

NORTH CLOVERDALE EAST

***NEIGHBOURHOOD
CONCEPT PLAN***

PLANNING
&

DEVELOPMENT DEPARTMENT
CITY OF SURREY



SURREY
CITY OF PARKS

NORTH CLOVERDALE EAST

***NEIGHBOURHOOD
CONCEPT PLAN***

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**NORTH CLOVERDALE
NEIGHBOURHOOD CONCEPT PLAN
EAST NEIGHBOURHOOD**

NORTH CLOVERDALE NEIGHBOURHOOD CONCEPT PLAN

August 29, 1994

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ACKNOWLEDGEMENTS

This Neighbourhood Concept Plan was prepared by Hunter Laird Engineering Ltd. for the North Cloverdale East Neighbourhood Steering Committee. Many people, private citizens, have contributed to the preparation of this Study. They are acknowledged for their contributions.

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**THIS NEIGHBOURHOOD CONCEPT PLAN (NCP)
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**NORTH CLOVERDALE
NEIGHBOURHOOD CONCEPT PLAN
EAST NEIGHBOURHOOD**

**SECTION I
LAND USE PLAN
AND SUBDIVISION CONCEPT**

EXECUTIVE SUMMARY

The East Neighbourhood of North Cloverdale is a triangle of holding properties bounded by the Fraser Highway on the north-east, 64th Avenue on the south and 184th Street on the west.

This Neighbourhood Concept Plan has been prepared for the East Neighbourhood to provide a detailed land use and subdivision base plan to use in evaluating rezoning and subdivision applications. It was developed through a process involving three public meetings, sessions with individual landowners, meetings with City staff and input from relevant government agencies. It outlines the type, size and location of the various land uses, the pattern of subdivision, the vehicular and pedestrian circulation, the location of neighbourhood facilities, the treatment of the ravine and trees, and guidelines for the development of the neighbourhood. For reference, the Appendix contains the North Cloverdale Local Area Plan as approved by Council.

The Land Use Plan provides for a combined elementary school and neighbourhood park, together with a Neighbourhood House as the focus of the neighbourhood. Townhouses, cluster housing and detached small lot housing are located around the school/park site and linking pathways will facilitate walking. Townhouses and cluster housing are also located along the Fraser Highway to enable a buffer to be created. The remainder of the neighbourhood will be developed with conventional detached single family housing. Private sector daycare facilities will be strongly encouraged to be located on non-cul-de-sac lots near to the park. It is estimated that the development of the East Neighbourhood will result in the construction of 383 standard single family houses, 230 traditional small lot houses, and up to 885 units of townhouses and cluster housing, and will generate a population of approximately 4,307.

In order to ensure that enough family-oriented housing is developed to support the construction of the elementary school, it is recommended that the City of Surrey encourage family-oriented designs for the townhouse and cluster housing projects, particularly those near the school site, and that the City also monitor the ratio of family units to non-family units to ensure that at least 50% of the total number of townhouse and cluster housing units are family-oriented.

In response to the public's opposition to the local convenience use, and an application for a similar use being processed for land on the north west corner of 184th Street and 64 Avenue in the West Neighbourhood, no provision has been made for local convenience within the Phase I East Neighbourhood (as is indicated in the Local Area Plan). Upon further review, the Parks and Recreation Department have determined that the small "parkette" north of the Firehall is not required and all parkland needs for this neighbourhood will be provided at the combined School Park Site.

The Plan is generally consistent with the intent and objectives of the Official Community Plan and the Local Area Plan. The benefits include a strong focus of educational and recreational facilities, a variety of both detached and attached housing, a road pattern that provides good access without encouraging undue through traffic, and a walkway system for pedestrians, cyclists and skaters that encourages exercise, social interaction and the use of transit.

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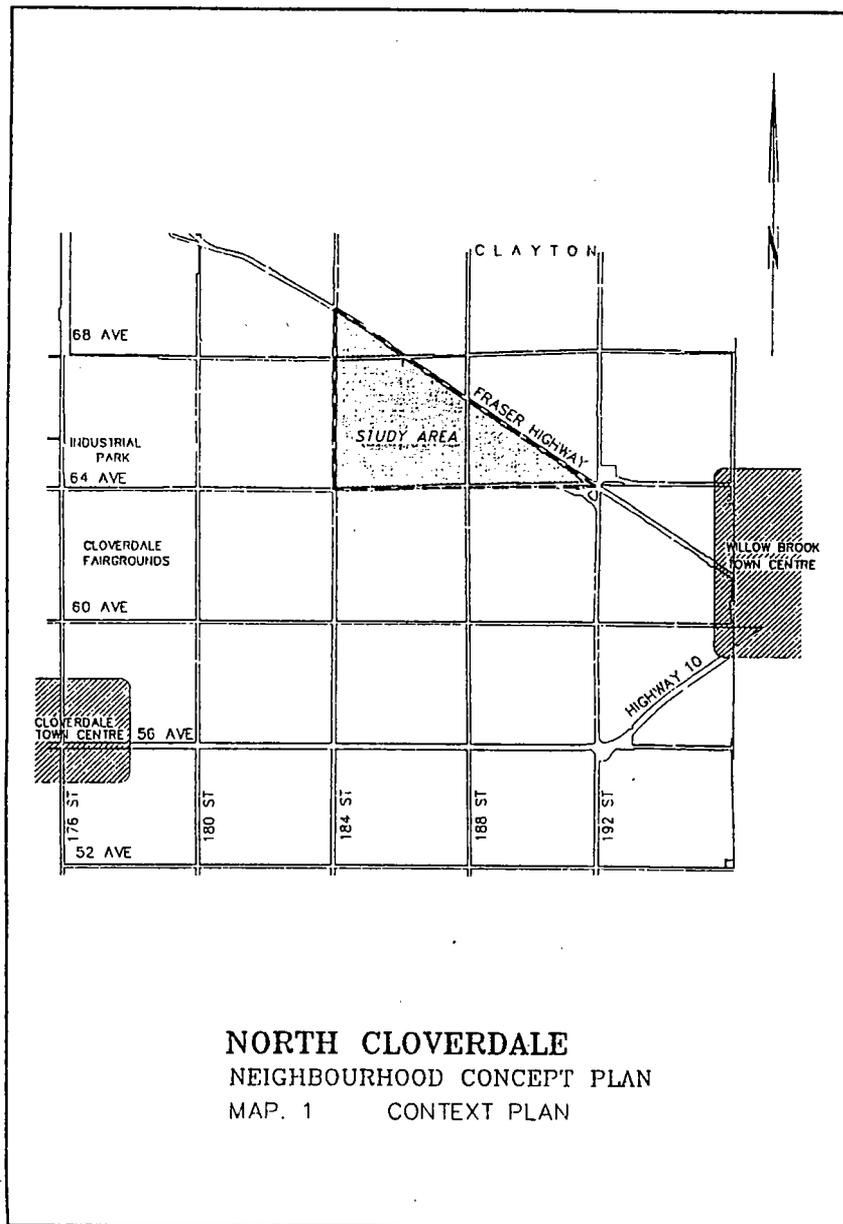
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1.0 INTRODUCTION

1.1 Location

The East Neighbourhood of North Cloverdale is the first phase of two urban neighbourhoods proposed for development in the North Cloverdale Local Area Plan which was adopted by Council in 1993. It is a 192 acre triangle of suburban holding properties situated on the north edge of East Cloverdale's new urban neighbourhood. It is bounded by three major arterial roads; Fraser Highway on the north-east, 64th Avenue on the south and 184th Street on the west.



1.2 Purpose

The purpose of this Neighbourhood Concept Plan is to implement Phase I of the North Cloverdale Local Area Plan, approved by Surrey City Council in 1993. The Plan provides a detailed land use and subdivision base plan to use in evaluating rezoning and subdivision applications in the neighbourhood. It identifies land uses by the type, size and location, designates the transportation network, local neighbourhood facilities, and will ultimately schedule the provision of services and demonstrate how community facilities are to be provided.

The Plan responds to the request by a significant number of landowners to change the use of their property to urban residential uses. It has been prepared through a process which included three public meetings with the residents, sessions with individual landowners, meetings with City of Surrey staff and input from relevant government agencies involved in the land development approval process. Every effort has been made to make this Neighbourhood Concept Plan consistent with the intent and objectives of the Official Community Plan and the North Cloverdale Local Area Plan. Additional components will address in detail the servicing issues and financial implications of development of the triangle for urban uses.

2.0 PHYSICAL FEATURES

2.1 Topography

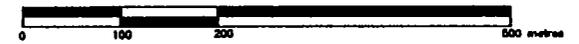
From a high point along 64th Avenue near 188th Street, the land slopes away to the west, north and east. The slope is very gentle with an average range at between 3-5 percent. A ravine and creek located next to the Fraser Highway and 184th Street intersection flows westward through the west neighbourhood, ultimately draining into the Serpentine River.

**NORTH CLOVERDALE
NEIGHBOURHOOD CONCEPT PLAN
TOPOGRAPHIC PLAN**

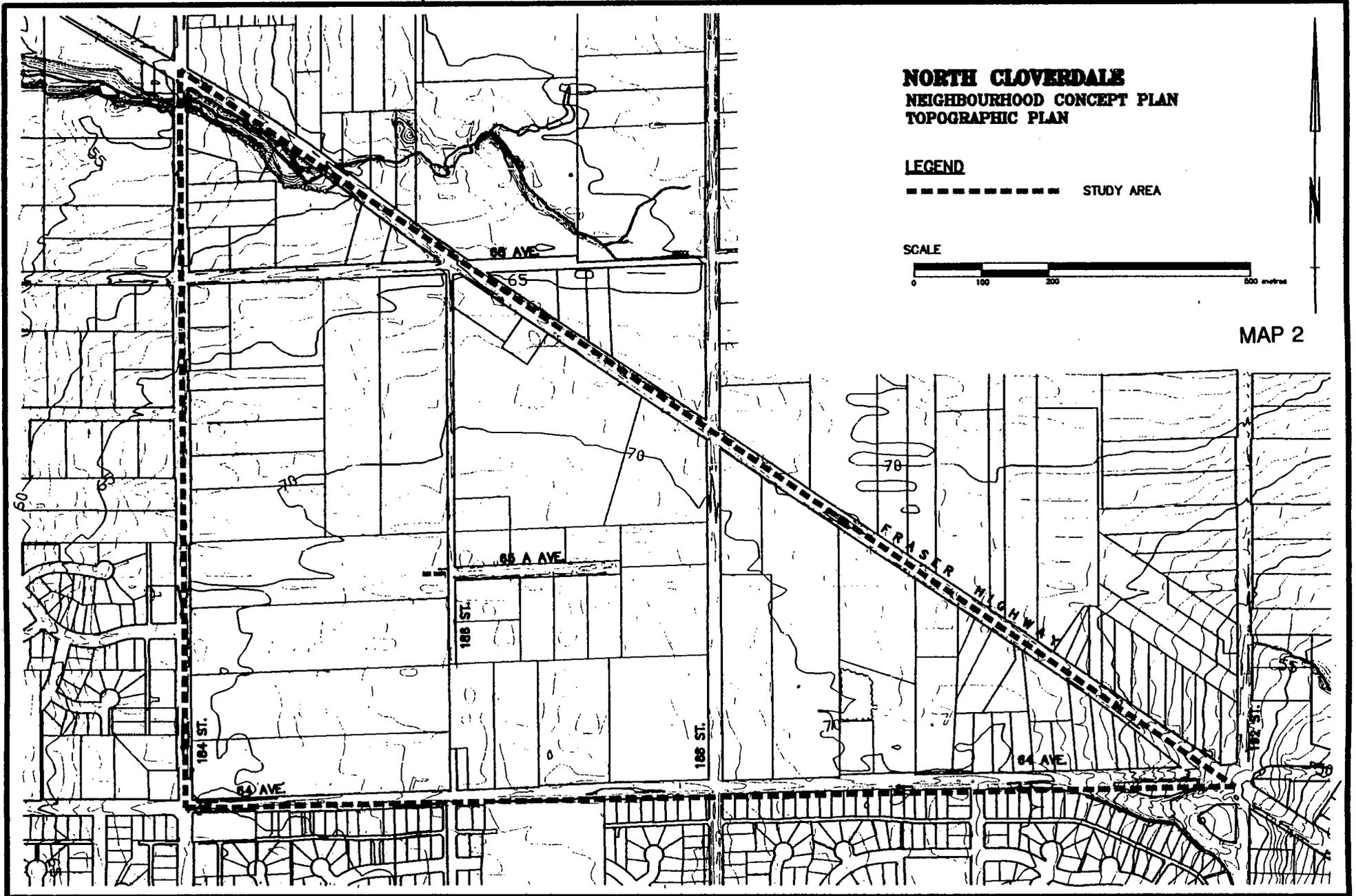
LEGEND

----- STUDY AREA

SCALE



MAP 2



2.2 Soils

The majority of the soils in the neighbourhood consist of Bose soils, which are 30 to 160 cm. of slightly to moderately stony gravelly lag or glacial outwash over moderately coarse textured glacial till and some moderately fine textured glaciomarine deposits. They are moderately well drained, being rapidly pervious in the upper part, but changing to slowly pervious in the compact glacial till underlay. Telluric seepage along the surface of the dense, compact subsoil is usual after prolonged, heavy rain. Another less dominant soil type found in the area are the Watcom soils which are moderately fine textured glaciomarine deposits that drain moderately well with telluric seepage.

East of 188th Street, there are Boosey soils which are similar to Bose soils but where drainage is poor with a perched water table. Other soils in the north and east sides of the neighbourhood include Haney soils which are gravelly glaciofluvial deposits that drain well to rapidly, Scat soils which are moderately fine textured glaciomarine deposits that drain poorly with perched water tables, and Sunshine soils which are sandy littoral and glacial outwash deposits that drain well to moderately well. These soils have very limited use for agriculture, and no land in Phase I is in the Agricultural Land Reserve. The use of this land for urban residential purposes will not be inhibited by these soil characteristics.

2.3 Vegetation

Much of the land in the neighbourhood is cleared pasture land or covered with poor quality alder and cottonwood. However, some stands of mostly deciduous trees exist along the ravine, the 188 Street right-of-way and to the rear and sides of some of the residential properties fronting on 184th Street and 66th and 68th Avenues. With the exception of the vegetation in the ravine, there is little vegetation worthy of preservation. Map 3 shows the vegetation coverage extrapolated from air photos.

3.0 LAND STATUS

3.1 Current Designations and Zoning

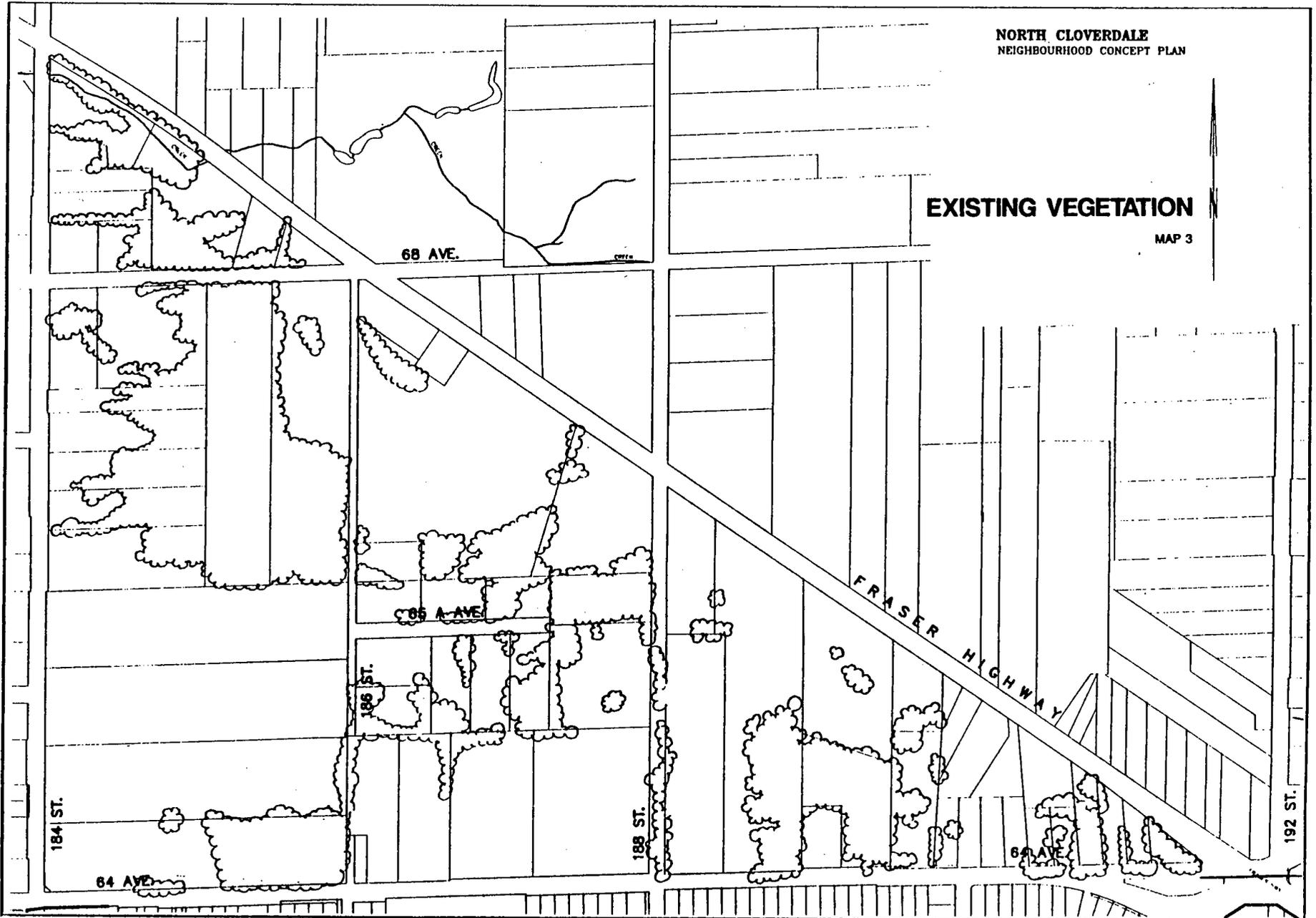
All of the land involved in the East Neighbourhood (Phase I) is designated urban in the Official Community Plan. The majority of the parcels in the neighbourhood are, however, currently zoned one-acre residential. There are three parcels along the Fraser Highway at 186th Street which have commercial zoning including a drive-in theatre, two parcels: one on 184th Street and the other on the Fraser Highway have agricultural zoning, and one property on 64th Avenue is zoned for an Assembly Hall.

The existing commercial zoning amounts to 19.75 acres or 10% of the study area. (Map 4 shows the existing zones based on Bylaw No. 12000).

**NORTH CLOVERDALE
NEIGHBOURHOOD CONCEPT PLAN**

EXISTING VEGETATION

MAP 3



**NORTH CLOVERDALE
EXISTING ZONING**

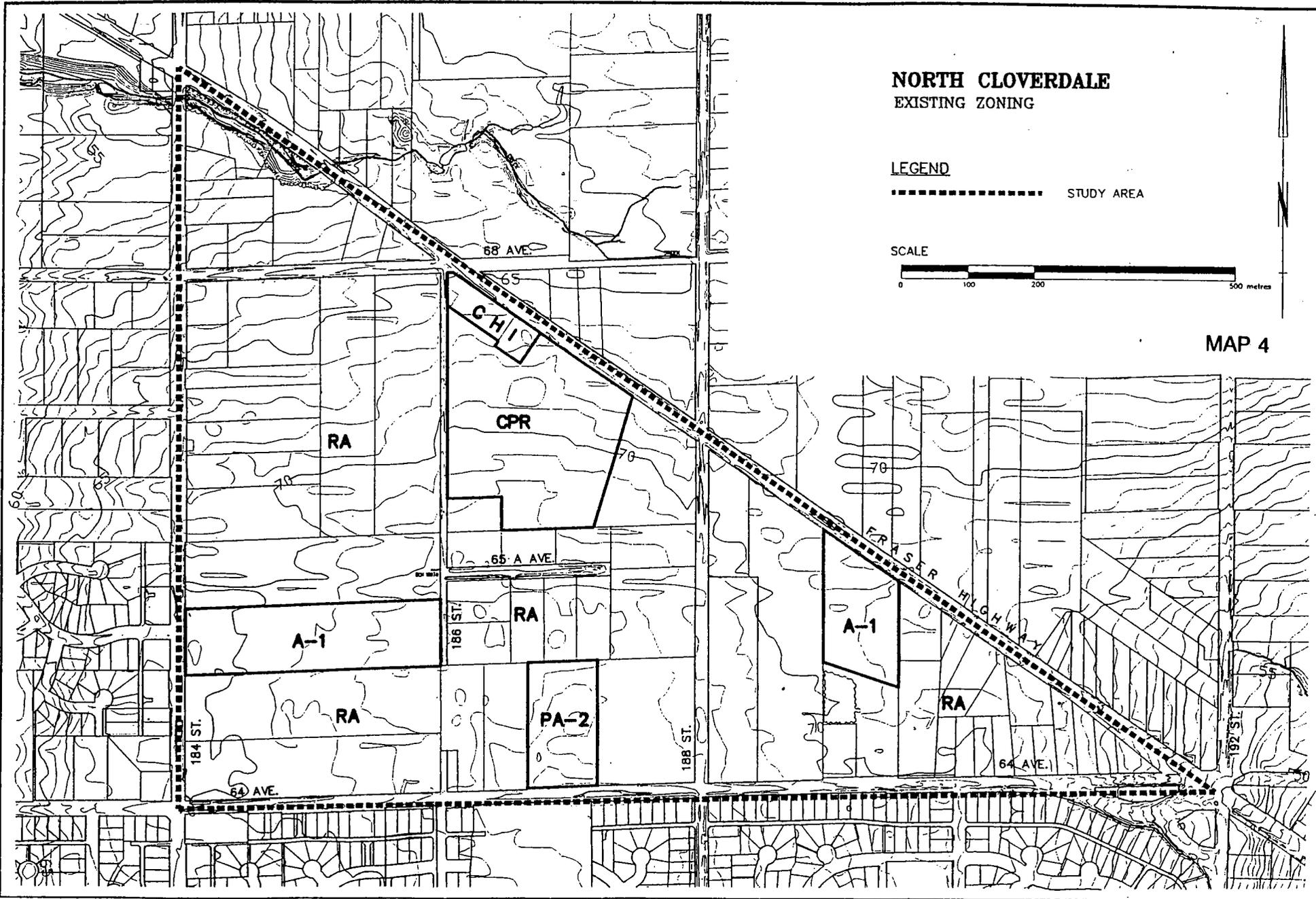
LEGEND

..... STUDY AREA

SCALE



MAP 4



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3.2 Existing Land Uses

The east Neighbourhood consists of 66 individual parcels of land ranging in size between .25 acre and 16.5 acres, most of the parcels are holding lands used for rural residential purposes. However, there are a number of existing commercial activities located along the Fraser Highway, including a used car lot, drive-in theater which is presently used on a seasonal basis, a bakery and an automotive service station. In addition, there is a large regional church and new Fire hall located on 64th Avenue.

3.3 Lands Under Application

As of March, 1994, there are eleven current development applications currently being processed in the neighbourhood. As shown on Map 5, they encompass approximately 124 acres, or 65% of the gross area of the neighbourhood.

4.0 LAND USE PLAN

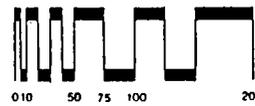
4.1 Development Objectives

The development objectives for the East Neighbourhood Land Use Plan respond to the need for livable neighbourhoods, efficient use of land, and provision of local community facilities and a variety of housing types within neighbourhoods. Key objectives include:

- arranging land uses so that the neighbourhood focus is on the combined School and Park site
- providing educational, recreational, social and daycare facilities on a neighbourhood scale
- encourage the development of affordable family housing through the efficient use of land.
- providing for a balanced community through a variety of housing types, including enough family-oriented housing to support the construction of an elementary school site so that children do not have to cross a major road to attend
- providing for efficient vehicular movements without encouraging undue through traffic
- encouraging the use of transit as an alternative to the automobile
- facilitating pedestrian movements including walking, skating and cycling
- protecting natural features such as the ravine, and preserve vegetation worthy of preservation according to Surrey's Tree Cutting and Preservation Bylaw

North Cloverdale Neighbourhood Concept Plan

Current Development Proposals (March, 1994)

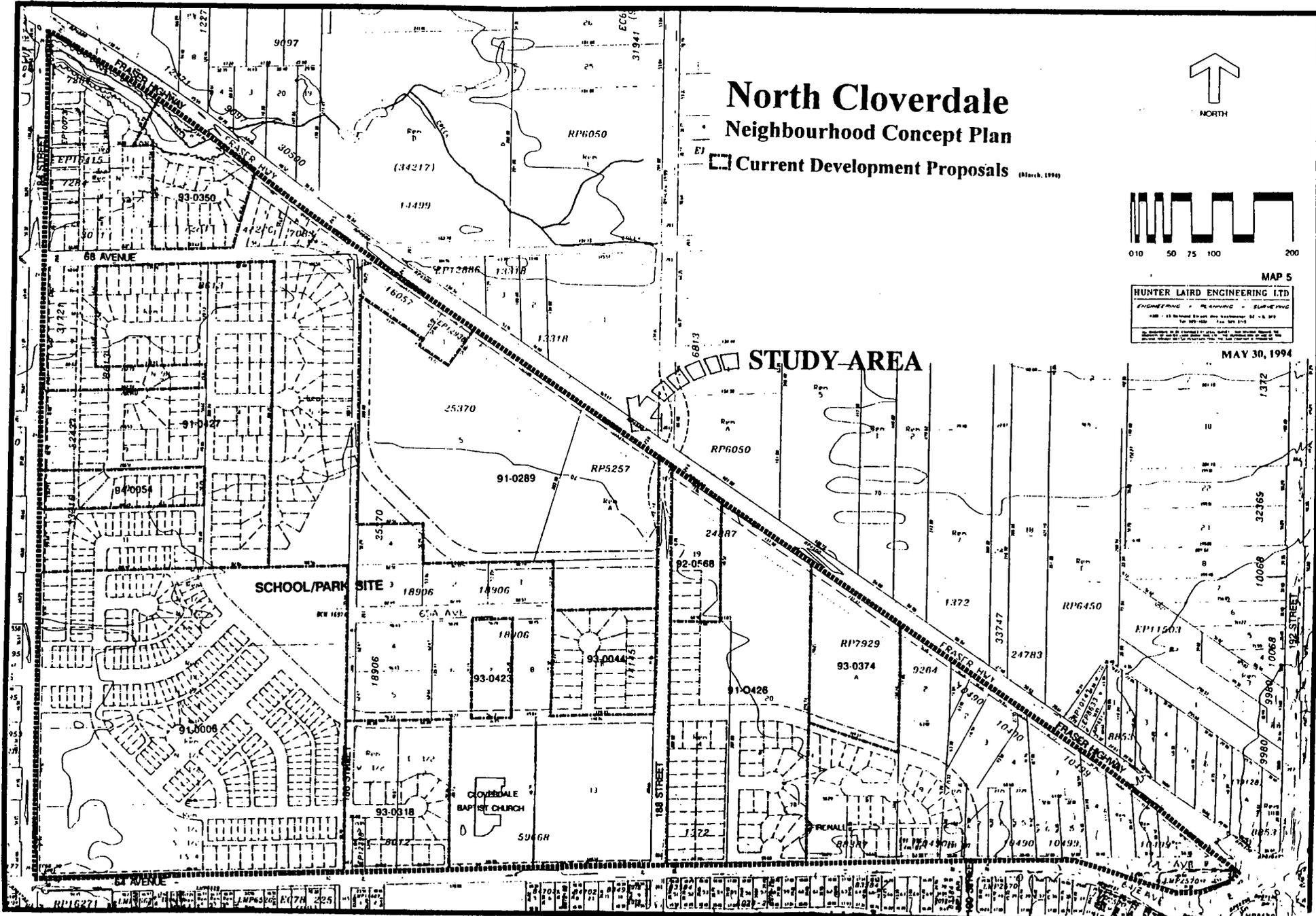


MAP 5

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MAY 30, 1994

STUDY-AREA



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4.2 Overall Development Concept

The Land Use Plan for the neighbourhood is shown on Map 6. The pattern of land uses, roads, and subdivision has been derived from the Local Area Plan, input from public meetings and comments from government agencies. It responds to a need for more affordable and less land consumptive housing by proposing an efficient subdivision pattern and a mixture of housing types. The benefits of the plan include a neighbourhood with a strong focus, a variety of both detached and attached housing, a more efficient use of land, and the opportunity to provide a diverse demographic mix capable of supporting the various amenities being proposed in the Local Area Plan.

The plan provides for a combined elementary school and neighbourhood park, as a focus for the neighbourhood. This centrally located facility may also include a neighbourhood house and community run day care. These facilities are centrally located in the neighbourhood so that children and other residents in the neighbourhood can get to them without having to travel long distances or cross any major roads. An efficient pedestrian circulation system makes walking safe and convenient.

Around the school and park site, higher density townhouses and traditional small lot housing are located to facilitate use of these amenities by more people. Townhouses and cluster housing are also located along the Fraser Highway so that a buffer can be created within these lands to screen the residences from the noise and fumes of the highway. The remainder of the neighbourhood will be developed with conventional detached urban single family housing.

No site for local convenience shopping is provided for in the plan. This is at variance with the Local Area Plan which indicated a commercial site at the corner of 64th Avenue and 184th Street. The change to the plan is in response to the opposition which was voiced at the public hearing involving the owner's project and the NCP public information meeting. In addition, there is an active development application proposing the necessary commercial uses for the north-west corner of the intersection. It would, in the opinion of the Sterring Committee, be preferable to have all the commercial uses needed for this area located in one complex on the same corner.

A summary of land uses proposed in the Neighbourhood Concept Plan are listed in table 1 (Land Use Summary).

North Cloverdale Neighbourhood Concept Plan

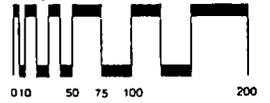
- Land Use Plan & Subdivision Concept (MARCH, 1994)



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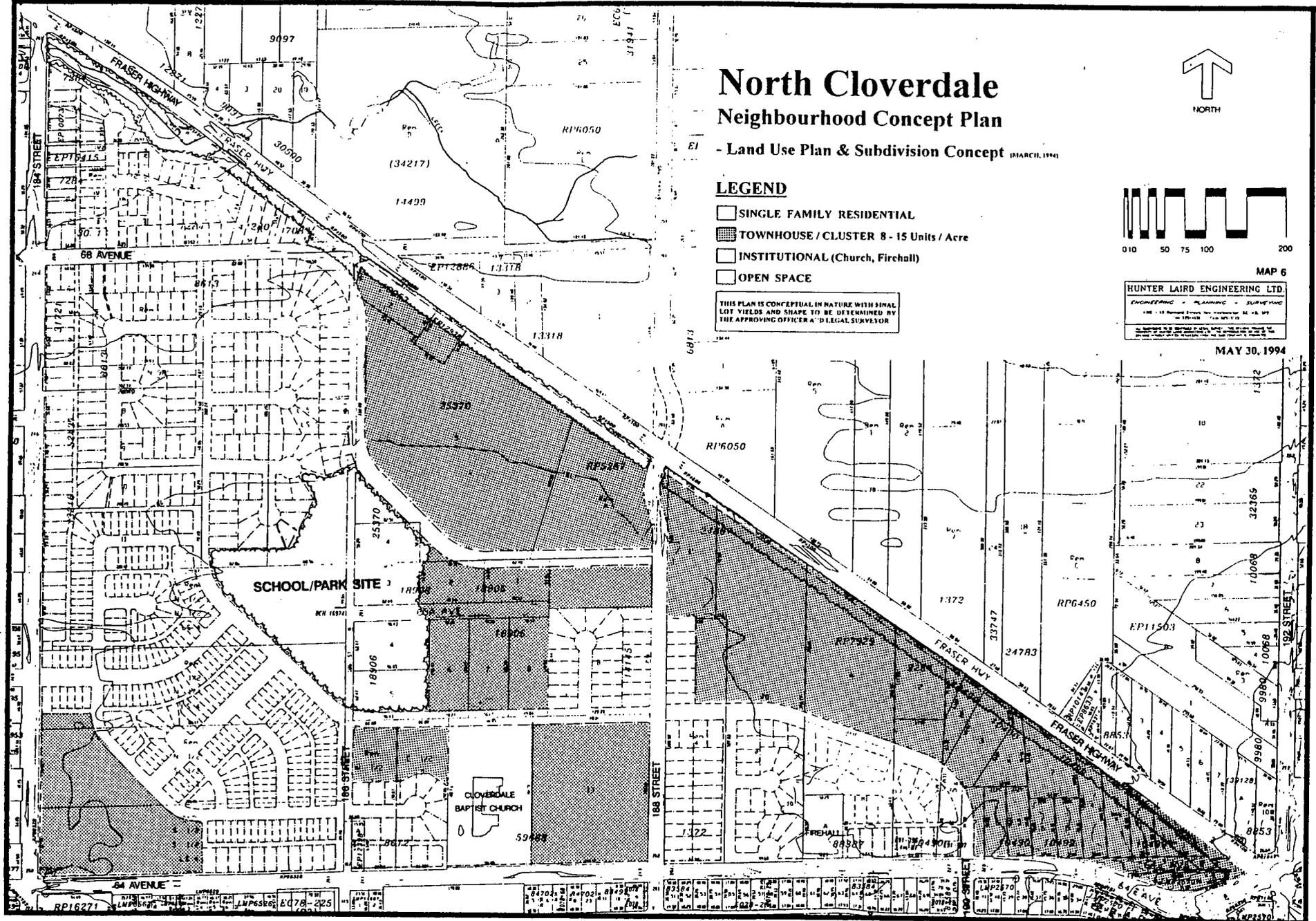
-  SINGLE FAMILY RESIDENTIAL
-  TOWNHOUSE / CLUSTER 8 - 15 Units / Acre
-  INSTITUTIONAL (Church, Firehall)
-  OPEN SPACE

THIS PLAN IS CONCEPTUAL IN NATURE WITH SMALL LOT YIELDS AND SHAPE TO BE DETERMINED BY THE APPROVING OFFICER A LEGAL SURVEYOR



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MAY 30, 1994



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TABLE ONE

LAND USE SUMMARY

LAND USE	AREA	%
ROADS	30.93	16 %
DETACHED SINGLE FAMILY	70.48	37 %
TOWNHOUSE / CLUSTER	67.33	35 %
INSTITUTIONAL	5.70	3 %
SCHOOL / PARK	17.56	9 %
TOTAL	192.00	100 %

4.3 Roads

The shape of the Phase I neighbourhood is defined by the bordering arterial roads: Fraser Highway, 64 Avenue and 184 Street. The existing and proposed road system is shown on the Circulation System Map 7. The main vehicular circulation within the neighbourhood will be on an internal loop, which will provide direct access to the school and neighbourhood park, as well as to the limited local roads and adjacent residential uses. The loop will have two accesses from 184th Street at Claytonhill Drive and 68th Avenue, and three accesses from 64th Avenue at 186th, 188th and 190th Streets. One access from the Fraser Highway at 188th Street will be maintained and a realignment of this intersection is proposed to improve its function and safety. These roads will provide good access to the surrounding arterials and Provincial Highway without encouraging undue amounts of through traffic within the neighbourhood. The existing access to Fraser Highway at 186 Street and 68 Avenue is to be closed as it is not deemed safe nor necessary to support the land use plan. The surplus land from this intersection closure can be incorporated into the landscape buffer adjacent to Fraser Highway.

