe conveyance of the 1:100 year major flows is normally provided using the roadways surface, to the detention ponds.

Developers have expressed a desire to build developments with homes that have finished basements. In order to permit finished basements, the 1:100 year Hydraulic Grade Line

must be below the proposed minimum basement elevation in accordance with the City design criteria.

Due to the economic and development industry desire for basement homes, developers within the East Clayton NCP will design the storm sewers sufficiently deep to accommodate basement houses. **Table 7.5.3** lists the conceptual design sizes for the trunk storm sewers as shown in **Figure 7.5.1**. Developers will confirm the sewer sizes at the time of development to conform to the current City design Guidelines.

Servicing for development in the vicinity of the detention ponds will include consideration of the impact of the ponds on the surrounding HGL for the major flows.

The servicing concept for the NCP was designed to be as independent of offsite servicing constraints as possible. Due to existing constraints in the downstream storm sewers and the lack of available detention, an overflow sewer to the existing Surrey storm sewer system will be required to service the southeast corner of the NCP east of 194<sup>th</sup> Street and south of 67<sup>th</sup> Avenue. Upgrades to the 196<sup>th</sup> Street storm sewer are required for excess flows at 65 and 64<sup>th</sup> Avenues (see **Figure 7.5.1**). Development of this area is allowed to proceed with interim detention until the 196 street trunk sewer has been completed.

Although developers may convey the 1:100 year flows in a pipe system, a safe over-land flow path must be provided in all drainage catchments.

Storm sewers that service areas greater than 20 hectares are deemed to be Trunk sewers and are eligible for DCC rebates as per the City of Surrey current eligibility criteria.

**Table 7.5.3 – Storm Sewer Conceptual Sizing**

		AREA		DESIGN FLOW								PIPE DATA				
From MH	To MH	Area Code	Increment Area (ha)	Runoff Coeff. R	Increment A*R	Total A*R	Time of Concentration			Major System		Pipe Capacity (m3/s)	Friction Factor n	Pipe Slope (%)	Pipe Diam. (m)	Pipe Length (m)
							To Entry (min)	Critical Time (min)	In Pipe Section (min)	Rainfall Intensity (mm/hr)	Total Peak Flow (m3/s)					
A190	A180	A-11	16.6	0.46	7.6	7.6	15.0	15.0	0.9	49.1	1.04	1.20	0.013	3.8%	0.600	235
A210	A180	A-10	28.1	0.46	12.9	12.9	15.0	15.0	1.3	48.6	1.74	1.89	0.013	5.0%	0.675	400
A180	Pond A	-	0.0	0.00	0.0	20.6	15.0	16.3	0.1	48.4	2.76	2.99	0.013	1.2%	1.050	30
Pond A	A100										<b>0.86</b>	0.96	0.013	5.0%	0.525	800
A150	A130	A-7	12.0	0.41	4.9	4.9	15.0	15.0	0.8	49.3	0.67	0.84	0.013	1.0%	0.675	115
A140	A130	A-5	8.0	0.41	3.3	3.3	15.0	15.0	1.7	47.9	0.44	0.61	0.013	1.0%	0.600	220
		A-6	7.7	0.41	3.2	3.2	15.0	15.0	0.1	50.4	0.44	1.03	0.013	-	0.675	20
A130	A120					11.4	15.0	16.7	0.3	47.5	1.50	1.57	0.013	2.0%	0.750	65
A120	Pond B	A-3	9.3	0.41	3.8	15.2	15.0	17.0	0.1	47.3	1.99	2.20	0.013	1.5%	0.900	30
Pond B	Creek										<b>0.89</b>	0.96	0.013	5.0%	0.525	220
A220	A100	A-2	11.1	0.55	6.1	6.1	15.0	15.0	1.6	48.1	0.82	0.96	0.013	5.0%	0.525	420
A100	OFFSITE					26.7					3.58	3.86	0.013	2.0%	1.050	400
B140	B130	B-5	13.3	0.52	6.9	6.9	15.0	15.0	0.7	49.4	0.95	1.06	0.013	3.0%	0.600	160
B130	B120	B3/B4	29.5	0.52	15.3	22.3	15.0	15.7	0.1	49.3	3.05	3.86	0.013	2.0%	1.050	30
B120	Pond E	B-7	11.4	0.52	5.9	35.1	15.0	15.8	0.9	47.8	4.66	4.77	0.013	1.5%	1.200	235
B200	B190	B-2	9.6	0.52	5.0	5.0	15.0	15.0	3.9	44.9	0.62	0.74	0.013	3.0%	0.525	800
B190	B180	B-1	11.3	0.90	10.2	15.2	15.0	18.9	1.0	43.8	1.84	2.56	0.013	2.0%	0.900	240
B180	Pond E	B-6	10.4	0.52	5.4	25.6	15.0	19.9	0.1	43.6	3.10	3.30	0.013	1.5%	1.050	30

**Bold Font Indicates Specified Pond Release Rate**



## 7.5.4 Community Detention Facilities

The NCP drainage concept shown in *Figure 7.5.1* has 5 community detention ponds.

The objective of the ponds is to attenuate the post development flows of the 1:5 year storm event to 50% of the post development 2 year flow, or to attenuate the post development flows from the 1:5 year storm events to pre-development levels. Downstream concerns on the safe conveyance of flows will require that the ponds also be designed to control the post-development 100-year flows to pre-development levels.

*Table 7.5.4* lists the detention ponds estimated size and land requirements to meet the above objectives. The detention ponds were assumed to be wet ponds to provide water quality benefits. The actual size and operation of the ponds must be determined at the time of construction. The proposed pond sizes were based on single event modeling. The final design of the ponds will be based on a continuous simulation of the catchment area runoff.

Pond A is located near the top of the catchment where no existing watercourse exists. This pond may be designed as a dry pond with non-permanent wetland components as identified in the preceding “*Green Infrastructure*” section.

The detention ponds will be designed to service the adjacent lands for basements in accordance with the previous section. *Figure 7.5.1* shows the approximate location of facilities and *Table 7.5.4* summarizes the approximate storage requirements for the 5-year and 1-100 year design events.

**Table 7.5.4 - Estimated Stormwater Pond Costs**

Pond	Contributing Catchments		Storage Volumes			Surface Area		Capital Costs		
	ID's	Area (ha)	Dead Vol (m3)	5-Yr (m3)	100-Yr (m3)	5-Yr (m2)	100-Yr (m2)	Construction Cost (\$)	Land Cost (\$)	Total Cost (\$)
A	A-10, A-11, A-12	83.6	8360	15,232	20,563	13,709	17,136	\$966,500	\$856,800	<b>\$1,823,300</b>
B	A-3, A-4, A-5, A-6, A-7	52.71	5271	9,604	12,965	8,643	10,804	\$609,400	\$540,200	<b>\$1,149,600</b>
C	A-9	18.6	1860	3,389	4,575	3,050	3,813	\$215,000	\$190,600	<b>\$405,600</b>
D	A-8	16.93	1693	3,085	4,164	2,776	3,470	\$195,700	\$173,500	<b>\$369,200</b>
E	B-1, B-2, B-3, B-4, B-5, B-6, B-7	90.43	9043	16,476	22,243	14,829	18,536	\$1,045,400	\$926,800	<b>\$1,972,200</b>
<b>TOTAL</b>	-	<b>289</b>	<b>28,866</b>	<b>29,404</b>	<b>33,061</b>	<b>47,334</b>	<b>59,168</b>	<b>\$3,337,100</b>	<b>\$2,958,400</b>	<b>\$6,295,500</b>

Notes: *Pond Construction Costs*

Excavation Cost           \$ 47.00 / m3

Land Cost                   \$ 50.00 / m2

Ponds will be constructed to provide local amenity to the community in terms of aesthetics and recreational use. Maintenance access and operation will be clearly defined in the design documents for the detention ponds.

Development within a catchment may proceed with interim detention only when the land for the ultimate detention ponds has been secured. The ponds shown are DCC eligible items. Cost estimates include allowance for detailed design, construction, landscaping and land acquisition costs.

### **7.5.5 Watercourses**

As noted above the NCP drains to three existing watercourses. Where watercourses are located adjacent to proposed development, the developer is responsible to meet the requirements of the environmental agencies including the Ministry of Land Water and Air Protection and Fisheries and Oceans Canada as applicable at the time of development.

Under the current regulations, developers will dedicate 15 metres or 30 metres from the top of bank of any watercourse identified as having habitat value. The 15 metre requirement is for low density development and 30 metres for high density.

All development will meet the required land development guidelines for water quality preservation through the use of appropriate Best Management Practices through all stages of the development.

### **7.5.6 Infiltration**

Stormwater infiltration measures are a requirement of the Clayton NCP. The requirements for infiltration systems are presented in the preceding “*Green Infrastructure*” section for both building lots and roadways. The infiltration devices provide runoff volume reduction benefits. All developments must meet the infiltration component of the NCP. These measures are aimed at mitigating the impact of tree cover removal and conversion of pervious areas to impervious areas.

Infiltration measures are not eligible for DCC rebates as they service local development and mitigate the impacts of individual developments. Alternate means to address stormwater sustainability will be considered.

### **7.5.7 Phasing**

Development in the NCP will be phased to complete all the downstream trunk sewers before upstream areas are developed. **Figure 7.6.1** shows the likely phasing for the NCP.

## 7.5.8 Financing

*Figure 7.5.1* shows the DCC eligible infrastructure of ponds and storm trunk sewers. The costs of the various elements are listed in the *Table 7.5.5*. Section 7.6 provides a summary of the NCP financing and the financing mechanisms available to development.

**Table 7.5.5**  
**Trunk Storm Sewer DCC Items**

Trunk Item No.	Location	Scope (Type & Size of Works)	Total Cost	DCC Component Cost (Through upsizing contribution by City)
1	194 St, 69 Ave - 68 Ave	235m - 600mm main	\$ 125,000	\$ 125,000
2	68 Ave, 192 St - 194 St	400m - 600mm main	\$ 213,000	\$ 213,000
3	194 St and 68 Ave - Pond A	30m - 1050mm main	\$ 26,000	\$ 26,000
4	194 St, 68 Ave - 64 Ave	800m - 525mm main	\$ 381,000	\$ 381,000
5	193 St, 65 Ave - Pond B	95m - 750/900mm main	\$ 71,000	\$ 71,000
6	Pond B - Creek	220m - 525mm main	\$ 105,000	\$ 105,000
7	Pond A		\$ 1,823,300	\$ 1,823,000
8	Pond B		\$ 1,149,600	\$ 1,150,000
9	Pond C		\$ 405,600	\$ 406,000
10	Pond D		\$ 369,200	\$ 369,000
11	196th St Trunk, 64th to McLellan Cr Outfall	1,300m - 900mm main	\$ 1,053,000	\$ 1,053,000
12	69th Ave and 188th St - Pond E	265m - 1050/1200mm main	\$ 239,000	\$ 239,000
13	68th Ave and 188th St - Pond E	270m - 900/1050mm main	\$ 232,000	\$ 232,000
14	Pond E		\$ 1,972,200	\$ 1,972,000
<b>TOTALS</b>			<b>\$ 8,165,000</b>	<b>\$ 8,165,000</b>

**Project**  
**City of Surrey**  
**East Clayton NCP**

5m Contour  
 East Clayton NCP Boundary  
 Watercourse  
 Major Storm Catchment Boundary  
 Storm SubCatchment Boundary  
 A-10 Strm SubCatchment ID  
 Detention Pond  
 Existing Storm Sewer  
 Proposed Local Sewer  
 Proposed Trunk Sewer  
 Offsite Connection

Note : On-lot Infiltration Measures are required in each catchment

**E A R T H T E C H N I C S**  
 Earth Tech Canada Inc.  
 1901 Beaver Street, 9th Floor  
 Burnaby, B.C. V5C 6S3

Scale: N.T.S.