The plan has been reviewed by an independent Traffic consultant and found to be conceptually acceptable. Specific access egress points will be reviewed at the detailed site planning and engineering review stage. The Land Use Plan shows a number of roads to be dedicated through the subdivision process. Representing over 30 acres of land, these roads are required to support the land uses and densities proposed by the Plan. A summary of the roads to be provided are listed in table two.

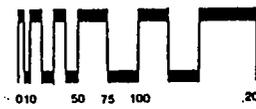
North Cloverdale Neighbourhood Concept Plan

- Circulation Concepts (MARCH, 1994)



LEGEND

- ○ PEDESTRIAN PATHWAY
- ▭ ARTERIAL ROAD
- ▬▬▬ COLLECTOR ROAD
- ▬▬▬ LOCAL ROAD
- ▬▬▬ SIDEWALK/WALKWAY



MAP 7
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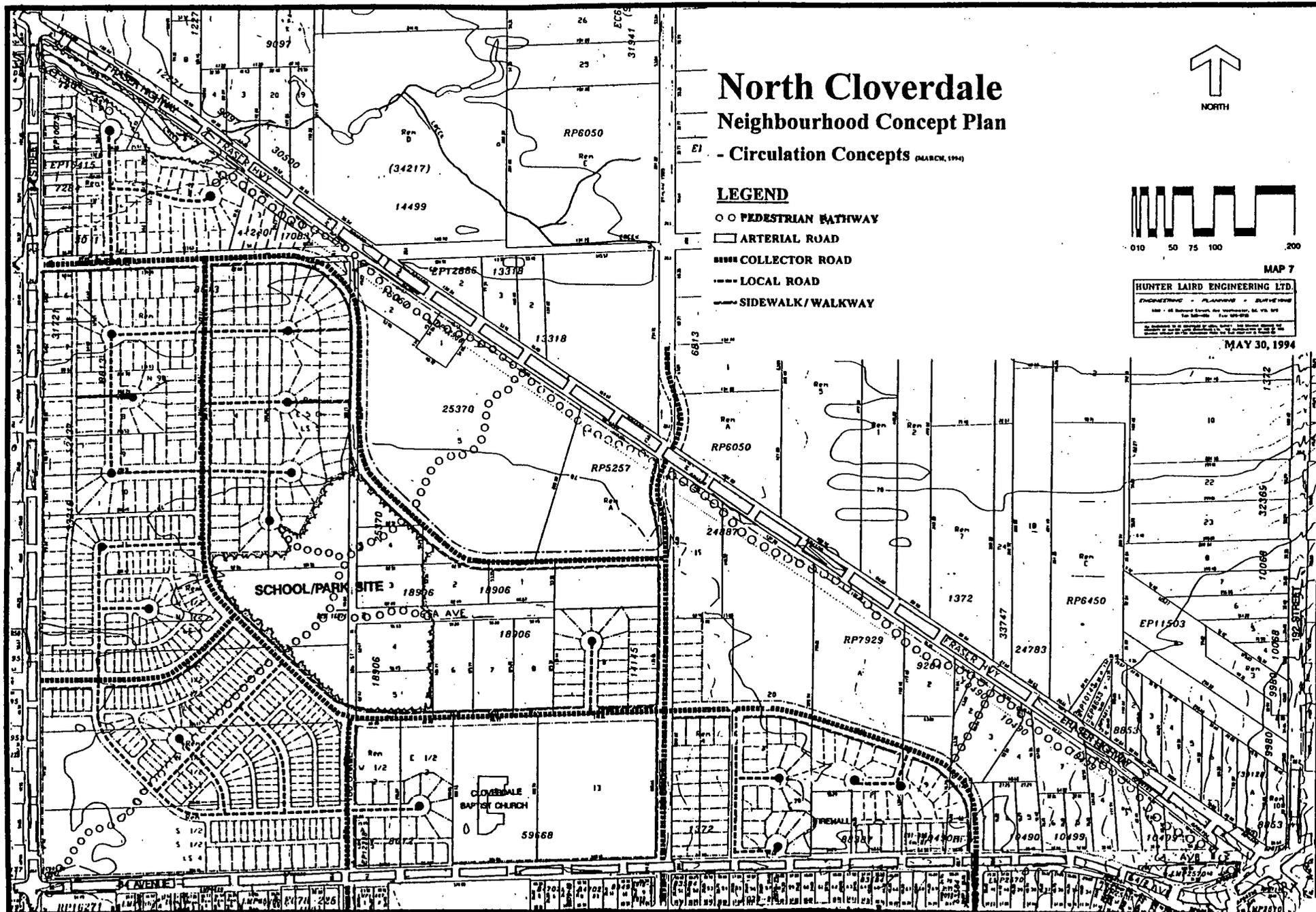


TABLE TWO
ROADS TO BE DEDICATED

	LENGTHS	AREA
COLLECTOR ROADS	2,995 M	59,900 M ²
LOCAL ROADS	3,025 M	50,000 M ²
LANES	2,545 M	15,270 M ²
	8,565 M (5.32 Miles)	125,170 M ² (30.93 Acres)

4.4 Transit

The Neighbourhood Concept Plan has been submitted to B. C. Transit for their information and consideration in selecting bus transit routes and locating bus stops. Service into the neighbourhood, including bus connections to the new Skytrain Station in Surrey City Centre, will be encouraged at the earliest opportunity.

Public transit service for this neighbourhood will likely utilize the major roads on the perimeter of the triangle, e.g., Fraser Highway, 184 Street and 64 Avenue. The Neighbourhood Concept Plan has made provisions for a number of pedestrian access points to these perimeter streets at regular intervals to make access to future bus stops convenient. Pedestrian access to these bus routes will be achieved by the use to a combination of roads, sidewalks, walkways and pedestrian pathways.

4.5 Pedestrian Pathways

The system of pedestrian pathways are also shown on the Circulation Map 7. The purpose of the pedestrian circulation network is to facilitate walking exercise and social interaction and to provide a more efficient and direct access for pedestrians to the proposed transit service. The pathways are designed to connect the major destinations within the neighbourhood (e.g., the school/park) with the intersection of 64th Avenue and 184th Street and the Fraser Highway, and provide regular accesses to future bus routes along Fraser Highway, 184 Street and 64 Avenue. A combined pedestrian/bike path will

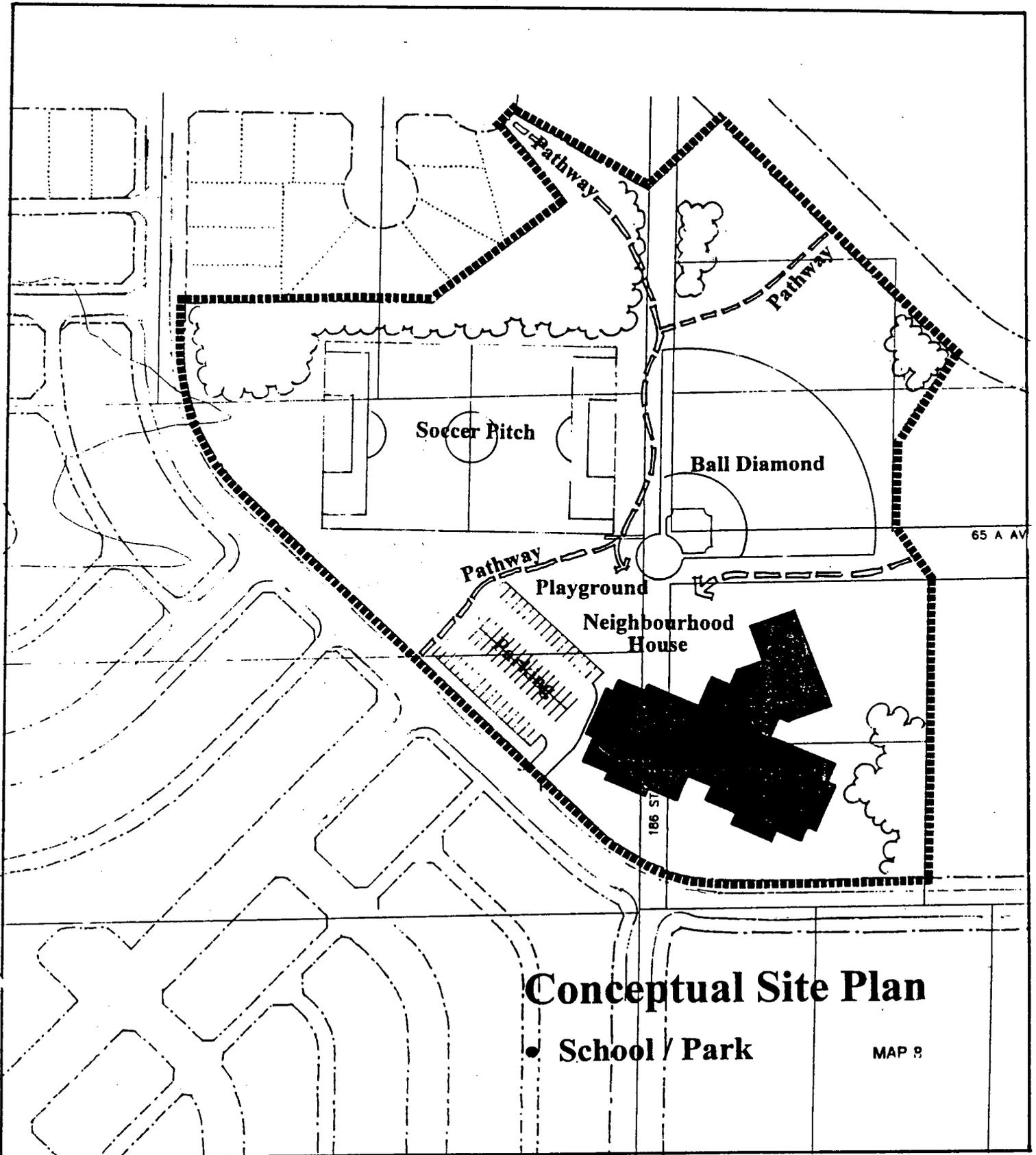
be constructed adjacent to Fraser Highway. This pathway will be designed to weave through the landscaped buffer and provide a safe and attractive environment for walkers, joggers, skaters and cyclists. Other pedestrian links are provided for through the provision of walkways and the strategic placement of sidewalks on the collector and arterial roads. In total, more than 6 miles of 'pedestrian only' areas are provided for in the plan.

4.6 Elementary School and Neighbourhood Park Site

A joint elementary school and neighbourhood park site will be developed. It encompasses a total of approximately 13.2 acres in the centre of the neighbourhood and will accommodate all public parkland needs for this neighbourhood. The selected location and configuration facilitates assembly through statutory contribution and acquisition from lands under existing as well as future development applications, and combines with lands already acquired by the School District #36. It has the advantage of being nearly central to the neighbourhood for convenience of access for residents and provides a focal point for the neighbourhood. It is directly accessible from two collector roads and is the central destination of the pedestrian system. It has been configured to provide a attractive visual focus for those entering the neighbourhood from 184th Street along Claytonhill Drive and from 64th Avenue via 186th Street; both main entrances to the neighbourhood. The location of the site and its arrangement within the vehicular and pedestrian circulation systems make it the central feature of the neighbourhood, and will help to develop the neighbourhood's sense of identity. Map 8 shows a conceptual site plan for the joint school/park site which demonstrates the ultimate site development. This plan has been prepared with impute from the School District Planner and Park and Recreation Department.

4.7 Neighbourhood House

The Local Area Plan suggests that a Neighbourhood House be located in the neighbourhood park. Its purpose is to provide a modest facility (\pm 3000 sq. ft.) where indoor community activities like meetings, crafts, games, etc. can take place and may house community day care operation. This facility will in turn help establish the school/park as a neighbourhood focus, not just for educational and recreational activities, but cultural pursuits as well. The neighbourhood house is not intended to compete with or replicate programs offered at the Cloverdale Recreation Centre and Teen Centre. It has been suggested by the Parks and Recreation Department that this facility should at this time be part of the School development. Consideration should be given to attaching this facility to the Elementary School building. The precise size of the Neighbourhood House as well as the means of realizing it, ownership and operating details will be determined during financial implications process.



Conceptual Site Plan

● School / Park

MAP 8

4.8 Daycare

Private sector day care facilities should be encouraged to locate within the neighbourhood especially next to or near the neighbourhood park. From a locational perspective it is preferable that private daycare's within the home be located in a residential area but not on a cul-de-sac street. On the basis of information provided by the City Planning Department in the Local Area Plan, it is estimated that the neighbourhood will generate the need for child care spaces for 14 infants, 20 toddlers, 41 group , 6 pre-school and 101 after school care children. The Cloverdale Baptist Church is currently licensed to provide day care for 35 pre-school and 15 after school children and could provide additional spaces if demand warranted. It is recommended that the City encourage the private sector to provide daycare spaces by supporting zoning applications from individuals as the neighbourhood develops. It is also possible that the neighbourhood house could be utilized for daycare as part of it's multifunctional purpose.

4.9 Housing Types

The residential elements of the plan have been allocated to support the structural concept of the neighbourhood as set out in the Local Area Plan, as well as to respond to current market conditions. The predominant forms of housing will be standard single family detached housing on 6,000 sq.ft. lots, traditional small lot affordable housing on 3,000 sq.ft lots, townhouses and cluster housing. The townhouses, cluster housing and traditional small lot housing have been located around the school and park site, adjacent to the 64th Avenue/184th Street intersection and along the Fraser Highway. The standard single family housing occupies the remainder of the neighbourhood and provides a transition to the existing urban neighbourhoods to the south and west. The Land Use Plan has been arranged to permit all parcels of land to realize an equitable development yield.

This plan provides for approximately 383 standard single family lots, 230 traditional small lots, and 750-945 units of townhouses and cluster housing. Precise unit counts for the multi-family sites, as well as the yields, lot sizes and configurations for the detached family housing will be determined at the detailed site planning stage when the respective applications are processed and the Approving Officer and City staff provide their input to the submissions.

In order to ensure that enough family-oriented housing is developed to support construction of the elementary school (a minimum of 750 family oriented units are needed), it is recommended that the City of Surrey encourage family-oriented architectural designs for the townhouse and cluster housing projects, particularly those near the school/park site. The initial review of the plans being prepared for the townhouse/cluster sites indicate that this 50% target will be achieved. It is also recommended that the City monitor the ratio of family units to non-family units as the development proceeds to ensure the target of 50% of the total number of townhouse and cluster housing units

within the neighbourhood are family-oriented. Individual developments may be all family or non-family in character so long as this target for the neighbourhood is achieved.

A statistical summary of the land uses, together with estimates of the number of units and population generated, is provided in Table 3.

4.10 Land Use and Population Statistics

The following table summarizes the land uses in the neighbourhood as presented in the Land Use Plan Map 6. Estimates of the number of the number of housing units of each type are shown, based on anticipated densities. The estimates of the number of people generated by each type of housing is based on information on household sizes provided by the City Planning Department.

TABLE THREE

DEVELOPMENT PROJECTIONS

Land Use	Area (Ac)	# of Units	Population	
Single Family Residential	101.41	613	1962	based on 3.2 person/household
Townhouse / Cluster Residential	67.33	885	2345	based on 50% 2-bdm: 2.5 person/household and 50% 3 bdm: 2.8 person/household
Institutional	5.70	-0-		
School & Park	17.56	-0-		
TOTALS	192.0	1498	4307	

As is evident from these preliminary figures, it is estimated that the development of the east neighbourhood will result in a total of approximately 1498 housing units, and a population of 4307. While the number of housing units is slightly higher than the 1298 estimated in the Local Area Plan for the East Neighbourhood, the population is within two percent of the Local Area Plan's estimate of 4270. This change is the result of a more detailed evaluation of the demographic implications of unit type and household size for the townhouse/cluster lands than was provided for in the Local Area Plan.

5.0 ENVIRONMENTAL CONSIDERATIONS

5.1 Ravine/Watercourse

A ravine, with an intermittent watercourse, is located in the north west corner of the neighbourhood, at the intersection of 184 Street and Fraser Highway. This ravine and watercourse will be retained through the development process in an environmentally responsible manner. Residential development adjacent to the ravine will be kept back from the top of bank as required by the Ministry of Environment. The area of the ravine is to be preserved in its natural state and the setback from the top of the bank is proposed to be designated as open space. The precise delineation of the ravine area boundaries and setback will be determined utilizing the Ministry of Environment "Land Development Guidelines" detailed surveying, environmental analysis and input from the Ministry of Environment personnel during the subdivision stage.

5.2 Tree Retention

Existing trees worthy of retention should be preserved during the site planning and development review process. Preservation will be accomplished in accordance with the provisions of the Tree Removal and Replacement, Bylaw. All native trees and vegetation in the ravine and required preservation zone are to be retained as well, quality trees identified by detailed survey should be incorporated into planning for individual sites where practical.

6.0 DEVELOPMENT GUIDELINES

Development in the North Cloverdale neighbourhood should proceed using Surrey's standard zones whenever possible, e.g., RF, RF(G), RM10, RM15, etc. In some instances, the creation of comprehensive zones to accommodate innovative development proposals may be necessary. When considering the use of comprehensive zones, the ultimate development should generally be consistent with the objectives and policies of the neighbourhood concept plan. A possible future zoning map is included in the Appendix to provide a development guide for land uses and density.

The predominant development form will be single family homes. Representing 53 % of the land in the neighbourhood, the development of these lands will for the most part be regulated by the RF Single Family Residential Zone. Some innovative traditional small lot proposals will be accommodated to improve the availability of more affordable Single Family homes and increase the mixture of housing types. In addition, some urban gross density (RF(G)) type lots are proposed in the north west corner of the neighbourhood adjacent to the ravine. The use of this zone in this location will enhance the preservation of the ravine, as 15 % of the land involved can be preserved for open space. While not shown on the land use and subdivision plan, it is believed that urban gross density (RF(G))

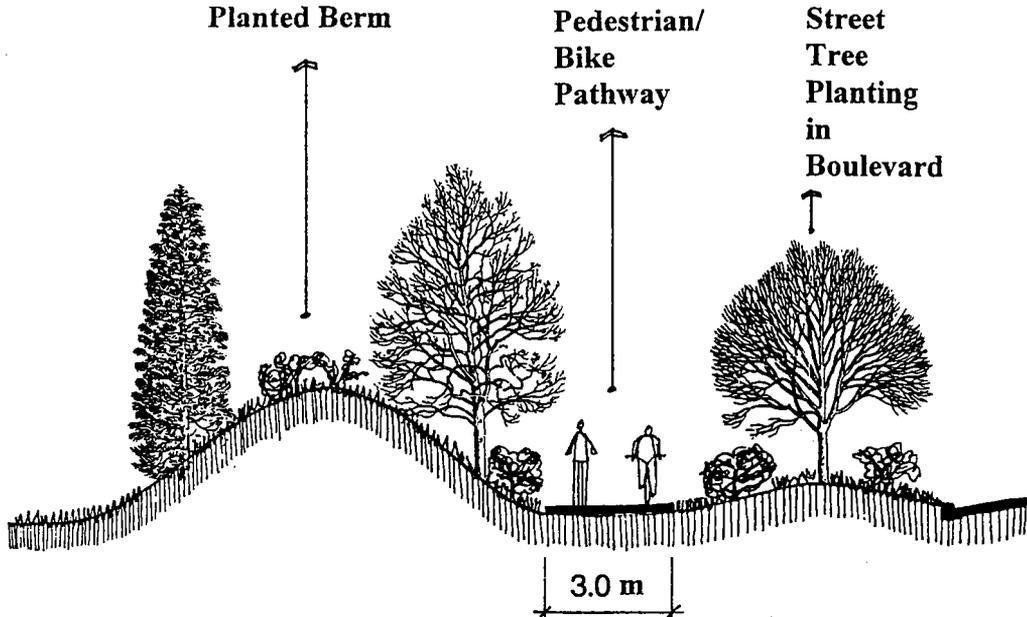
lots adjacent to the combined school and park site should also be permitted if those owners/developers choose, as the additional open space available through this zone (15 % opposed to 5 %) would contribute to the park land inventory and make this open space area even more attractive and usable.

The ability to regulate single family housing design and siting is very limited through the zoning process. Nevertheless, it is believed to be important to the implementation of this plan that certain policies and practices be observed in the development of this neighbourhood. Specifically, the following should be considered:

- The East Neighbourhood shall be serviced with urban standard roads and utilities. Servicing standards which complement innovative site planning and the architecture of individual developments should be encouraged.
- Building design guidelines which prescribe a minimum architectural standard should be adopted with each single family development approval.
- Homes should be sited on the lots so that the front of the house faces the street. On corner lots the architectural elements of the house should be used on both street-facing elevations.
- When lane access is available to a lot, consideration should be given to providing vehicle access from the lane. At intersections, driveways should be provided at the opposite end (interior) of the lot to avoid potential traffic and pedestrian conflicts.
- The City does not permit direct vehicle access to lots fronting 184th Street, 64th Avenue and Fraser Highway all arterial roads. The plan has provided alternative access to all properties fronting these roads by either lanes, frontage roads or local streets.
- Townhouse/cluster housing is the second largest allocation of land in the neighbourhood at 35 %, and the design and siting of these developments should be regulated by the Development Permit process. Section 945 of the Municipal Act allows the City to designate these multifamily sites as Development Permit Areas and it is suggested that the City do so for the east neighbourhood as well.
- The land use and subdivision plan has created a number of locations where single family homes and townhouse/cluster homes will share the same streetscape. In these circumstances, the townhouse/cluster homes should be designed to face these streets and provide a gradual transition from the detached single family homes to the attached units. The multiple dwelling units should be sensitive to the scale as well as siting of the single family units across the street.

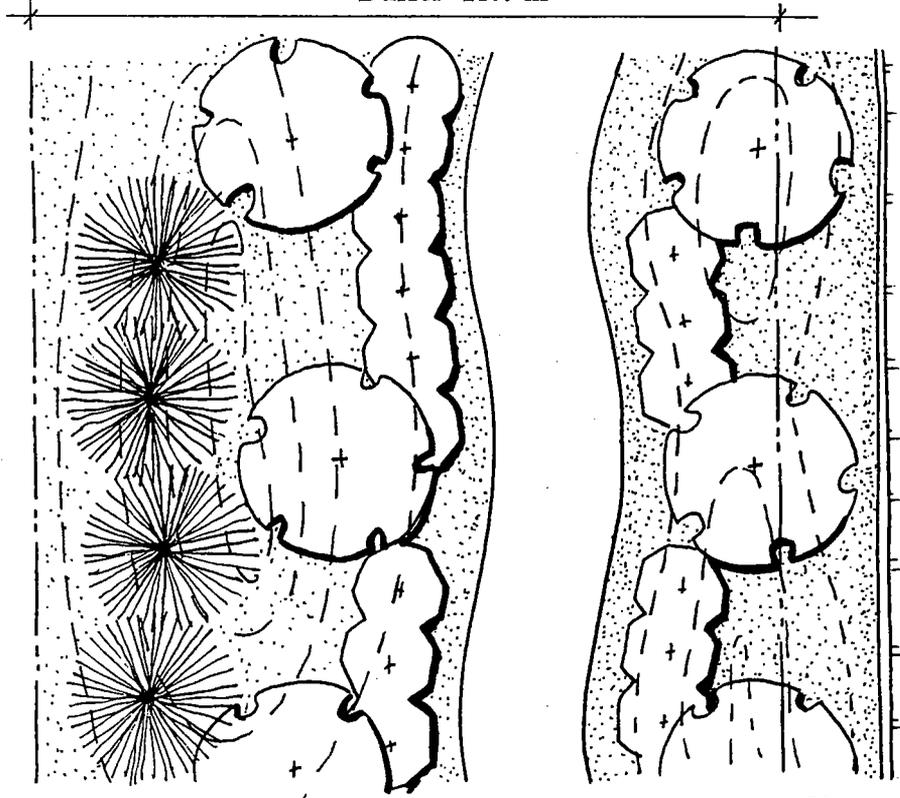
- Landscaped transitions can also be utilized so long as the planting does not create a fortress impression from the street nor conflict with CPTED design principles.
- The townhouse designated areas along Fraser Highway show a 15 metre wide buffer along the south side of the Fraser Highway. It is the intent of the plan that the buffer remain private property but that public access by way of a pedestrian/bicycle path be developed through this area. This buffer should be tastefully landscaped to provide screening for the residential units, and produce an attractive streetscape for travellers along Fraser Highway. (See Buffer/Bikeway Sketch for the Concept.)
- A second major pedestrian linkage is proposed to traverse the neighbourhood from the intersection of 64 Avenue and 184 Street to Fraser Highway. Where this pathway goes through townhouse developments and the school and park site, it is the intent of the circulation concept that the pathways be continued through these sites and the connections be completed. While it is not necessary for the paths to travel in a direct, straight line, it is important that the connections be completed. Actual alignments can be determined during the detailed site planning process for the townhouse sites. Finally, when the pathways run through private property the public should be free to use them and public access should be secured when the sites are developed.
- Pathways should be designed to encourage use by walkers, joggers, skaters, and cyclists. In consultation with the Sterring Committee's Landscape Architect it has been determined that to accommodate the anticipated users generated by this neighbourhood, the minimum width of the path surface should be 3.0 metres. When the path is adjacent to local roadways, this width may be reduced to a 1.5 metre sidewalk standard as it is reasonable to expect bicycles to travel on local roads when they are available. Should Surrey wish to expand the purpose of the pathway adjacent to Fraser Highway to service a more regional or community function, enough space is provided to widen this pathway to a more elaborate standard.
- The phase one neighbourhood is not rich with indigenous tree cover. For this reason, it is suggested that an average of two trees per unit be planted with the new developments. Whenever possible, and when it would not interfere with the placement of driveways or utility corridors, trees should be placed in the front boulevards. When applicable, replacement planting, required as part of any cutting permit, could contribute to the suggested planting contributions.

Pathway / Buffer Concept



Section

Buffer 15.0 m



Fraser Highway

Plan View

7.0 SERVICING

7.1 Roads

The Phase 1 Study Area is serviced by the regional and municipal road network. Access to the regional network is available via Fraser Highway to the north. Both 184th Street and 64th Avenue which define the Study Area to the west and south are currently designated Municipal arterial roads giving access to both Municipal and Regional road networks. Expansion of the arterial road network is not required to service the proposed Neighbourhood Concept Plan.

188th Street, which bisects the Study Area and crosses Fraser Highway to the North is classified as a major collector road. 68th Avenue west of the Study Area is classified as a collector road on the Municipal road grid map. The proposed Neighbourhood Concept Plan extends 68th Avenue as a collector road through the study area to intersect with 188th Street south of Fraser Highway. The Plan also provides for a second collector road extending from 68th Avenue at the 185th Street alignment, curving to the east generally along the 65 Avenue alignment, intersecting with 188th Street and extending eastward and curving southward to intersect with 64th Avenue at 190 Street. Both collector roads service the school and park sites and the proposed higher density residential land uses.

The additional traffic movements in and out of the Study Area from Fraser Highway and the arterial roads are adequately accommodated by the intersections proposed by the internal road network as designated in the Neighbourhood Concept Plan.

Provision has been made in the Neighbourhood Concept Plan for the necessary road dedication to permit the future widening of Fraser Highway to a four lane standard by the Ministry of Transportation and Highways including additional widening to accommodate turning movements at the intersection on 188 Street. The Plan provides for the protection of necessary right-of-way widths for 184 Street and 64th Avenue to Surrey's arterial road standard (13.5 metres from centreline). The right-of-way width for 188 Street, classified a major collector, will be 22 metres.

To accommodate the additional traffic generated by the development of North Cloverdale new traffic signals and channelization will be required at the intersection of 188 Street and Fraser Highway and 188 Street and 64 Avenue. New left turn lanes will be required off 184 Street and 64 Avenue into the Study Area at all proposed road intersections. These works and the traffic signalizations are arterial road related and can be provided for in an amended 10 Year Servicing Plan to be funded out of development cost charges.

All internal roads will be the responsibility of developers to construct as required through the rezoning and subdivision approval process. The local road pattern shown on the Neighbourhood Concept Plan is designed to provide an efficient and balanced layout from the arterial and collector road systems. The proposed internal road classifications are

shown on Map 9. Minor variations to the road layout and Standards shown may be permitted based upon detailed subdivision evaluation. Developers will be required to ensure that subdivision submissions recognize the subdivision potential of adjacent property owners.

No direct access to single family residential lots will be permitted from 184 Street, 64 Avenue and Fraser Highway.

All internal roads are to be finished with street lights, sidewalks, and curb and gutters in accordance with the City's Subdivision Control Bylaw or as specifically altered through the approval of a development variance permit.

7.2 Water

Water supply and pressure to the Study Area is provided through the existing Pump Station located at 72 Avenue west of 192 Street at the Clayton Hill Reservoir site. The Study Area is within the 115 m H.G.L. pressure zone and is well serviced by an existing 300 mm grid main on 184 Street and a 400 mm diameter grid main on 188 Street feeding from the Reservoir. There is an existing 150 mm diameter on 64 Avenue.

Surrey's ultimate water grid map relative to the Study Area shows requirements for additional grid mains to be constructed east/west along the 68 Avenue alignment and the 64 Avenue alignment. The 10 year Servicing Plan provides for the construction of a new 300 mm diameter grid main on 64 Avenue between 184 Street and 192 Street.

Map 10 shows the proposed watermain extensions and internal network servicing the Study Area in accordance with the Neighbourhood Concept Plan. The watermain extensions provide for an ultimate east/west 250 mm diameter grid main along the 68 Avenue extension to 188 Street. All other mains proposed are 200 mm diameter. The proposed watermain system is adequate to meet domestic and fire flow demands generated by the Land Uses of the Neighbourhood Concept Plan.

Watermains will be extended in accordance with the proposed Plan by each developer as required. The oversizing cost for the proposed grid mains above 200 mm diameter would be refundable from development cost charges. Each developer, through the development process will be required to demonstrate that the system, as extended, will be capable of complying with the City's Design Criteria for interim and ultimate fire flow conditions with regards to fire flow, residual pressure and velocity.

7.3 Sanitary Sewer

That portion of the Study Area south of approximately the 66A Avenue extension is currently within a sanitary sewer catchment area. There are existing sanitary sewers on 184 Street at Claytonhill Drive, on 64 Avenue between 184 Street and 186 Street; and between 190 and 192 Streets. These are capable of being extended into the Study Area to service those lands which lie within their catchments. Due to topographic constraints, a significant portion of the Study Area north of the approximate 66 Avenue alignment and west of 188 Street, lies outside the existing sanitary sewer catchment and is not currently serviced by a sanitary sewer. This area will be serviced on an interim basis by an extension of the existing sanitary sewer system at 66 Avenue and 177 Street, running north/south to 68 Avenue along a right-of-way and east/west along 68 Avenue to the Study Area.

Ultimately, a new large diameter trunk sewer will be required to service long term development of North Cloverdale Phase II and the Clayton area. This trunk sewer follows an alignment parallel with 176 Street between 60 Avenue and 72 Avenue. The construction of this trunk is included in the City's 10 year Servicing Plan. When this trunk is constructed to 68 Avenue sewage may be diverted west along 68 Avenue from the interim sewer extension. The sewer in the right-of-way would then be taken out of service.

The extension of the 68 Avenue sewer to the Phase I Neighbourhood will be designed and sized so that it can be connected, in the future, to this ultimate trunk sewer, and accommodate that portion of the proposed Phase II Neighbourhood within its catchment and future long term development of the upland area north of Fraser Highway in Clayton. This sewer would be constructed under a cost sharing agreement between participating Phase I and Phase II Neighbourhood developers and landowners with cost recovery from an area based latecomer on the benefitting lands and oversizing costs funded from development cost charges.

As development proceeds in advance of the trunk sewer construction, the capacity of the existing downstream sanitary sewer along 176 Street from 65 Avenue to 60 Avenue will be exceeded. Upgrading of this sewer system will be required to accommodate the ultimate development of the Phase I and Phase II lands within its catchment. A portion of this upgrading between 61A Avenue and 60 Avenue is included in the 10 Year Servicing Plan.

The existing sanitary sewer on 64 Avenue and 192 Street can be extended to service that portion of the Neighbourhood east of and immediately adjacent to 188 Street. The downstream sewer system on 192 Street conveys sewage to ultimately discharge to the GVS&DD lift station located at 196 Street and 52 Avenue. The sewer section discharging to the lift station is currently at capacity. There is provision in the City's 10 year Servicing Plan for the construction of a new trunk relief sewer to bypass the lift station and adjacent sewers from 60 Avenue and 196 Street to 52 Avenue and 188 Street. If development of

the Phase I Neighbourhood Lands proceed in advance of the construction of this trunk relief sewer, the existing sewer immediately upstream of the lift station will become surcharged. In the event that surcharging becomes critical to adjacent users, this section of sewer must be upgraded.