**Figure 7.5.1**  
**Storm Servicing Plan**



## 7.6 INFRASTRUCTURE FINANCING

### 7.6.1 Infrastructure Financing

The financial analysis of the five infrastructure categories on DCC funding and cost sharing was based on the following approach and planning assumptions:

- a. Land use Plan and Population projections (October 1999) provided by the City of Surrey Planning Department were used to develop the infrastructure designs.
- b. The Full Build-Out condition was used to design the component sizing of each infrastructure category and thereby to confirm all required future DCC Infrastructure elements for the Plan Area.
- c. For the NCP Build-Out condition, current DCC Policies and Principles require that, based on Current (July 2002 Bylaw # 14650) DCC Rates, revenues should balance out or exceed the expenditures for the area as a whole.
- d. Annually, any projected variances between DCC revenue and expenditures are to be addressed by the benefiting developers through signed agreements. The City will not finance interim works. However, the City may assist developers to recover their front-end over-expenditures on DCC eligible works that benefit larger areas than their individual developments.

Using the above guidelines, the projected revenues were computed for each infrastructure category. **Table 7.6.1** summarizes the resulting potential revenues for six DCC categories (arterial roads, collector roads, sanitary, water and storm systems, and parks). These are computed using the projected number of units for each type of land use in the East Clayton NCP area, the current unit DCC Rates (July 2002 Bylaw # 14650) and medium density range development, as an average condition over the area.

The DCC eligible Infrastructure elements for the East Clayton area, their projected capital costs of construction and DCC eligible costs were also estimated using above guidelines. These are summarized in Tables and shown in Figures in each section.

A comparison of the estimated revenues and costs was carried out; **Table 7.6.2** is a summary of the projected variance between the DCC revenues and the DCC eligible expenditures, for the five infrastructure categories. This comparison shows that there would be DCC revenue shortfalls in the sanitary component; with a surplus in roads, water and storm infrastructure components. Overall, for the area, a surplus in DCC revenues is projected.

**Table 7.6.1  
East Clayton DCC Revenues Financial Projection Using 2002 Rates (Bylaw # 14650)**

Land Use	Equivalent ID # From Sch.-B	Units		Sanitary		Water		Storm		Arterial		Major Collector		Parks	
		Rate	Revenue	Rate	Revenue	Rate	Revenue	Rate	Revenue	Rate	Revenue	Rate	Revenue	Rate <sup>1</sup>	Revenue
RA	7	820	28,700	951	33,285	5236	183,260	5517	193,095	1394	48,790	0	-	-	-
6-10 UPA	9	820	369,820	951	428,901	2618	1,180,718	5517	2,488,167	1394	628,694	5575	2,514,325	5575	2,514,325
10-15 UPA	10	745	357,600	865	415,200	1545	741,600	5020	2,409,600	1269	609,120	5575	2,676,000	5575	2,676,000
15-25 UPA	10	745	973,715	865	1,130,555	1545	2,019,315	5020	6,561,140	1269	1,658,583	5575	7,286,525	5575	7,286,525
25-45 UPA*	13-	0.46	974,832	0.54	1,144,368	1.01	2,140,392	2.35	4,980,120	0.59	1,250,328	5.11	10,829,112	5.11	10,829,112
Comm/Res**	14-	550	171,600	630	196,560	650	202,800	3030	945,360	770	240,240	6670	2,081,040	6670	2,081,040
Live/Work	10	745	292,040	865	339,080	1545	605,640	5020	1,967,840	1269	497,448	5575	2,185,400	5575	2,185,400
Work/Live	10	745	105,045	865	121,965	1545	217,845	5020	707,820	1269	178,929	5575	786,075	5575	786,075
Commercial (Office)	24-	248	255,936	288	255,936	390	402,480	1545	1,594,440	390	402,480	0	-	0	-
Commercial (Spec)	23-	248	89,032	288	89,032	1702	611,018	2372	851,548	599	215,041	0	-	0	-
Commercial (Neigh)	23-	248	10,912	288	10,912	1702	74,888	2372	104,368	599	26,356	0	-	0	-
<b>Total</b>			<b>3629232</b>		<b>4,165,794</b>		<b>8,379,956</b>		<b>22,803,498</b>		<b>5,756,009</b>		<b>28,358,477</b>		<b>28,358,477</b>

1 with 5% park Dedication

\* Average size 1200

\*\* Average size 1000

**Table 7.6.2: Summary of DCC Revenue and Expenditures  
At Full Build-Out <sup>(1)</sup>**

<b>Infrastructure Category</b>	<b>Projected DCC Revenue <sup>(2)</sup></b>	<b>Projected DCC Expenditures <sup>(2)</sup></b>	<b>Balance (Revenue – Cost)</b>
Arterial Roads	\$22,804,000	\$11,106,000	\$11,698,000
Major Collector Roads	\$5,756,000	\$5,270,000	\$486,000
Sanitary Sewers	\$3,629,000	\$4,873,000	-\$1,244,000
Water	\$4,166,000	\$2,177,000	\$1,989,000
Storm	\$8,380,000	\$8,165,000	\$215,000
<b>Total</b>	<b>\$44,735,000</b>	<b>\$31,591,000</b>	<b>\$13,144,000</b>

(1) *The City of Surrey collects DCC's on a community basis and not on a NCP or area basis. The table shows the cost of DCC eligible works required to service the East Clayton NCP Plan area. This table also shows that the NCP could be self-financing.*

(2) *Values rounded to nearest \$1,000*

## 7.6.2 Funding Methods

The following is summary of various method methods and mechanisms available, based on the current City Servicing Standards and Bylaw's:

- DCC Rebates
- Development Coordinated Works (DCW)
- Upsizing
- Frontage Latecomer
- Area Latecomer

The applicability of each of the above funding methods must be reviewed for each project in accordance with the current City criteria.

## 7.6.3 Development Phasing

A Development Phasing Plan has been prepared for the NCP. This plan, shown in *Figure 7.6.1*, illustrates the extent of the three proposed development phases.

These phase boundaries were based on the ability to service these areas with the existing downstream sanitary and storm sewer systems. Downstream capacity constraints were taken into consideration in determining the developable area for each phase.

In addition, the feasibility strategy of ensuring adequate DCC funds are available for each phase, to cover infrastructure-financing costs for that phase, was adopted into the phasing plan.

<p>Project</p> <p><b>City of Surrey</b></p> <p><b>East Clayton NCP</b></p>	<p>5m Contour</p> <p>East Clayton NCP Boundary</p> <p>Phasing Boundary</p> <p>(2) Development Phase Number</p> <p>Development Phase 1</p> <p>Development Phase 2</p> <p>Development Phase 3</p>	<p><b>EARTHTON</b></p> <p>Earth Tech Canada, Inc. 1801 Rosser Street, 8th Floor Burnaby, B.C.</p> <p>Scale: N.T.S.</p>	<p><b>Figure 7.6.1</b></p> <p><b>Development Phasing Plan</b></p>
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# APPENDICES

## APPENDIX I

# EAST CLAYTON CHARRETTE. CONSTITUENCY AND ISSUES

Constituencies of Interest	<b>PARTICIPANTS</b>	Workshop Date & Location	Design Table Spokesperson	Issues
Development Industry	John Turner, Progressive Const.; Carla Kalke, Parklane; James Evans, Suncor; Ladan Ahmadzadeh, Steve Hall, CMHC; Kelvin Neufeld, Fraser Valley Real Estate Board; Raghib Gurm, Bridgewater Development Corp.	February 2 Clayton Community Hall	John Turner, Progressive Construction Ltd.	-integrate open space uses to serve multiple functions -fees and levies currently discourage the construction of smaller units and secondary suites -flexibility in the plan to respond to market changes and allow for innovation -the sustainable concepts are marketable with challenges -forestry should serve both a function and aesthetics -blend densities -parking on street or in back lanes -consumer education is key to maintaining sustainability
City of Surrey and Consultants	How Yin Leung, Judith Robertson, Wendy Whelen, Francisco Molina, Kris Nichols, Planning; Eric Emery, Leif Bjorseth, Ken Zondervan, Engineering; Jean Lamontagne, Greg Ward, Parks, Rec and Culture; John Strandt, Marc Berube, Fire; Shirley Steele, RCMP; Jane Farquharson, Sudu Vatagodakumbura, Reid Crowther	February 22 Planning Room 1, City of Surrey	How Yin Leung, Francisco Molina, Wendy Whelen, Planning  Eric Emery Engineering  Jean Lamontagne Parks  John Strandt Fire	-need to incorporate alternatives for drainage -alternatives for street widths and servicing are required -integrate ideal sites for parks and water detention for cost effectiveness -allocate adequate space for trees -establish parking performance standards -resolve safety in back lanes -reduce City maintenance costs, i.e. increasing costs associated with trees and concrete competing for the same space -factor in liability issues early in the process -educate consumers and builders
City of Surrey Operations	Gerry McKinnon, Dale Hadden, Jeff Thomson, Operations; Carrie Baron, Engineering	March 5 Works Yard, City of Surrey	Gerry McKinnon, Dale Hadden, Operations	
Environment	Dave Nanson, Barry Chilibeck, DFO; Marie Lou Verge, Environment Canada; Brent Moore, Miles Stratholt, Krista Payette, Environment, Lands & Parks; Lynne Holt, Ross Wetzel, Surrey Environmental Advisory Committee; Mike Bose, Surrey Agriculture Advisory Committee; Mark Salerno, CMHC; David Melnychuk, Agriculture & Food; Bruce Gunn, Agricultural Land Commission	March 4 Clayton Community Hall	Barry Chilibeck DFO Erin Stoddard MELP	-establish a monitoring program to document the goals and the extent to which they are achieved -consider natural habitat protection -take the notion of sustainability to the household level (SMART houses) -increase awareness and stewardship through consumer education -monitor and promote energy use and efficiency -establish municipal official and decision-maker buy-in
Utilities and Services	Ron Baker, Gary Richert, BC Tel; Martin Kobayakawa, TransLink; Tom Vine, BC Hydro; Robin Kingman, Canada Post; Jennifer Woods, Roger's Cable	March 17 Clayton Community Hall	Allan Grant BC Hydro	-integrate transit and land use planning -explore alternative approaches to servicing in the Clayton area -postal services need to be involved at the time of subdivision -underground servicing is more efficient in higher density areas -lane width needs to accommodate all utilities
Community	Clayton Area Citizens (CAC) Committee; East Clayton Citizens Advisory Committee; East Clayton Property Owners Society (Executive); Clayton Community Association (Executive); Port Kells Community Assoc. (President)	March 23 Clayton Community Hall	Norman Alexander CAC	-build trust in the planning process -safety and maintenance of back lanes is a concern -City by-laws currently prohibit aspects of the sustainable alternative -Will sustainability concepts translate well into Clayton, it is not an urban centre?

East Clayton Neighbourhood Concept Plan

Summary an Status of Issues Raised During Planning Process

Issues	Identification						Status						
	Workshops	Public	Charrette		CAC	Open House	Resolved (1)			Pending (2)			
			Design Team	Working Sessions			Design Team	Sub-table	External(3)	Design Table	Sub-table	Demonstration (4)	External
<b>Planning</b>													
<b>Densities</b>	*	*	*	*	*	*	*	*					
<b>Land Uses &amp; Allocation</b>													
Residential	*	*	*	*	*	*	*	*					
Mixed Uses			*	*	*		*	*					
Commercial	*		*	*	*	*	*	*					
Business Park		*	*	*	*	*	*	*					
Live/Work		*	*	*	*		*	*					
Work/Live		*	*	*	*		*	*					
Schools/Parks/Civic	*		*	*	*	*	*	*					
<b>Infrastructure</b>													
Drainage	*	*	*	*	*	*	*	*			*		
Water/Sanitary	*	*		*	*	*			*			*	
Integrated Green Infrastructure	*		*	*	*	*	*	*			*		
<b>Utilities/Services</b>													
<b>Transportation</b>													
Transit	*		*	*	*	*	*	*	*				
Design Arterials/Collectors	*		*	*	*	*	*	*			*		
Local Streets	*	*	*	*	*	*	*	*			*		
Parking	*	*	*	*	*	*	*	*			*		
Lanes	*	*	*	*	*	*	*	*			*		
Designation	*		*	*	*	*	*	*			*		*
Energy													
Greenhouse Gas Reduction	*		*	*	*	*	*	*			*	*	
<b>Public Safety</b>													
Street Pattern/Width	*		*	*	*	*	*	*			*		
Lanes	*	*	*	*	*	*	*	*			*		
Building Form	*	*	*	*	*	*	*	*	*	*	*	*	
Crime Prevention	*	*	*	*	*	*	*	*	*	*	*	*	*
Facilities	*		*	*	*	*	*	*			*		*
<b>Natural Environment</b>													
Green Spaces	*	*	*	*	*	*	*	*			*		
Riparian Zones	*		*	*	*	*	*	*			*		
Forestry	*		*	*	*	*	*	*			*		
Natural Habitat	*		*	*	*	*	*	*			*		
Water Quality	*	*	*	*	*	*	*	*			*		
Soils	*	*	*	*	*	*	*	*	*		*		
<b>Agricultural Lowlands</b>	*	*	*	*	*	*	*	*			*		*
<b>Marketability</b>	*	*	*	*	*	*	*	*			*		*
<b>Liability</b>	*	*	*	*	*	*	*	*			*		*
<b>Planning Process</b>													
Resident/Landowners	*	*	*	*	*	*	*	*			*	*	*
Building Trust	*	*	*	*	*	*	*	*			*	*	*
Policy Makers	*	*	*	*	*	*	*	*			*	*	*
Buy-In	*	*	*	*	*	*	*	*			*	*	*
<b>Implementation</b>													
<b>Design/Construction</b>													
Integrated Green Infrastructure	*	*	*	*	*	*	*	*			*		
Natural Drainage System	*	*	*	*	*	*	*	*			*		
Landscaping	*		*	*	*	*	*	*			*		
Urban Forestry	*	*	*	*	*	*	*	*			*	*	*
Fire/Public Safety	*	*	*	*	*	*	*	*			*	*	*
Cross Sections	*		*	*	*	*	*	*			*		
<b>Energy</b>													
Smart Housing	*	*	*	*	*	*	*	*			*		*
District Heating	*	*	*	*	*	*	*	*	*	*	*	*	*
Mixed Uses	*	*	*	*	*	*	*	*			*		
<b>Regulatory System</b>													
Flexibility	*	*	*	*	*	*	*	*			*	*	*
DCC's/Fees/Levies	*	*	*	*	*	*	*	*	*	*	*	*	*
Land Development System	*	*	*	*	*	*	*	*			*	*	*
Compensation	*	*	*	*	*	*	*	*			*	*	*
<b>Stream Monitoring</b>	*	*	*	*	*	*	*	*			*		
<b>Life Cycle Costs</b>	*	*	*	*	*	*	*	*			*		*
<b>Maintenance</b>	*	*	*	*	*	*	*	*	*	*	*	*	*
<b>Marketing</b>	*	*	*	*	*	*	*	*			*		*

Notes:  
 (1) Resolved: Issue is advanced towards resolution or resolved.  
 (2) Pending: Issue is advanced and needs more attention  
 (3) External: outside the scope of Planning Process  
 (4) Demonstration: actual development project that will apply performance standards and develop construction standards

## APPENDIX II

### THE PLANNING AREA GENERAL BACKGROUND INFORMATION

## **BACKGROUND**

### **Historic Settlement Pattern of Surrey**

The pattern of modern settlement in Surrey was governed in large part by the existing landscape structure, organic development, and the agricultural grid. The landscape structure is distinguished by the low-lying floodplains of the Serpentine and Nicomekl River systems, which are contained on three sides by a ridge/hill/upland terrain. This structure influenced the placement of a trail system, which was built diagonally along the ridges and through the valley floor, thereby connecting New Westminster and Vancouver eastwards to the BC Interior and southwards to Washington State. The Semiahmoo Trail (1872), Yale Road (1875), and McLellan Road (1874-5) (later King George Highway, Fraser Highway, and No. 10 Highway, respectively), connected the uplands to the lowlands and stimulated early organic development along the ridges and dryer portions of the lowlands. Early district lot subdivision created a loose gridiron framework based on 160-acre parcel units (see *Figure 1*).

### **Clayton's Cultural History**

Formerly called Serpentine Flats, or Serpentine Valley, Clayton was named in 1889 by the postmaster, John George, for his native Clayton, Ohio. Begun in 1871, Yale Road (now Fraser Highway), was for many years the lifeline to New Westminster and Vancouver. The construction of the Fraser River Bridge in 1904, and the gravelling and extension of the Clover Valley Road (renamed the Pacific Highway) as far as the US border by 1913, established Clayton's role as a major Surrey transportation hub. This role was further enhanced in 1923 by the paving of the Pacific Highway (176<sup>th</sup> Street as of 1957). The first Crown land grant was granted to John Wesley Pickard in 1883. By 1891, with a population of about 300, Clayton had two churches, at least one paid school teacher, and a train service to New Westminster.

Topographically, Clayton Centre lies on the high ground known as Clayton Hill (above the flats of the Serpentine River to the south and west, and the Nicomekl River to the south and east). Its main industry was farming. Before the end of the First World War, most farming in Surrey was carried out on the Serpentine flood plain; however, returning soldiers could only purchase on higher ground. These new residents practiced poultry farming, as it required less capital investment and land than did other types of farming. Dairy farmers and the growers of feed crops prospered on the "flats" below.

### **Site Location/Context**

The East Clayton district is an approximately 250-hectare (617-acre) area located on the southeastern edge of the larger Clayton district, an approximately 909-hectare (2,250-acre) area on the Surrey/Langley border. Located within one of the Lower Mainland's fastest growing municipalities and in close proximity to several ecologically important areas, Clayton is a diverse planning area with a number of opportunities and constraints. It is bordered by the Agricultural Land Reserve on its north and west sides, by Fraser Highway on its south side, and by the Langley border (196<sup>th</sup> Street) on its east side. The

East Clayton district lies east of 188<sup>th</sup> Street, and south of 72<sup>nd</sup> Avenue to Fraser Highway (see *Figure 2*). Its low net densities, narrow curbsless roads, and expansive views to the surrounding agricultural lowlands give Clayton its distinctive rural character.

Figure 1. Historic Settlement Pattern of Surrey

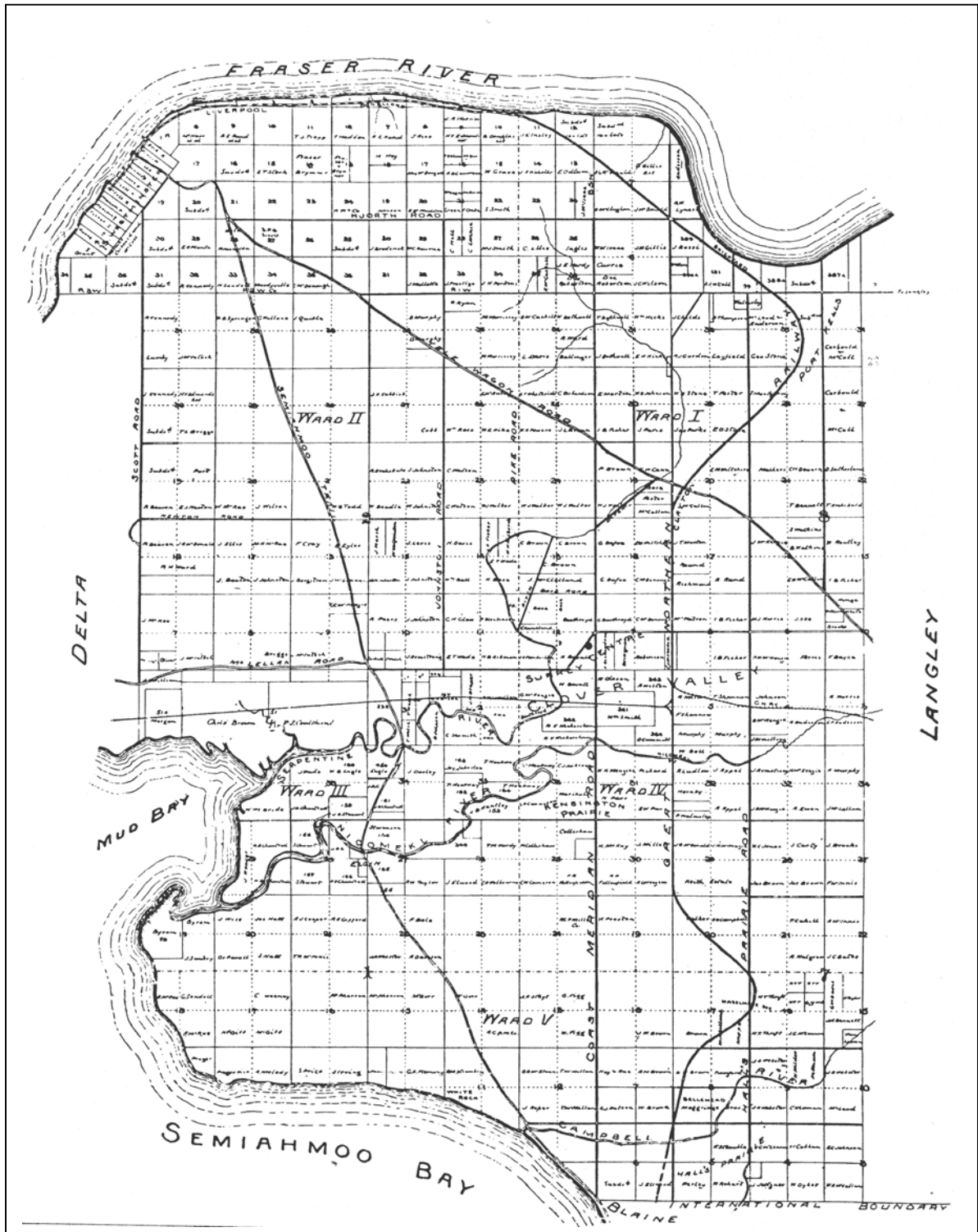
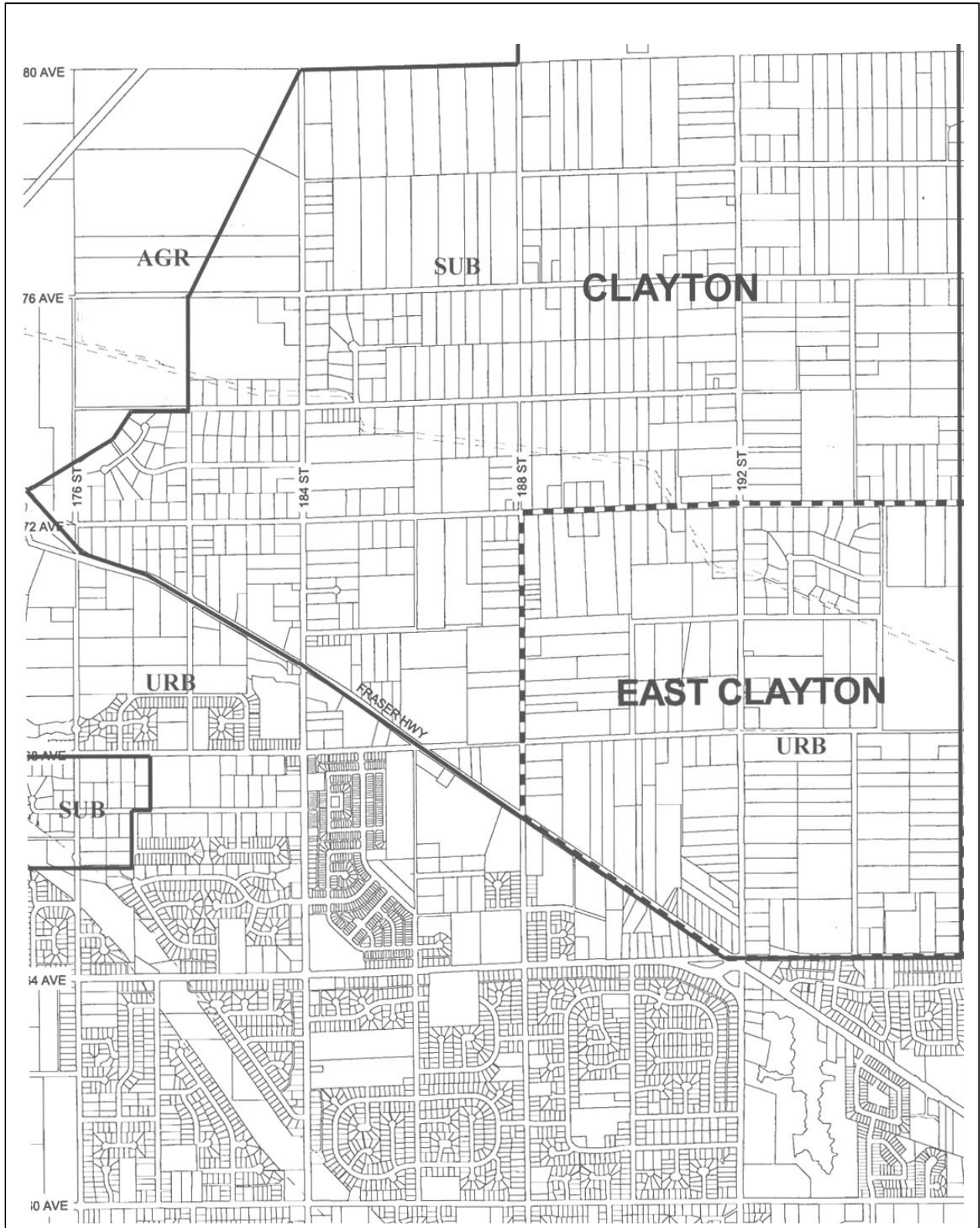