Map 11 shows the proposed Sanitary Sewer Concept Plan servicing internal development within the Neighbourhood. Each developer will be responsible for extending sanitary sewers as required in accordance with the City's Subdivision Control Bylaw.

7.4 Storm Drainage

There are no storm sewers within Phase I except on the periphery along 184 Street, along sections of 64 Avenue east of 184 Street and 64 Avenue at Fraser Highway. The Phase I lands drain both west and east roughly at the 188 Street alignment.

The lands west of 188 Street drain via the 184 Street and Fraser Highway drainage systems to an existing watercourse north of 68 Avenue. The existing system along Fraser Highway consists of roadside ditches and cross culverts which outfall to the watercourse at its crossing with Fraser Highway north of 68 Avenue. The 184 Street system consists of closed storm sewers and ditches which outfall to the watercourse at its crossing north of 68 Avenue.

To mitigate the impact of development on the downstream watercourse, a Community Detention Pond is proposed in the 10 year Servicing Plan on the watercourse upstream of its crossing under 184 Street. This location is not suitable for a Community Detention Pond site as the slope configuration limits available storage volume at reasonable depths and its proximity to Fraser Highway would be a safety hazard under ponded conditions. The flatter topography adjacent to the watercourse immediately north of Fraser Highway is more suitable for siting a Community Detention Pond which would service ultimate development of the catchment north of the Highway. This location is upstream of the Phase I lands. To mitigate the impact of development of the Phase I lands on the downstream watercourse peak drainage flows should be controlled to pre-development levels. This can be accomplished by constructing a storm detention basin designated for the Phase I lands or by incorporating this portion of the Phase I lands with the proposed Phase II NCP Study Area for drainage purposes.

The former option would involve a permanent Detention Basin adjacent to 184th Street and the watercourse. The conceptual Storm Sewer Servicing Plan shows a possible site for a Storm Detention Basin located on the west side of 184th Street. This location is suitable as the topography is flatter and there is a relatively large cleared area so impact on existing tree stands would be minimal.

The latter option would involve construction of an interim Detention Pond at this site until such time as the Phase II lands have been developed and trunk sewer servicing is extended along 68th Avenue. Ultimately, any detention arrangement for the Phase II lands would be enlarged to accommodate the additional drainage from Phase I. To preserve base flow to the intervening watercourse, low flows would be diverted via a flow diversion chamber located at the intersection of 68th Avenue and 184th Street. Both options will be presented for consideration in the Engineering Services Section of the NCP Report.

A new storm sewer system will be required along 184 Street, 68 Avenue and Fraser Highway into the Study Area to service the developed catchment.

The lands generally east of 188 Street and north of 64 Avenue drain east via the Fraser Highway and 64 Avenue ditch systems to the existing storm sewer crossing under Fraser Highway at 64 Avenue. All drainage from new development in the Study Area within this catchment should be directed to this location via a new storm sewer system extending along Fraser Highway and 64 Avenue to the internal road system.

Map 12 shows a conceptual layout plan for the storm sewer system necessary to service both catchments within the Phase I Neighbourhood.

Storm sewer extensions to new subdivisions within the Phase I Neighbourhood will be the responsibility of each developer as required in accordance with the Subdivision Control Bylaw. The major system upgrading of the existing storm sewers on 184 Street north of 64 Avenue and the construction of any permanent Detention Pond and storm sewer extensions on 64 Avenue and Fraser Highway constitute works normally funded by Development Cost Charges.

The Community Detention Pond and storm sewer extensions on 184 Street north of 68 Avenue, 68 Avenue east of 184 Street and Fraser Highway to 188 Street are included in the City's 10 year Servicing Plan. The Servicing Plan should be amended to include the remaining major storm sewer construction on 184 Street and 64 Avenue and Fraser Highway.

7.5 Hydro/Telephone and Street Lighting

All extensions of the B.C. Hydro electrical and telephone distribution systems into the Study Area shall be located underground as required under the City's Subdivision Control Bylaw. Ornamental street lighting shall be provided by developers on all streets.

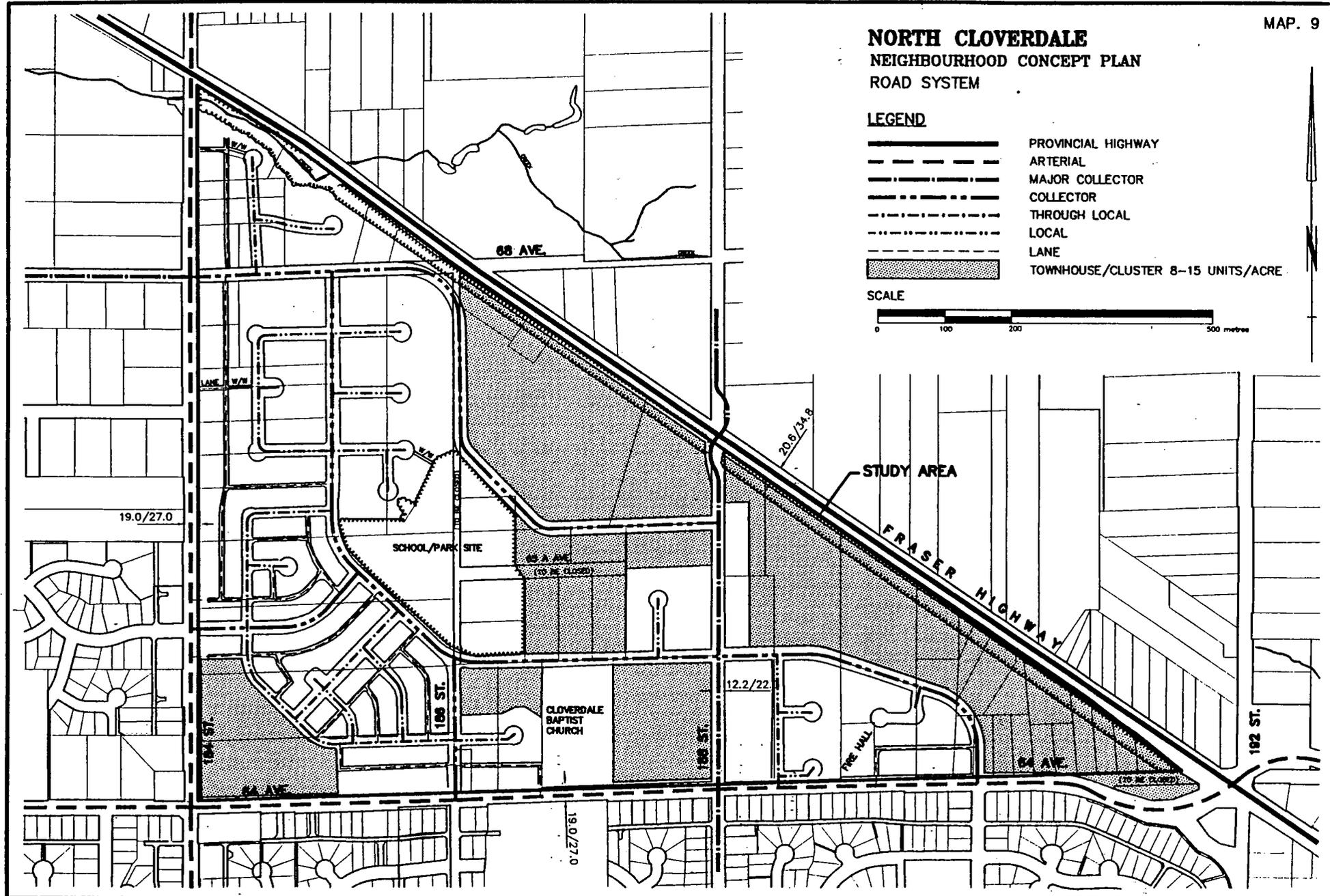
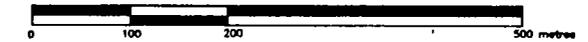
June 3, 1994

NORTH CLOVERDALE NEIGHBOURHOOD CONCEPT PLAN ROAD SYSTEM

LEGEND

-  PROVINCIAL HIGHWAY
-  ARTERIAL
-  MAJOR COLLECTOR
-  COLLECTOR
-  THROUGH LOCAL
-  LOCAL
-  LANE
-  TOWNHOUSE/CLUSTER 8-15 UNITS/ACRE

SCALE

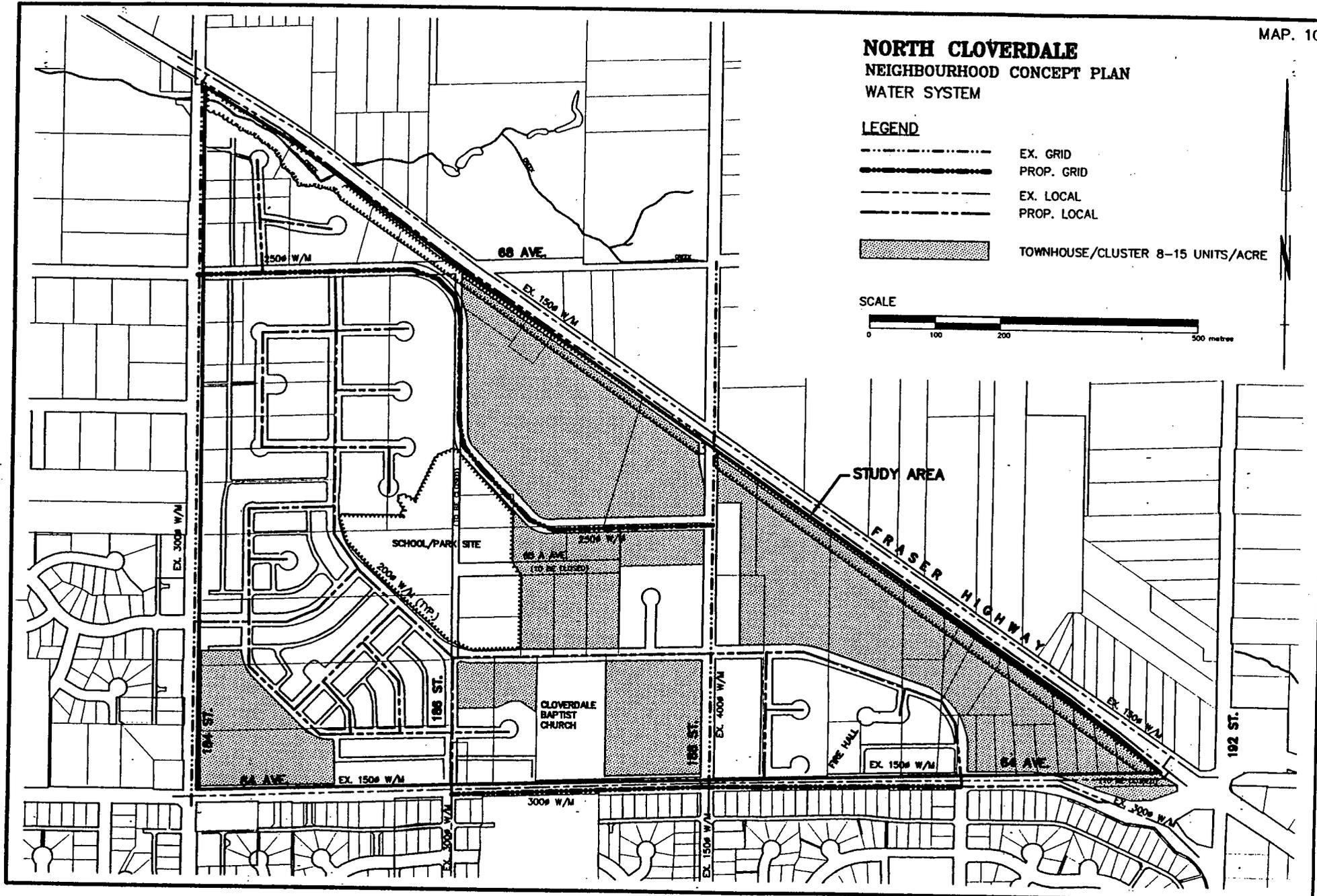
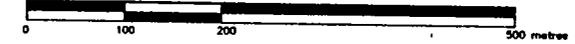


NORTH CLOVERDALE NEIGHBOURHOOD CONCEPT PLAN WATER SYSTEM

LEGEND

-  EX. GRID
-  PROP. GRID
-  EX. LOCAL
-  PROP. LOCAL
-  TOWNHOUSE/CLUSTER 8-15 UNITS/ACRE

SCALE

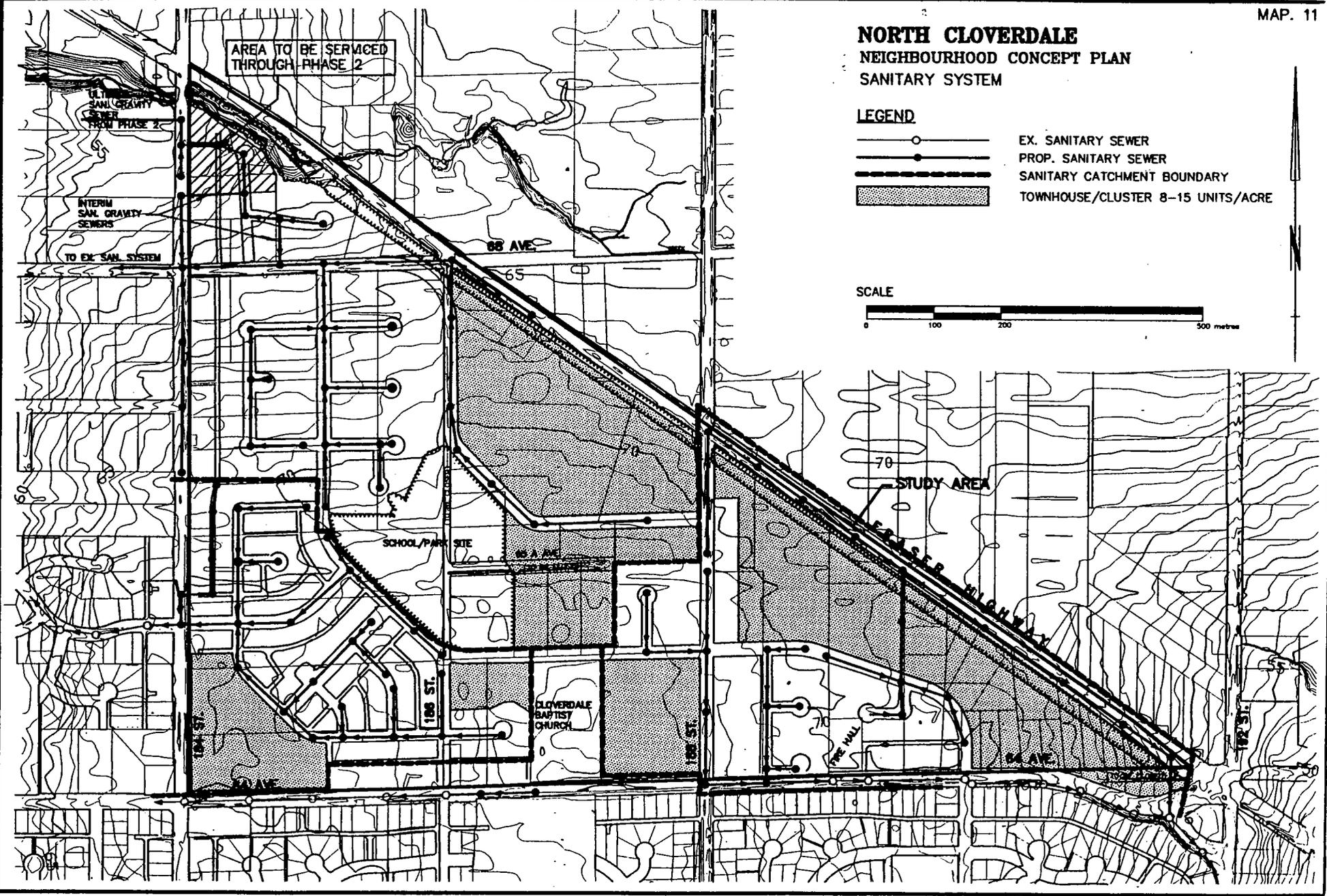
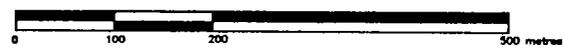


NORTH CLOVERDALE NEIGHBOURHOOD CONCEPT PLAN SANITARY SYSTEM

LEGEND

-  EX. SANITARY SEWER
-  PROP. SANITARY SEWER
-  SANITARY CATCHMENT BOUNDARY
-  TOWNHOUSE/CLUSTER 8-15 UNITS/ACRE

SCALE

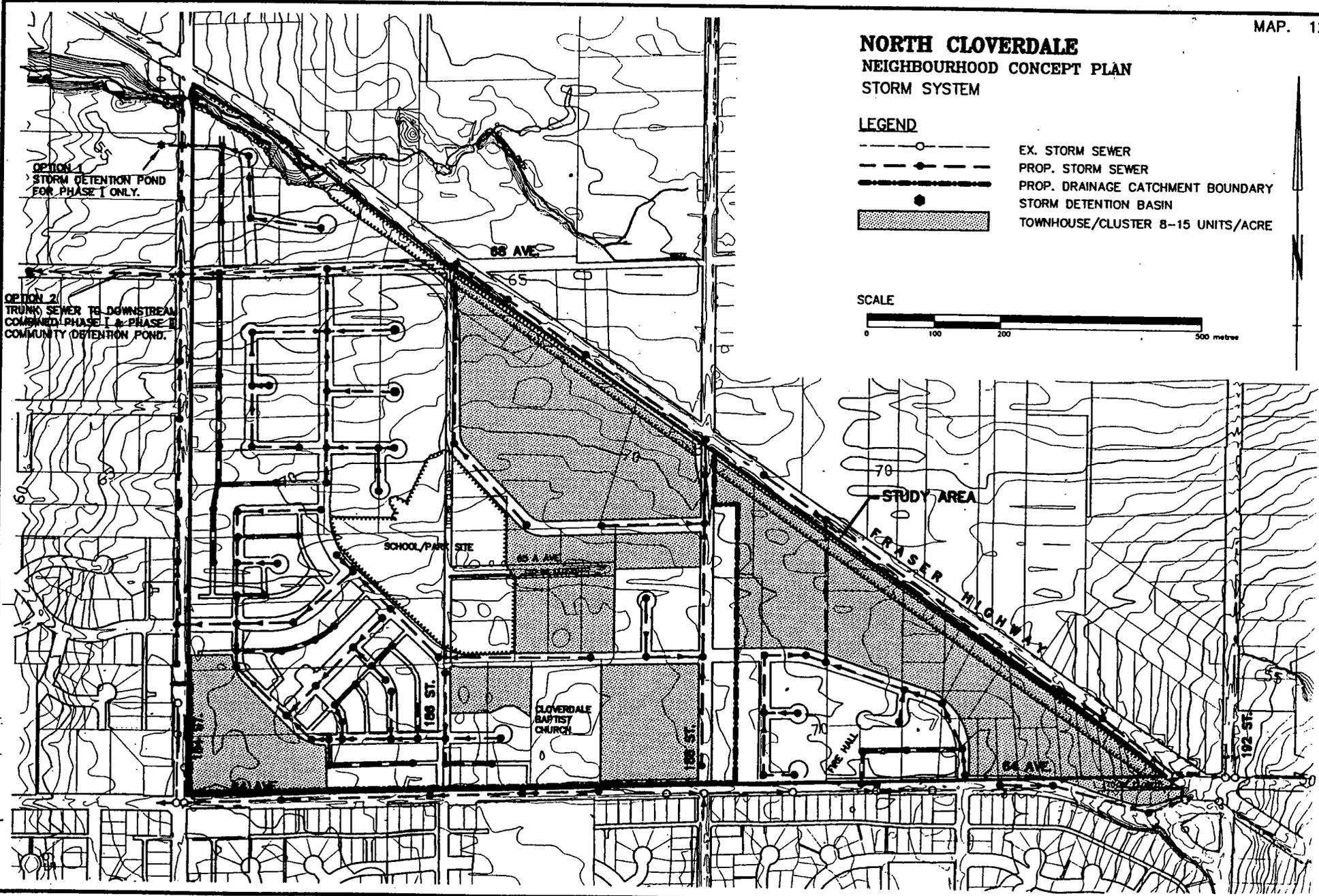
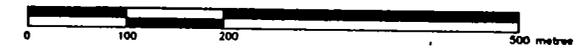


NORTH CLOVERDALE
NEIGHBOURHOOD CONCEPT PLAN
STORM SYSTEM

LEGEND

-  EX. STORM SEWER
-  PROP. STORM SEWER
-  PROP. DRAINAGE CATCHMENT BOUNDARY
-  STORM DETENTION BASIN
-  TOWNHOUSE/CLUSTER 8-15 UNITS/ACRE

SCALE



UNTER LAIRD

**NORTH CLOVERDALE
NEIGHBOURHOOD CONCEPT PLAN
EAST NEIGHBOURHOOD**

**SECTION II
EVALUATION OF
ENGINEERING SERVICES**

August 22, 1994

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SEPARATE BOOKLET

APPENDIX I - Engineering Terms of Reference for North Cloverdale Phase I N.C.P.

APPENDIX II - Water System Analysis

APPENDIX III - Sanitary System Analysis

APPENDIX IV - Hydrology & Drainage

APPENDIX V - Agency Comments

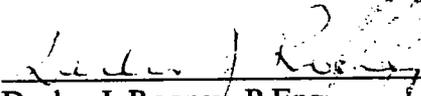
1. INTRODUCTION

This Engineering Services Report forms part of the North Cloverdale East Neighbourhood Concept Plan. Surrey Council requires that Neighbourhood Concept Plans be prepared as a condition of development approval for lands in the North Cloverdale area. The triangle of land bounded by 184 St to the west, 64 Ave to the south and Fraser Highway to the north, the "Study Area", has been designated as the first phase of this process which is called the North Cloverdale East Neighbourhood Concept Plan. The Engineering Services Report is required to address the servicing requirements of the Land Uses proposed in the Concept Plan and identify the works required to adequately service these uses. Services include roads and traffic, water supply, sanitary sewer and drainage.

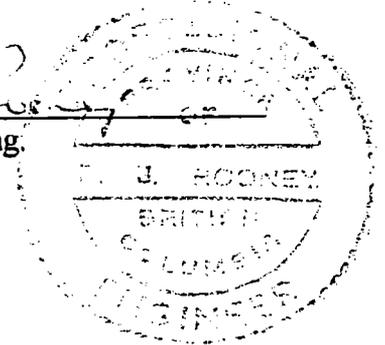
This Report is completed in accordance with the engineering terms of reference for the North Cloverdale Phase I Neighbourhood Concept Plan which were issued by the Land Development, Environment and Research Division of the City of Surrey Engineering Department on December 22nd, 1983. These terms of reference are contained in Appendix I.

The Report preparation included regular consultations and meetings with the Steering Committee of the North Cloverdale Owners Group. The conclusions and recommendations of the Report are endorsed by the Steering Committee

HUNTER LAIRD ENGINEERING LTD.


Declan J. Rooney, P.Eng.

August 19, 1994



2. LAND USE PLAN

2.1 Proposed Land Uses & Development Pattern

As outlined in the North Cloverdale East Neighbourhood Concept Plan document, the land uses proposed provide for a variety of housing in the form of multiple family townhome and single family lot development. The pattern of land uses, road and subdivision, is derived from the North Cloverdale Local Area Plan. The Neighbourhood Plan as shown on Figure 1 includes a combined Elementary School and Neighbourhood Park centrally located in the neighbourhood.

A unique feature of the plan is the reduced frontage type of single family lot subdivision proposed on the southwesterly corner of the study area. This responds to a need for more affordable and less land consumptive housing. The concept proposed provides for a neo-traditional style of housing on compact lots with rear lane access similar to the older development patterns in the west side of Vancouver and areas of Burnaby and New Westminster. This housing will have reduced front yard setbacks with all garage access from the rear lanes.

The remainder of the single family designated areas are to be conventional sized lots with front driveway access except for those lots fronting on the arterial roads where rear lanes are provided. The multiple family component of the Plan provides for townhome and cluster housing development with densities ranging from eight to fifteen units per acre.

The following table extracted from the Neighbourhood Concept Plan summarizes the projected development yield from the designated land use types:

Land Use	Area (ac.)	No. of Units
Detached Single Family	71.48	
- Conventional Lot		386
- Traditional Compact Lot		227
Townhouse/Cluster Residential	66.33	885
Institutional	5.70	
School/Park	17.56	-
Roads	30.93	
TOTAL	192 ac.	1498

2. LAND USE PLAN

2.2 Population Projections

The Neighbourhood Concept Plan recommends that at least 50% of the total number of townhouse and cluster housing units be family oriented. Using estimates of the number of people generated by each type of housing as provided by the City Planning Department, the following table summarizes the ultimate population projections for the study area. In evaluating servicing requirements however, design populations have been calculated from the land uses in accordance with the City Engineering Department's Design Criteria Manual for the purpose of this report.

Land Use	Persons per Dwelling Unit	No. of Dwelling Units	Population
Single Family Residential	3.2	613	1962
Townhouse / Cluster Residential	2.5 (50% 2 bedroom) 2.8 (50% 3 bedroom)	885	2345
Institutional & School	50 per ac.	5.7 ac.	285
TOTAL			4592

2.3 Development Phasing

Development applications for several parcels within the study area are currently being processed through the Surrey Planning Department. These applications vary in location, on the east, central and west sides of the triangle. It is each developers intention to proceed with development as soon as approvals are obtained and phasing will therefore be dictated by services extensions.

The application by Parklane Cascadia covering the southwest corner of the study area has immediately adjacent services which are capable of being extended through the site. Therefore it is anticipated that this will be the first development to proceed. Other developments, both east and west of 188 St, may proceed with the extension of the necessary services and offsite improvements as identified in the following sections of this report.

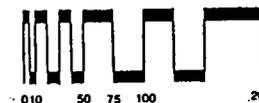
2. LAND USE PLAN

Map 5 following, extracted from the Neighbourhood Concept Plan, shows the distribution of current development applications throughout the Study Area.



North Cloverdale Neighbourhood Concept Plan

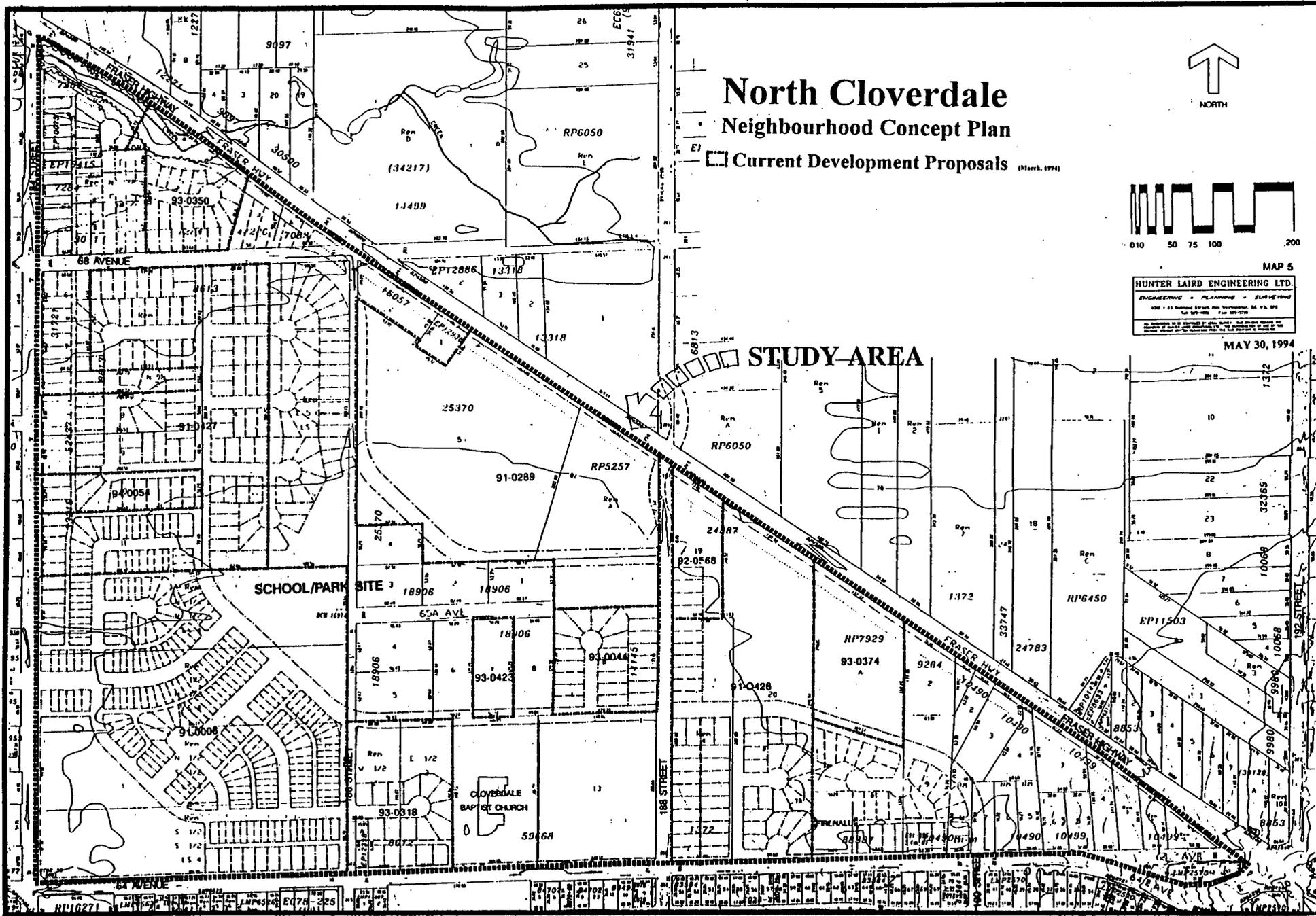
 Current Development Proposals (March, 1994)



MAP 5
HUNTER LAIRD ENGINEERING LTD.
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1300 - 44th Street, New Westminster, B.C. V3L 5P2
Tel: 993-8888 Fax: 993-2200

MAY 30, 1994

STUDY AREA



5

MAP 5

3. ROADS & TRAFFIC

3.1 Existing Road System

The Study Area is serviced by the Regional and Municipal Road Network. Access to the Regional Network is available via Fraser Highway to the north. Both 184 St and 64 Ave which define the Study Area on the west and south, are currently designated Municipal arterial roads which give access to both Municipal and Regional Road Networks. The study area is therefore well serviced with a relatively good rectangular grid network of roads existing in this part of Surrey. Surrey's R91 Grid Road Plan does not designate any further arterial road requirements within the study area.

184 St has two existing lanes north/south and is signalized at its intersection with Fraser Highway and 64 Ave. 64 Ave has two existing lanes east/west with signalized intersections at both 184 St and Fraser Highway. The intersection with Fraser Highway has recently been upgraded to provide for full turning movements in all directions.

188 St in the Study Area is a partially completed two lane rural standard road. This is designated as a future major collector road on the R91 Grid Road Plan. 68 Ave is a two lane east/west roadway which is paved to a rural standard between 184 St and Fraser Highway. This roadway is classified as a major collector road west of 184 St on Surrey's R91 Grid Road Plan.

Only two other road dedications exist within the neighbourhood. These are 186th St to half dedication width which runs south from 68 Ave; and 65A Ave which runs from 186th St to approximately 400m east, giving access to properties along its frontage. 186th St is partially constructed to a two lane surface dressed rural type standard. Both 65 Ave and the portion of 186th St on the School Park site will not be part of the development road pattern and will therefore require closure.

3.2 Traffic Study

The terms of reference for the Engineering Services component of the Neighbourhood Concept Plan requires that a traffic study be undertaken to determine the immediate area impacts of the Neighbourhood development. This traffic study has been completed by Ward Consulting Group, Traffic Engineering Consultants, and is submitted as a separate document. In general the Report assesses the areas' road network under increasing traffic conditions within a 10 year time horizon. The Report estimates normal traffic growth and it's consequence on the road network within the context of improvements contemplated by the City's 10 Year Servicing Plan and the Ministry of Transportation and Highways. The additional traffic growth generated by the proposed land uses within the Study Area is superimposed and resulting additional improvements identified.

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3.3 Fraser Highway

Fraser Highway (Highway 1A) is a two lane highway which connects Langley to the Whalley area of Surrey and is under the jurisdiction of the Ministry of Transportation and Highways. In the vicinity of the Study Area, Fraser Highway has a posted speed of 80km per hour. It's intersection with 184 St to the west and 68 Ave/192 St to the east are signalized and provide for turn lanes. Provision is made in the Neighbourhood Concept Plan for the necessary road dedication to give an ultimate dedicated right-of-way width of 34.8 metres. This will facilitate the future widening of Fraser Highway to a full four lane standard by the Ministry of Transportation and Highways.

The development plan provides for closing off the existing access to Fraser Highway at 186th St and 68 Ave. This access configuration is unsafe and is not necessary to support the Land Use Plan. The access to Fraser Highway from 188 St is to be maintained under the proposed plan. A realignment of 188 St is recommended in the Plan to give a better angle of intersection with Fraser Highway. A conceptual plan of this proposed realigned intersection is shown on Figure 3.

The installation of a traffic signal is proposed for this intersection and should be implemented when the realignment of 188 St is completed.

3.4 Development Road Pattern

The proposed Concept Plan provides for access roads to the neighbourhood from 184 St at 68 Ave and 65 Ave and from 64 Ave at 186th St, 188 St and 190 St. 188 St will connect 64 Ave with Fraser Highway and is designated as a major collector road on Surrey's R91 Grid Road Plan.

Three internal collector roads are proposed to provide access from the neighbourhood and the school park site to the Municipal arterial and Regional Highway Network. These include the extension of 68 Ave from 184 St connecting to 188 St, 185th St from the 68 Ave extension which runs north/south to the school park site and then east/west as 65 Ave to intersect with 188 St. East of 188 St this road fronts the proposed multiple family and single family areas and curves north/south to intersect with 64 Ave at 190 St. The secondary accesses connecting to this road from 184 St at Claytonhill Drive and 64 Ave at 186th St are also designated as collector roads.