Figure 2. East Clayton Context





## Existing Land Uses

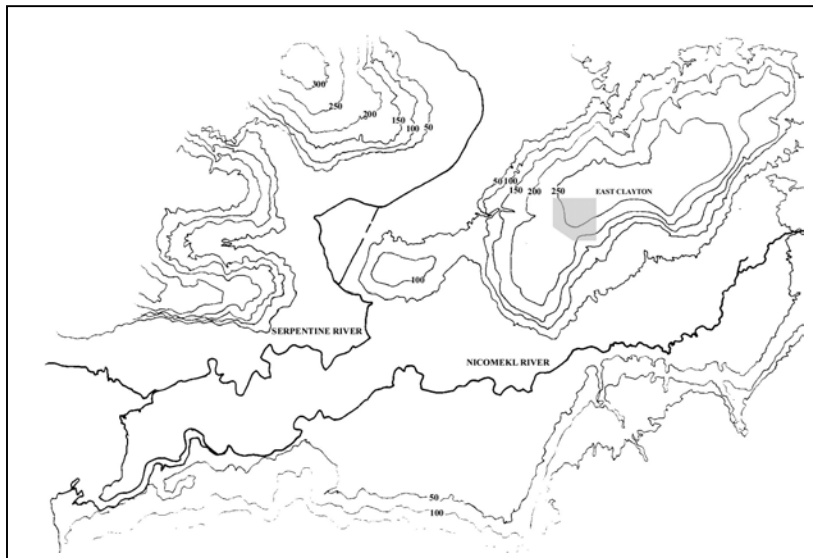
As part of its urban growth concept, the *Official Community Plan* for Surrey designates East Clayton as “Urban,” meaning that it may be provided with the urban infrastructure (i.e., water, sewer, roads) necessary to support urban densities (of at least 6 dwelling units per acre).<sup>2</sup> The remainder of Clayton is identified as “Suburban,” meaning, depending on its location, it may have long term development potential subject to land-use planning with local residents or may be permanently low density (i.e. 2 dwelling units per acre or less). **Figure 3** shows the general land use patterns for Clayton as indicated in the Clayton General Land Use Plan which was approved in principle by City Council in January 1999.

The primary existing land-use in the area covered by the East Clayton NCP is residential and contains 191 individual parcels. Most land is privately owned, and approximately 460 people currently live in the area. The area consists of parcels averaging three-quarters of an acre to 10 acres, with some parcels as large as 60 acres. Subdivision generally conforms to the historical agricultural grid, with the exception of Aloha Estates, a suburban subdivision of one-acre parcels built in the 1980s and located near the southeast corner of 72<sup>nd</sup> Avenue and 192<sup>nd</sup> Street.

Other new development that has occurred over the past 10 to 15 years has been centred around 192<sup>nd</sup> Street and Fraser Highway. Near the study area is a small service station/corner store located at 80<sup>th</sup> Avenue and 192<sup>nd</sup> Street, and a small commercial node at 184<sup>th</sup> Street and the Fraser Highway. There are a number of agricultural activities taking place in Clayton, including rangeland, hay, dairy, and poultry operations. Most of these operations are occurring within the agriculturally zoned land (ALR) to the north and west of Clayton; however some are dispersed within the site.

## Topography

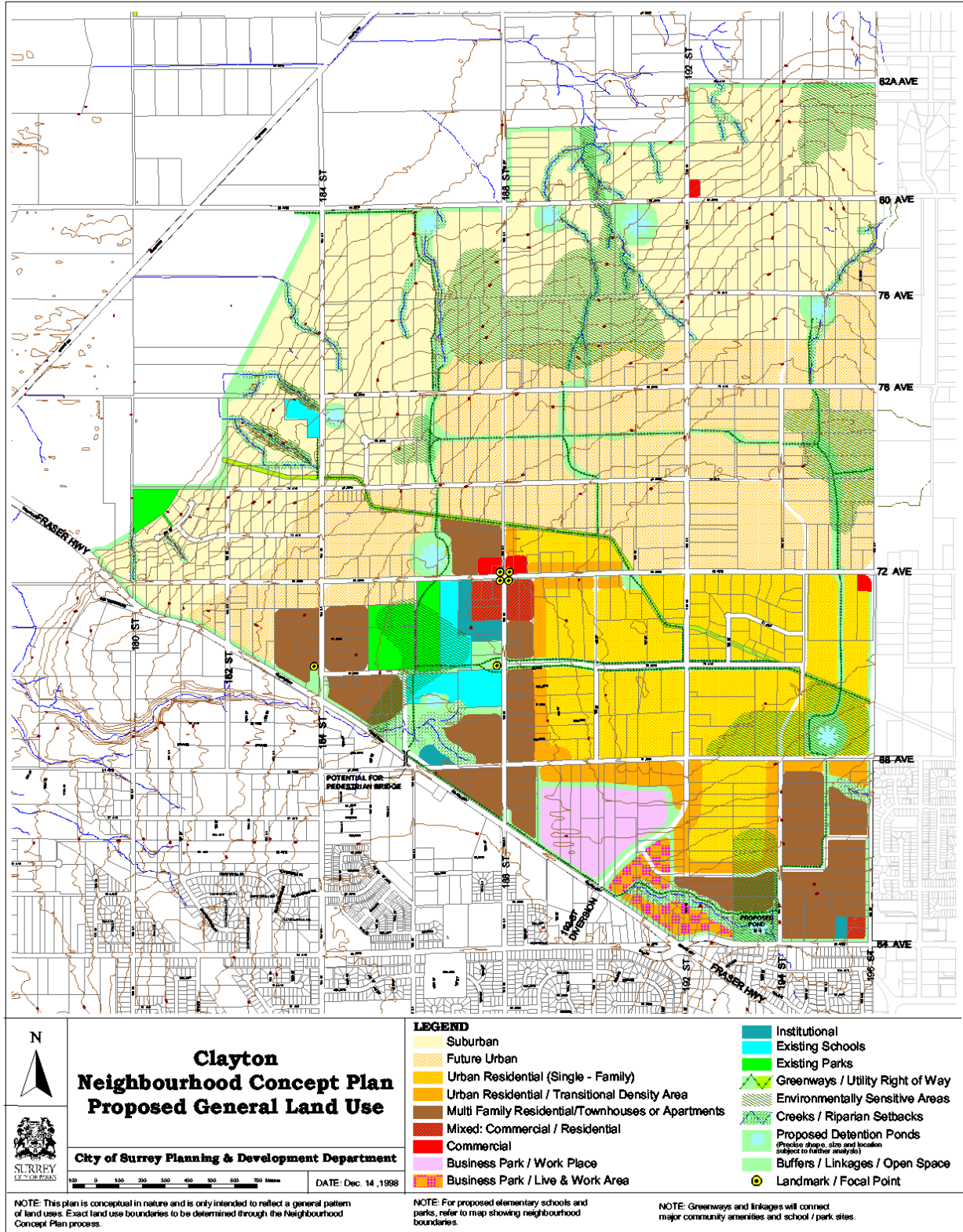
East Clayton is located on a gently sloping upland region at Surrey’s far eastern edge. The area is defined primarily by two distinct ridgelines, the first of which runs approximately parallel to 192<sup>nd</sup> Street, and the second of which crosses the northern portion of the site diagonally. Following these ridge lines, the site drains, generally, in a southerly direction to the Nicomekl



River on the southeast, and in a westerly direction to the Serpentine River on the site’s west (see **Figure 2.4**). Significant slopes on the site range from 6 per cent to 9 per cent, with flat hilltop areas ranging from 0 per cent to 2 per cent. An uncharacteristically steep area, with slopes in excess of 10 per cent, exists along a small portion of the eastern edge of the site (at the Horner Creek headwaters).

Micro-topographical elements include roadside swales and ditches as well as natural drainage channels and ravines (occurring through wooded areas). With the exception of the less than 10 per cent slopes and the southeastern portion of the site, and individual channel and stream banks, no slopes present particularly difficult construction challenges.

Figure 3 Clayton General Land Use Plan





## Vegetation

Clayton is primarily a mixture of fields and relatively young stands of mixed forest. Historically, vegetation conformed to that found in the Coastal Western Hemlock (CWH) biogeoclimatic zone, which covers much of the Lower Mainland region and consists of Western hemlock, Douglas fir, and western red cedar. However, logging activity between 1912 and 1930, together with more recent clearing and suburban development, has resulted in the formation of younger forest blocks dominated by red alder, paper birch, black cottonwood, and big-leaf maple, with conifers occurring as individuals or in small clusters.

The report entitled *Clayton Area Neighbourhood Concept Plan: Environmental Report* (from this point referred to as the Dillon Report), completed by Dillon Consulting Limited and Strix Environmental Consulting, provides a detailed bio-inventory and assessment of the sensitivity and significance of Clayton's terrestrial habitat, using forest blocks and watercourses as the primary study units. In general, most large and small forest blocks are in a relatively early stage of development and are located in the least disturbed portions of the East Clayton area. They are distinguished by their high level of species diversity and large proportions of introduced species as compared with the largest and most established forest blocks located to the north and west of the study area.

The Dillon Report located a number of "highest valued natural areas", designated as requiring priority for protection based on several criteria. These criteria include, but are not limited to: supporting or potentially supporting significant wildlife, plant or fish species; providing nesting, roosting and/or foraging habitats for various raptors; and facilitating groundwater recharge and discharge important or potentially important to downstream aquatic systems. **Figure 2.3**, the Clayton General Land Use Plan, shows areas of environmental sensitivity within the larger Clayton area.

The area to the north of 68<sup>th</sup> Avenue is described as a large forest block and field, and consists of a combination of habitats suitable for nesting and hunting by raptors. Evidence of several species has been observed in this area including Great horned owl, Red-tailed hawk, and Douglas' squirrel.

The area to the north of Fraser Highway is characterized by mixed vegetation including bigleaf maple, Sitka spruce, Douglas fir, western hemlock, and several large black cottonwoods. Wildlife species observed include Red-tailed hawk and eastern cottontail.

## Soils

The subsurface geology in the uplands of east Surrey consists largely of Capilano sediment, which is composed of deposits ranging from moderately coarse-textured glacial till to moderately fine-textured glaciomarine sediments. The primary soil unit is Bose, a soil typically found on the upland areas of the Sunshine Coast, Delta, and Surrey municipalities.<sup>4</sup> Bose is characterized by a sandy loam or gravelly, loamy sand surface texture. This surface texture may be up to 10 centimetres (3.9 inches) thick and is underlain with a deeper, coarser gravelly sand or sandy subsurface. Immediately below this is a more impervious layer, approximately 50 centimetres (19.6 inches) thick, of

glacial till or glaciomarine deposits, which is composed of either red cemented sand or silty clay loam. Undisturbed and uncompacted, the heavy soils of the substrata can normally absorb approximately 1.0 millimetre (.39 inches) of water per hour during winter conditions and approximately 1.0 millimetres to 2.0 millimetres (.39 inches to .8 inches) per hour during summer conditions.

With a low water-holding capacity, extensive agricultural and forestry use are limited. However, with depths of up to 1.5 metres (5 feet), the soil-bearing capacity is able to support moderate urban development, although low subsoil permeability and high water tables limit septic tank use.

## Streams and Hydrology

Positioned on a high point within the larger Fraser River Basin, the uplands of Clayton are separated by the Serpentine Basin to the west, and the Nicomekl Basin to the southeast, each of which drains directly into Boundary Bay to the south. Once covered by forests, peat bogs, and marsh lands, this upper area functioned as a sponge, absorbing a large percentage of runoff and controlling discharge to sensitive aquatic systems. More recent suburbanization and forest clearing along the ridges and high areas has altered the integrity of these systems, resulting in ever lower base flows in upland watercourses, and flooding, erosion, and land wasting along the slopes and in the lower floodplain areas. Within the Serpentine lowlands and the Langley Township, increased flooding, protracted periods of springtime soil saturation caused by storm flow from upland urban areas, and poor water quality are issues of rising public concern.

The hydrological regime for the East Clayton district consists primarily of ditched and piped channels running along roadways and property lines. The sources of natural channel flows in the Clayton area vary from groundwater discharge in forested areas to storm sewers in more developed areas. There are several natural stream channels occurring within this area, many of which have had their source of flow altered due to increased development and conventional stormwater systems. Often, alterations to sources of flows lead to changes in stream hydrology and morphology, resulting in loss of aquatic life, increases in peak flows, and reductions in base flows.

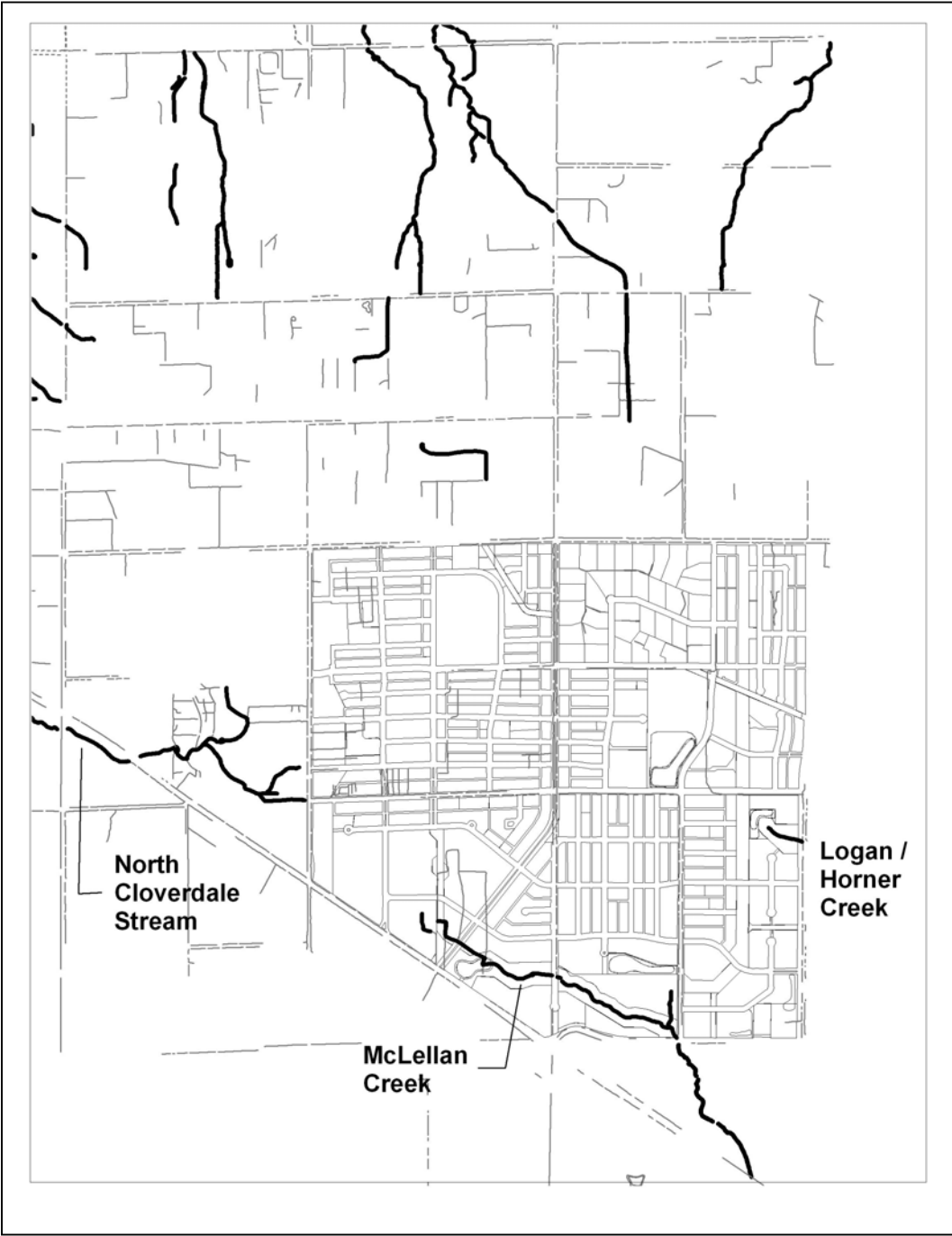
The Dillon Report utilizes Surrey's existing stream classification system in order to identify and rank aquatic habitats according to their sensitivity to physical disturbance. It found that the site's existing drainage network provides the best opportunity for habitat connectivity through the restoration of natural riparian habitat, and identifies three watercourses within the East Clayton area that warrant special consideration. The first is North Cloverdale Creek, which is located on the southern boundary of the study area which drains into the Serpentine Basin. This stream is primarily a channelized, low-gradient ditch of between 0.75 metres (2.5 feet) and 2.0 metres (6.5 feet) in width, and between 1.0 metres (3.3 feet) and 2.0 metres (6.5 feet) in depth and it provides important overwintering habitat for juvenile salmonids. Horner Creek (located to the east of the site above 68<sup>th</sup> Avenue and also referred to as Logan Creek), and McLellan Creek (located just north of Fraser Highway), are of a lower classification and do not currently support young fish, although they do supply significant food/nutrient value to downstream fish populations. **Figure 2.6** show the location of these three water courses in addition to the ditch network.

In addition, the network of roadside ditches and swales running adjacent to roadways and property lines provides, during periods of intermittent flow, for the conveyance of nutrients to more valuable fish habitats downstream as well as habitat areas for terrestrial and avian wildlife. These ditches are also valued for their capacity to enhance the infiltration of runoff into the ground during periods of low flow.

The riparian zones associated with these watercourses are essential components of a healthy aquatic environment, providing food, cover, shade, bank stability, and erosion control. Many of these areas, due to their relatively mature and diverse vegetation and their proximity to water, are also important habitat areas for wildlife. The Ministry of Water, Land and Air Protection (WLAP) Land Development Guidelines require preservation zones (setbacks) of at least 15 horizontal metres (50 ft.) from the top-of-bank of all waterways that support fish habitat. Accordingly, all streams and their riparian setbacks must be permanently protected either through registration of a restrictive covenant, through dedication as park land, or through purchase by the municipality, which shall itself agree to restrict the use of these setbacks to maintain ecological function therein.

Reflecting the recommendations of the Dillon Report for the protection and enhancement of areas of high natural value, the East Clayton NCP recommends that development proceed in ways that balance multiple objectives while ensuring that impacts to existing and expected species are mitigated.

Figure 2.6 Stream Classification Map for Clayton



### TRANSPORTATION BACKGROUND

1. "Clayton. Generalized NCP Transportation Planning Stage I Report: Background Data, Issues, Objectives, Opportunities and Constraints", May 5, 1997, Reid Crowther & Partners Ltd.
2. Technical Memo entitled "Clayton Generalized Neighbourhood Concept Plan: Major Road Network Requirements", December 12, 1997, Reid Crowther & Partners Ltd.
3. Technical Memo entitled "Refinements to Clayton GNCP Road Network", May 14, 1998, Reid Crowther & Partners Ltd.
4. "Clayton Generalized NCP: Engineering Servicing Plan Report", November, 1998, Reid Crowther & Partners Ltd.
5. "East Clayton NCP Sustainable Development: Transportation, Drainage, Water Supply and Sanitary Servicing Issues and Constraints", April, 1999, Reid Crowther & Partners Ltd.
6. "East Clayton NCP Sustainable Development: Transportation and Drainage Servicing Concept Plan", July 27, 1999, Reid Crowther & Partners Ltd.
7. "Clayton Transportation Modeling", October 13, 1999, Reid Crowther & Partners Ltd.



**STREET CHARACTERISTICS AND DESIGN  
CRITERIA**

**APPENDIX IV - EAST CLAYTON  
STREET CHARACTERISTICS AND DESIGN CRITERIA**

STREET CLASS CHARACTERISTICS		ARTERIALS	
		MAJOR: PARKWAY	MAJOR: TYPICAL
CROSS SECTION CODE		A	B
<b>A. SERVICE FUNCTIONS AND CHARACTERISTICS</b>			
<b>A.1</b>	Traffic Volume Ranges	10,000 to 30,000 vpd; peak direction during peak hour from 1,000 to 1,600 vph	10,000 to 30,000 vpd; peak direction during peak hour from 1,000 to 1,600 vph
<b>A.2</b>	Flow Characteristics	uninterrupted two-way flow except at traffic signals, typically spaced no less than 200m apart. Transit stops may require pull-outs subject to posted speed.	uninterrupted two-way flow except at traffic signals. Transit stops may require pull-outs subject to posted speed.
<b>A.3</b>	Access/Intersection Characteristics	mid-block access to local roads typically via right-in/out only in order to maintain continuous median and improved safety & traffic flows. Left turn bays required at most intersections, whether signalized or not. Rear lanes are preferred for property access; however, frontage roads considered in special circumstances. No direct access permitted	limited mid-block access to local roads permitted, left turn bays provided for all full movement intersections. Rear lanes required for property access. No direct access permitted
<b>A.4</b>	Design / Operating Speed	60-70 km/h design speed; operating speed should be 50-60 km/h	60-70 km/h design speed; operating speed should be 50-60 km/h
<b>A.5</b>	Frequent User Types	all user types: passenger vehicles, small and large trucks, transit vehicles, pedestrians, cyclists	all user types: passenger vehicles, small and large trucks, transit vehicles, pedestrians, cyclists
<b>A.5a</b>	Design Vehicle(s) at Intersections	fire trucks, WB-15 and transit vehicle must be able to make all turns without sweeping into opposing lanes of traffic on Arterials or Collectors (on Locals, 1.0m encroachment is permitted for trucks/fire trucks). Transit vehicles and trucks must be able to make turns without encroaching more than 1.0m into lanes of same-direction flow. Fire trucks can encroach fully into lanes of same-direction flow	fire trucks, WB-15 and transit vehicle must be able to make all turns without sweeping into opposing lanes of traffic on Arterials or Collectors (on Locals, 1.0m encroachment is permitted for trucks/fire trucks). Transit vehicles and trucks must be able to make turns without encroaching more than 1.0m into lanes of same-direction flow. Fire trucks can encroach fully into lanes of same-direction flow
<b>A.5b</b>	Design Scenario(s) for Travel Way Width	transit bus (2.6m) or truck (2.6m) passing a car (2.1) travelling in the same direction, and a bicycle (1.0m). Emergency vehicles expected to encroach into same-direction traffic lanes or width for cyclists	transit bus (2.6m) or truck (2.6m) passing a car (2.1) travelling in the same direction, and a bicycle (1.0m). Emergency vehicles expected to encroach into same-direction traffic lanes or width for cyclists
			5,000 vpd-10,000 vpd; peak direction during peak hour from 400 to 800 vph
			interrupted two-way flow, at signalized/stop controlled intersections, transit stops, mid-block pedestrian crossings and when parking maneuvers occur. Transit operations interrupt flow; curb extensions required at bus stops. Major pedestrian zone requires slower operating speeds
			short blocks between 60m and 100m required. No mid-block access to individual properties; rear lanes required. Parallel back access roads/lanes required for adequate circulation and access to rear parking. Left turn bays at Arterial and Major Collector intersections only.
			50 km/h design speed; operating speed design objective is 20-30 km/h to support "pedestrian zone"
			major pedestrian zone, with small trucks, some larger delivery trucks, transit, passenger vehicles and pedestrians. Lower numbers of cyclists due to higher traffic volumes/high parking turnover.
			WB-15 trucks and transit vehicles should be able to physically negotiate turns at intersections, but only at locations where they are regularly expected to be turning. 1.0m encroachment into sidewalk and main line opposing lanes is allowable since travel lanes are wide, but not for transit vehicles. Emergency vehicles/large trucks permitted to mount curbs at intersections (large, curb lei-downs possible).
			transit bus (2.6m) passing a cyclist (1.0m) in one travel lane without encroaching into oncoming traffic. Emergency vehicles expected to encroach into extra width for cyclists. Angle parking also requires wider travel lane for safe backing manoeuvre.