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Completing the road hierarchy, access from the collector road system is provided by an arrangement of through local roads and cul-de-sacs. This local road pattern, as shown on the Neighbourhood Concept Plan, provides for an efficient and balanced layout to give graduated access to the collector and arterial road systems.

Direct access to single family and residential lots is not permitted from 184 St, 64 Ave and Fraser Highway. Lots fronting onto the arterial roads will be provided with rear lane accesses or frontage roads in accordance with Surrey's standards.

As noted in the preceding Land Use section, the neo-traditional style of housing in the plan is to be provided with rear lanes. For this housing all garage and driveways will be limited to rear access.

All internal roads, including 188 St, will be the responsibility of developers to construct as required through the rezoning and subdivision approval process. The City's 'urban forest' road standard is to be applied within the Study Area. Minor variations to the road layout and standards shown may be permitted, through City Council variance approval, based upon detailed subdivision evaluation. City Council is currently considering a Development Variance Permit under application 6991-0006-00 for the area bounded by 64 to 66 Avenues and 184 to 186 Streets to reflect the proposed Neo-Traditional Neighbourhood Concept. Developers will be required to ensure that subdivision submissions recognize the subdivision potential of adjacent property owners.

3.5 Surrey Capital Works - 10 Year Servicing Plan

The City of Surrey's current 10 Year Servicing Plan establishes a program of works to facilitate the provision of municipal engineering services to accommodate existing and projected growth. The current plan covers the period from 1993 to 2002. The road and highway improvements contemplated in this servicing plan of relevance to the study area are summarized as follows:

Item	Description	Ref No.
64 Ave - 176 St to 184 St.	Widen to 4 lanes	1412
Fraser Highway - 176 St to 196 St	Urban Features	4006
188 St - 60 Ave to 64 Ave	Widen to 4 lanes	1083
60 Ave - 184 St to 188 St	Widen to 12.2 metres	1361
60 Ave at 180 St	Traffic Signal Replacement	4558
60 Ave at 184 St	Traffic Signal Replacement	4559

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These works are planned in response to anticipated growth within the region, which includes the Study Area

3.6 External Improvements

The Traffic Study identifies a number of system improvements required to mitigate the impact of traffic growth directly from the development on the adjacent road network and provide for safe and efficient access. These are summarized as follows:

Item	Description
Intersection of Fraser Highway & 188 St	Provide widening to accommodate channelization and signalization for full turning movements
Intersection of Fraser Highway & 64 Ave	Provide widening for additional through lanes
Intersection of 64 Ave & 188 St	Widening for left turn lanes - both directions on 64 Ave - and signalization
184 St	Provide widening and painted channelization for left turn lanes into the development at 68 Ave and 65 Ave
64 Ave	Provide widening for left turn lanes and painted channelization for movement into the development at 186th St and 190 St
64 Ave & 184 St, North and East sides	As development proceeds, provide sidewalk and street lighting to accommodate future 4 laning of these arterial roads

Internally, the intersection of 66 Ave extension and 188 St has to be located no closer to Fraser Highway than as shown on the Concept Plan. The distance between these two intersections as shown will accommodate the necessary turning movements. Direct access to the multiple family parcels between these two intersections should be restricted from 188 St.

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At the present time a traffic study is underway on the Phase II lands and the resulting review of the impact of the combined works may necessitate a change to the proposed works and the projected schedule of construction.

3.7 Internal Road Classifications & Design Standards

Figure 2 shows the road classifications proposed for the internal road network. These are grouped into the following categories:

Road Classification	Road Dedication (m)	Pavement Width (m)	Sidewalks
Arterial	27	19 (including 4.4 metre median)	2
Major Collector	24	12.2	2
Collector	20	11	1
Through Local - Conventional	20	8.5	1
Limited Local - Conventional	16.5	8.0	0
Through Local - Neo-Traditional Neighbourhood	15.25	8.5	2
Limited Local - Neo-Traditional Neighbourhood	15.25	8.0	2

The Concept Plan provides for the protection of a dedicated width along the Fraser Highway of 17.4 metres from the existing centre line. This dedication will be sufficient to permit the future widening of Fraser Highway to a 4 lane standard including the necessary channelization and turning lanes at the intersection with 188 St. Figure 3 shows a conceptual layout for the Fraser Highway and 188 St intersection which illustrates a potential intersection configuration within the proposed road dedications. Detailed design for the intersection will confirm the actual alignment of the roadways and dedications.

3. ROADS & TRAFFIC

The Concept Plan provides for the future widening to full arterial road standard of 64 Ave and 184 St by indicating a dedicated width requirement of 13.5 metres from the existing centre line. This will permit a full four lane divided arterial road standard including turning movements at intersections. The standard cross-section for the arterial road is to be in accordance with Standard Drawing SSD-R11 of the City of Surrey Engineering Department book of Standard Drawings. Dedications and design cross-section standards for the major collector, collector and conventional lot local roads are to be in accordance with Standard Drawing SSD-R9. To allow safer pedestrian passage for park and school users from and to the east portion of the Neighbourhood, the pavement width at the internal intersections of 188 St should be narrowed on both sides of the intersection by the width of the parking lanes.

The proposed road dedications for the local roads within the proposed Neo-Traditional Neighbourhood is non-standard in that road dedications and utility corridors are slightly less than provided in the Standard Drawings. The standards proposed for these roads are shown on Figure 4. In order for these standards to be adopted, the developers will be required to obtain a Development Variance Permit for the variances prior to subdivision approval.

The plan for the Neo-Traditional Neighbourhood (NTN) portion includes rear lanes. These are intended to provide access to rear yard garages, carports or parking pads for all of the lots. The housing forms will incorporate the rear yard access feature, so front yard driveways will not be permitted. The proposed road standard for these areas, which includes an 8.5 metre wide pavement width for through local and 8.0 metre width for limited local and sidewalks on both sides, will permit onstreet parking and pedestrian movement and access. As driveways are not required, barrier curbs are proposed in keeping with the traditional neighbourhood concept.

Rear lanes are to be to City Standard Drawing SSD-R17 with a 6 metre wide dedicated right-of-way and a 5.4 metre pavement width with roll-over curb and gutter on both sides. Any variation of this standard will require a development variance permit prior to subdivision approval.

In general, roadway design standards shall conform to Table 2.5.1.4 of the Design Criteria Manual, Document 1 of Surrey Subdivision Bylaw. The Concept Plan identifies two through local roads with right angle alignments, similar to that permitted for limited local roadways. The nature of these two roads is intended to service local traffic only and the right angle alignments should assist in reducing the running speed of traffic through these areas.

3. ROADS & TRAFFIC

Schedule A of the Surrey Subdivision Bylaw provides that through local roads adjacent multiple family designated land uses should have an 11 metre pavement within a 20 metre dedicated roadway. However, to remain in keeping with the character of the proposed Neo-Traditional Neighbourhood, the internal local road fronting the multiple family designated parcel on the south-west corner of the study will vary from this. This road is proposed to remain at an 8.5 metre wide pavement width similar to the alternative standard proposed for the internal roads of the NTN area, except that an additional 2.5 metre wide parking lane on a public passage statutory right-of-way will be added for the frontage of the townhouse parcel. This variation will require a Development Variance Permit prior to subdivision approval.

Lighting levels for all roadways are to be in accordance with the table on Roadway Design Standards. Streetlighting within the Neo-Traditional Neighbourhood area will be ornamental post-top style in character with the neighbourhood.

To maintain the streetscape and slow traffic egress from the lanes, sidewalk letdowns are recommended at lane entrances versus the use of curb return intersections.

3.8 Public Transit

As noted in the Traffic Study, the Concept Plan road network will allow sufficient designation of transit routes to adequately service the proposed neighbourhood. Any of the external arterial roads or internal collector roads are capable of being designated as transit routes and can readily accommodate buses and bus bays. The road layout has been submitted to B.C. Transit for their information and consideration in locating bus transit routes and bus stops in the future. A copy of their comments and subsequent response are provided as Appendix V to this Report. The Plan provides for sufficient pedestrian corridors along street sidewalks or pedestrian walkways to permit easy access to possible future transit routes, from any part of the neighbourhood.

3.9 Pedestrian & Cyclist Circulation

The arrangement of collector roads within the neighbourhood provides easy access to pedestrians and cyclists from the local road network to possible transit routes, Fraser Highway and the Arterial Road system. The Concept Plan provides for a pedestrian/bike path within the buffer strip running along Fraser Highway. The pedestrian/bike pathway

3. ROADS & TRAFFIC

proposed is a 3.0 metre wide asphalt walk which slightly exceeds the Ministry of Transportation & Highways standard for a two-way bike path. Although the pathway is intended to be a joint-use pedestrian cyclist facility the width proposed is considered adequate considering the suburban nature of the location and the anticipated user frequency. Detailed design of the pathway should incorporate adequate access through the buffer to the NCP lands and to Fraser Highway.

The Concept Plan provides for a 3.0 metre wide diagonal walkway crossing the study area south-west to north-east from the 64 Ave/184 St intersection to Fraser Highway through the multiple family sites, single family area and Park site. This will give access to both pedestrians and cyclists from Fraser Highway, 64 Ave and 184 St to the School Park site. The walkway and collector roads radiate out from the School Park site allowing movement in all directions for pedestrian and bicycle users. Figure 5 shows the street, road and walkway routes which can be utilized by pedestrians and cyclists. It is suggested that lighting be considered along the walkway in those that are not serviced by roadway streetlights.

3.10 Cost Estimates - Major Works

The construction costs of the major works for the external improvements as identified in section 3.6 as a consequence of this development are estimated as follows:

	Item	Cost
1.	Add 2nd Through Lane E.W./N.S. on Fraser Hwy - 64 Ave intersection	300,000.00
2.	Add Left Turn Lane at Intersection of 64 Ave & 188 St including traffic signals	200,000.00
3.	Add Left Turn Lane at Intersection of Fraser Hwy & 188 St including traffic signals	350,000.00
4.	Add Left Turn Lanes on 184 St at 65 Ave	120,000.00
5.	As above on 64 Ave at 186 St	120,000.00
6.	As above on 184 St at 68 Ave	120,000.00
7.	As above on 64 Ave at 190 St	120,000.00
8.	Add Sidewalk & Streetlighting Frontage 64 Ave & 184 St	412,000.00
9.	Add Urban Features on Fraser Highway from 184 St to 192 St	500,000.00
	TOTAL	\$2,042,000.00

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The preliminary estimates are expressed in current dollars and include allowances for contingency and engineering. The item for the 64 Ave and 184 St sidewalk and streetlighting on the development side does not include the road widening as this has not been identified as a requirement necessitated by development of the Neighbourhood in the Traffic Study.

3.11 Phasing & Implementation

There are a number of significant development applications within the Study area which are currently being processed through the Surrey Planning Department. These are fairly evenly distributed within the west, central and easterly sections. These developments will proceed concurrently with internal phasing as market conditions dictate. The Traffic Study concludes that the external road system, with the improvements as noted will be able to accommodate this concurrent development. Based on an anticipated annual market absorption rate of between 200 and 300 units, and assuming that current development applications proceed as anticipated, we have projected a schedule for completing the external Roadworks improvements. The completion schedule is as follows:

Completion Year	Item
1994	Left Turn Lanes - 184 St at 65 Ave
1994	Left Turn Lanes - 64 Ave at 186 St
1995	Left Turn Lanes - 184 St at 68 Ave
1996	Left Turn Lanes - 64 Ave at 188 St
1997	Intersection Fraser Highway & 188 St
1998	Left Turn Lane - 64 Ave at 190 St
1999	Second Through Lane - EW/NS Fraser Highway & 64 Ave
2000	Urban Features - Fraser Highway Frontage
1994 to 2000	Sidewalk & Streetlighting - 64 Ave & 184 St

3. ROADS & TRAFFIC

Warrants can be established by the Traffic Consultant which would establish a threshold for the implementation of each of the proposed works. The rate of development could then be monitored to more accurately forecast the timing of each of the proposed items.

The item for the addition of urban features along Fraser Highway for the frontage of the Study Area, is included in the current 10 Year Servicing Plan. As all of the other items are arterial road or regional road related, the 10 Year Servicing Plan should be amended to include these works so that they are provided for in an amended the Development Cost Charge Bylaw. The works could then be implemented by a combination of direct developer constructed works and works by the City. A review of the 10 Year Servicing Plan is anticipated in the Summer of 1995 with the subsequent review and revision of the Development Cost Bylaw. In the event that development proceeds to a point where the implementation of any of the works is required in advance of an amendment to the 10 Year Servicing Plan, individual developers would have to weigh the impact of bearing the cost of construction of the applicable item to proceed in advance of eligibility for DCC rebates.

Developer constructed works would be refunded from the Developers' road component of the development cost charge payment for the specific development. City designated works would be planned as part of each years capital works projects and be funded by the Development Cost Charge Fund. Developer constructed works would be designed and constructed concurrently with the adjacent development. The following categorizes the works recommended for Developer and City construction:

A. <u>Developer Constructed</u>	<u>Completion Year</u>
Add left turn lane on 184 St at 65 Ave	1994
Add left turn lane on 64 Ave at 185 St	1994
Add sidewalk and streetlighting frontage 64 Ave & 188 St	1994 to 2000
Add left turn lane on 184 St at 68 Ave	1995
Add left turn lane on 64 Ave at 188 St including signalization	1996
Add left turn lane on 64 Ave at 190 St	1998
B. <u>City Constructed Works</u>	
Reconstruction of the intersection of Fraser Highway & 188 St including left turn lanes and signalization	1997
Add second through lane east-west/north-south on Fraser Highway - 64 Ave intersection	1999
Add urban features Fraser Highway for frontage of Study	

Area

1999

4. WATER SUPPLY & DISTRIBUTION

4.1 Existing Water Supply & Distribution

The Study Area lies within the service area of the Clayton Hill Pump Station located at 72 Ave west of 192 St. This pump station pumps from the Clayton Hill Reservoir which is fed by the G.V.R.D. bulk regional water system. The Study Area is within the 115 metre HGL pressure zone and is serviced from the pump station by an existing 300mm grid main on 184 St and a 400mm diameter grid main on 188 St. There is an existing 150mm diameter main on 64 Ave. The existing water distribution system servicing the area is shown on Figure 6.

4.2 Development Demands

The land use designations as provided in the Neighbourhood Concept Plan will impose an additional water supply demand on the existing municipal water supply system. The additional demands were calculated based on the proposed land uses with population projected from the City's Engineering Department Design Criteria Manual and are tabulated as follows:

A. Domestic

Average Daily Demand	26.3 litres/sec
Maximum Peak Day Demand	52.6 litres/sec
Peak Hour Demand	105.2 litres/sec

B. Fire Flow

Neo-Traditional Single Family	60 litres/sec
Traditional Single Family	60 litres/sec
Multiple Family Townhouse	120 litres/sec
Multiple Family Townhouse/Low Density Apartment	120 litres/sec
School	120 litres/sec

Appendix II shows a nodal distribution of these demands throughout the Study Area. Design flows for all water supply mains servicing the Neighbourhood must be the greater of maximum day domestic demand plus fire flow at a residual head of 14 metres or peak hour domestic demand at a residual head of 28 metres.

4. WATER SUPPLY & DISTRIBUTION

4.3 Designated Grid Mains & Surrey 10 Year Servicing Plan

The 10 Year Servicing Plan identifies and provides for growth related improvements to the regional supply system as shown on the schedule for water supply work projects. This schedule does not include any works of relevance to the Study Area.

The City has designated a grid network within each supply zone of all mains 250mm diameter and greater which will be necessary to service saturation development. Of relevance to the Study Area, this ultimate water grid map shows a requirement for additional grid mains to be constructed east-west along the 68 Ave alignment and the 64 Ave alignment.

The 10 Year Servicing Plan provides for the construction of a new 300mm diameter grid main on 64 Ave between 184 St and 192 St. The north-south grid mains on 184 St, 188 St and 192 St adjacent and within the Study Area already exist. Provision has been made within the subdivision immediately south of 64 Ave between 184 St and 186 St for a 300mm diameter watermain which connects back to 64 Ave in lieu of the grid main on 64 Ave between 184 St and 186 St.

4.4 Proposed Distribution System

Figure 6 shows a conceptual layout of the water distribution system within the Study Area based on the land uses and road pattern provided in the Neighbourhood Concept Plan. The layout provides for the grid mains as required on the ultimate grid main map by showing a 250mm diameter main on 68 Ave connecting from 184 St to 188 St and a 300mm diameter main parallel to or along 64 Ave connecting from 186 St to the existing 300mm diameter main on 64 Ave west of 192 St. All other local mains would be 200mm diameter.

4.5 Hydraulic Network Analysis

Surrey's design criteria for the design of watermains requires that system extensions be capable of supplying water under the following conditions:

4. WATER SUPPLY & DISTRIBUTION

<u>Demand Condition</u>	<u>Residual Head</u>	<u>Maximum Main Velocity</u>
Peak Hour Demand	28 metres	-
Maximum Day plus Fire Flow	14 metres	2 metres/sec

The proposed distribution system was analyzed and checked for adequacy in accordance with the above criteria. Nodal demands were assigned as provided in Appendix II with the nodes numbered as shown on Figure 6. The system was analyzed using the City's permitted simplifying assumption for the starting hydraulic grade level of 70% available static in the offsite grid mains on 184 St, 188 St and 192 St. As the fire flow condition is more critical for watermain design in this context, fire flows were allocated at a number of critical locations and the system residual head was verified. The locations chosen were adjacent to the proposed Multiple Family and School areas as these had the higher fire flow requirement. Details of the network analysis and results are included in Appendix II.

A specific check was made on the existing 150mm diameter main on 64 Ave between 192 St and 184 St. This main was found to be adequate to provide fire flow to the fronting properties under the permitted design criteria. This verification is also included with Appendix II.

4.6 Cost Estimates - Grid Mains

The grid mains designated to be constructed run along the 68 Ave extension connecting between 184 St and 188 St and on 64 Ave from 186 St to the west of 192 St. The 10 Year Servicing Plan provides for the 300mm diameter grid main on 64 Ave. The Servicing Plan also includes an allowance for upsizing contributions to grid mains for oversizing of mains constructed by developers. In accordance with Surrey policy these upsizing costs are contributed to developers from development cost charges provided that the main size is not a requirement to deliver fire flow to the specific development.

The estimated cost for the designated 64 Ave grid main and the upsizing of the 68 Ave extension main is as follows:

- | | | |
|----|---|--------------|
| 1. | Upsize Watermain 200mm to 250mm along 68 Ave and 66 Ave from 184 St to 188 St | \$ 31,200.00 |
| 2. | 300mm Watermain on 64 Ave from 186 St to West of 192 St | \$214,000.00 |

4. WATER SUPPLY & DISTRIBUTION

4.7 Phasing & Implementation

Because of the existing grid mains on 184 St, 188 St and 192 St, phasing of developments within the Study Area may proceed relatively concurrently within the westerly, central and easterly sectors. Watermains are to be extended in accordance with the conceptual layout plan by each Developer as required. The oversizing cost for the proposed 68 Ave extension grid main would be a contribution from development cost charges. Each Developer, through the development process, will be required to demonstrate that the system, as extended, will be capable of complying with the City's design criteria for ultimate and interim fire flow conditions.

As there are currently applications being processed for developments adjacent to the 68 Ave extension between 188 St and 184 St, we have projected that this watermain will be installed by the relevant Developers during 1994 and 1996.

As there is an existing 150mm diameter watermain on 64 Ave, the ultimate grid main is not required for local water supply purposes. This grid main is to be constructed under a Surrey Capital Works project and funded through development cost charges. No amendments are required to the water supply component of the 10 Year Servicing Plan as a result of development proceeding within the Neighbourhood Concept Plan area.

The grid main on 64 Ave is listed under the schedule for major grid works in the 10 Year Servicing Plan to be started before 1997. Given the market projections for the pace of development which predict that the Study Area will be fully developed by the year 2000, the 64 Ave grid main should be constructed no later than 1998 but this may change due to area needs.

An alternative to constructing the 64 Ave grid main which would allow for its implementation as development proceeds would be to upsize the distribution main to grid main status on 186 St between 64 Ave and 65 Ave, on 65 Ave and 65 Ave extension which intersects with 64 Ave, between 186 St and 190 St. This could be accomplished at an upsizing cost of \$100,000.00. A disadvantage is that the main on 64 Ave would remain at 150mm diameter. The Appendix II analysis shows that the existing 150mm diameter main would be capable of satisfying fire flow supply needs for the existing and projected land uses along the 64 Ave frontage. The internal upsizing is therefore a viable alternative to the grid main construction on 64 Ave. The cost for this alternative over the nominal size main construction would be as follows:

4. WATER SUPPLY & DISTRIBUTION

Upsizing on 186 St & 65 Ave	100,000.00
Reduced Length of new 300mm diameter main on 64 Ave between 190 St & 191 St	<u>50,000.00</u>
TOTAL COST	<u>\$150,000.00</u>

The upsizing cost has been calculated from a nominal 200mm diameter main to a 300mm diameter main. The hydraulic analysis confirmed that a 200mm diameter main is adequate when the network is completed. However, as the main gets extended progressively within the Neighbourhood without looping, individual developments may require larger than the nominal size main for fire flows. In this event, upsizing contributions would be based on the larger size so the total upsizing cost may be less than \$100,000 when completed.

The cost of the upsizing alternative is considerably less than the cost for constructing a 300mm diameter grid main on 64 Ave and is recommended due to the reduced costs and the implementation possible by developers as their developments proceed. This option has been included in Section 7 which summarizes the major servicing costs.

5. SANITARY SEWER

5.1 Existing Sewer System

There are existing sanitary sewers on 184 St at Claytonhill Drive, on 64 Ave between 184 St & 186 St, and on 64 Ave between 190 St and 192 St. The portion of the Study Area south of approximately the 66A Ave extension west of 188 St is currently within a sanitary sewer catchment area and is capable of being serviced by an extension of the existing sanitary sewers on 184 St at Claytonhill Drive and on 64 Ave west 186 St. The existing sanitary sewer on 64 Ave east of 192 St is capable of being extended into the Study Area to service those lands which lie within its catchment.

The existing sewer system on 184 St runs west along Claytonhill Drive to 65A Ave and ultimately connects to the gravity sewer system on 176 St. This system runs south along 176 St to discharge to a 750mm diameter trunk sewer at 60 Ave and 176 St.

The existing sanitary sewer on 64 Ave and 192 St runs south along 192 St to 54 Ave and discharges through an outfall sewer on 196 St to an existing sanitary pump station located at 52 Ave and 196 St. This pump station pumps sewage from a section of Surrey and Langley to the existing 675mm diameter G.V.R.D. trunk sewer which runs west on 52 Ave from 188A St. Figures 8 and 9 show the major existing sanitary sewers relative to the Neighbourhood.

5.2 Sewer Catchments

.1 Internal

Due to topographic constraints, a significant portion of the Study Area north of the approximate 66A Ave alignment and west of 188 St lies outside the existing sanitary sewer catchment and is not currently serviced by a sanitary sewer. For gravity service, this area would require a sewer extension along 68 Ave from 176 St. The topography immediately east of 188 St and north of 64 Ave and the triangle bounded by 188 St, 64 Ave and Fraser Highway lends itself to being serviced by an extension of the 192 St/64 Ave existing sanitary sewer into the Area.

New development fronting 64 Ave, west of 188 St, can be serviced to the existing sewer system on 64 Ave west of 186 St or an extension of this system east of 186 St.

5. SANITARY SEWER

For sanitary sewer purposes, the Neighbourhood will have two primary catchments, one draining west to the 176 St sewer system and one draining east and then south to the 192 St sewer system. The westerly catchment will have three sub-catchments - Catchment A draining to a sewer extension on 68 Ave, Catchment B to the existing Claytonhill Drive sanitary sewer and a small sub-Catchment D discharging to the existing 64 Ave sewer system. The system, downstream of Catchment D, flows west and south to discharge to the trunk sewer at 180 St. and #10 Highway. These catchment areas are shown on Figure 7. East of 188 St, the easterly catchment, Catchment C, would be serviced by sewer extensions from the existing 64 Ave and 192 St sanitary sewer system.

.2 External

The sewer system serving both the westerly and easterly internal catchments also service intervening downstream catchments and future development within upstream catchments. Figure 7 identifies both the downstream and upstream catchments based on topography, legal ownership and constraints imposed by natural physical features such as ravines and water courses. The relative catchment areas are tabulated as follows:

A.	<u>West Catchment</u>	
	68 Ave system downstream catchment	80 ha
	Catchment A	36 ha
	Upstream catchment	120 ha
	Claytonhill Drive - 65 Ave system downstream catchment	24.5 ha
	Catchment B	18 ha
B.	<u>East Catchment</u>	
	192 St system downstream catchment	108 ha
	196 St system downstream catchment	95 ha
	Catchment C	22 ha
	Upstream catchment	40 ha

5. SANITARY SEWER

5.3 Designated Trunk Sewers & Surrey 10 Year Servicing Plan

As outlined in the North Cloverdale Local Area Plan a new large diameter trunk sewer will ultimately be required to service the long term development of North Cloverdale Phase II and the Clayton area. This trunk sewer is shown following a northerly alignment parallel with 176 St between 60 Ave and 68 Ave and north-easterly along the top of the slope at approximately the 15m contour to Fraser Highway and 72 Ave. Construction of this trunk is included in the City's 10 Year Servicing Plan at an estimated cost of \$5 million.

From the easterly catchment, the downstream sewer system on 192 St conveys sewage to ultimately discharge to the GVS & DD lift station located at 196 St and 52 Ave. Discharge to this lift station is limited under a user agreement between Surrey and the GVS & DD. To reduce significantly the area draining to the lift station, there is provision in the City's 10 Year Servicing Plan for the construction of a new trunk relief sewer to bypass the lift station and adjacent upstream sewers. This relief sewer is designated to run on a diagonal alignment partway along Highway #10 Langley Bypass from 60 Ave and 196 St to 52 Ave and 188A St. The section between 192 St and 188 St will cross private lands and requires acquisition of right-of-ways. The total cost of this relief sewer as designated in the 10 Year Servicing Plan is \$972,300.00. \$604,300.00 applies to the section between 192 St and 188A St.

5.4 Development Sewage Flows

Section 2 of this Report outlines the land uses designated in the Neighbourhood Concept Plan. Using this data, the designated land uses within the internal sewer catchment boundaries, and the City's Design Criteria for calculating sewage flows, the following peak flows from each catchment are calculated:

Catchment A	40.3 lps (litres per second)
Catchment B	19.0 lps
Catchment C	30.0 lps
Catchment D	29.0 lps

5. SANITARY SEWER

5.5 System Capacity Analysis - "West" Catchment

As noted previously, the neighbourhood will be divided into two main sewer catchments - west and east. The westerly catchment has two main sub-catchments - A and B. Catchment B will discharge to an existing 200mm diameter sewer on Claytonhill Drive. This sewer runs west from Claytonhill Drive on a right-of-way under the B.C. Hydro transmission line to a 250mm diameter sewer on 65 Ave as shown on Figure 8.

Using the City's design criteria for sewage flows, this section of existing sewer was analyzed for capacity under peak sewage flow conditions from its existing serviced catchment. Two scenarios for development in the catchment were used in the analysis, the first based on existing development and connections; and the second assuming full development of existing serviced land to the land uses designated in the existing Official Community Plan. For existing development conditions, the catchment was reviewed for the type and size of existing developed parcels, the number of installed connections, the extent of occupied parcels and the type of existing buildings on the parcels occupied. Based on this analysis sewage flow rates were derived and applied to the system. This methodology could be confirmed by conducting flow monitoring of critical sections of the existing sewer where it may be considered significant to the conclusions of the Report. This analysis is detailed in Appendix II in spreadsheet format. The tabulation from the analysis demonstrates that for assumed existing conditions all sections of sewer operate within pipe capacity. A second stage of analysis was completed with the addition of peak sewage flow from development within Sub-Catchment B discharging again for assumed existing conditions in the downstream catchment. The resulting spreadsheet tabulation is also shown in Appendix III with the percentage of full pipe flow for each section also tabulated.

The existing sewerage system on 176 St running south from 65A Ave to the existing trunk on 60 Ave was analyzed for capacity under peak sewage flow condition from its existing catchment for existing developed condition. For those lands within its existing serviced catchment, the analysis shows that the sewer does have sufficient capacity to convey the peak sewage flow.

A second analysis was performed with the addition of sewage flow from Sub-Catchment B to existing conditions. With the exception of one section of 250mm diameter sewer between 62 and 61A Ave which is marginal, all sections of sewer will operate within capacity. The section of sewer between 61 Ave and 60 Ave is listed in the 10 Year Servicing Plan for upgrading to 600mm diameter.

5. SANITARY SEWER

With the catchment fully developed to Official Community Plan designations, the sewer system on 176 St. would surcharge significantly.

The development of Catchment A would, at the very least, involve the extension of the existing sanitary sewer system from 176 St on 66 Ave. The sewer system was analyzed with peak sewage flow from both Catchments A and B added. The spreadsheet for both existing development and Community Plan developed conditions shows that nearly all sections of sewer on 176 St to 61A Ave would operate under surcharged conditions.

The existing sanitary sewer within the industrial subdivision on 66 Ave and 176A St was included in the analysis with Catchment A connected as it is possible to have this sewer extended north to 68 Ave and east to the Study Area at 184 St

5.6. System Capacity Analysis - "East" Catchment

The easterly sewer catchment will be serviced by an extension of the existing 200 mm diameter sanitary sewer system on 64 Ave at 192 St. This sewer discharges south along 192 St along a system of 200 mm, 250 mm and 300 mm diameter sewers which ultimately discharge to the existing GVS&DD sanitary lift station at 196 St and 52 Ave. The existing system on 192 St may be interconnected with the sewer system east of 192 St by overflow junction manholes located at 60 Ave and Enterprise Way. These could be arranged to permit diversion of some sewage flow out of the 192 St system. This existing sewer system and its catchment is shown on Figure 9.

As with the West Catchment, the sewer system was analyzed under peak sewage flow conditions from its existing and committed serviced catchment. Again, the development scenarios were existing and full development to Official Community Plan designation. The same methodology was utilized as with the West Catchment for estimating sewage flow from existing development. Surrey's Design Criteria for equivalent population projection was used for the Community Plan analysis and allowance was made for the future connection of the Aloha Subdivision north of Fraser Highway. The results of the analysis is shown on spread sheet format in Appendix III. In the analysis, it was assumed that modifications at the junction manholes would be completed to permit some overflow diversion to the connecting sewers. On this assumption, sections of sewer downstream of Highway #10 were found to be marginal.

5. SANITARY SEWER

A second stage of analysis was completed with the addition of development within Catchment C discharging to the system. In the analysis it was again assumed that the junction manholes would be adjusted to permit overflow sewage to divert to the system east of 192 St. For the purpose of the analysis it was assumed that 15.4 litres per second would be diverted at junction manhole C16 at 60 Ave and 42 litres per second at junction manhole C21 at Enterprise Way. Under this condition the analysis reveals that two sections of sewer would be surcharged south of Highway #10.

The impact of the sewer overflows to the system east of 192 St was also analyzed and included in the spread sheet tabulation in the Appendix. The analysis concludes that the system can accommodate the amount of diversion assumed under existing development conditions. We understand that the City will be undertaking the necessary works to provide for such overflow diversions.

It should be noted that in the analysis the 400 mm diameter sewer running south along 196 St is also marginal north of 54 Ave. However, this presumes full development within its catchment and, except for the junction manhole overflow diversions, does not service the East Catchment of the proposed Neighbourhood development. As noted, the sewage overflow diversions from the 192 St system to the 196 St sewer can be accommodated in the intervening sewers under existing development conditions. The flow in the 196 St sewer will be impacted slightly by the additional flow from the Neighbourhood development but this is not significant and will not result in any greater impact on the properties serviced. Construction of the Ultimate Relief Trunk Sewer along Highway #10 Bypass will immediately alleviate capacity constraints in the downstream sewers.

5.7 Offsite Servicing Options - "West" Catchment

The system analysis revealed that development of the westerly portion of the neighbourhood would overtax the capacity of sections of the existing sewer system on 176 St. As provided in the City's 10 Year Servicing Plan, ultimately a new large diameter trunk sewer will be required to service long term development of North Cloverdale Phase II and the Clayton area. The design parameters given to us by the City for this trunk as part of the Terms of Reference, show a requirement for an invert elevation of 5.5 metres at 176 St and 68 Ave and an ultimate design flow of 625 litres per second. Given the

5. SANITARY SEWER

gradient available south from 176 St to the existing trunk sewer, the new trunk sewer diameter would be in the order of 1050 mm at a depth of some 12 metres at 68 Ave. Given the anticipated soils conditions, it is almost certain that this construction would involve small bore diameter tunnelling at significant cost. We have estimated that this trunk sewer from 60 Ave to 65 Ave would cost in the order of \$2,000,000.00.

As noted in Section VB of the North Cloverdale Local Area Plan Report, "The high cost (\$5m) may preclude developers from front ending this trunk, thus requiring Surrey to capitalize and front end this facility." The cost of this trunk sewer is obviously beyond the funding capability of development in the westerly catchment of the neighbourhood. Sections of the alignment shown for the trunk sewer crosses private lands for which right-of-ways do not exist and in one case crosses under an existing house. A lengthy process of right-of-way acquisition would be required in advance of trunk sewer construction. A trunk sewer is therefore not a realistic option for servicing the North Cloverdale East Neighbourhood. In the long term, the sanitary sewer development cost charge funds generated by such development would, however, contribute towards this trunk sewer construction.

Two alternative options have been identified to provide the capacity required to service development within the West Catchment of the Study Area. These are (a) upgrading of the 176 St sewer or (b) construction of a lift station at 176A St and 68 Ave and forcemain south on 176 St to the existing trunk on 60 Ave. These options are considered as follows:

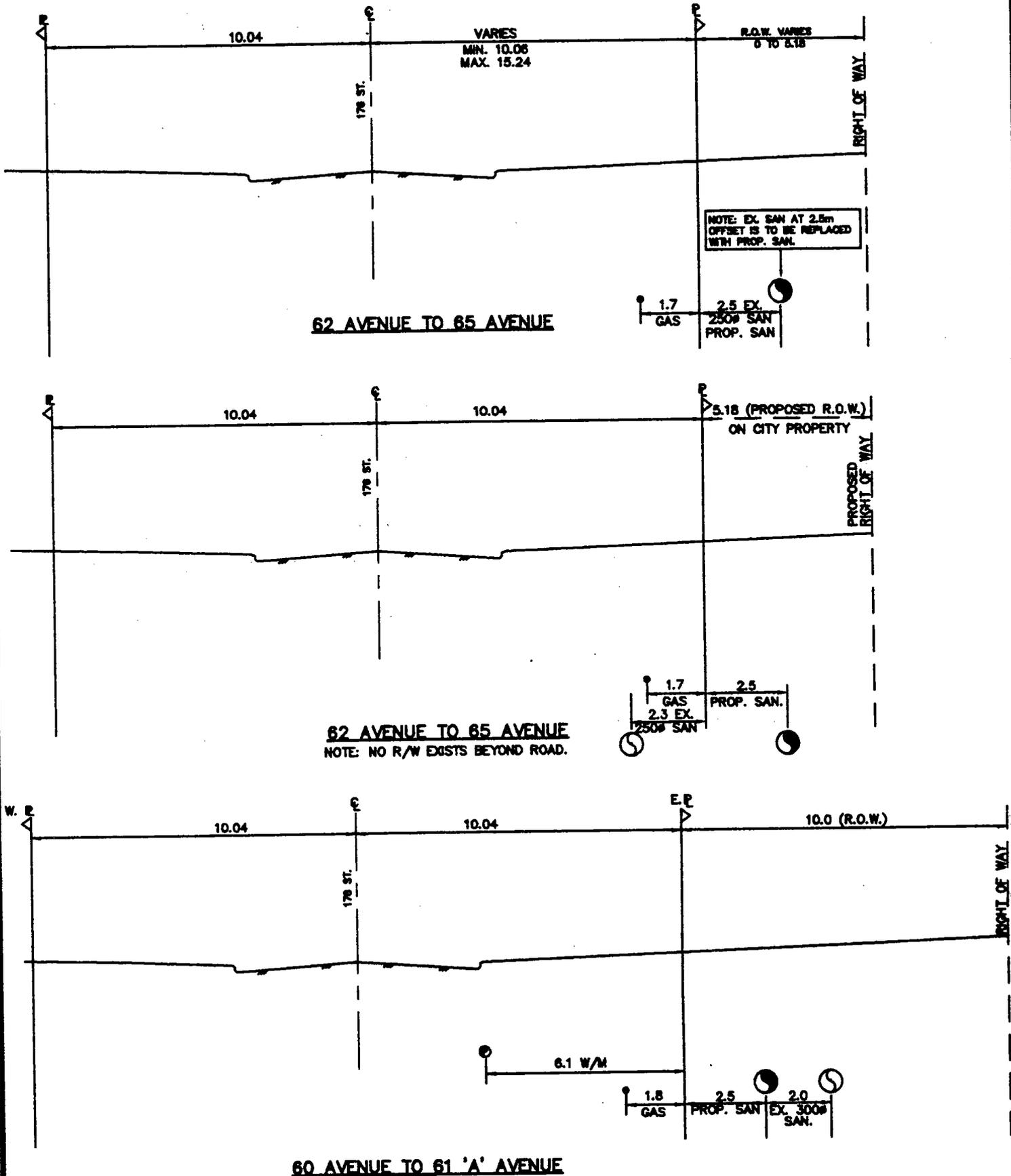
(a) Upgrading 176 St Sewer

The spread sheet analysis in Appendix II shows that sections of the existing 176 St sanitary sewer up to 66 Ave. would be surcharged with the addition of development from Sub-Catchment A and B of the West Catchment. The additional sewage flow could be accommodated by replacing the existing sanitary sewer with a new larger diameter sewer which would function to service this area until the ultimate trunk sewer is constructed. The upgrading of the section between 60 and 60A Ave is already provided for in the 10 Year Servicing Plan. The replacement sewer could be constructed either along the alignment of the existing sewer or immediately adjacent thereto. The existing sewers are constructed for the most part within a right-of-way adjacent to 176 St so no additional right-of-way acquisition would be necessary. The new sewer would be constructed so as not to run under the future roadway widening contemplated by the Ministry of Transportation & Highways for 176 St. The diagram following shows in cross section the relationship of the existing sewer and possible replacement sewer with the existing facilities on 176 St.

NORTH CLOVERDALE

OFFSITE SANITARY SERVICING

176 ST. SEWER UPGRADE



5. SANITARY SEWER

Sub-Catchment A is not presently serviced with a sanitary sewer. This area could be serviced by an extension of the existing sanitary sewer system within the industrial subdivision on 66 Ave from the end of the cul-de-sac north to 66A Ave, east to 180 St and north to 68 Ave. The sewer would then be extended from this location east along 68 Ave to the Study Area sized as a trunk to accommodate ultimate development within its catchment. The catchment includes the Study Area, that portion of Phase II south of the Ravine, and future long term development north of Fraser Highway which has a projected peak flow of 78 litres per second as outlined in the engineering terms of reference.

Once the ultimate trunk sewer is constructed, all sewage flow within the sewer on 68 Ave could be diverted to the trunk sewer by an extension west along 68 Ave. The section on 68 Ave would be 450 mm diameter. The sewer sizing from 68 Ave south would be 250 mm diameter as limited by downstream size. This would be adequate to service the westerly catchment of the Study Area. The spread sheet analysis for the sewer system in Appendix II includes these sewers together with the existing sewers on 65A Ave, 176A St and 66 Ave.

A possible lower cost alternative to constructing the sewers on 66A Ave and 180 St would be to construct a sewer from the end of the existing 450 mm diameter sewer on 68 Ave south on a right-of-way on lots 16 and 17 from 68 Ave to 66A Ave. This alternative is shown on Figure 10 and should be considered only if the necessary right-of-ways can be acquired. We should note that the existing section of 450 mm diameter sewer on 68 Ave immediately west of 180 St is constructed to ultimate size.

The advantage of this upgrading alternative is that it would allow development to proceed not only within the Study Area but also within that portion of Phase II within its gravity catchment. Development of these lands would allow development cost charge funds to be generated to contribute to the funding of the ultimate construction of the North Cloverdale trunk sewer.

(b) Lift Station & Forcemain

The construction of a sanitary lift station in the vicinity of 68 Ave and 176A St pumping to a forcemain south along 176 St to the 60 Ave trunk sewer is an alternative for servicing both the westerly catchment of the Study Area and a specific portion of the proposed Phase II Neighbourhood. This lift station would be constructed on the alignment of the ultimate trunk sewer such that service mains connecting to the lift station could be diverted to the ultimate trunk sewer when completed.

5. SANITARY SEWER

The forcemain would be constructed south along 176 St on an alignment parallel to the existing sanitary sewer south of 65 Ave and be sized to ultimate capacity. Sub-Catchment A of the westerly catchment would be connected to the lift station with the construction of a new sanitary sewer along 68 Ave. The sewer would be sized to ultimate capacity to service both the Phase II area within its catchment, the Study Area and long term future development north of Fraser Highway within its catchment.

Once the ultimate trunk sewer is constructed, the lift station and forcemain would be available to serve the West Cloverdale Catchment. One option for reuse of the lift station is the servicing of the low lying areas west of 176 St and north of 64 Ave which lie within the Agricultural Land Reserve. The provision for servicing this land has in large measure dictated the invert elevation of the ultimate trunk sewer at the low elevation of 5.5 metres. If these lands are not required to be serviced with gravity sanitary sewer back to the trunk main, the trunk main could be raised substantially to effect a significant reduction in its cost. The location, and arrangement for the alternative lift station and forcemain are shown on Figure 10.

The advantage of this pumping option is that it would make available to the City a lift station asset which would be available to service the West Cloverdale Catchment, it would provide service to a large area of the proposed Phase II Study Area, and would not require interim upgrading of the 176 St sanitary sewer. The main disadvantage is that it would incur an initially higher capital cost but this is not significant. The 68 Ave. trunk sewer, ultimate forcemain and elements of the lift station which are sized to ultimate requirements will be eligible for inclusion as Development Cost Charge funded items. Developers within the West Catchment may proceed by opting to construct these facilities with the City contributing the cost of the 68 Ave trunk sewer, ultimate 176 St forcemain and ultimate elements of the Lift station. Due to the burden which this construction would impose on the sanitary sewer Development Cost Charge Fund, developers within the West Catchments A & B should pay up front and not defer all of the sanitary sewer component of their Development Cost Charges payable upon development approval.

Under these conditions, the Sanitary Lift station option is recommended to service the West Catchment A with sanitary sewer.

5. SANITARY SEWER

5.8 Offsite Servicing Options - "East" Catchment

It is proposed to service the "East" Catchment by extending the existing sewer system on 192 St and 64 Ave into the Study Area. As noted in the analysis, the 192 St system with the addition of development flows from the Study Area "East" Catchment, has capacity downstream as far as Highway #10 assuming that the flow diversions at 60 Ave and Enterprise Way are implemented.

The 10 Year Servicing Plan's ultimate trunk relief sewer from Highway #10 and 192 St to the existing GVRD trunk on 52 Ave is estimated to cost \$604,000.00. The alignment for this trunk crosses a significant number of private properties for which right-of-ways do not exist. Construction planning for the trunk sewer will therefore require a lengthy process of right-of-way acquisition at an as yet indeterminate cost. It is therefore not realistic to expect that development of the lands within the catchment of the Study Area will fund the relief trunk.

The analysis of the existing sewer system shows that sections south of Highway #10 would ultimately be surcharged with full development from the East Catchment of the Study Area connected.

As the relief trunk sewer will ultimately be constructed, the existing sewer system could be extended progressively into the "East" Catchment. When sewage flows become critical to the sections of undersized sewer noted in the analysis, these sections must be upgraded. This will permit development to proceed within the Study Area which will in turn allow greater time for the construction planning and right-of-way acquisition for the trunk relief sewer and generate some of the funds towards the cost from the sanitary sewer component of the development cost charges.

In the interim, sewage flows should be monitored to confirm existing conditions and the stage at which flows may become critical. The assessment of the existing system shows that sewer sections downstream of Highway #10 and 192 St. to 196 St have shallow grade. Until the relief trunk is constructed, the 400mm and 450mm sewers downstream of 54 Ave to the Lift station will convey all sewage flow from the catchment and it is possible that these sections may become critical in the intervening period. A contingency upgrading fund should therefore be established to provide for this possibility.

5. SANITARY SEWER

5.9 Study Area Sewage Collection System

Figure 11 shows a conceptual layout for the sanitary sewer system internal to the Study Area. The sewer arrangement is consistent with the internal sanitary catchment boundaries as noted in the preceding section.

With the exception of an area shown hatched on the northwest corner of the Neighbourhood, all of the proposed development lands can be serviced to either an extension of the sewer system on 68 Ave for Catchment A, the existing sewer on Claytonhill Drive for Catchment B, an extension of the 64 Ave/192 St sanitary sewer for Catchment C and connection and extension to the 64 Ave sanitary sewer system for Catchment D.

The triangle of land lying north of 68 Ave and bounded by 184 St and Fraser Highway slopes away from 68 Ave. Due to practical depth limitations the sewer on 68 Ave will not be able to provide gravity service for a significant portion of this area. The internal sewers are therefore arranged to be ultimately serviced through the proposed Phase II Neighbourhood. It is possible to provide interim gravity service to a portion of this area by deepening the 68 Ave sewer. The layout plan shows interim gravity sewers which could likely be constructed on right-of-ways north of 68 Ave which would permit these sections of the development to be serviced until the Phase II lands are fully developed and the sewer system extended along the northerly ravine. It is not possible to provide gravity service to the area shown hatched on the plan and, as an interim lift station would not be approved by the City, we have shown this area to be serviced in conjunction with the ultimate development of the proposed Phase II lands.

5.10 Cost Estimates - Trunk Mains and Interim Works

Cost estimates for the trunk sewers, sewer extensions and interim works outlined in the preceding sections are summarized as follows:

5. SANITARY SEWER

(a) “West” Catchment

.1 Sanitary Lift Station Option:

Item	Estimated Cost
1. Sanitary Lift Station	\$300,000.00
2. 176 St Forcemain	\$300,000.00
3. 68 Ave. Ultimate Sanitary Sewer - 176A St. to Fraser Hwy.	
.1 176A St. to 184 St.	\$441,000.00
.2 184 St. to Fraser Hwy.	\$160,000.00
Total Cost	\$1,201,000.00

(b) “East” Catchment Contingency

Item	Estimated Cost
1. 196 St. Sanitary Sewer Upgrading south of 54 Ave.	\$97,000.00
2. Sanitary Sewer Upgrading on R/W north of 54 Ave.	\$95,000.00
Total Cost	\$192,000.00

As outlined, the North Cloverdale Local Area Plan and Ten Year Servicing Plan includes provision for the construction of trunk sewers and trunk relief sewers which will ultimately service the North Cloverdale and Clayton areas including the Study Area. The estimated cost for these facilities as listed in the Ten Year Servicing Plan is \$5,000,000.00 for the North Cloverdale 176A St trunk and \$972,200.00 for the Langley Bypass relief trunk. The percentage contribution to these facilities by development in the Study Area pro rated in proportion to the relative catchment areas is calculated on the following table.

5. SANITARY SEWER

Trunk Facility	Estimated Cost	Study Area Catchment % of Total	Study Area Cost Allocation
North Cloverdale Trunk	\$5,000,000.00	5.5%	\$275,000.00
Langley Bypass Relief Trunk	\$ 972,300.00	11%	\$107,000.00

This analysis demonstrates that development of the Study Area is expected to contribute \$382,000.00 towards the ultimate construction costs. This amount should be made available from the development cost charges generated by development.

5.11 Phasing and Implementation

Development applications are currently being processed for both west, east and central properties within the Neighbourhood. Accordingly, there will be a need for providing sewer service to all of the sanitary catchments internal to the Study Area. Lands within Catchments B, C, and D are serviced by an existing sewer. Lands within Catchment A will require the construction of a new sewer on 68 Ave together with the associated offsite upgrading and improvements.

Within Catchment B, development may proceed with developers paying up front the sanitary sewer component of their Development Cost Charges. For Catchment A, the sanitary lift station and ultimate forcemain and 68 Ave trunk sewer will be required with the City contributing the cost of ultimate trunk sewer, forcemain and lift station elements from the Development Cost Charge Fund.

For the East Catchment, individual developers will be required to extend the existing sanitary sewer system on 64 Ave either westward along 64 Ave and then internal to the site or from the 192 St intersection along King George Highway as provided in the Conceptual Sanitary Servicing Plan. As development proceeds in advance of the construction of the ultimate relief trunk sewer, a contingency fund contributed to by these developers will be established to provide for possible critical sewer upgrading.

Based on the anticipated rate of development the following is an estimated schedule of works that will be required:

5. SANITARY SEWER

A. "West" Catchment

Option 2 - Sanitary Lift Station Forcemain

<u>Year</u>	<u>Item</u>
1995	Sanitary Lift Station and Forcemain
1995	68 Ave. ultimate sanitary sewer - 176A St. to Fraser Highway

B. "East" Catchment

<u>Year</u>	<u>Item</u>
1995	Possible 196 St. Sanitary Sewer Upgrading - south of 54 Ave.
1995	Possible upgrading Sewer Section in Right-of-Way north of 54 Ave.

Implementation of the offsite works and upgrading will be achieved in the following manner:

(a) "West Catchment"

Development of the southwest corner within Catchment B should be allowed to proceed in advance of the downstream upgrading with the developer paying up front the sanitary sewer component of the Development Cost Charges. The 68 Ave sanitary lift station and 176 St forcemain is required to service development in Catchment B and these facilities should be constructed with the City contributing the Development Cost Charge eligible components of these works.

The 10 Year Servicing Plan and Development Cost Charge Bylaw should be amended to include the ultimate sanitary sewer construction on 68 Ave so that this construction will qualify for development cost charge refund.

5. SANITARY SEWER

(b) "East Catchment"

A monitoring program should be implemented to assess sewage flows in the downstream system. A contingency fund to complete downstream sewer upgrading identified as critical to sewer capacity restrictions south of Highway #10 should be provided with development of the "East" Catchment. As this measure would allow "East" Catchment developers to proceed in advance of the Relief Trunk Sewer construction, each developer would be assessed a charge as his share of the contingency upgrading fund. The unit cost assessed would be the cost of the upgrading contingency divided by the number of units in the East Catchment as provided by the Neighbourhood Plan.

6. DRAINAGE

6.1 Existing Storm Drainage System

There are no storm sewers within the Study Area except on the periphery along 184 St, 64 Ave and sections of Fraser Highway. The topography within the Study Area is gently sloping to the west, north and east from ground just north of 64 Ave west of 188 St. The existing storm system along 184 St conveys drainage northwards to discharge to a natural watercourse which crosses under 184 St just south of Fraser Highway. This watercourse flows directly westward through a well defined ravine to the lowlands and discharges to the Serpentine River.

Along the north boundary, there is an existing ditch on the south side of Fraser Highway which runs west and east from roughly the 188 St alignment. West of 188 St, the Fraser Highway ditch discharges to the watercourse north of 68 Ave. East of 188 St, the ditch system discharges to an existing storm sewer which runs east under Fraser Highway at the 64 Ave alignment. This storm sewer system runs east along 64 Ave to connect to a culvert crossing under 64 Ave at approximately the 194 St alignment. This culvert conveys drainage from the natural watercourse system extending north of 64 Ave.

The existing topography, relevant watercourses and existing storm sewers are shown on Figure 12.

6.2 Drainage Catchments - External and Internal

The Study Area lands lie within two drainage catchments, west and east divided roughly along the 188 St alignment. The "West" Catchment is drained by the existing natural watercourse which also drains a large area of land north of Fraser Highway. The "East" Catchment of the Study Area is drained by the 64 Ave ditch and storm sewer system east of Fraser Highway to the culvert crossing and downstream system from 64 Ave and 194 St. This drainage system serves a large section of land north of Fraser Highway. External and internal catchments are shown on Figure 12. Relevant catchment areas are summarized as follows:

1. "West" Catchment

	<u>Existing</u>	<u>Development</u>
External Upstream Catchment	106 ha.	106 ha.
Study Area Catchment	<u>47 ha.</u>	<u>64 ha.</u>
Total Catchment Area	<u>153 ha.</u>	<u>170 ha.</u>

6. DRAINAGE

2. "East" Catchment

External Upstream Catchment	98 ha.	98 ha.
Study Area Catchment	<u>23 ha.</u>	<u>17 ha.</u>
Total Catchment Area	<u>121 ha.</u>	<u>115 ha.</u>

6.3 Neighbourhood Development Drainage System

Development of the Neighbourhood as provided in the Land Use Plan requires that an assessment be made of its impact on the downstream drainage system. Existing storm sewers servicing the immediate catchment must be evaluated for the increased flow and a conceptual storm water management plan should be developed to provide for the planned and orderly extension of new storm sewers to service the developing areas. Figure 13 shows a Conceptual Layout Plan for the storm sewer system servicing both catchments within the Neighbourhood. The post developed catchment boundary is modified slightly from the natural boundary to take account of land use patterns and the impact of constructing 188 St.

The "West" Catchment will be serviced by trunk systems along Fraser Highway and 68 Ave and on 184 St from Claytonhill Drive to 68 Ave. The "East" Catchment will drain to trunk systems along Fraser Highway and 64 Ave discharging to the existing storm sewer system crossing under Fraser Highway at 64 Ave.

6.4 Hydrologic Analysis

To assess the impact of development on the downstream drainage systems and existing storm sewers, the catchments were modeled using the MIDUSS Computer Model to give synthetic runoff hydrographs for the existing and post developed conditions. The model setup, calibration parameters and routing are given in Appendix IV. The results of the analysis give estimated peak runoff flows from the respective catchments for the five year return period storm as follows.

"West" Catchment

Pre Developed

2.02 c.m.s.

Post Developed

3.46 c.m.s.

6. DRAINAGE

"East" Catchment

Pre Developed

1.27 c.m.s.

Post Developed

1.60 c.m.s.

6.5 Major System Flood Routing

Surrey's Design Criteria Manual requires that urban drainage systems be considered to have two components, a minor system designed to convey runoff from a five year return period storm, and a major system designed to convey runoff from a hundred year return period storm. The minor system may consist of underground conduits, open channels and watercourses. The major system consists of surface flow paths, roadways and watercourses. Major flow can be accommodated by both the storm sewer and road system. The roadway should not have a water depth more than 200 mm except for arterial roads where the flood level is not to exceed the road crown. Creek culvert crossings of arterial roads should therefore be capable of conveying the major system without overtopping.

The westerly and easterly watercourses are major system flow paths. In order to assess the impact of Neighbourhood development, estimates of major system peak flows were calculated for both catchments as outlined in Appendix IV. These are summarized as follows:

(a) "West" Catchment

	<u>Existing</u>	<u>Study Area Developed</u>
Fraser Hwy Culvert	4.0 c.m.s.	4.0 c.m.s.
184 St Culvert	4.1 c.m.s.	4.1 c.m.s.
Watercourse West of 184 St.	5.6 c.m.s.	6.9 c.m.s.

(b) "East" Catchment

64 Ave at 192 St	1.6 c.m.s.	1.5 (1) c.m.s.
64 Ave at 194 St	4.5 c.m.s.	4.4 (1) c.m.s.

(1) Note post developed catchment reduced.

6. DRAINAGE

To contain major system flows, the proposed storm sewer drainage systems on 184 St, 68 Ave and Fraser Highway should be designed to accommodate the post developed major system peak flow condition without surcharging. Figure 13 shows the designated major flow routes serving the proposed Neighbourhood's internal road network and development parcels.

6.6 Downstream Drainage System Evaluation - "West" Catchment

.1 184 St Storm Sewer

The existing storm sewer system on 184 St consists of 525 mm and 600mm diameter pipes from Claytonhill Drive to the watercourse cross culvert north of 68 Ave. These storm sewers are at a depth of between 1 - 2.5 metres and a grade of 1.9% to 2.3%. The storm sewers south of 68 Ave have a limiting capacity of 0.65 c.m.s. south of 68 Ave. The estimated post developed peak flow from within the Neighbourhood discharging to this system is 2.3 c.m.s. for the five-year peak runoff condition. Due to the capacity restriction and the shallow depth which limits extension potential, this storm sewer system must be replaced with a new storm trunk sewer.

.2 Culvert Crossings - Fraser Highway & 184 St

The culvert crossing which conveys the westerly watercourse under Fraser Highway services 106 hectares of largely undeveloped land. This culvert is a 900mm diameter pipe culvert with an estimated capacity before overtopping of 2.7 c.m.s. The calculated 100-year peak flow at this location is 4.0 c.m.s. which exceeds the capacity of the culvert. A new 1.5 metre diameter pipe culvert would have the necessary capacity for the major system. Drainage at this location is not impacted by development of the Neighbourhood Lands so the requirement for the culvert upgrading is not a result of the Neighbourhood development.

The existing culvert crossing under 184 St south of Fraser Highway consists of a 900mm diameter pipe culvert. This has a calculated capacity of 2.7 c.m.s. before overtopping. The calculated 100-year peak flow at this location is 4.1 c.m.s. The culvert should be upgraded to convey major system flows with a 1.5 metre diameter pipe culvert. This culvert should be upgraded prior to any arterial road widening of 184 St.

6. DRAINAGE

3 Downstream Watercourse

The existing watercourse flows west from the 184 St culvert within a well defined natural ravine to discharge to the lowland drainage ditch/canal system along 176 St over a length of 1.7 km. The stream bed slope varies gradually from moderately steep to moderate. Degradation of the stream bed down to the underlying till has occurred along some sections of the watercourse. These give an indication of gradually increasing peak flow as the upland catchment develops. The erosion is currently less than 200mm in depth and is not considered critical. The natural ravine slopes are well treed, are steep to moderately steep and appear stable. Along the upper section there are instances where deadfalls and other debris cross the watercourse and provide opportunities for stream flow obstruction. In some instances undercutting of the stream bend is occurring and there are a number of locations where erosion is significant. Plates I and II show some of these conditions along the stream channel from 184 St to the lowlands.

At one location severe erosion of the watercourse bank has occurred from a simple discharge of a 100 mm drain tile which initially was discharging at the top of the slope (see Plate 2). This confirms that the ravine bank material is highly susceptible to erosion. During a site inspection, a strong sewage smell was detected from inflow south of 184 St giving indication of a failed septic system nearby.

This watercourse is deemed a natural amenity designated for preservation in the North Cloverdale Local Area Plan. Some erosion of the stream bed is already occurring along its length due to increasing flow from upland development. Due to its sensitivity, storm drainage discharge from upland development to this watercourse should be limited in accordance with Surrey's natural drainage policy.

4 Lowland Drainage

The natural watercourse discharges to a lowland ditch and canal system just east of 176 St. The system flows northward on the east side of 176 St to Fraser Highway and westward on the north side of Fraser Highway discharging to the Serpentine River through a flood box. The upland catchment area and flood box location is shown on Figure 14.

6. DRAINAGE

The City has commissioned a Study of the lowlands drainage in the Serpentine and Nicomekl River basins entitled "Serpentine Nicomekl Strategic Flood Control Study". This Study will include the North Cloverdale lowland catchment.

The lowland area upstream of the 176 St flood box has been noted to be subject to periodic flooding during extreme rainfall events. Observational information obtained from the City indicated that lowland flooding reaches an elevation of 1.0 metre G.S.C. datum at least once per year. The storm water modelling of the Study Area West Catchment indicated that the runoff volume from the Neighbourhood Development would not have any appreciable impact on these present lowland flood water elevations.

Upland detention storage does not affect the total volume of hydrograph runoff and therefore would not help in reducing lowland flooding in most storms. For development lands close to lowland drainage systems, the funding generated for drainage and storm detention might more appropriately be targeted to lowland drainage improvement works.

6.7 Downstream Drainage System Evaluation - "East" Catchment

The drainage outfall for the "East" Catchment is the existing storm sewer which runs along 64 Ave under Fraser Highway and along 64 Ave east to the culvert crossing at 94 St. This storm sewer system consists of 900 mm diameter, parallel 600mm diameter, and 750mm diameter sewers as shown on Figure 12. The limiting capacity of this section of sewers has been calculated to be 1.5 c.m.s. The peak five-year return period with the "East" Catchment developed in this section has been calculated at 0.9 c.m.s. and the peak 100-year runoff has been estimated at 1.4 c.m.s. The culvert under 64 Ave is a 1.7 metre by 1.1 metre elliptical pipe culvert with a calculated capacity of 7 c.m.s., the watercourse is enclosed with a storm sewer system consisting of 1.5 metre diameter and 1.35 metre diameter concrete pipes. Under surcharge condition, the calculated limiting capacity of the storm sewer pipe is 5.6 c.m.s. The 100-year peak storm runoff to this system with the "East" Catchment developed is calculated at 5.6 c.m.s. Details of the analysis are given in Appendix IV.

6. DRAINAGE

The downstream drainage system from the "East" Catchment is a major system flood path and the parameter for its assessment is peak storm runoff from the 100-year return period storm. The Conceptual Layout Plan for the storm sewer system extension into the Neighbourhood will result in a reduction of the catchment area draining to the "East" Catchment from its predeveloped condition. As the size of the catchment is small relative to the total catchment area draining to the 194 St culvert system, the impact of development in the "East" Catchment on 100-year peak flow from the entire catchment is minimal. It is therefore concluded that downstream upgrading is not required as a direct result of development in the East Neighbourhood Study Area.

6.8 Surrey Capital Works - 10 Year Servicing Plan

The 10 Year Servicing Plan includes allowances for the following Capital Works of relevance to the Cloverdale East Neighbourhood. These projects together with the estimated capital cost allowances are itemized as follows:

Description	Estimated Cost	Surrey Ref. #
Watercourse Erosion Protection from 178 St. to 184 St.	\$ 350,000.00	4075
Community Detention Facility 184 St. between 69 & 69A Ave.	\$1,350,000.00	3109
Community Detention Facility 180 St. at 68 Ave.	\$ 430,000.00	4084
Trunk Storm Sewer 184 St. between 68 to 69A Ave.	\$ 150,000.00	3192
Trunk Storm Sewer Fraser Highway, 185 to 198 St.	\$ 320,000.00	3232
Ditch Elimination 184 St. : 64 Ave. to Fraser Highway	\$ 110,000.00	3266
Ditch Elimination 64 Ave. : 184 St. to 192 St.	\$ 250,000.00	1415

6. DRAINAGE

The ditch elimination on 64 Ave has been completed.

The location shown for the Community Storm Detention facility at 184 St - 69 to 69A Ave appears to be directly in the watercourse. This facility is apparently intended to service the "West" Catchment of the Study Area and upland development north and east of Fraser Highway within its catchment.

6.9 Community Storm Detention Facility

To mitigate the impact on the downstream watercourse, storm runoff from development in the "West" Catchment of the Study Area should be limited to predevelopment levels by storm detention or other means. In order to service the "West" Catchment, a Community Storm Detention facility would have to be located west of Fraser Highway adjacent to 184 St or downstream of this location.

The computer modeling indicated that predevelopment 5-Year peak flows from the total "West" Catchment area is 2.02 c.m.s. 5-year peak flows from the developed "West" Catchment is 3.46 c.m.s. To limit the 5-Year peak runoff with the Study Area developed to predevelopment levels, the modeling concluded that a storage volume of at least 3,642 cubic metres would be required for a storm detention facility.

A preliminary assessment was made of the watercourse upstream of 184 St. This reach of watercourse is well incised in a ravine with relatively steep slopes between 184 St and the upstream culvert crossing under Fraser Highway. A flow obstruction could be installed to control downstream runoff. However, to provide the volume of storage required, the depth of impoundment necessary would be 3.6 metres. This depth exceeds the maximum permissible in the City's design criteria for a storm detention basin. In addition, this reach of the watercourse is immediately adjacent Fraser Highway and such a ponding depth would be a safety hazard. The construction of the necessary flow control obstruction may not be acceptable to the Ministry of Environment. The fluctuating water levels may destabilize the banks. A detention facility within the ravine has a limited capacity and would not likely be capable of accommodating in its present configuration additional storage volume for future development north of Fraser Highway. It may be possible to excavate out the present ravine slopes on the south side to create the additional storage volume required for the future upland development north of Fraser Highway. This would involve a large volume excavation and destroy the existing vegetation on the disturbance portion of the ravine bank and therefore would likely meet resistance from the Environmental agencies. Access for maintenance would be difficult. We have therefore concluded that this location is not suitable for the community detention facility.

6. DRAINAGE

The watercourse north of Fraser Highway is more gently sloping and less incised. Topography in general is flatter. This area therefore affords a better siting opportunity for a community detention facility to service future development of the upland catchment north of the Fraser Highway. However, a detention facility in this location would not be capable of servicing the "West" Catchment of the Study Area due to grade constraints.

A detention facility serving the "West" Catchment of the Study Area alone could be located upstream of the watercourse adjacent to 184 St either on the west or the east side. Subject to detail design, approximately 3 acres of land area will be required for the Detention Facility assuming relatively flat ground conditions. Immediately adjacent to 184 St, the topography on the east side has more slope than on the west side (4% vs. 2%), so land acquisition requirements and grading costs will be slightly greater. The land ownership is fragmented in smaller parcels on the east side with only one of the landholders participating in the Neighbourhood Concept Plan process. The land on the west side is relatively flat, has less trees and is more suited to grading and storm sewer flow routing relative to the watercourse. The significant property is under agreement for sale to a developer for development and there are no indications that both the property owner and developer may be amenable to sale of the land for Community Storm Detention Pond purposes. A significant property owner on the east side is now willing to offer a portion of his property for sale for detention purposes. The land area may not be sufficient so additional acquisition would likely be required. For now, the west side is recommended as a preferred location.

Due to beneficial impact on storm runoff water quality and because of improved aesthetic and amenity opportunities, a permanent wet pond is recommended. To ensure that post development flows are controlled for more frequent storms, storage volumes and flow control structures should also be designed to maintain the release rate to the downstream watercourse for the 2 year return period storm at the pre-development levels.

Figure 13 shows a detention facility on the west side of 184 St. With this arrangement, the hydrologic analysis gives a storage volume requirement of 5,904 cubic metres. Such a storage arrangement is not as efficient as one located directly in the watercourse but has the advantage of being more easily accessible for maintenance purposes and does not pose the same environmental and safety concerns as the watercourse location. However, as such a location would not be capable of servicing lands north of Fraser Highway, a separate facility would be required to accommodate development of this upland catchment in the future.

6. DRAINAGE

6.10 Downstream Servicing Options - "West" Catchment

To mitigate the impact on the downstream watercourse, it is acknowledged that post development storm drainage runoff be controlled by storm detention or otherwise. The preceding section outlined two options for storm detention, either directly in the watercourse or upstream of the watercourse adjacent to 184 St. With either of these facilities, the storm sewer system upstream must be arranged to direct all post development runoff to the detention site. The Conceptual Storm Sewer Layout Plan shown on Figure 12 is arranged so that storm trunk sewers along 184 St, 68 Ave and Fraser Highway convey post development flows to 184 St north of 68 Ave prior to discharge to the watercourse. With a detention facility adjacent to 184 St, a flow control manhole would be installed to divert peak flows into the detention facility either adjacent to 184 St or directly in the watercourse upstream of 184 St.

The 10-Year Servicing Plan includes a provision for a community detention facility east of 176 St. and south of 68 Ave. This site is located under the B.C. Hydro transmission line right-of-way and would service the proposed Phase II Neighbourhood. This location is capable of expansion to accommodate a greater storage area. The land under the right-of-way has less value than adjacent property and therefore land acquisition costs are less than for fully developable property.