**APPENDIX IV - EAST CLAYTON  
STREET CHARACTERISTICS AND DESIGN CRITERIA**

STREET CLASS CHARACTERISTICS		COLLECTORS	
CROSS SECTION CODE		MAJOR	MINOR: BUSINESS PARK
		City Std. Dwg. SSD R.4	C
<b>A. SERVICE FUNCTIONS AND CHARACTERISTICS</b>			
A.1	Traffic Volume Ranges	2,000 - 5,000 vpd; peak-direction during peak hour from 300 to 600 vph	2,000-5,000 vpd; peak direction during peak hour from 300 to 600 vph
A.2	Flow Characteristics	uninterrupted two-way flow except at traffic signals, stop signs and when parking manoeuvres occur. Transit stops do not require separate pull-outs	uninterrupted two-way flow except at traffic signals and stop signs, and when parking manoeuvres occur (limited). Transit stops do not require separate pull-outs
A.3	Access/Intersection Characteristics	local road access permitted but left turn bays only provided at major intersections. Rear lanes required for property access. Direct access should be limited as much as possible	access to local roads permitted. Left turn bays at major intersections. Well spaced direct property access typically permitted.
A.4	Design / Operating Speed	50 km/h design speed; operating speed design objective is 40 km/h	50 km/h design speed; 40 km/h operating speed
A.5	Frequent User Types	all user types: passenger vehicles, small and large trucks, transit vehicles, pedestrians, cyclists	small and large trucks, passenger vehicles, transit vehicles. Lower number of pedestrians and cyclists expected
A.5a	Design Vehicle(s) at Intersections	fire trucks, WB-15 and transit vehicle must be able to make all turns without sweeping into opposing lanes of traffic on Arterials or Collectors (on Locals, 1.0m encroachment is permitted for trucks/fire trucks). Fire trucks can encroach fully into lanes of same-direction flow.	fire, WB-15 and transit vehicles must be able to make all turns without sweeping into opposing lanes of traffic. No mounting of curbs permitted except for emergency vehicles.
A.5b	Design Scenario(s) for Travel Way Width	transit bus (2.6m) or truck (2.6m) passing an oncoming car (2.1) and cyclist (1.0m) at operating speed with parked car on one side. Emergency vehicles expected to encroach into width provided for cyclists	truck (2.6m) passing a transit vehicle or another truck (2.6m) at operating speed with parked car on one side. Note that travel way width must be carefully designed on curves (possibly widened) to allow for sweeping of truck overhangs. Wide curb lanes for cyclists must be "shared" when two large trucks pass.

**APPENDIX IV - EAST CLAYTON  
STREET CHARACTERISTICS AND DESIGN CRITERIA**

STREET CLASS CHARACTERISTICS	LOCALS			LOCALS
	RESIDENTIAL: TWO-WAY WITH PARKING D / E	RESIDENTIAL: QUEUEING WITH PARKING D & City Std Traditional Dwg's	RESIDENTIAL: QUEUEING WITH PARKING Neo-	COMMERCIAL / BUSINESS PARK City Std. Dwg. SSD R.4
CROSS SECTION CODE				
<b>A. SERVICE FUNCTIONS AND CHARACTERISTICS</b>				
A.1 Traffic Volume Ranges	500-1,000 vpd	200-500 vpd; if ultimate projected volume is higher, then should use Two-Way flow standard or consider mid-block location for passing	1,000 to 4,000 vpd	
A.2 Flow Characteristics	uninterrupted two-way flow except at traffic signals, stop signs and when parking manoeuvres occur. On-street parking encouraged to reduce traffic speeds. Traffic calming measures at least every 100m encouraged - all types appropriate	uninterrupted, queuing operation. Traffic calming measures likely not required, but if they are, all types are appropriate. On-street parking encouraged to reduce speeds	uninterrupted two-way flow except at stop signs and when parking manoeuvres occur. On-street parking provided only where necessary in order to maximize trees canopy, most of parking supply should be on interior lots, screened from street	
A.3 Access/Intersection Characteristics	short blocks less than 100m encouraged, with frequent stops/traffic calming measures to reduce operating speeds. Rear lanes required for property access in most situations. Driveway access allowed in special circumstances but not encouraged because they reduce space for trees, parking and negatively affect the drainage swales.	short blocks less than 100m encouraged, with frequent stops/traffic calming measures to reduce operating speeds. Rear lanes required for property access in most situations. Driveway access allowed in special circumstances but not encouraged because they reduce space for trees, parking and negatively affect the drainage swales.	access points to interior parking lots and their circulation road permitted. Left turn bays not required.	
A.4 Design / Operating Speed	40 km/h design speed, operating speed design objective is 30 km/h	30 km/h design speed, operating speed design objective is 20-30 km/h	40 km/h design speed, operating speed design objective is 30 km/h	
A.5 Frequent User Types	garbage vehicles, cars, cyclists, pedestrians	garbage vehicles, cars, cyclists and pedestrians	small and large trucks, garbage vehicles, cars, cyclists and pedestrians	
A.5a Design Vehicle(s) at Intersections	delivery/garbage vehicles must be able to negotiate intersections with any other road class. Full encroachment into oncoming lanes is allowable at Local/Local intersections but no encroachment permitted at Arterial or Collector intersections. Restriction of parking near intersection may be required to ensure safe manoeuvres and sight distance	delivery/garbage vehicles must be able to negotiate intersections with any other road class. Full encroachment into oncoming lanes is allowable at Local/Local intersections but no encroachment permitted at Arterial or Collector intersections. Restriction of parking near intersection may be required to ensure safe manoeuvres and sight distance	Large trucks must be able to make all turns without encroaching more than 1.0m into opposing lanes of traffic on local road. Emergency vehicles can fully encroach into opposing lanes	
A.5b Design Scenario(s) for Travel Way Width	two cars (2.1m) passing each other slowly with parking one or both sides. Fire trucks expected to encroach into oncoming lanes. Cyclists integrated with traffic	car (2.1m) passing an oncoming cyclist (1.0m) slowly, next to parked cars on both sides. Cyclists integrated with traffic	two large trucks (2.6m) passing one another at operating speed. Cyclists are not expected frequently, but if present, will be integrated with traffic	

**APPENDIX IV - EAST CLAYTON  
STREET CHARACTERISTICS AND DESIGN CRITERIA**

STREET CLASS CHARACTERISTICS		LANES	
		RESIDENTIAL LANE	COMMERCIAL LANE
CROSS SECTION CODE		City Std. Dwg. SSD R.12	City Std. Dwg. SSD R.12
<b>A. SERVICE FUNCTIONS AND CHARACTERISTICS</b>			
A.1	Traffic Volume Ranges	varies depending on residential density and length of lane. Should not exceed 200 vpd in most cases	varies depending on type/intensity of commercial land use, location of parking access, and length of lane. Should probably not exceed 1,000 vpd
A.2	Flow Characteristics	interrupted, queuing operation for all vehicles. Speed humps appropriate for lanes over 100 m long	interrupted, queuing operation for any vehicles larger than small/medium passenger cars. Speed humps in commercial lanes appropriate if speeds become too high
A.3	Access/Intersection Characteristics	frequent access to rear, residential garages permitted	access to rear parking lots of commercial street frontage and rear garages of adjacent residential or live/work permitted
A.4	Design / Operating Speed	20 km/h design speed, operating speed design objective is 10-20 km/h	20-20 km/h design speed, operating speed design objective is 10-20 km/h
A.5	Frequent User Types	garbage vehicles and passenger cars	delivery trucks, garbage vehicles and passenger cars
A.5a	Design Vehicle(s) at Intersections	delivery/garbage vehicles must be able to negotiate intersections with any other road class. Full encroachment into oncoming lanes is allowable at Local intersections but no encroachment permitted at Arterial or Collector intersections. Restriction of parking in rear lane near intersection may be required to ensure safe manoeuvres and sight distance	delivery/garbage vehicles must be able to negotiate intersections with any other road class. Full encroachment into oncoming lane is allowable at Local intersections but no encroachment permitted at Arterial or Collector intersections. Restriction of parking in rear lane near intersection may be required to ensure safe manoeuvres and sight distance
A.5b	Design Scenario(s) for Travel Way Width	truck (2.6m) slowly passing a parked car (which is partly pulled over onto lane "shoulder")	two passenger cars (2.1m) passing each other slowly opposite a parked car, or truck (2.6m) passing a parked car slowly.

**APPENDIX IV - EAST CLAYTON  
STREET CHARACTERISTICS AND DESIGN CRITERIA**

STREET CLASS CHARACTERISTICS		ARTERIALS	
		MAJOR: PARKWAY	MAJOR: TYPICAL
CROSS SECTION CODE		A	B
<b>B. CROSS SECTION ELEMENTS</b>			
<b>B.1 Roadway Features</b>			
B.1.1.	travel lanes	In Ultimate configuration: two 3.3m inside lanes with two 4.3m outside lanes to allow for left turn bays. At intersections, 3.2m wide cyclists, 3.2m wide left turn bays.	one travel lane in each direction of 4.3m. Left turn bays of 3.2m only at major intersections, developed by prohibiting parking.
B.1.2.	parking bays/lanes	parking is not permitted on 4 lane Ultimate Parkways; parking may be permitted with 2 lane Interim configuration, with 2.5m parking lane as noted above.	2 continuous 45 degree angle 5.7m parking bays, with curb extension at intersections, mid-block crossings and transit stops
B.1.3	median width	3.8m (0.6m with 3.2m left turn lanes at intersections)	painted 3.8 m wide median developed at major intersections (0.6m wide where left turn lane introduced)
B.1.4	total paved width	19m	varies 8.6m to 20m, depending on presence of angled parking
<b>B.2 Boulevard Features</b>			
B.2.1.	curb type (if present)	barrier curbs at road edge and at median	barrier curbs at road edge
B.2.2	sidewalks	2 concrete 1.5m wide sidewalks located outside of tree corridor. (when a Greenway coincides with Riparian Zone, 3.0m multi-use pathway is included within Riparian Zone and one 1.5m concrete sidewalk can be eliminated)	2 concrete 2.0m sidewalks located next to property line; it is recommended that an additional 1.0m width be included within the building set-back. Alternative pavement materials can be used, but there must be at least 2.0m clear of brushed concrete for wheelchair users
B.2.3	sidewalk/boulevard drainage	2% slope to curb and gutter	2% slope to curb and gutter
B.2.4	drainage swale/infiltration pit (if present)	5.0m wide grass swale in each boulevard for street run-off	n/a
B.2.5	street trees/landscaping	5.0m wide swale/street tree corridors on boulevards allows for medium trees which should be spaced 10-12m to achieve good canopy and traffic calming effect. Median of 3.8m allows for small and medium trees.	2.0m corridor for small street trees in grates on both sides. Automatic watering system may be required. Spacing should be 8-10m. Additional street trees/landscaping possible in curb extensions at intersections, mid-block crossings, transit stops.
B.2.6	total boulevard width (one side)	varies 6.5m to 8.5m	varies 4.0-9.7m, depending on presence of angle parking
<b>B.3. Utilities</b>			
<b>B.3.1 Location of Underground features</b>			
B.3.1.1	Storm Sewers (if present)	Runoff must be directed to wet ponds	minor storm water system under road pavement to deal with boulevard and street runoff. Runoff must be directed to wet ponds
B.3.1.2	Sanitary Sewer line	under road pavement	under road pavement
B.3.1.3	Water line	under road pavement	under road pavement
B.3.1.4	Hydro/Tel/Cable lines	under sidewalk (may be overhead on Arterials)	overhead in Commercial lane at rear of Mainstreet buildings
B.3.1.5	Gas line	under boulevard, at edge of sidewalk	under sidewalk
B.3.1.6	Street Light Lines	in street tree corridor or under sidewalk	under sidewalk
<b>B.3.2 Location of Surface features</b>			
B.3.2.1	Hydro transformers, etc.	in street tree corridor or overhead on poles	overhead in Commercial lane at rear of Mainstreet buildings
B.3.2.2	Fire hydrants	in street tree corridor but offset from curb at least 0.8m	in street tree corridor but offset from curb at least 0.8m
B.3.2.3	Street Light Poles	in street tree corridor but offset from curb at least 0.8m	in street tree corridor but offset from curb at least 0.8m
B.4.	Total Road Allowance Width	34.0m	28.0m
		27.0m (30.0m for 196 St 64 Ave to 68 Ave)	