Expansion of this facility to accommodate drainage from the "West" Catchment of the Study Area provides another option for offsite servicing. Under this concept, peak flow to the watercourse could be limited to predevelopment levels by a flow control manhole and overflow at the intersection of 68 Ave and 184 St. Flows up to predevelopment levels would continue to discharge north along 184 St to the watercourse with excess flow bypassed west in a trunk sewer down 68 Ave towards 176 St and the combined detention facility. This trunk sewer would be sized to accommodate local drainage from the future Phase II development and the overflow above predevelopment levels from the "West" Catchment of the Study Area up to the Five-Year return period storm level. Major system flows would continue to be directed to the watercourse along 184 St. In this manner, the watercourse would continue to receive base flows from the Study Area but be protected from frequent excess peak flows by the diversion westward. A major disadvantage of this option is that base flows from the diversion at 184 St to the watercourse would not receive the advantage of being routed through a detention facility so water quality of the runoff would not receive any improvement. In addition flows greater than the minor system release rate would not receive the benefit of some attenuation afforded by a Detention Pond.

6. DRAINAGE

Upland storm detention facilities are ordinarily designed for short duration storms in the order of 3 to 6 hours. Lowland flooding is usually a result of 24 hour to 72 hour storms. Upland detention facilities are largely ineffective in improving lowland flood conditions. Once the upland watercourse is protected by the diversion of peak flows under this option, it is arguable that subsequent storm detention just prior to the lowland drainage system is redundant. The level of storage provided by the detention facility in comparison to the lowland system is marginal. The proposed facility is located just upstream of the 176 St lowland drainage canal and thus savings in reduction of pipe sizes from peak flow would not be significant. Under these circumstances, serious consideration should be given to the necessity for providing such a storm detention facility and instead, funds allocated for storm detention could be targeted to an improvement scheme such as outlined in the foregoing section for reducing the lowland flooding.

For the purpose of this Report however, we have assumed a storm detention facility requirement as it has been included in the 10 Year Servicing Plan and is a component of the natural drainage policy adopted by the City of Surrey.

Construction and land acquisition costs were estimated for each of the three offsite storm detention options for the "West" Drainage Catchment. These are summarized as follows:

Option 1- Watercourse Detention Facility

1.	184 St Storm Sewer - 68 Ave. to Outfall & Flow diversion structure	\$ 150,000.00
2.	Flow control barrier and overflow spillway	\$ 150,000.00
3.	Detention area site preparation and channel improvements	\$ 100,000.00
4.	Access and fencing	\$ 50,000.00
5.	Land Acquisition - 2 acres @ \$75,000/ac.	\$ 150,000.00
	TOTAL	<u>\$ 600,000.00</u>

6. DRAINAGE

Option 2 - 184 St Upland Storm Detention Facility

1.	184 St Storm Sewer - 68 Ave. to Outfall, Flow Control Manhole & Outfall	\$ 150,000.00
2.	Storm Detention Pond, & Inlet & Outlet Piping	\$ 400,000.00
3.	Land acquisition 3 acres @ \$300,000/acre	<u>\$ 900,000.00</u>
	TOTAL	<u>\$1,450,000.00</u>

Option 3 - 68 Ave Trunk Sewer Bypass & Downstream Detention Facility

1.	Flow Diversion Chamber & 184 St. Outfall	\$ 150,000.00
2.	Trunk Storm Sewer 68 Ave. from 184 St. to 176 St.	\$ 420,000.00
3.	Expansion of Storm Detention Facility	\$ 450,000.00
4.	Additional Land Acquisition Cost 3.3 acres @ \$75,000/acre	<u>\$ 250,000.00</u>
	TOTAL	<u>\$1,270,000.00</u>

For Option 3 we have included only the oversizing cost for the 68 Ave. trunk sewer as a nominal size sewer for local area drainage would be required along 68 Ave. in any event to service future development in Phase II lands. Although Option 1 is the least cost alternative, it has, as outlined in the foregoing section, significant disadvantages, particularly from the safety, access and environmental perspective. For the purpose of this report we have therefore discounted this option.

The third option is overall the least cost alternative but this cost advantage is significantly reduced if the entire cost of the 68 Ave trunk sewer is taken into account. The cost comparison is influenced to a large degree by the assumptions made in land acquisition values. Relative changes in these values would affect the cost comparison. The advantage of the third option is that it would provide a combined facility with the Phase II lands thus affording future reduction in operating and maintenance costs.

6. DRAINAGE

The second option is a viable alternative but requires the purchase of approximately 3 acres of land at either of the locations noted. On the east side of 184 St. the land is not readily for sale for this purpose and thus the land acquisition cost may escalate, while on the west side we are advised that the land is more readily available.

Each of these alternatives provide a viable method for servicing the "West" Catchment. However, as the cost margin between Option 2 and Option 3 is not significant and as Option 2 is more readily implementable for this Neighbourhood and offers opportunity for improved water quality for runoff to the watercourse and aesthetic and amenity values, Option 2 is recommended and is selected for consideration in the Neighbourhood Concept Plan Costing and Implementation.

6.11 Downstream Servicing Options - "East" Catchment

The existing drainage system downstream of the "East" Catchment has been sized for major system flows. With the reduction in the catchment area as noted upon development of the Study Area, the hydrologic analysis concluded that the development of the "East" Catchment would not impact major system flows to the extent that the immediate sections of the downstream drainage system would be adversely impacted. Long term future development north of Fraser Highway within the catchment will, however, require further analysis of its impact.

As the downstream drainage system is an enclosed major system, there is little advantage in providing a storm detention facility for the resulting small portion of its catchment which comprises the "East" Catchment of the Study Area. It is therefore concluded that the "East" Catchment should be serviced directly to this system by an extension of closed storm sewers along Fraser Highway and 64 Ave from 192 St designed as warranted in accordance with the City's Design Criteria. Extensions on Fraser Highway and 64 Ave should at least be designed for major system capacity and as these are along arterial and regional roadways, should be included in development cost charge funded works.

Figure 13 shows a conceptual plan for the storm system within the Study Area. This is subject to modification as individual developments proceed with designs based on elevation constraints, roadway patterns and developers requirements for basements.

6. DRAINAGE

6.12 Cost Estimates - Trunk Sewers & Storm Detention Facility

Based on the foregoing assumptions and conclusions, we have prepared the following summary of the major storm drainage work items and detention facilities and their preliminary cost estimates.

	Item	Cost
<u>East Section</u>		
1.	Storm Sewer Fraser Highway 192 St to 188 St	<u>450,000.00</u>
<u>West Section</u>		
1.	Storm Detention Pond - Option 2	
	- Construction	400,000.00
	- Land	<u>900,000.00</u>
	TOTAL	1,300,000.00
2.	184 St Trunk Sewer - 68 Ave to Outfall	150,000.00
3.	184 St Trunk - 68 Ave to 65 Ave	300,000.00
4.	68 Ave Trunk - 184 St to Fraser Hwy	220,000.00
5.	Fraser Hwy - 68 Ave to 188 St	320,000.00
6.	184 St Culvert Improvement for Watercourse (Full Cost 250,000 - Phase I share - 35%)	87,500.00
7.	Watercourse Erosion Protection (Full cost 250,000 Phase I share - 35%)	<u>122,500.00</u>
	TOTAL	<u>\$2,500,000.00</u>

6. DRAINAGE

6.13 Phasing & Implementation

.1 "West" Catchment

Individual developments within the "West" Catchment will be proceeding as soon as development approvals are obtain and market conditions dictate. In particular, the lands on the southwest corner are anticipated to be ready for construction in advance of other properties. Due to the extensive drainage works which have been identified as being necessary to service the "West" Catchment lands, implementation will require phasing of the works over an initial period of years.

In order to generate funding by development cost charges for these works, individual developments should be permitted to proceed provided that interim measures are incorporated into their drainage system designs such as temporary onsite detention or otherwise to mitigate their immediate impact on downstream systems. In this manner, individual developments would proceed within the framework of an orderly construction program for downstream improvements.

The following table proposes a schedule for completing the major work items which have been identified

<u>Completion Year</u>	<u>Item</u>
1994	184 St. trunk 65 Ave. to 68 Ave.
1995	184 St. trunk sewer & outfall 68 Ave. to watercourse
1995	68 Ave. trunk 184 St. to Fraser Highway
1997	Storm detention pond
1998	Fraser Highway, 68 Ave. to 188 St.
1999	184 St. watercourse culvert upgrading

6. DRAINAGE

.2 "East" Catchment

As storm drainage facilities already exist adjacent to this catchment on 64 Ave and 192 St, any developer wishing to proceed will be responsible for extending the storm sewer as required in accordance with the City's Subdivision Control Bylaw. The ultimate storm sewer along Fraser Highway has been designated a trunk sewer facility. Individual developers proceeding in advance of this construction should be permitted to discharge on a temporary basis to the existing ditch system. The 10 Year Servicing Plan and Development Cost Charge Bylaw should be amended to include the trunk sewer on Fraser Highway and this work should be constructed in 1995.

7. Summary of Major Servicing Works & Funding

The following tables summarize the major servicing works which have been identified as being necessary to provide engineering services for the North Cloverdale East Neighbourhood Concept Plan. The tables identify the projected completion year and a preliminary estimate of costs. The table also identifies the items eligible for inclusion in development cost charge funded works once the amendments to the Cost Charge Bylaw and 10 Year Servicing Plan as recommended in the previous sections are adopted

Roadworks

	Item	Cost	D.C.C. Eligibility	Completion Year
1.	Add 2nd Through Lane E.W./N.S. on Fraser Hwy - 64 Ave intersection	300,000.00	300,000.00	1999
2.	Add Left Turn Lane Intersection 64 Ave & 188 St	200,000.00	200,000.00	1996
3.	Add Left Turn Lane Intersection Fraser Hwy & 188 St	350,000.00	350,000.00	1997
4.	Add Left Turn Lanes on 184 St & 65 Ave	120,000.00	120,000.00	1994
5.	As above at 64 Ave & 185 St	120,000.00	120,000.00	1994
6.	As above at 184 St & 68 Ave	120,000.00	120,000.00	1995
7.	As above at 64 Ave & 190 St	120,000.00	120,000.00	1998
8.	Add Sidewalk & Streetlighting Frontage 64 Ave & 184 St	412,000.00	412,000.00	1994 to 2000
9.	Add Urban Features on Fraser Highway from 184 St to 192 St	<u>500,000.00</u>	<u>500,000.00</u>	2000
	TOTAL	<u>\$2,242,000.00</u>	<u>\$2,242,000.00</u>	

7. Summary of Major Servicing Works & Funding

Water Supply

	Item	Cost	D.C.C. Eligibility	Year
1.	Upsize watermain along 68 Ave to 66 Ave	31,200.00	31,200.00	1994 to 1996
2.	Upsize watermain along 186 St, 64 to 65 Ave 65 Ave, 186 St to 64 Ave	100,000.00	\$100,000.00	1995 to 1998
3.	300 mm watermain on 64 Ave, 190 St to 191 St	<u>50,000.00</u>	<u>50,000.00</u>	1998
	TOTAL	<u>\$181,200.00</u>	<u>\$181,200.00</u>	

7. Summary of Major Servicing Works & Funding

Sanitary Sewer

	Item	Cost	Estimated D.C.C. Eligibility	Completion Year
<u>West Section</u>				
1.	176 St Forcemain	300,000.00	300,000.00	1995
2.	Sanitary Lift Station	300,000.00	200,000.00	1995
3.	68 Ave Ultimate Trunk Sanitary Sewer			
	180 St to Fraser Hwy			
	i) 180 St to 184 St	441,000.00	441,000.00	1995
	ii) 184 St to Fraser Hwy	<u>160,000.00</u>	<u>160,000.00</u>	1995
	TOTAL	<u>\$1,201,000.00</u>	<u>\$1,101,000.00</u>	

East Section

1.	Possible Interim Sanitary Sewer Upgrading 54 Ave to Lift Station	97,000.00	--	1995+ *
2.	Possible Upgrading 192 St N of 54 Ave	<u>95,000.00</u>	--	1995+ *
	TOTAL	<u>\$192,000.00</u>		

Note: items depicted * are recommended to be paid as an upgrading contingency fund by developers on a unit charge contribution basis.

7. Summary of Major Servicing Works & Funding

Drainage

	Item	Cost	D.C.C. Eligibility	Completion Year
<u>East Section</u>				
1.	Storm Sewer Fraser Highway 192 St to 188 St	450,000.00	450,000.00	1995
<u>West Section</u>				
1.	Storm Detention Pond - Phase I share			
	- Construction	400,000.00		
	- Land	<u>900,000.00</u>		
	TOTAL	1,300,000.00	1,300,000.00	1995
2.	184 St Trunk Sewer - 68 Ave to Outfall	150,000.00	150,000.00	1995
3.	184 St Trunk - 68 Ave to 65 Ave	300,000.00	300,000.00	1994
4.	68 Ave Trunk - 184 St to Fraser Hwy	220,000.00	220,000.00	1995
5.	Fraser Hwy - 68 Ave to 188 St	320,000.00	320,000.00	1997
6.	184 Street Culvert Improvement for Watercourse (Full Cost 250,000 - Phase I share - 35%)	87,500.00	87,500.00	1999
7.	Watercourse Erosion Protection (Full cost 250,000 Phase I share - 35%)	<u>122,500.00</u>	<u>122,500.00</u>	2000
	TOTAL	<u>\$2,950,000.00</u>	<u>\$2,950,000.00</u>	

7. Summary of Major Servicing Works & Funding

Several of the items listed as being eligible for development cost charge funding are not currently included in the City's Development Cost Charge Bylaw and Capital Works 10 Year Servicing Plan. As part of the Neighbourhood Concept Plan Approval Process, the Development Cost Charge Bylaw and Servicing Plan should be amended to include these works as follows:

ROADS

Arterial Widening

New Item	Intersection of 64 Ave & 188 St	Add left turn lanes	\$ 200,000.00
New Item	Intersection of Fraser Hwy & 64 Ave	Add 2nd through lanes	\$ 300,000.00
New Item	Intersection of 184 St & 65 Ave	Add left turn lanes	\$ 120,000.00
New Item	Intersection of 64 Ave & 186 St	Add left turn lanes	\$ 120,000.00
New Item	Intersection of 184 St & 68 Ave	Add left turn lanes	\$ 120,000.00
New Item	Intersection of 64 Ave & 190 St	Add left turn lanes	\$ 120,000.00
New Item	64 Ave - 184 St to 192 St & 184 St - 64 Ave to Fraser Hwy	Streetlights & Sidewalk	\$ 412,000.00

Provincial Highway Improvements

New Item	Intersection of Fraser Hwy & 188 St	Add left turn lanes	\$ 350,000.00
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DRAINAGE

Trunk System

New Item	184 St: 65 Ave to 68 Ave.	New sewer	\$ 300,000.00
New Item	68 Ave: 184 St to Fraser Hwy	New sewer	\$ 220,000.00
New Item	184 St: 69 Ave Culvert Crossing	Culvert replacement	\$ 87,500.00

FIGURES & PLATES

7. Summary of Major Servicing Works & Funding

Ditch Enclosure

New Item	Fraser Highway - 188 St to 192 St.	New Sewer	\$ 450,000.00
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Water

No Changes

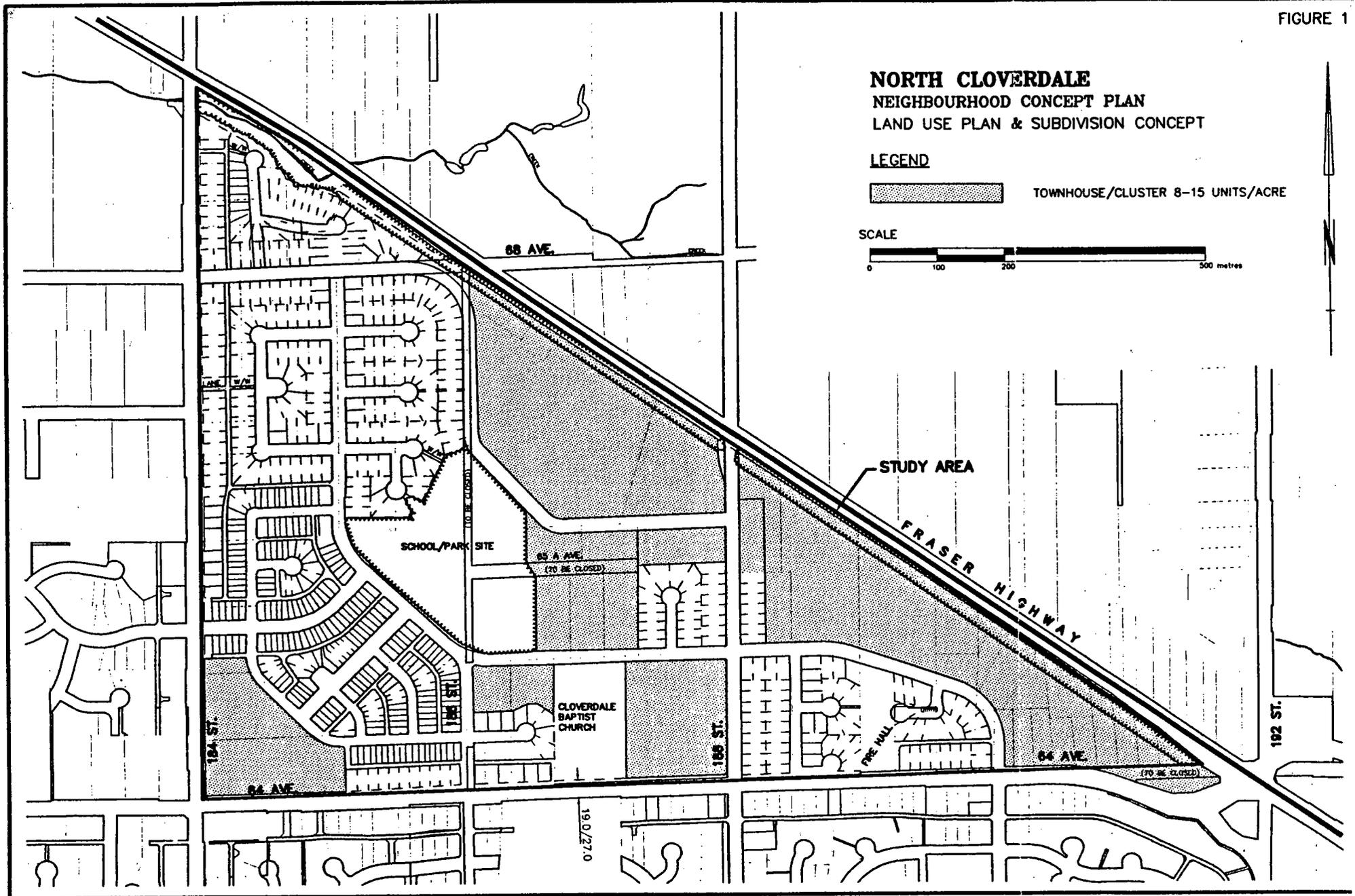
SANITARY SEWER

Trunk for New Area

New Item	68 Ave: 176A St - 184 St	New sewer	\$ 441,000.00
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New Item	68 Ave: 184 St - Fraser Hwy	New sewer	\$ 160,000.00
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FIGURE 1



**NORTH CLOVERDALE
NEIGHBOURHOOD CONCEPT PLAN
ROAD SYSTEM**

LEGEND

	PROVINCIAL HIGHWAY	(34.8m ROW)
	ARTERIAL	(27.0m ROW)
	MAJOR COLLECTOR	(24.0m ROW)
	COLLECTOR	(20.0m ROW)
	THROUGH LOCAL	(20.0m ROW)
	LOCAL	(16.5m ROW)
	LANE	(6.0m ROW)
	TOWNHOUSE/CLUSTER	8-15 UNITS/ACRE

* ROAD WIDTHS WITHIN THE AREA BOUNDED BY 66 AVE - 64 AVE/ 184 ST. - 186 ST. ARE PROPOSED FOR VARIANCE TO NEO TRADITIONAL NEIGHBOURHOOD STANDARDS

SCALE

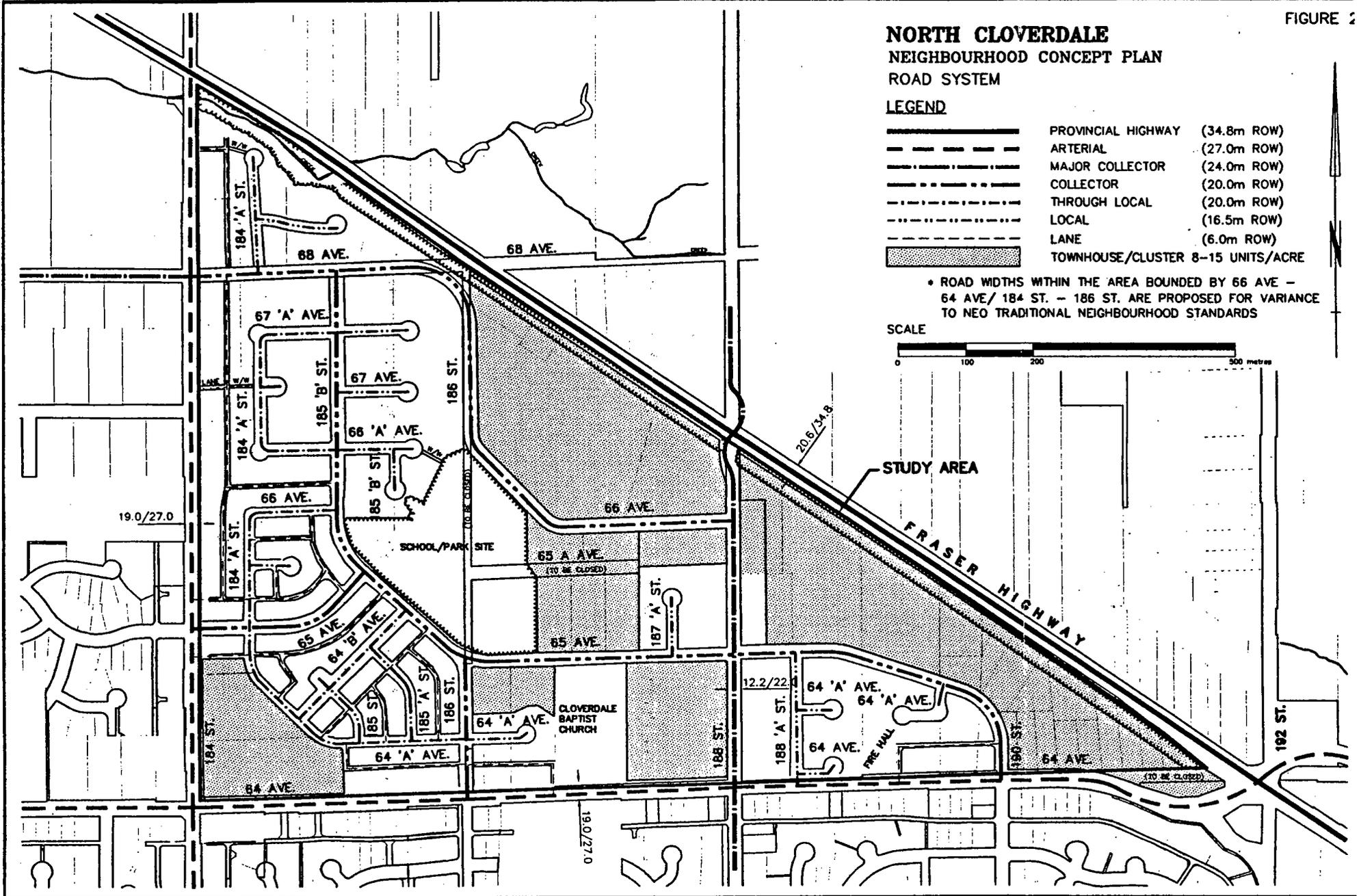
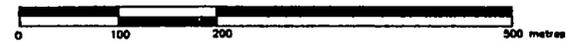
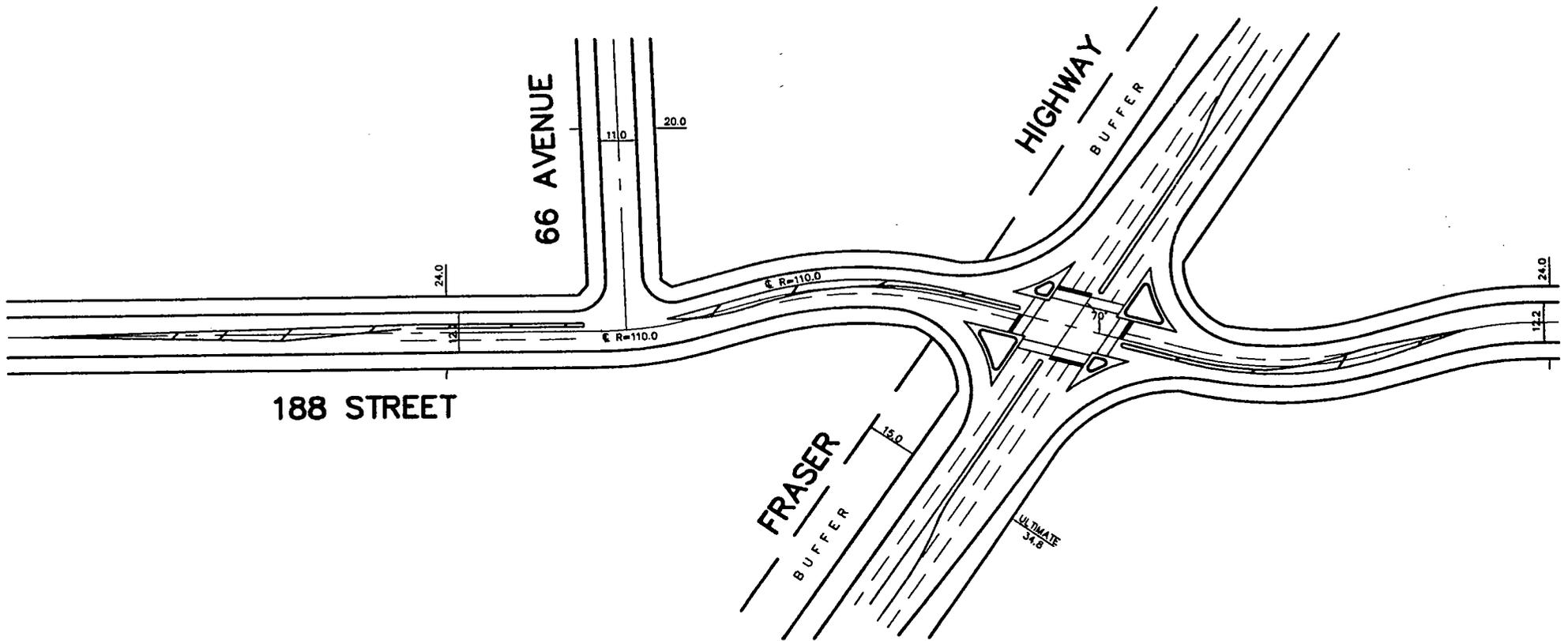
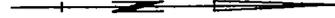


FIGURE 3

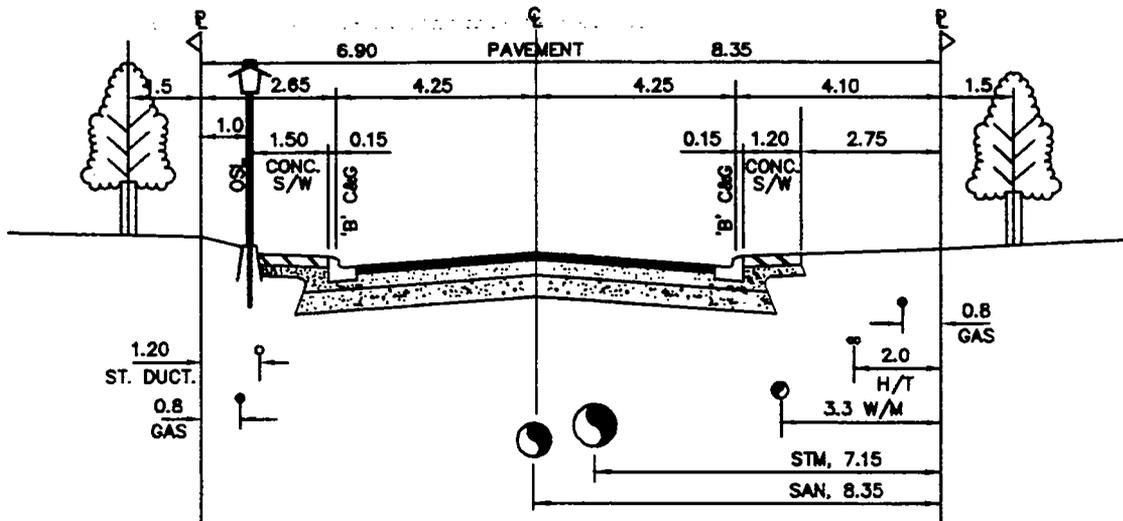
NORTH CLOVERDALE
FRASER HIGHWAY & 188 STREET
'CONCEPTUAL'
INTERSECTION SCHEMATIC

SCALE

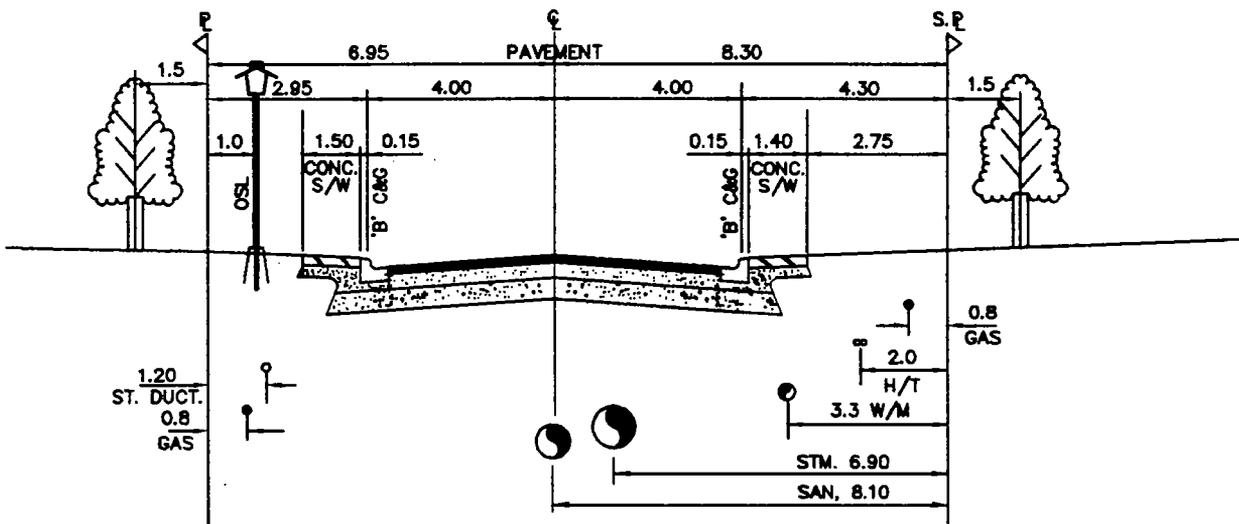


NORTH CLOVERDALE ROAD STANDARDS NEO-TRADITIONAL HOUSING

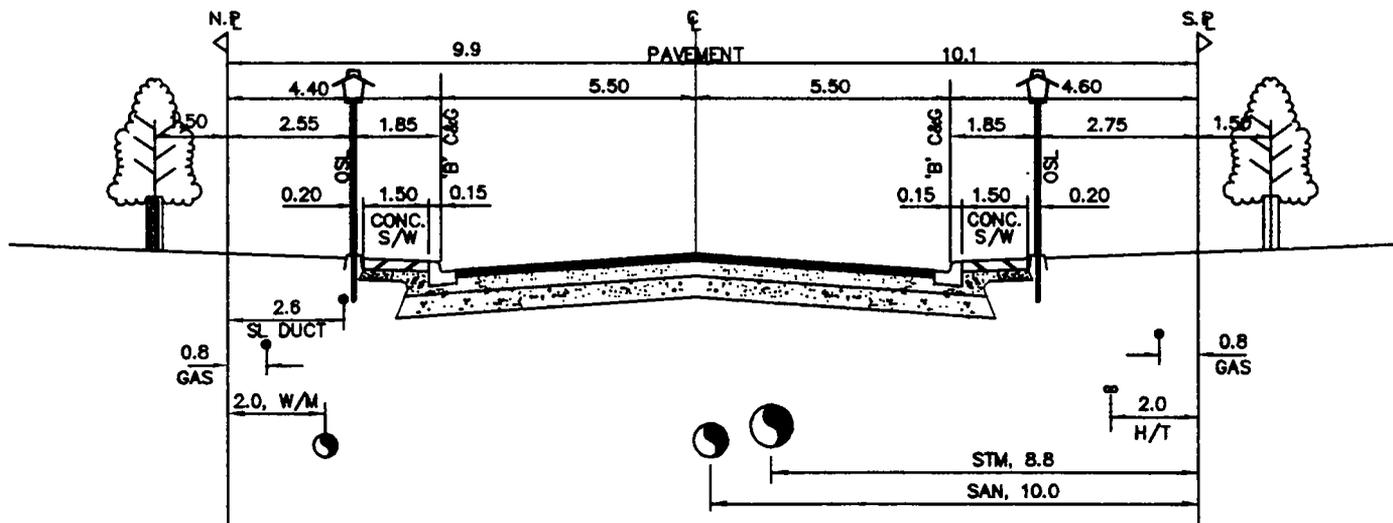
FIGURE 4



THROUGH LOCAL ROAD



LIMITED LOCAL ROADWAY



LIMITED COLLECTOR

FIGURE 5

NORTH CLOVERDALE NEIGHBOURHOOD CONCEPT PLAN PEDESTRIAN & CYCLIST ROUTES

LEGEND

- PEDESTRIAN CIRCULATION VIA WALKWAYS
- CYCLISTS ROUTES
- [Hatched Box] TOWNHOUSE/CLUSTER 8-15 UNITS/ACRE

SCALE

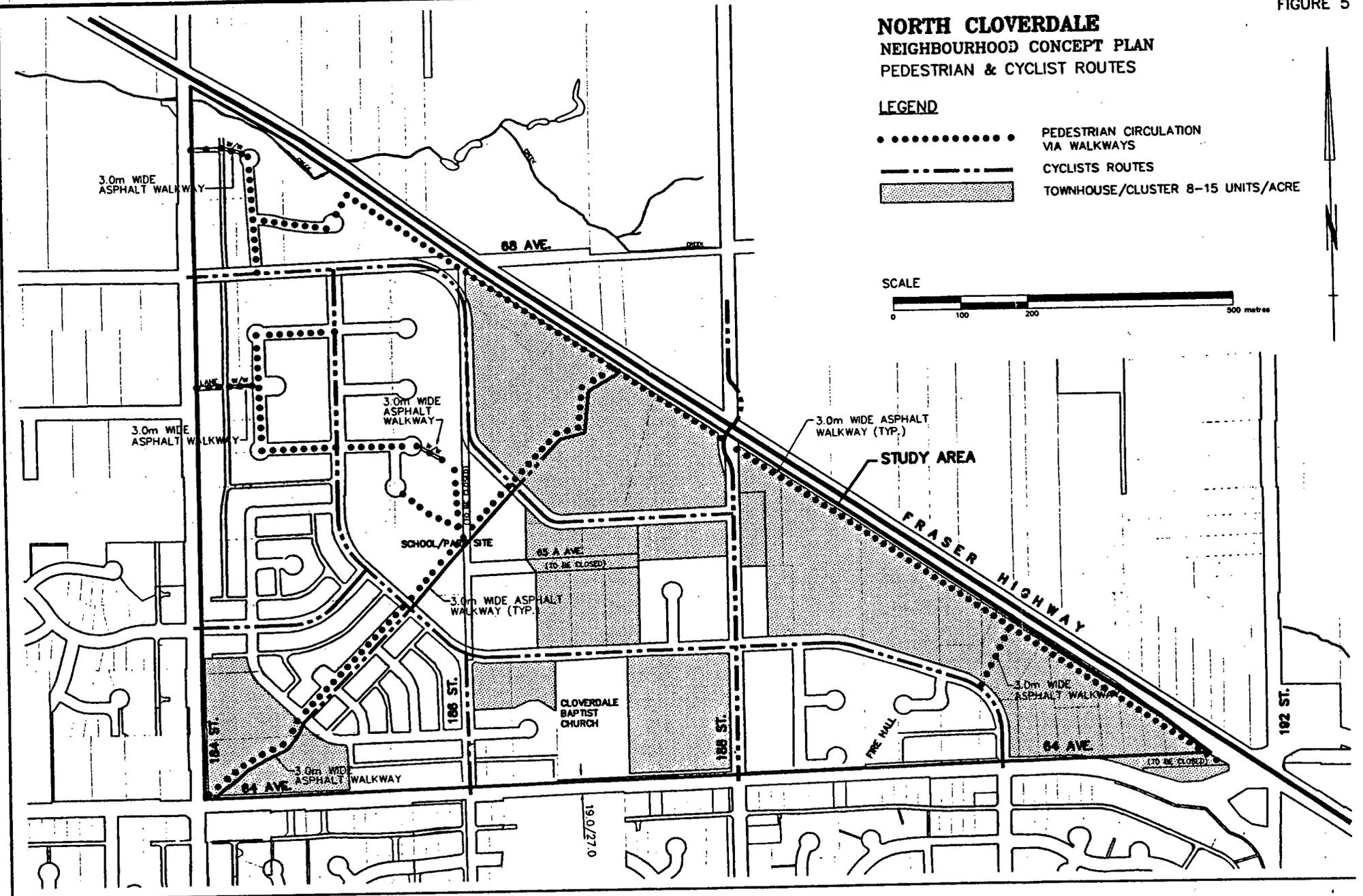
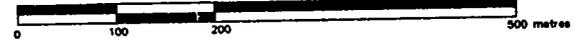


FIGURE 6

NORTH CLOVERDALE
NEIGHBOURHOOD CONCEPT PLAN
WATER DISTRIBUTION SYSTEM
LEGEND

- EX. GRID
- PROP. GRID
- EX. LOCAL
- PROP. LOCAL
- △ PIPE NUMBER
- NODE NUMBER
- TOWNHOUSE/CLUSTER 8-15 UNITS/ACRE

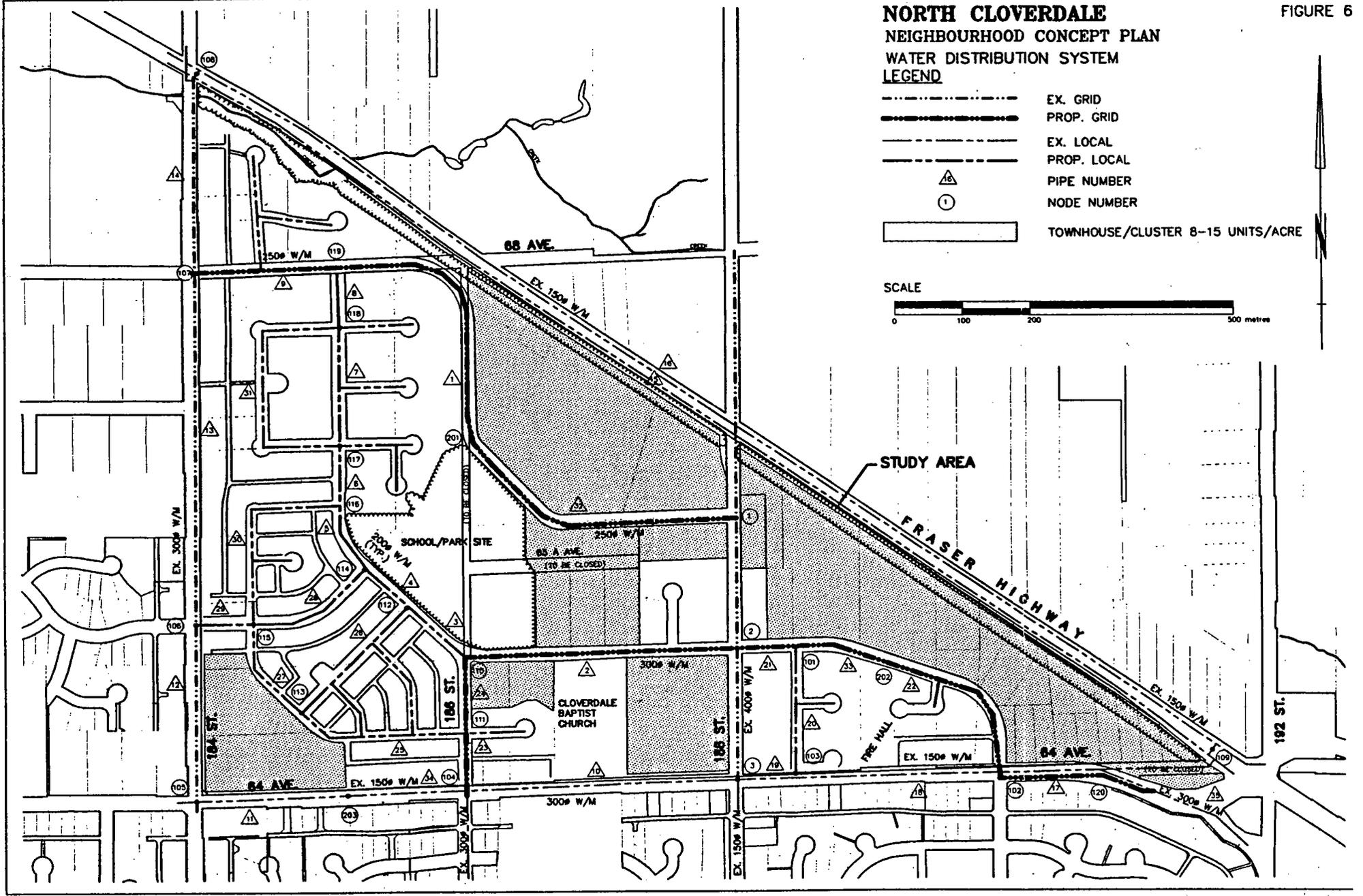
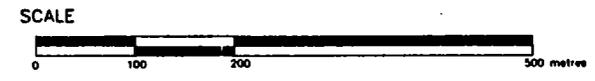


FIGURE 7

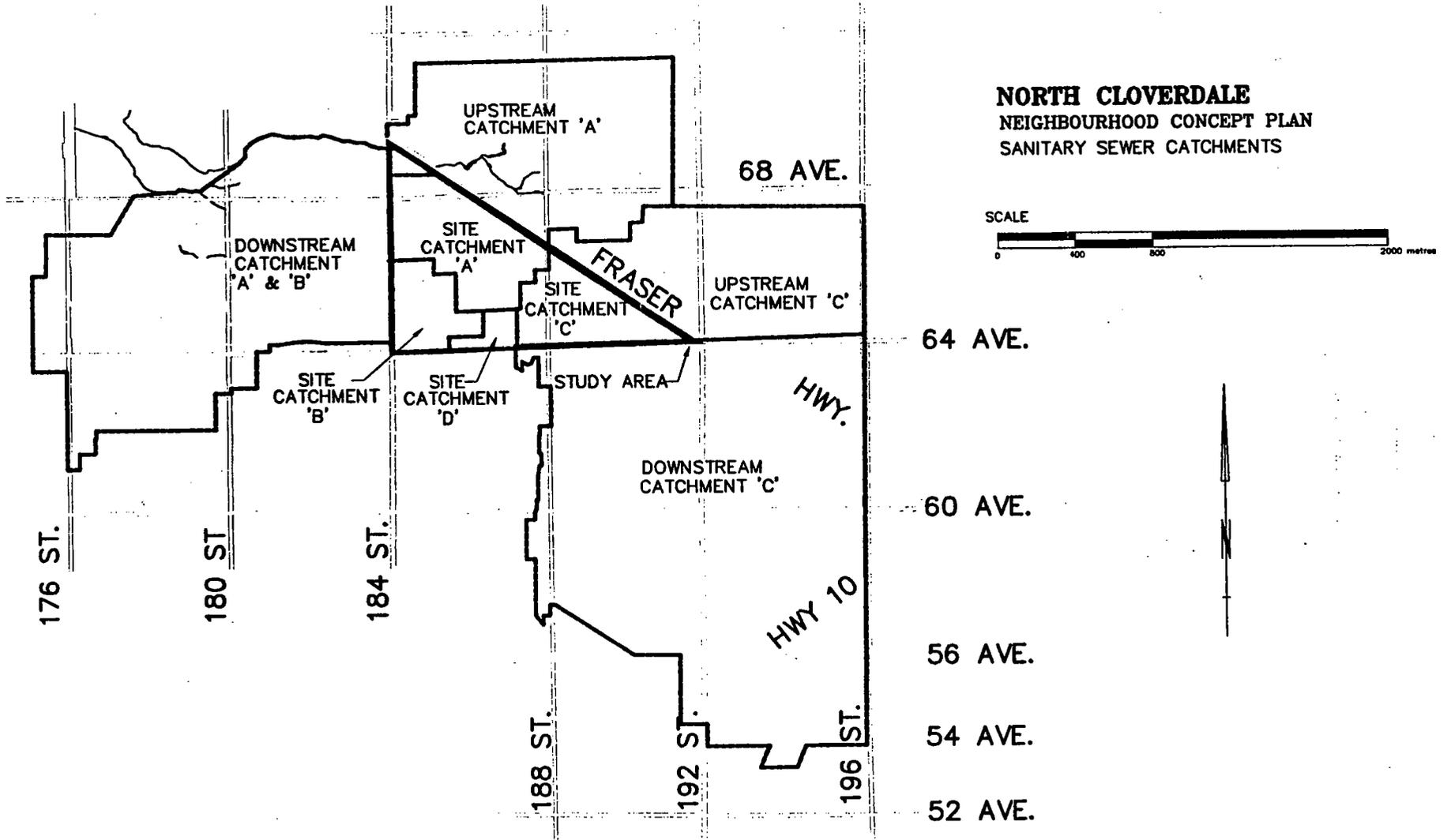


FIGURE 8

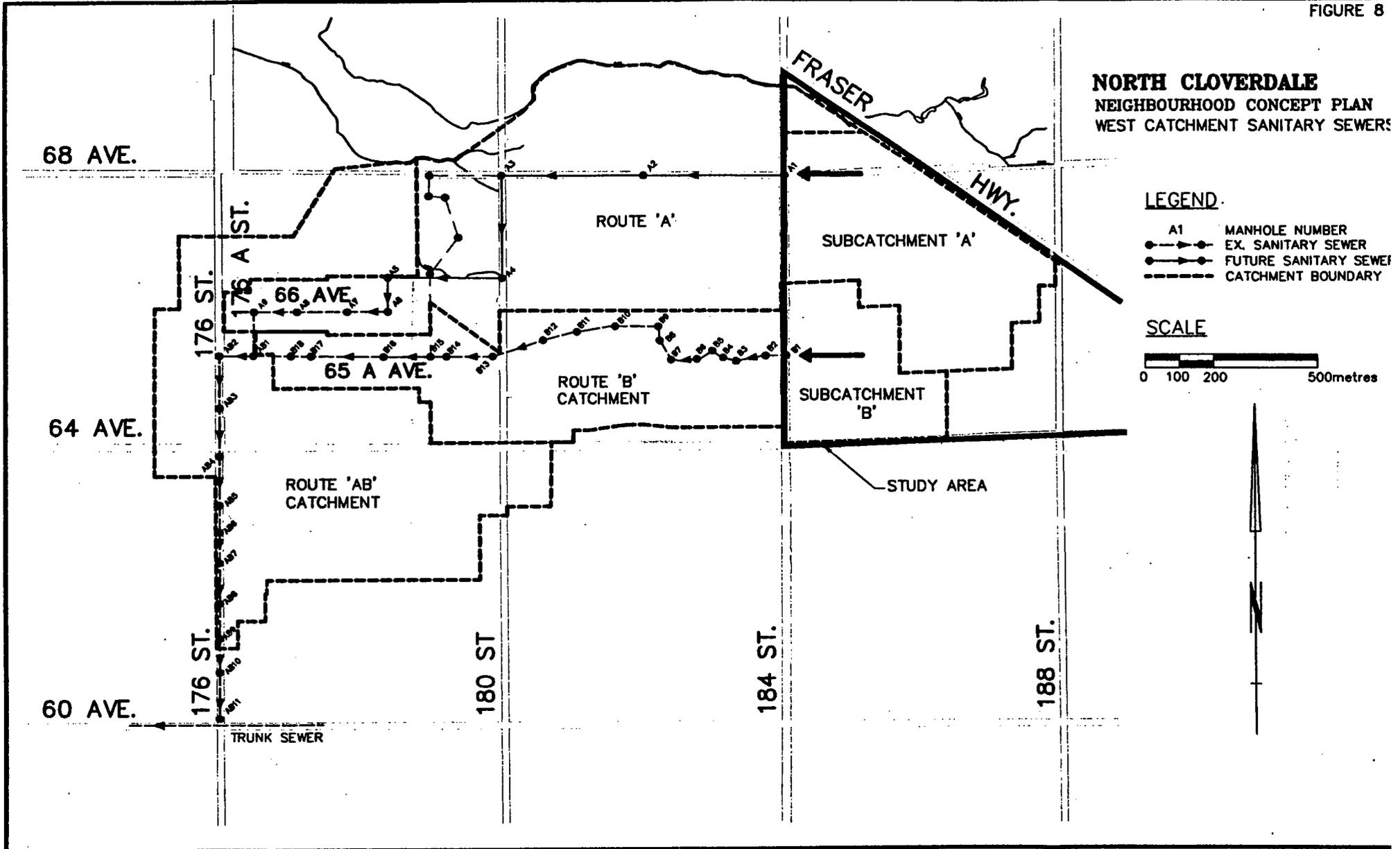


FIGURE 9

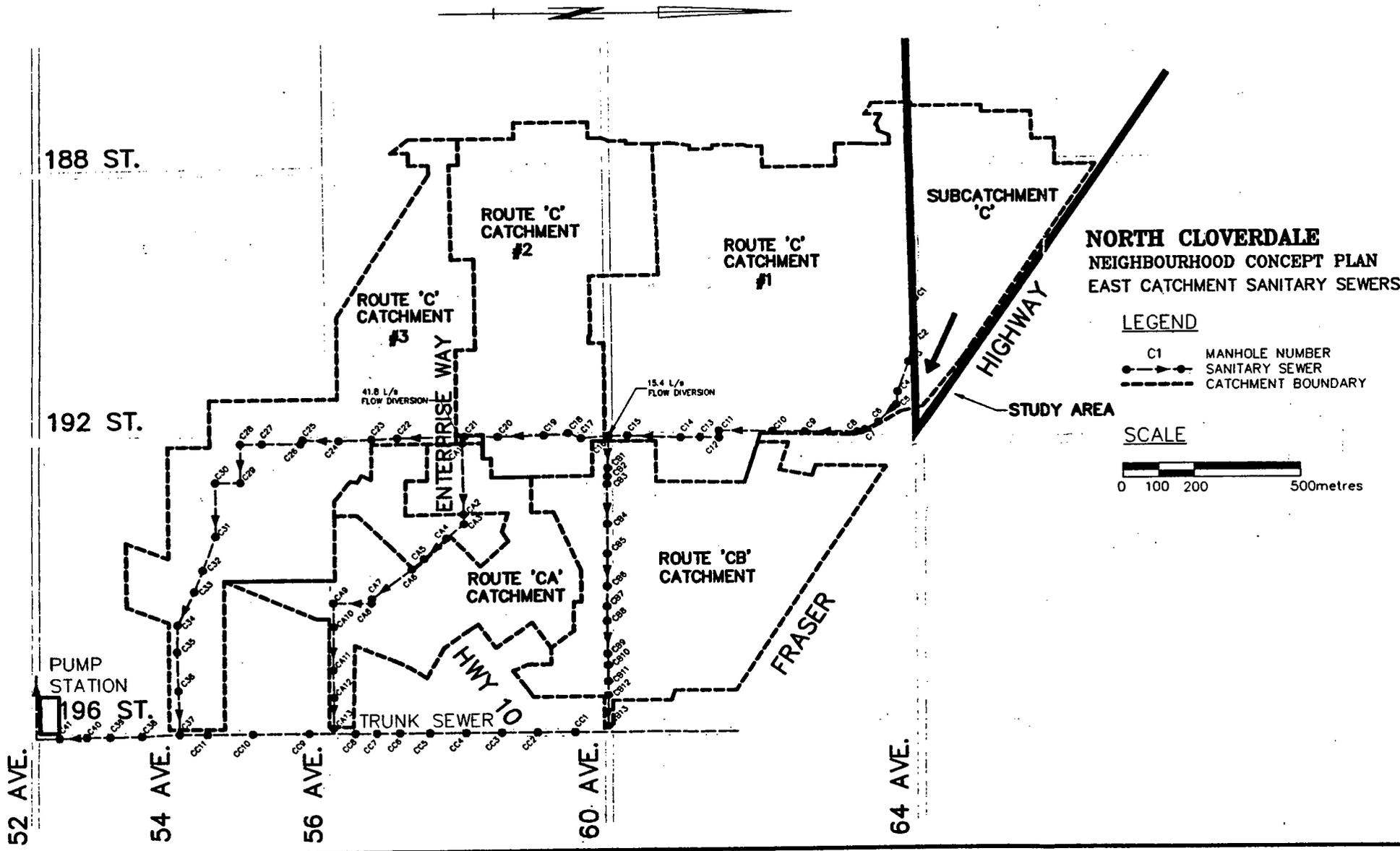
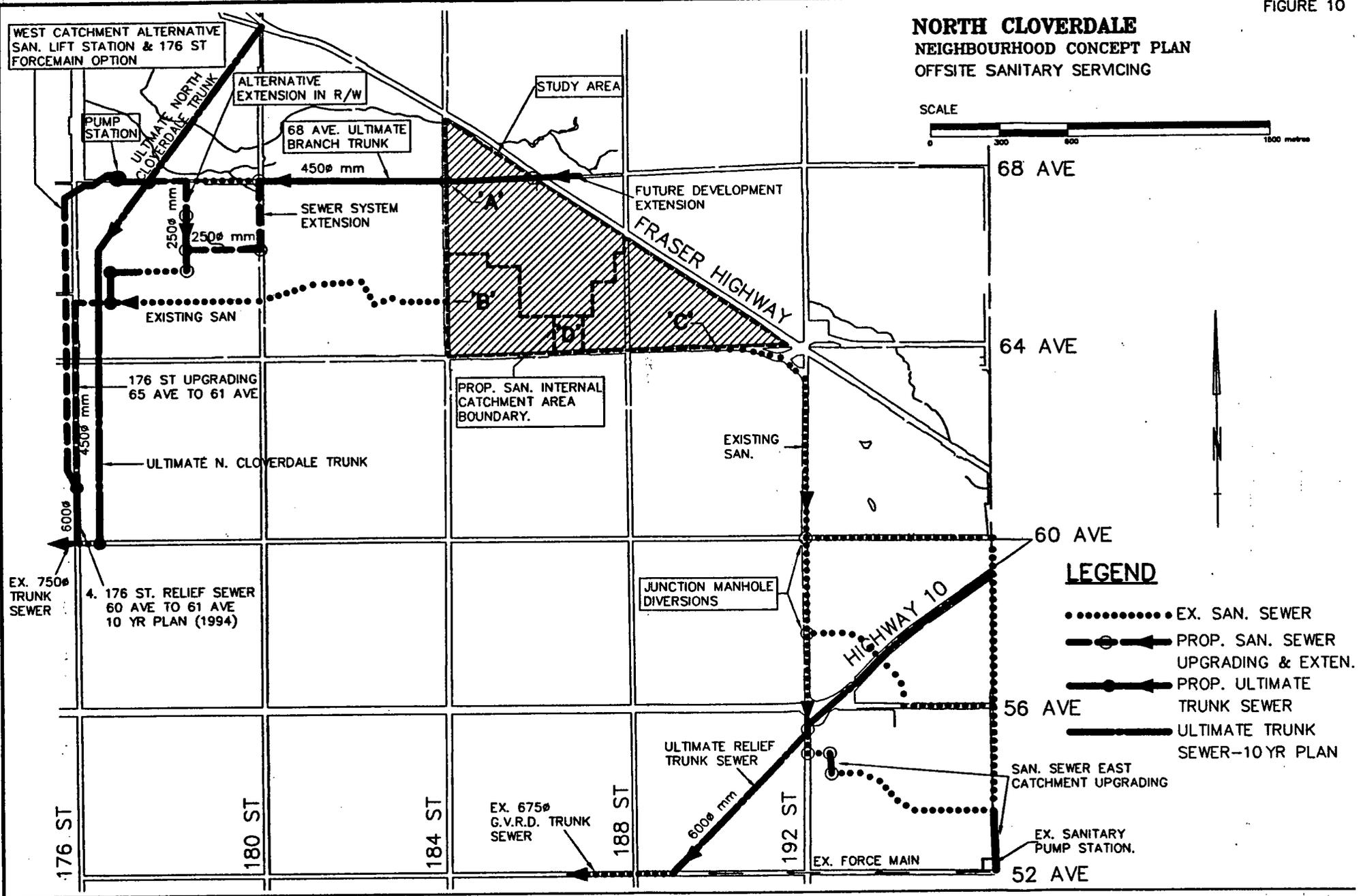
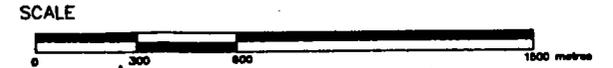


FIGURE 10

NORTH CLOVERDALE NEIGHBOURHOOD CONCEPT PLAN OFFSITE SANITARY SERVICING



LEGEND

- EX. SAN. SEWER
- - - - -> PROP. SAN. SEWER UPGRADING & EXTEN.
- > PROP. ULTIMATE TRUNK SEWER
- > ULTIMATE TRUNK SEWER-10 YR PLAN

NORTH CLOVERDALE
NEIGHBOURHOOD CONCEPT PLAN
SANITARY SEWER SYSTEM

LEGEND

-  EX. SANITARY SEWER
-  PROP. SANITARY SEWER
-  SANITARY CATCHMENT BOUNDARY
-  TOWNHOUSE/CLUSTER 8-15 UNITS/ACRE

SCALE

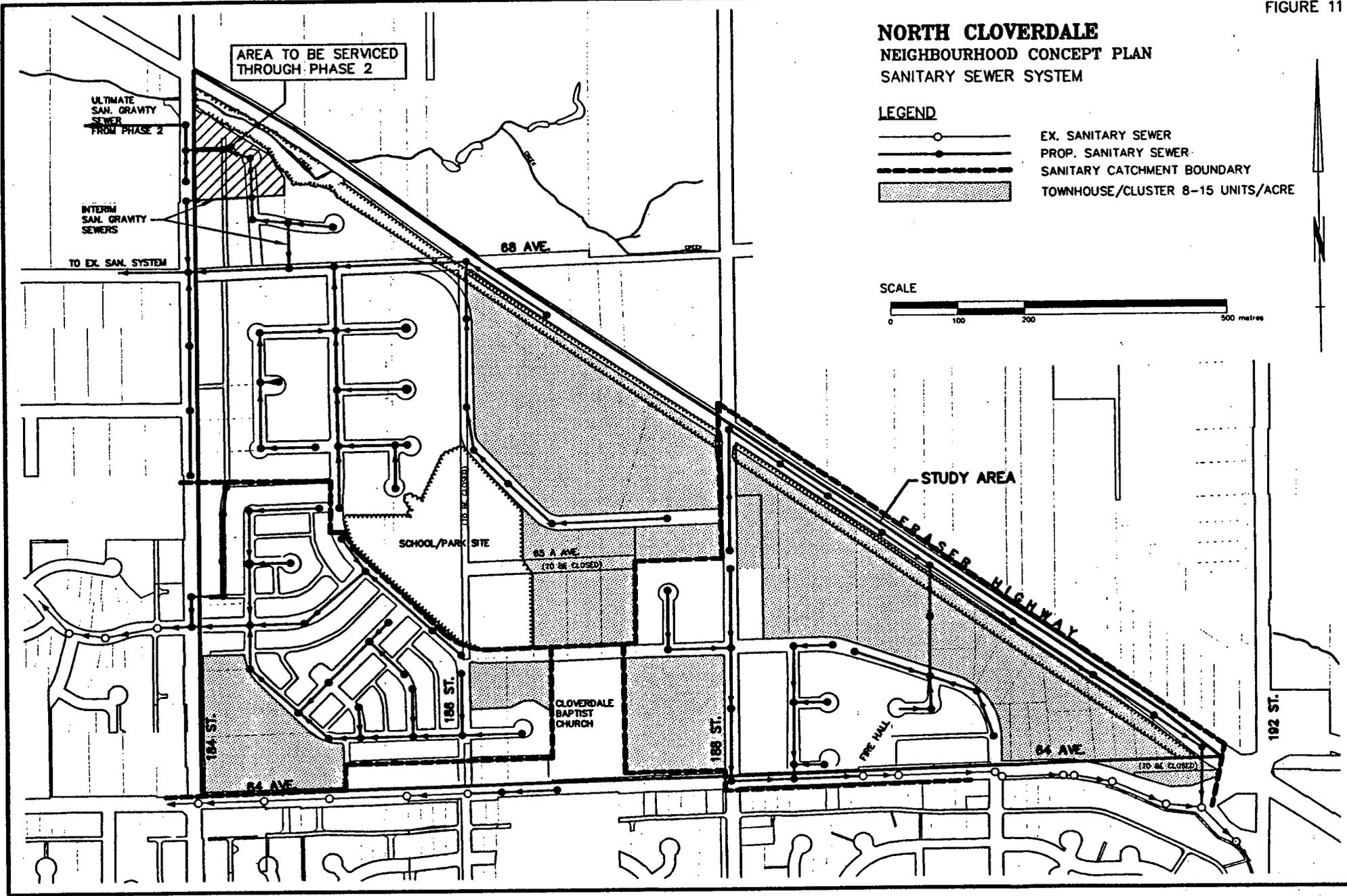
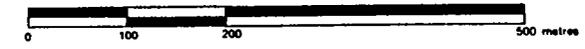
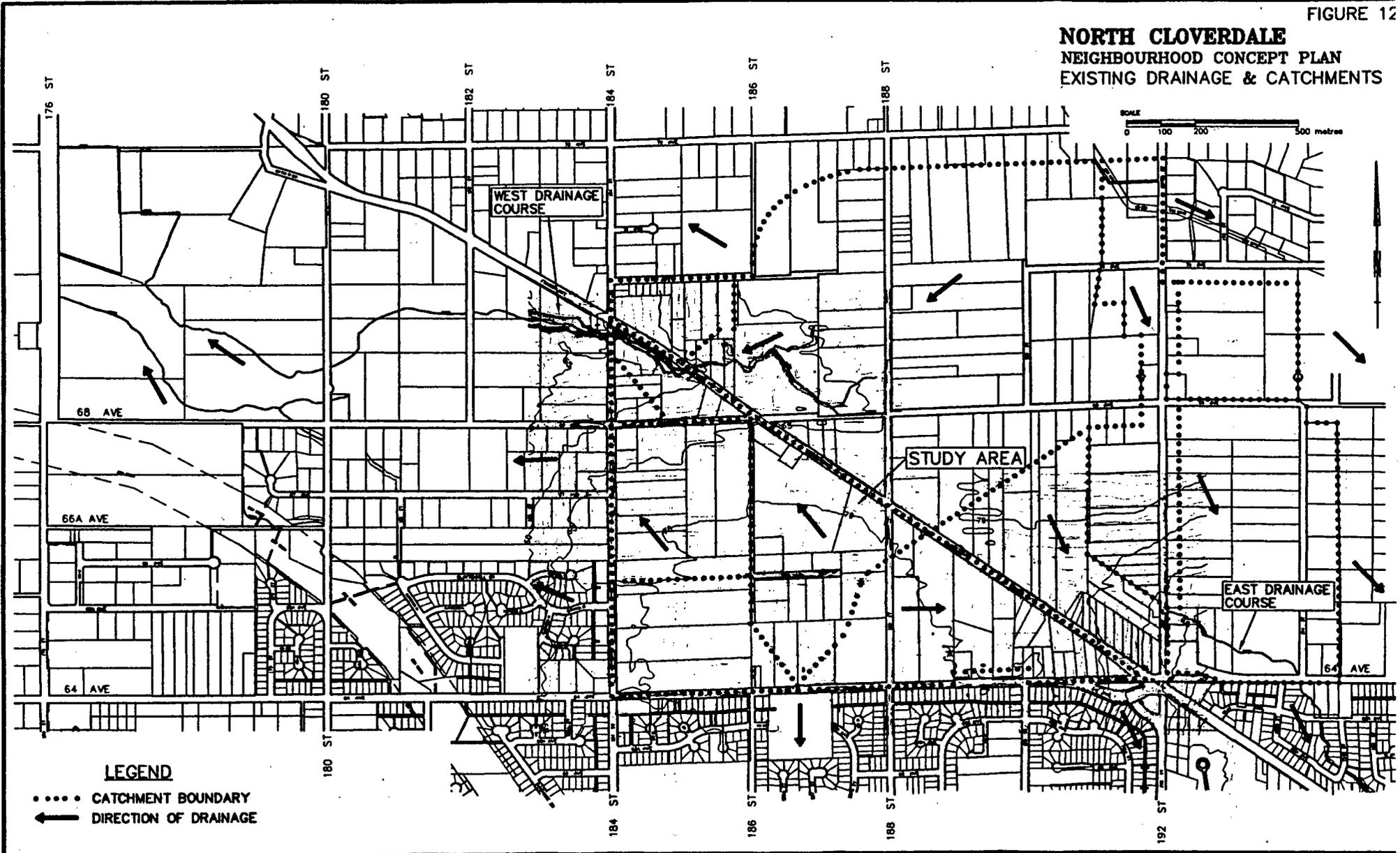


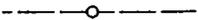
FIGURE 12

NORTH CLOVERDALE
NEIGHBOURHOOD CONCEPT PLAN
EXISTING DRAINAGE & CATCHMENTS

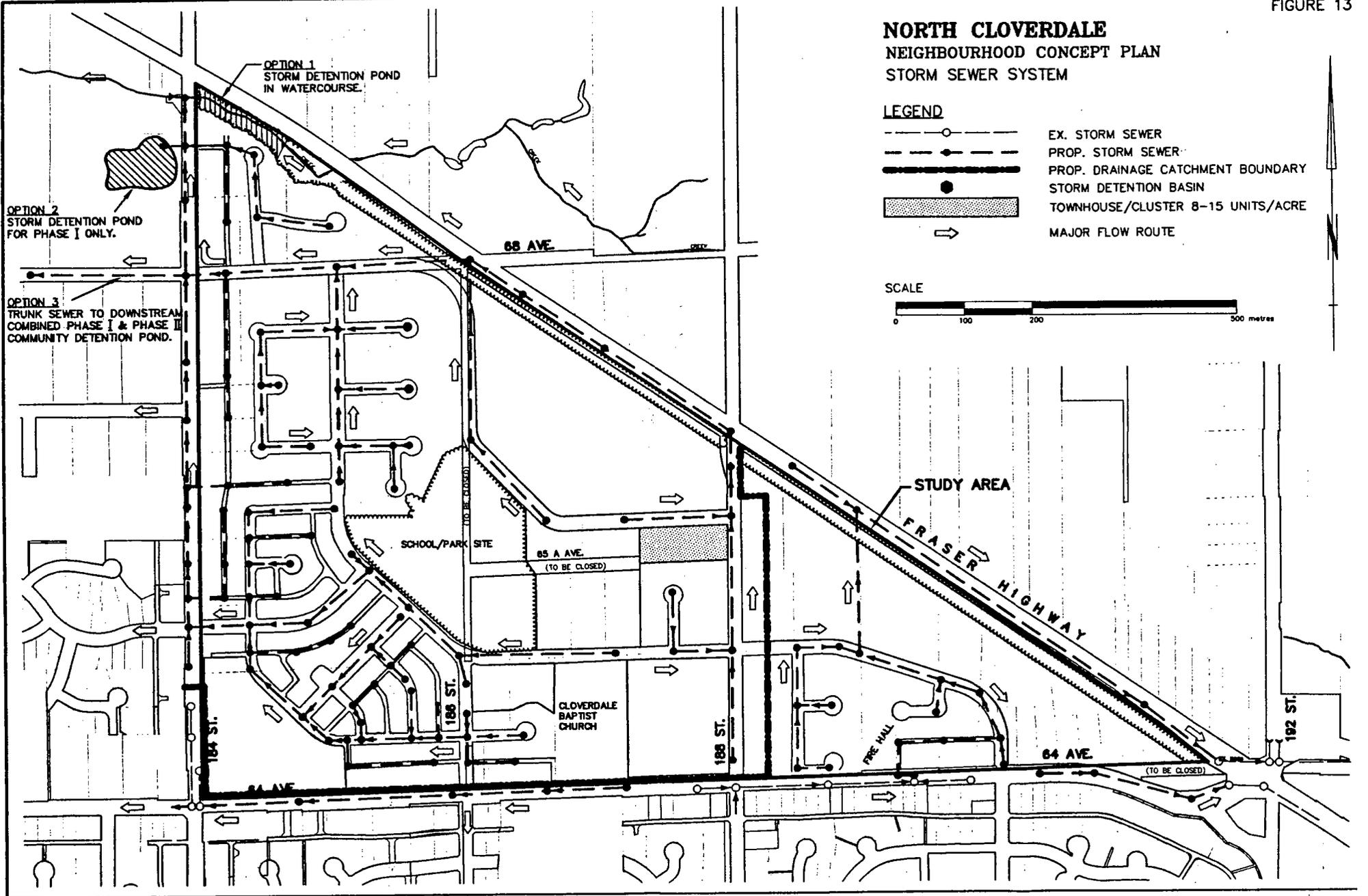


**NORTH CLOVERDALE
NEIGHBOURHOOD CONCEPT PLAN
STORM SEWER SYSTEM**

LEGEND

-  EX. STORM SEWER
-  PROP. STORM SEWER
-  PROP. DRAINAGE CATCHMENT BOUNDARY
-  STORM DETENTION BASIN
-  TOWNHOUSE/CLUSTER 8-15 UNITS/ACRE
-  MAJOR FLOW ROUTE

SCALE



OPTION 2
STORM DETENTION POND
FOR PHASE I ONLY.