**APPENDIX IV - EAST CLAYTON  
STREET CHARACTERISTICS AND DESIGN CRITERIA**

STREET CLASS CHARACTERISTICS		COLLECTORS	
CROSS SECTION CODE		MAJOR	MINOR: BUSINESS PARK
City Std. Dwg. SSD R.4			C
<b>B. CROSS SECTION ELEMENTS</b>			
<b>B.1 Roadway Features</b>			
B.1.1.	travel lanes	one 3.35m travel lane in each direction with 1.5m bicycle lanes	one 4.85m shared travel lane in each direction
B.1.2.	parking bays/lanes	parking one side only is permitted in parking pockets; parking pocket locations to be as per Figure 7.2.3	one side limited parking pockets. Parking bays should be implemented next to "Live/Work" area only.
B.1.3	median width	Only 0.6 m wide on 188 Street south of 68 Ave	Only at key entry points (3.0 m wide)
B.1.4	total paved width	12.2m (between intersections; could be less at "pinched" intersection locations)	12.2m (between intersections; could be less at "pinched" intersection locations)
<b>B.2 Boulevard Features</b>			
B.2.1.	curb type (if present)	barrier curb	barrier curb
B.2.2	sidewalks	2 concrete 1.5m wide sidewalks located outside of tree corridor	2 concrete 1.5m wide sidewalks located outside tree corridor
B.2.3	sidewalk/boulevard drainage	2% slope to curb and gutter	2% slope to curb and gutter
B.2.4	drainage swale/infiltration pit (if present)	n/a	n/a
B.2.5	street trees/landscaping	two street tree corridors 2.0m wide on boulevards. Which allows small trees only, spaced 8-10m apart.	two street tree corridors 2.0m wide on boulevards. Which allows small trees only, spaced 8-10m apart.
B.2.6	total boulevard width (one side)	4.9m	4.9m
<b>B.3. Utilities</b>			
<b>B.3.1 Location of Underground features</b>			
B.3.1.1	Storm Sewers (if present)	minor storm water system under road pavement to deal with boulevard and street runoff. Runoff must be directed to wet ponds	minor storm water system under road pavement to deal with boulevard and street runoff. Runoff must be directed to wet ponds
B.3.1.2	Sanitary Sewer line	under road pavement	under road pavement
B.3.1.3	Water line	under road pavement	under road pavement
B.3.1.4	Hydro/Tel/Cable lines	under sidewalk	under sidewalk
B.3.1.5	Gas line	under boulevard, at edge of sidewalk	under boulevard, at edge of sidewalk
B.3.1.6	Street Light Lines	in street tree corridor or under sidewalk	in street tree corridor or under sidewalk
<b>B.3.2 Location of Surface features</b>			
B.3.2.1	Hydro transformers, etc.	in street tree corridor	in street tree corridor
B.3.2.2	Fire hydrants	in street tree corridor but offset from curb at least 0.8m	in street tree corridor but offset from curb at least 0.8m
B.3.2.3	Street Light Poles	in street tree corridor but offset from curb at least 0.8m	in street tree corridor but offset from curb at least 0.8m
B.4.	Total Road Allowance Width	22.0m	22.0m

**APPENDIX IV - EAST CLAYTON  
STREET CHARACTERISTICS AND DESIGN CRITERIA**

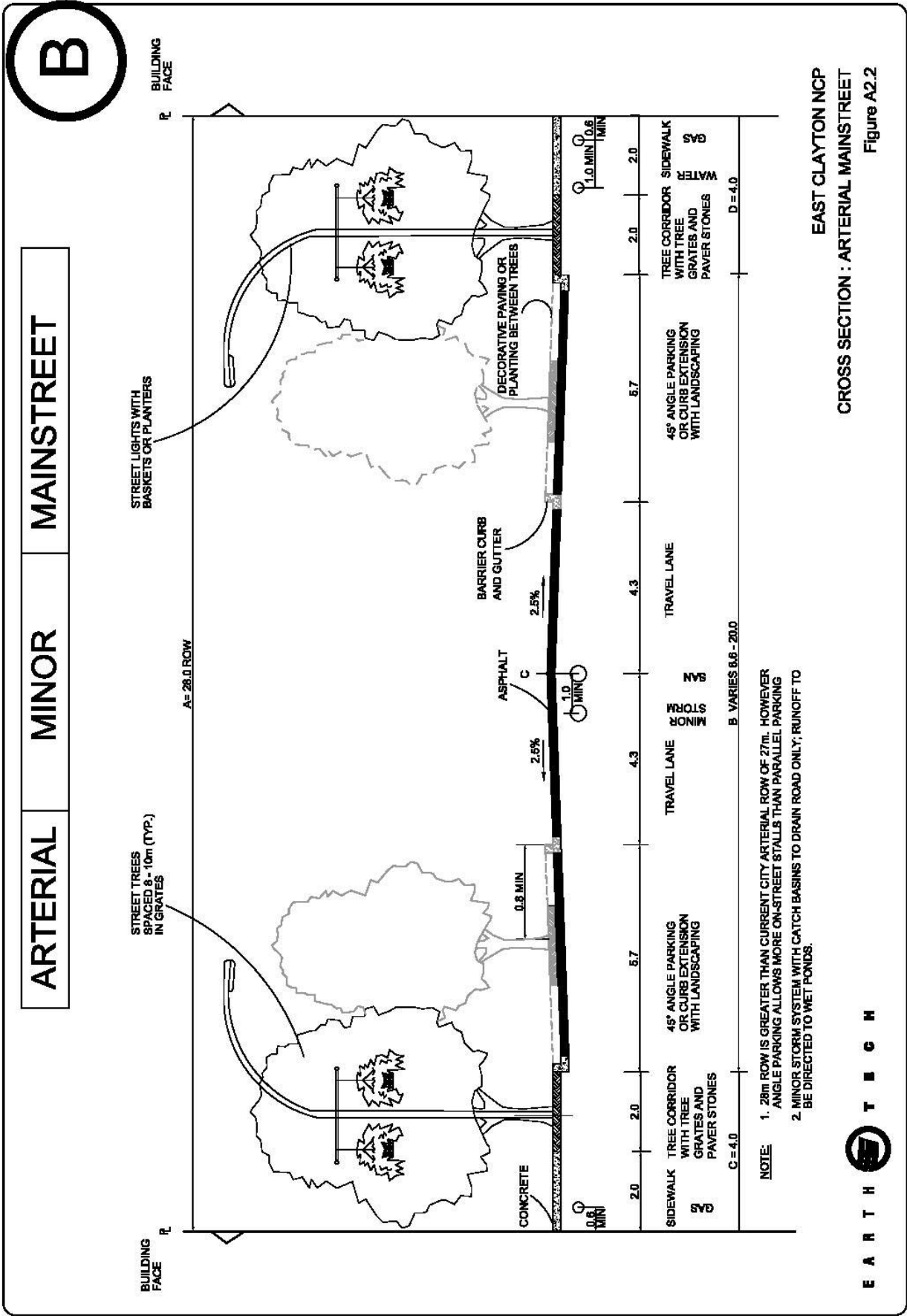
STREET CLASS CHARACTERISTICS		LOCALS			LOCALS	
		RESIDENTIAL: TWO-WAY WITH PARKING	RESIDENTIAL: QUEUEING WITH PARKING	COMMERCIAL / BUSINESS PARK	D & City Std	Neo-Traditional Dwg's
CROSS SECTION CODE		D / E				
<b>B. CROSS SECTION ELEMENTS</b>						
<b>B.1 Roadway Features</b>						
B.1.1.	travel lanes	two travel lanes of 3.0m	1 shared travel lane of 4.0m (3.0m for limited local)	two shared travel lanes of 4.375m each		
B.1.2.	parking bays/lanes	one or two continuous parking lanes of 2.25m	two continuous parking lanes of 2.25m	limited parking bays of 2.25m permitted within street tree corridor on one side		
B.1.3	median width	Only at key entry points (3.0 m wide)	none	none		
B.1.4	total paved width	8.5 - 10.5m	8.5m (8.0m for limited local)	11.0m		
<b>B.2 Boulevard Features</b>						
B.2.1.	curb type (if present)	barrier curb	barrier curb	barrier curb		
B.2.2	sidewalks	2 concrete 1.5m wide sidewalks located outside of tree corridor	2 concrete 1.5m wide sidewalks located outside of tree corridor	2 concrete 1.5m wide sidewalks located outside of tree corridor		
B.2.3	sidewalk/boulevard drainage	2% slope to drainage swale/infiltration pit	2% slope to drainage swale/infiltration pit	2% slope to curb and gutter		
B.2.4	drainage swale/infiltration pit (if present)	one or two 3.25m swale/infiltration pit.	one or two 3.25m swale/infiltration pit.	n/a		
B.2.5	street trees/landscaping	3.25m street tree corridor for small to medium trees on side without swale (if applicable). With swale, street tree type/size/spacing will be dependent of swale/infiltration design. Perforations in infiltration pipe discontinued adjacent to tree to avoid saturated soil conditions	3.25m street tree corridor for small to medium trees on side without swale (if applicable). With swale, street tree type/size/spacing will be dependent of swale/infiltration design. Perforations in infiltration pipe discontinued adjacent to tree to avoid saturated soil conditions	4.25m corridor for street trees/ shared with parking pockets one side, 2.0m other side		
B.2.6	total boulevard width (one side)	4.75m	4.75m	4.5m (excluding parking pocket area)		
<b>B.3. Utilities</b>						
<b>B.3.1 Location of Underground features</b>						
B.3.1.1	Storm Sewers (if present)	n/a	n/a	minor storm water system under road pavement to direct water to bio-filtration stream/ponds in business park		
B.3.1.2	Sanitary Sewer line	under road pavement	under road pavement	under road pavement		
B.3.1.3	Water line	under road pavement	under road pavement	under road pavement		
B.3.1.4	Hydro/Tel/Cable lines	under sidewalk	under sidewalk	under sidewalk		
B.3.1.5	Gas line	under boulevard, at edge of sidewalk	under boulevard, at edge of sidewalk	under boulevard, at edge of sidewalk		
B.3.1.6	Street Light Lines	in street tree corridor or under sidewalk	in street tree corridor or under sidewalk	in street tree corridor or under sidewalk		
<b>B.3.2 Location of Surface features</b>						
B.3.2.1	Hydro transformers, etc.	in street tree corridor	in street tree corridor	in street tree corridor		
B.3.2.2	Fire hydrants	in street tree corridor but offset from curb at least 0.8m	in street tree corridor but offset from curb at least 0.8m	in street tree corridor but offset from curb at least 0.8m		
B.3.2.3	Street Light Poles	in street tree corridor but offset from curb at least 0.8m	in street tree corridor but offset from curb at least 0.8m	in street tree corridor but offset from curb at least 0.8m		
B.4.	Total Road Allowance Width	20.0m (22m for 70 Avenue)	18.0m (17.0m for limited local)	20.0m		



**APPENDIX IV - EAST CLAYTON  
STREET CHARACTERISTICS AND DESIGN CRITERIA**

STREET CLASS CHARACTERISTICS		LANES	
		RESIDENTIAL LANE	COMMERCIAL LANE
CROSS SECTION CODE		City Std. Dwg. SSD R.12	City Std. Dwg. SSD R.12
<b>B. CROSS SECTION ELEMENTS</b>			
B.1	Roadway Features		
B.1.1	Travel lanes	one shared travel lane of 5.4m	two travel lanes of 3.7m each
B.1.2	parking bays/lanes	none	none
B.1.3	median width	none	none
B.1.4	total paved width	5.4m	7.4m
B.2	Boulevard Features		
B.2.1	curb type (if present)	roll over curbs	rollover curbs
B.2.2	sidewalks	n/a	n/a
B.2.3	sidewalk/boulevard drainage	n/a	n/a
B.2.4	drainage swale/infiltration pit (if present)	n/a	n/a
B.2.5	street trees/landscaping	n/a	n/a
B.2.6	total boulevard width (one side)	0	0
B.3	Utilities		
B.3.1	Location of Underground features		
B.3.1.1	Storm Sewers (if present)	minor storm water system under road pavement to deal with street runoff. Runoff must be directed to wet ponds	minor storm water system under road pavement to deal with street runoff. Runoff must be directed to wet ponds
B.3.1.2	Sanitary Sewer line	n/a	n/a
B.3.1.3	Water line	n/a	n/a
B.3.1.4	Hydro/Tel/Cable lines	n/a	overhead on poles
B.3.1.5	Gas line	n/a	n/a
B.3.1.6	Street Light Lines	n/a	street lighting provided in Commercial lanes on hydro poles
B.3.2	Location of Surface features		
B.3.2.1	Hydro transformers, etc.	n/a	overhead on poles
B.3.2.2	Fire hydrants	n/a	n/a
B.3.2.3	Street Light Poles	n/a	street lighting provided in Commercial lanes on hydro poles
B.4	Total Road Allowance Width	6.0m	8.0m

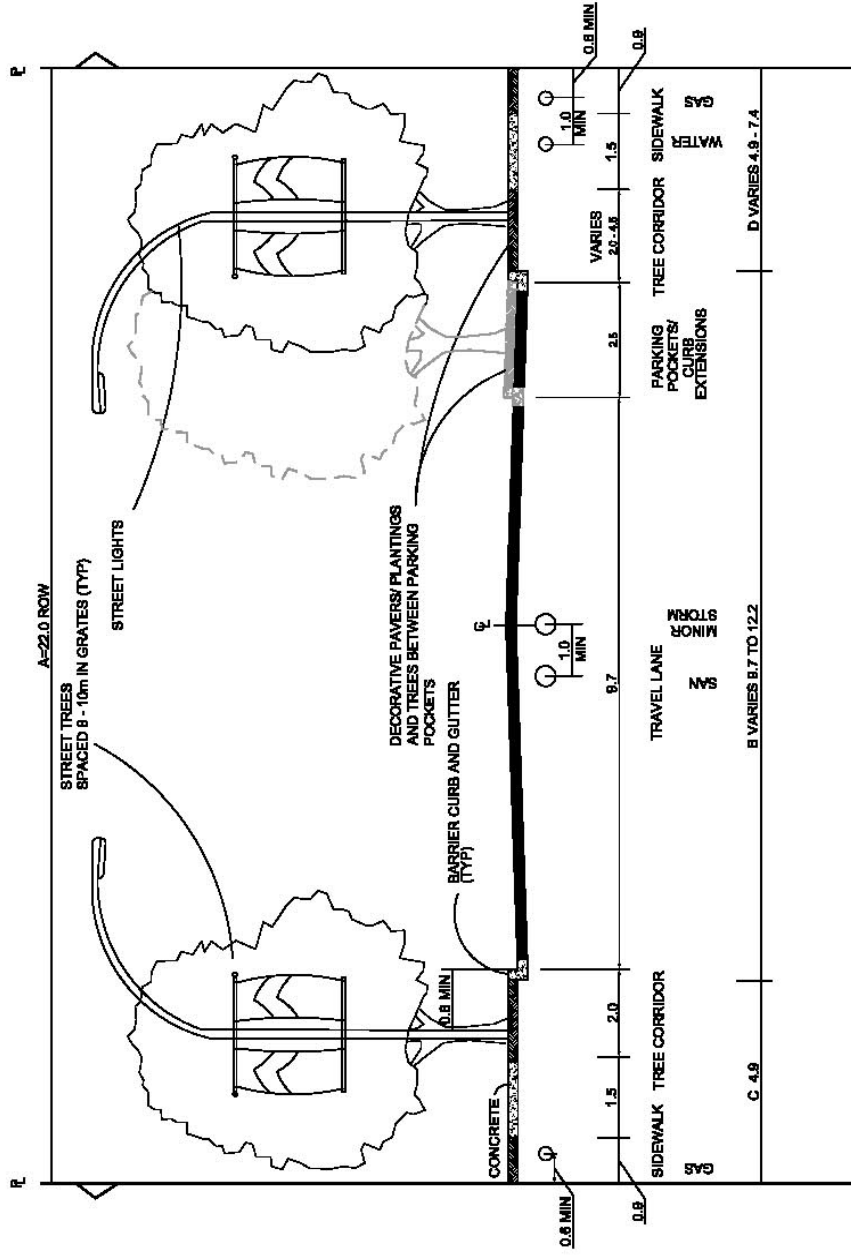




COLLECTOR

MINOR

BUSINESS PARK



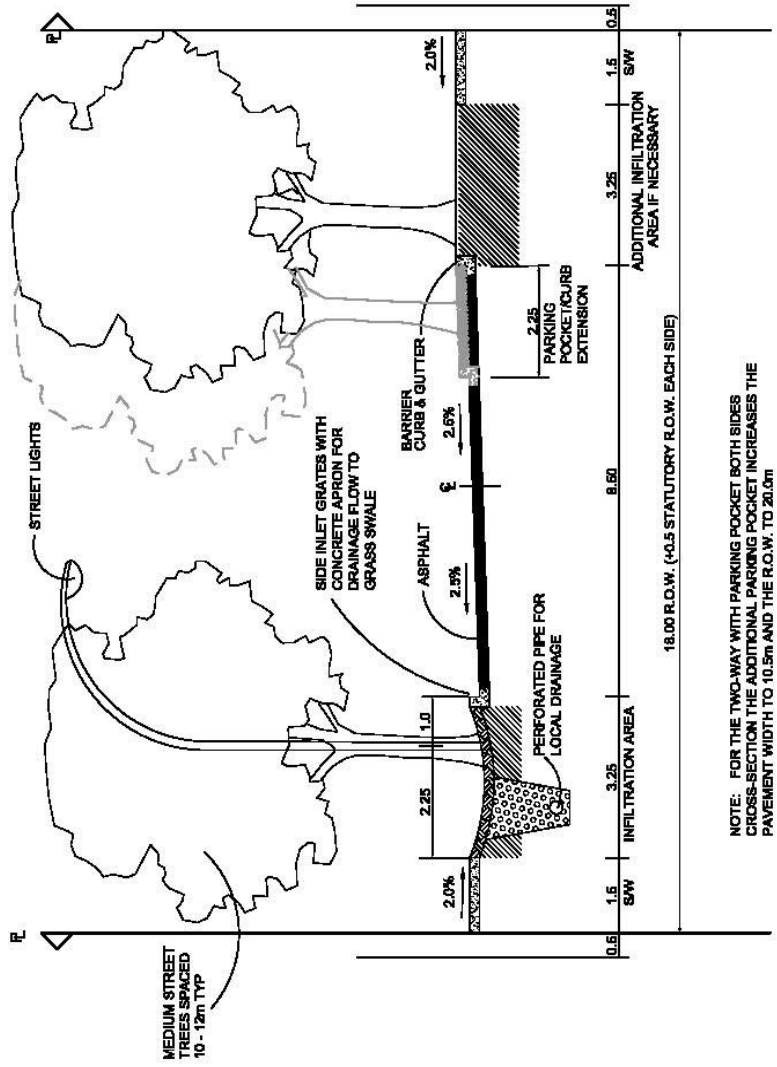
NOTE: 1. MINOR STORM SYSTEM WITH CATCH BASINS TO DRAIN ROAD ONLY; RUNOFF TO BE DIRECTED TO WET PONDS.

EAST CLAYTON NCP  
 CROSS SECTION : BUSINESS PARK COLLECTOR  
 Figure A2.3



D

LOCAL	RESIDENTIAL	TWO WAY QUEUEING
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NOTE: FOR THE TWO-WAY WITH PARKING POCKET BOTH SIDES CROSS-SECTION THE ADDITIONAL PARKING POCKET INCREASES THE PAVEMENT WIDTH TO 10.5m AND THE R.O.W. TO 20.0m

EAST CLAYTON NCP  
CROSS SECTIONS : RESIDENTIAL LOCALS  
Figure A2.4





## **APPENDIX V**

# **TRAFFIC CALMING**

## Appendix V

### APPROPRIATE APPLICATION OF TRAFFIC CALMING MEASURES

TYPE	MEASURE	APPROPRIATE APPLICATION			
		LOCAL ROADS	MINOR COLLECTOR ROADS	MAJOR COLLECTOR ROADS	ARTERIAL ROADS
<b>VERTICAL SHIFT (Primary Measures)</b>					
	Raised Crosswalk	✓			
	Plateaus or Raised Intersections	✓			
	Rumble Strips	✓	✓		
	Sidewalk Extension	✓	✓ <sup>(1)</sup>		
	Speed Humps / Cushions	✓			
<b>HORIZONTAL SHIFT (Primary Measures)</b>					
	Chicane	✓			
	Curb Extension	✓	✓	✓	
	Curb Radius Reduction	✓	✓ <sup>(2)</sup>		
	On-Street Parking	✓	✓	✓	
	Raised Median Island	✓	✓	✓	✓
	Traffic Circle	✓			
	Roundabout		✓	✓	✓
<b>OBSTRUCTION (Primary Measures)</b>					
	Directional Closure	✓			
	Diverter	✓	✓		
	Full Closure	✓			
	Raised Intersection Channelization	✓	✓	✓	✓
	Raised Median Through Intersection	✓	✓		
	Right-in/out Island	✓			



TYPE	MEASURE	APPROPRIATE APPLICATION			
		LOCAL ROADS	MINOR COLLECTOR ROADS	MAJOR COLLECTOR ROADS	ARTERIAL ROADS
<b>SIGNING (Secondary Measures)</b>					
	Maximum Speed Sign	✓	✓		
	Right/Left Turn Prohibition Sign	✓	✓	✓	✓
	One-Way Sign	✓			
	Stop Sign	✓	✓ <sup>(3)</sup>		
	Through Traffic Prohibited Sign	✓			
	Traffic-Calmed Neighbourhood Sign	✓	✓		
	Yield Sign	✓			
<b>PAVEMENT TREATMENT (Secondary Measures)</b>					
	Special Surfaces (colours, textures)	✓	✓	✓ <sup>(4)</sup>	✓ <sup>(4)</sup>
	Road Markings	✓	✓	✓	✓
<b>SUPPORTING ENVIRONMENTAL FEATURES (Secondary Measures)</b>					
	Landscaping	✓	✓	✓	✓
	Entrance Details	✓	✓		

**Notes:**

The information contained in this table is based upon research and engineering judgment of Reid Crowther & Partners Ltd. and does not represent City of Surrey policy, or the policies of any other jurisdiction/industry publication.

- (1) appropriate only if sidewalk extension is flush with road surface, i.e., not on a raised platform or flat-top hump
- (2) must be individually reviewed to ensure larger vehicles on major collectors can perform turning maneuvers without sweeping into opposing lanes on Major Collector
- (3) subject to traffic analysis
- (4) appropriate in boulevard or sidewalk crossings only