OPTION 3
TRUNK SEWER TO DOWNSTREAM
COMBINED PHASE I & PHASE II
COMMUNITY DETENTION POND.

OPTION 1
STORM DETENTION POND
IN WATERCOURSE.

STUDY AREA

FRASER HIGHWAY

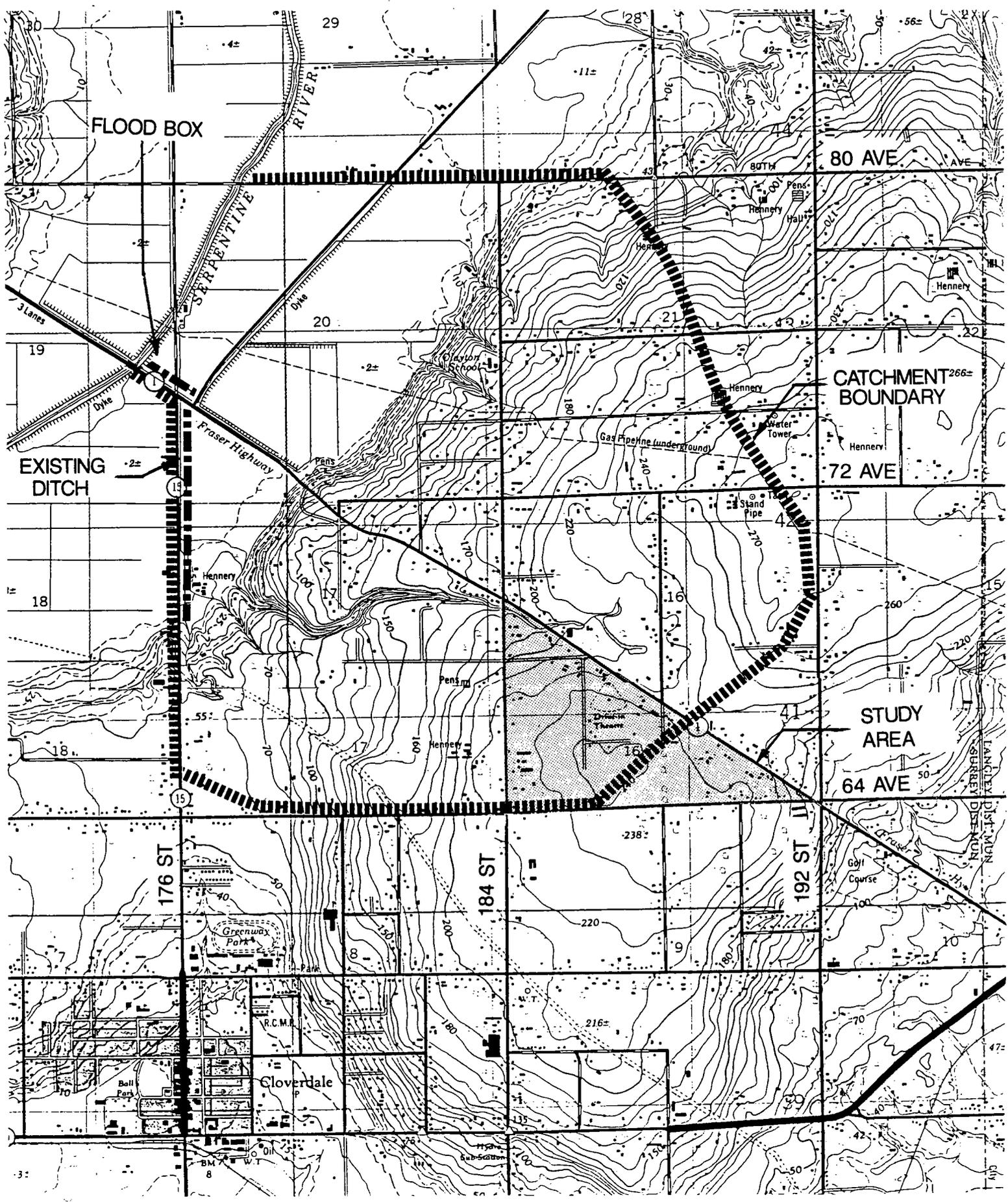
SCHOOL/PARK SITE
65 A AVE.
(TO BE CLOSED)

CLOVERDALE
BAPTIST
CHURCH

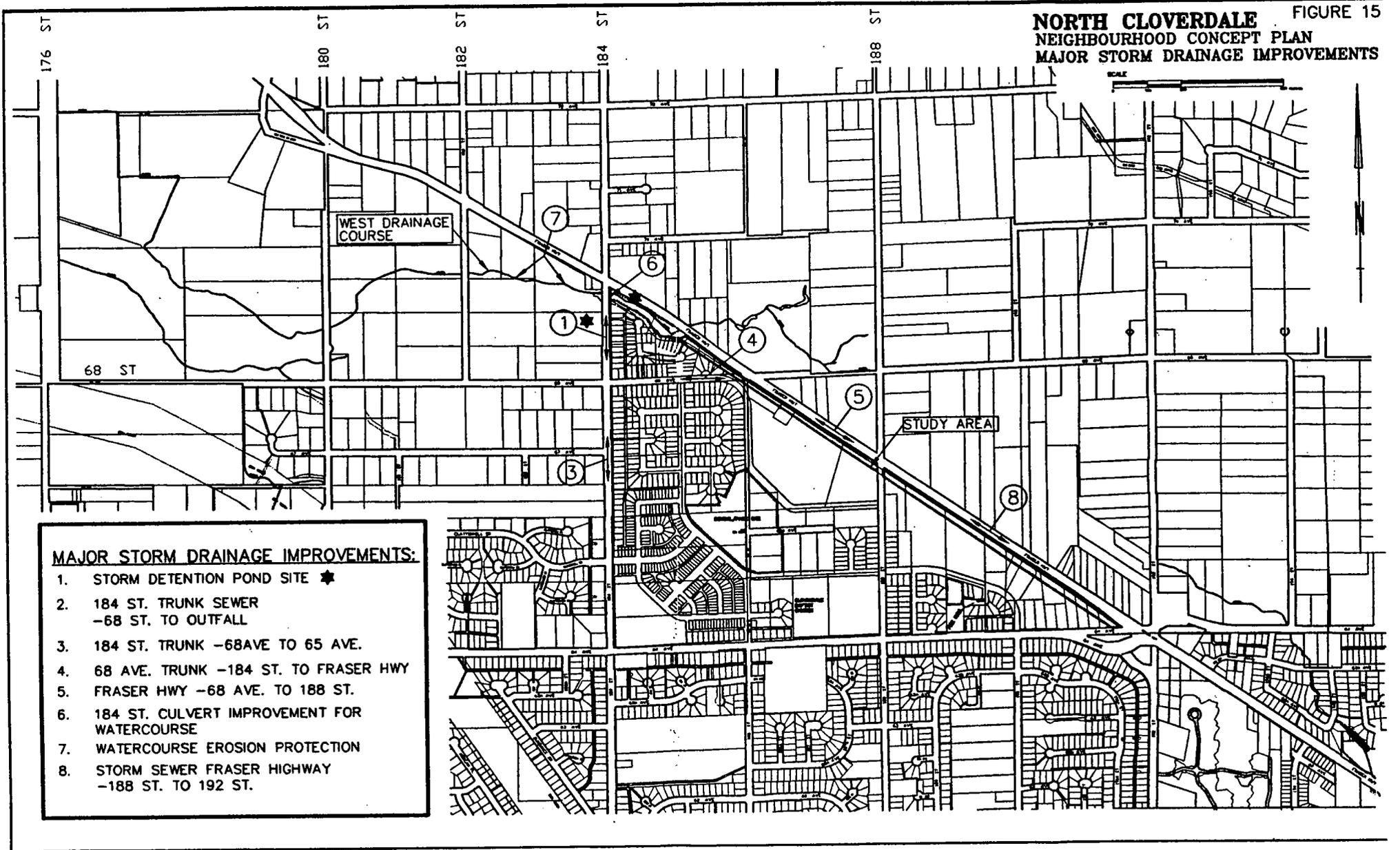
FIRE HALL

64 AVE.
(TO BE CLOSED)

NORTH CLOVERDALE LOWLAND DRAINAGE



NORTH CLOVERDALE FIGURE 15
NEIGHBOURHOOD CONCEPT PLAN
MAJOR STORM DRAINAGE IMPROVEMENTS



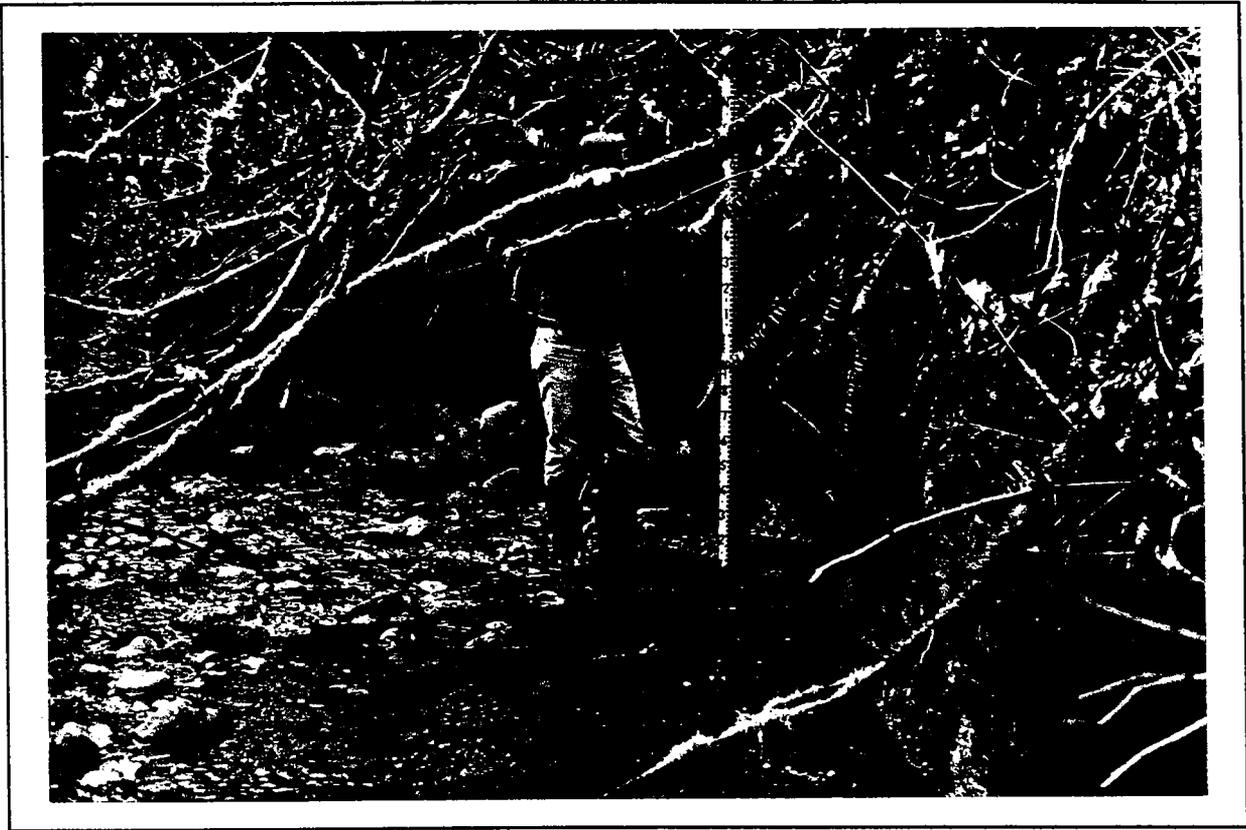
- MAJOR STORM DRAINAGE IMPROVEMENTS:**
1. STORM DETENTION POND SITE ★
 2. 184 ST. TRUNK SEWER
-68 ST. TO OUTFALL
 3. 184 ST. TRUNK -68AVE TO 65 AVE.
 4. 68 AVE. TRUNK -184 ST. TO FRASER HWY
 5. FRASER HWY -68 AVE. TO 188 ST.
 6. 184 ST. CULVERT IMPROVEMENT FOR WATERCOURSE
 7. WATERCOURSE EROSION PROTECTION
 8. STORM SEWER FRASER HIGHWAY
-188 ST. TO 192 ST.



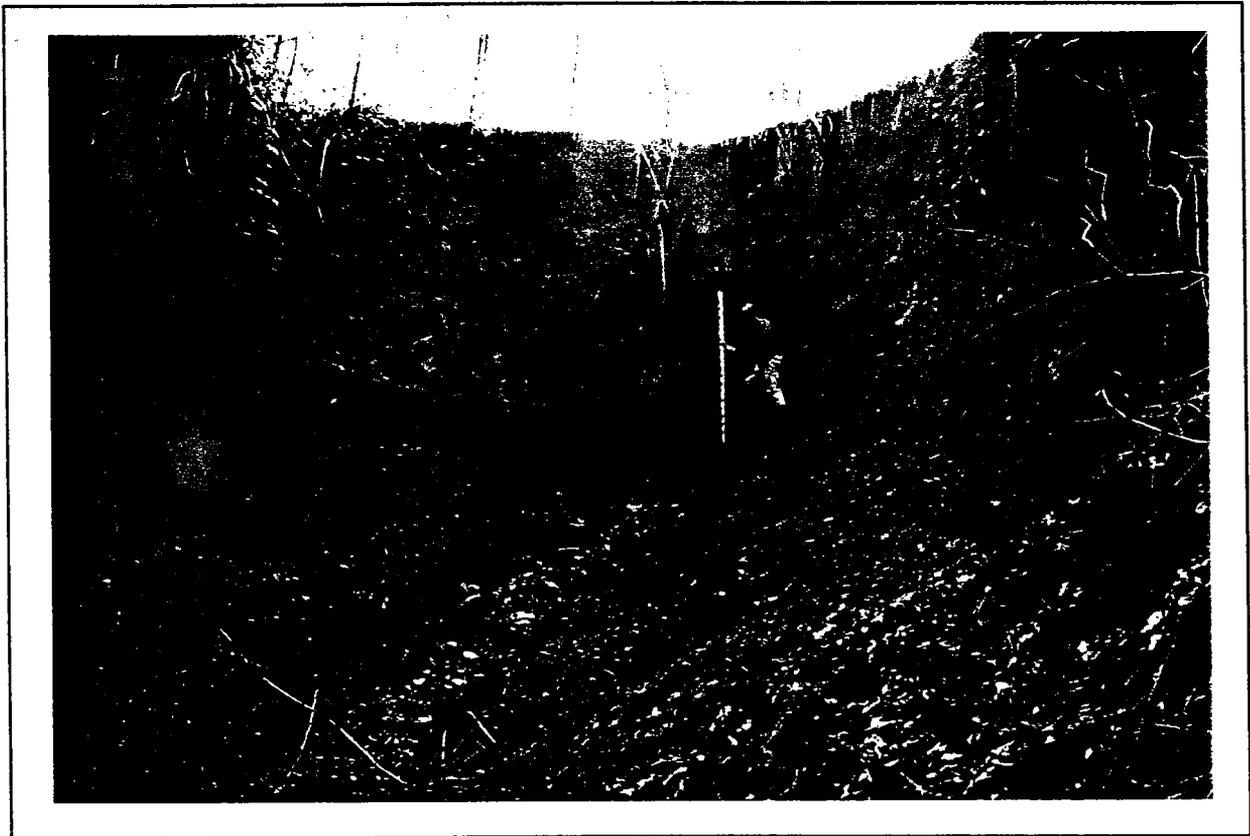
Typical Debris Immediately West Of 184 Street.



125 metres West Of 184 street - Bed Material Lost,
Till Erosion Of Approximately 200 mm.



Historical Bank Erosion West Of 182 Street Alignment.



Significant Bank Erosion At 18039/89 - 68 Avenue
Resulting From The Discharge Of A 100 mm Drain Tile.

**NORTH CLOVERDALE
NEIGHBOURHOOD CONCEPT PLAN
EAST NEIGHBOURHOOD**

**SECTION III
EVALUATION OF
AMENITY REQUIREMENTS**

August 26, 1994

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- Townhouse/Cluster Housing
- Other Land Uses

Procedure For Collecting Contributions

Scheduling the Provision of Amenities

BACKGROUND

According to the terms of reference for the Neighbourhood Concept Plan as originally introduced, an NCP is to be initiated by either a majority of owners or owners of 70% of the land in the neighbourhood that was subject to an NCP. In addition, the NCP was to be prepared by a qualified consulting team. In August of 1993, the owners of 70% or more of the land in North Cloverdale advised the City of Surrey they would prepare an NCP and joined together to form the North Cloverdale Steering Committee. They engaged Hunter Laird Engineering Ltd. to undertake a planning and engineering study which would assist the Steering Committee in forming the Neighbourhood Concept Plan for North Cloverdale's East Neighbourhood. After a series of information meetings, open houses and a number of revisions to the draft NCP, a detailed land use plan together with development guidelines were submitted to Surrey Planning and Development staff in the Spring of 1994. After a significant amount of staff review, discussion and amendments, the land use and subdivision plan for the North Cloverdale neighbourhood was re-submitted in its final form in May of 1994. On June 15, 1994, Surrey City Council approved the Land Use and Subdivision plan for the North Cloverdale neighbourhood unanimously.

This report details the financial commitments that the North Cloverdale Steering Committee have proposed to address the amenities and facilities required to accommodate development in the East Neighbourhood. It has been prepared in accordance with the schedule agreed to between the Steering Committee and Surrey Planning and Development Department.

N.C.P. PREPARATION COSTS AND AMENITIES

The North Cloverdale Neighbourhood Concept Plan - East Neighbourhood Steering Committee believes that amenities should be paid for when the demand is generated or services are utilized. To this extent, the Steering Committee proposes that the costs of the Planning and Preliminary Engineering Studies to prepare the NCP and contributions to fund the provision of amenities be collected on a per unit basis. The items which need to be funded by the East Neighbourhood have been established in the adopted Local Area Plan, the NCP Land Use and Subdivision (Section I) and through discussions and review with City Staff. The North Cloverdale Neighbourhood Concept Plan - East Neighbourhood Steering Committee recommends that the development in the East Neighbourhood contribute towards the funding of the following items.

1. **Planning and Preliminary Engineering**

Planning and Preliminary Engineering Studies to prepare the Neighbourhood Concept Plan for the East Neighbourhood have been paid for by a select group of Landowners/Developers who are part of the East Neighbourhood Steering Committee.

The Steering Committee engaged Hunter Laird Engineering Ltd. and other specialist subconsultants to prepare the Neighbourhood Concept Plan for the East Neighbourhood. A budget for the project was established to meet the terms of reference negotiated with the City. The budget approved by the Steering Committee is approximately \$102,000. This corresponds to a charge of \$68 per unit.

The Steering Committee recommends that the cost of the Planning and Preliminary Engineering Cost front-ended by the select group of landowners in the Study Area be refunded to the front enders and recovered by the City on a per unit basis as development applications are received. The City should establish a special application levy to recover these funds from non-participating landowners.

The consultant budgets approved by the Steering Committee are:

Planning & Preliminary Engineering	\$ 102,000	\$68/unit
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AMENITY SPECIFIC FUNDING PROPOSAL

1. Parkland Assembly

The Neighbourhood Concept Plan Land Use and Subdivision Plan (Section I) has identified approximately 9% (17.56 Acres) of the Study Area to be designated for Open Space. Included in this calculation is 13.21 acres for the Combined Elementary School and Neighbourhood Park which serves as a focal point for the Neighbourhood. The remaining 4.35 acres will be provided in the environmentally protected ravine lands in the northwest corner of the Study Area.

The 13.21 acre School/Park site assembly is shown on the enclosed Plan 1. This site can be assembled by combining statutory land dedications, closure of unnecessary road right-of-ways, consolidation with lands already owned by the School District #36 and compensation back to adjacent landowners who are asked to dedicate land beyond the statutory requirements. This land assembly is summarized in the following table:

Table 1
Land Assembly for Elementary School Neighbourhood Park Site

Area/Acres	Source
5.09	Consolidated School District #36 Properties
1.10	Roads to be closed/exchanged
2.607	5% land dedication from adjacent properties
4.413	Acquired from adjacent properties in excess of the statutory dedications
13.21	Total School/Park site

Funding for the acquisition by Surrey of the additional 4.413 acres is available from revenues generated for Parkland purposes within the Neighbourhood. Table 2 demonstrates that the funding available for the land acquisition will occur from development as it proceeds and that projected annual revenues for parkland purposes from development in the East Neighbourhood will exceed the projected expenditures every year, with a total surplus of revenues of \$6,594,170.00, which will be used for the acquisition of Community and District Parks outside the Study Area.

AMENITY SPECIFIC FUNDING PROPOSAL

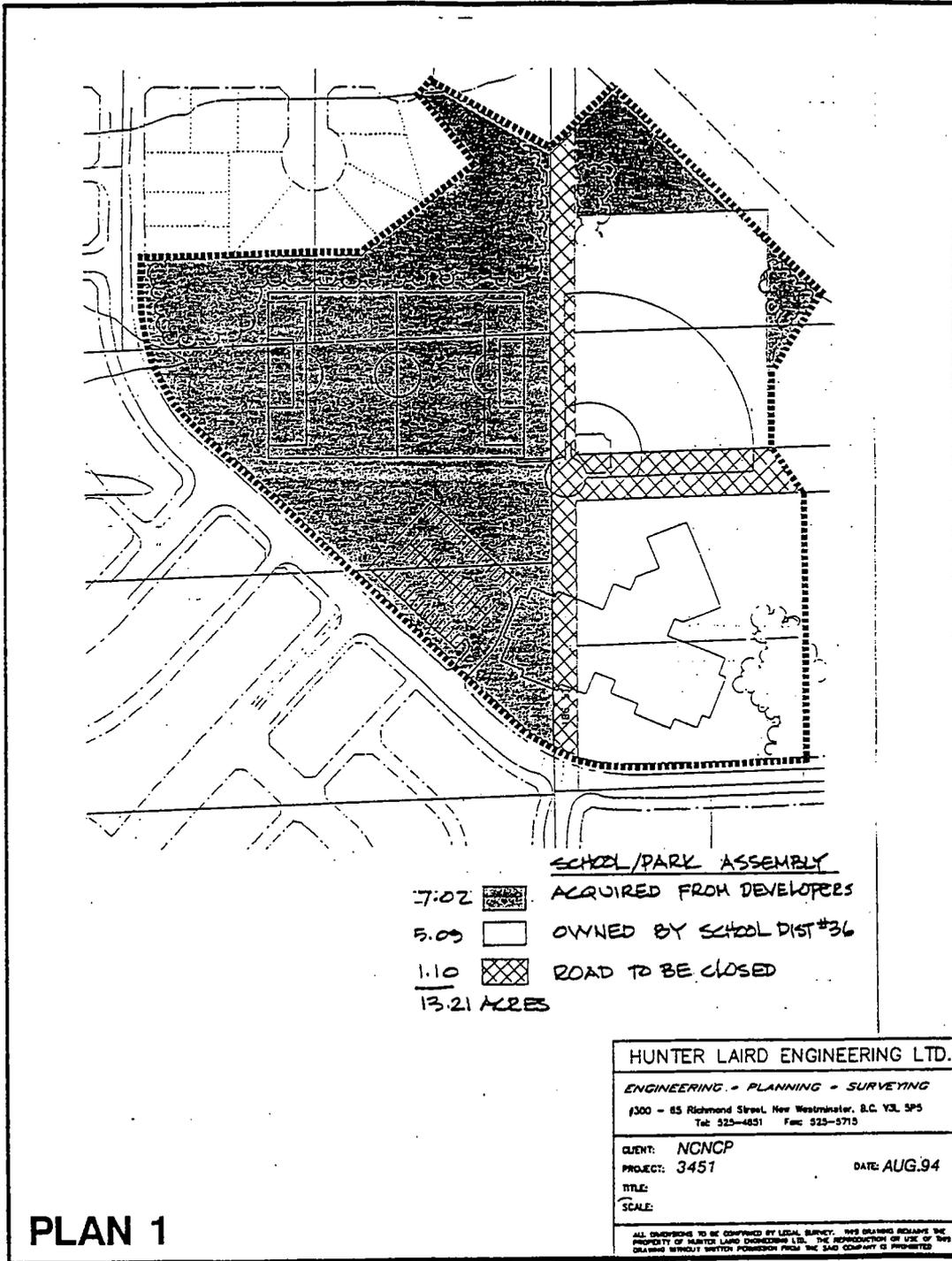
Table 2
Projected Revenues for Parkland Purposes and Expenditures for Acquisitions

(Figures shown are based on 1994 estimates. Actual values will be determined by Appraisals and established valuation procedures.)

Year		1994	1995 - 2000	Total
# of	SF	290	323	613
Units	MF	125	760	885
Revenues				
\$	SF (1)	723,120		723,120
	SF	100,800	1,356,600	1,457,400
	MF	756,250	4,598,000	5,354,250
	5% payments (3)	225,000	596,000	821,000
SUBTOTAL		1,805,170	6,550,600	8,355,770
Expenditures				
(Land Acquisitions) (2)				
-	Parklane-Cascadia	840,000		
-	Action (lot 4)		120,000	
-	Drive-In Site		321,600	
-	Dr. Lee (Rems)		480,000	
SUBTOTAL		840,000	921,600	1,761,600
TOTAL		+965,170	+5,629,000	+6,594,170

1. Assumes that 262 units will be created with the current development fees.
2. Assumest hat the current land value is \$60,000 per conventional lot and \$40,000 per smaller lots.

3. Based on the above current market values. However, the market value quoted may change over time.



AMENITY SPECIFIC FUNDING PROPOSAL

The calculation of compensation back to landowners has been based on a current rawland value of \$60,000 per lot for conventional single family lots and \$40,000 per lot for the smaller Neo-traditional lots. The projected compensation formula proposes that all compensation back to landowners be based on single family land values. The following Table 3 summarizes the proposed compensation.

Table 3

	Surplus Area Acre	Estimated # of Lots	Value of Compensation
Parklane / Cascadia	2.270	21	\$ 840,000
Action (Lot 4)	0.279	2	\$ 120,000
Drive-In Site	0.741	5.36	\$ 321,600
Dr. Lee (Rem 5)	1.123	8	\$ 480,000
TOTAL	4.413	36.36	\$1,761,600

- Note: - Final areas to be acquired must be confirmed by legal surveyor.
- Final compensation value must be confirmed by the City of Surrey and approved by the City Council.

2. **Parkland Development and Neighbourhood House**

The Local Area Plan and Neighbourhood Concept Plan have identified the need to fund landscaping and development costs of the Neighbourhood Park combined with the Elementary School Site. For the purpose of budgeting, development costs have included the construction costs of the proposed Neighbourhood House. In view of the conceptual vision for this park, and the uncertainty of the need for the Neighbourhood House, the Steering Committee believes that the City should be authorized to redirect funds collected for the Neighbourhood House to landscaping and additional parkland development within the Neighbourhood Park as deemed appropriate by the City. Based on an evaluation of the cost of these amenities by the consultants, it is proposed by the Steering Committee that \$505,000 be budgeted for these amenities. This corresponds to a per unit cost of \$366.

AMENITY SPECIFIC FUNDING PROPOSAL

3. Library Books

The Local Area Plan identified a capital expenditure of \$395,000 to upgrade the book collection system for the North Cloverdale area. Based on the unit projections in the Local Area Plan, the East Neighbourhood has 34.8% of the total number of units projected by that Plan. This corresponds to a **\$137,450** capital expenditure requirement to be funded by development in the East Neighbourhood. The Steering Committee proposes that new development pays its share of this cost at **\$92** per unit.

Table 4
Schedule of Amenity Contributions

	Budget	Per Unit Contribution
Parkland Development and Neighbourhood House	\$505,000	\$366
Library Books	\$137,460	\$ 92
TOTAL AMENITY CONTRIBUTIONS	\$642,460	\$458

The cost estimates and revenue calculations are based on 1994 dollars. In order to accommodate for inflation over the time frame of this schedule, the costs for Planning and Preliminary Engineering and Amenity Contributions should be allowed to increase by the annual increase in the consumer price index. Furthermore, interest revenues accrued from the Amenity Contributions should remain within the East Neighbourhood account for expenditure in the East Neighbourhood.

PAYMENT PROCEDURES

The North Cloverdale Neighbourhood Concept Plan East Neighbourhood Steering Committee recommends that contributions to amenities be collected and paid as they are utilized or as development projects reach the final stage of development approval. To accomplish this, the Planning & Preliminary Engineering Costs should be recovered through a **special application levy to be collected at the time development applications are submitted**. For this purpose, development is defined as application for rezoning, subdivision, Development Permit or Building Permit, whichever occurs first. With respect to the Amenity Contribution component, it is suggested that they be collected and paid similar to the procedure for collecting Development Cost Charges. This is summarized as follows:

- ***Single Family Rezoning and Subdivisions:***

Contributions will be collected prior to Final Adoption of the applicable zoning bylaw amendment and concurrent with the subdivision servicing agreement. The full component of the charges will be secured by a $\frac{1}{3}$ cash payment upfront with the final $\frac{2}{3}$'s secured by Letter of Credit with $\frac{1}{3}$ payable after one year and the final $\frac{1}{3}$ payable after two years.

e.g.: $\frac{1}{3}$ cash with Servicing Agreement
 $\frac{1}{3}$ payable after 1 year] Secured by Letter
 $\frac{1}{3}$ payable after 2 years] of Credit

- ***Townhouse/Cluster Housing:***

Contributions will be collected prior to the issuance of any building permit and paid by the same established $\frac{1}{3}$, $\frac{1}{3}$, $\frac{1}{3}$ formula. However, because construction may occur in phases, and zoning may be given for the whole site, the developer will register an Agreement in the form of a restrictive covenant on title prior to requesting final adoption of the zoning bylaw amendment. The Agreement can specify that the owner of the site will make the Amenity Contribution prior to the issuance of a building permit.

- ***Other Land Uses:***

For the other land uses, e.g. Recreational and Institutional, the "Equivalent Service Connections per Hectare" formula from the Latecomer Procedure Manual will be used to calculate contributions from these lands as they develop.

Recreational : 10 units/Hectare (4 units/Acre)
Institutional : 10 units/Hectare (4 units/Acre)

For the purpose of these calculations, Churches will be considered Institutional

PROCEDURE FOR COLLECTING CONTRIBUTIONS

The Steering Committee envisions a modified and more expeditious approval process for projects in the NCP area based on the adopted NCP and the need for the applicant to acknowledge the NCP program and the schedule of contributions proposed by the Steering Committee.

- Applications for development submitted to Planning and Development Department.
- In addition to the completed application forms and standard fees charged by the City the **applicant shall pay the Planning and Preliminary Engineering Study component of the NCP** on a per unit basis. This will allow the developer/owner to acknowledge the NCP program and the need to contribute to the funding of Neighbourhood Contributions. A letter acknowledging the program and agreement to contribute toward the amenities identified in the NCP could be supplied by the applicant with the applications.
- Staff review of application.
- **Report to Council will acknowledge that the application is within an NCP Neighbourhood and the applicant has agreed to contribute to Neighbourhood Amenities according to the schedule prepared by the Steering Committee and accepted by the City.**
- Bylaw approvals will follow the established process.
- Detailed Engineering and Subdivision design would follow the established process, using the adopted NCP as a guide.
- Servicing Agreement process will **include the securing of NCP Amenity Contributions as suggested in the Payment Procedures section.**

SCHEDULING THE PROVISION OF AMENITIES

The Steering Committee recommends that amenities be provided when the population within the East Neighbourhood is adequate to support the need. In order to establish the time frame, the Steering Committee have proposed a unit threshold method for provision of the Amenities. The Schedule established will ensure that services are provided to serve the new population when justified. In addition, because the main focus of the Neighbourhood is the combined Elementary School and Park the timing of the School Construction was considered in establishing this schedule.

Finally, the revenues from Amenity Contributions should match the expenditures necessary to fund the expenditure when they are scheduled. Due to variations in the business cycle, the supply of new housing units may vary from year to year from the projections in the following table therefore the date in which amenities are scheduled may vary from this schedule.

An example of how the amenities could be provided by this NCP is shown in the following unit threshold table.

	1994	1995	1996	1997	1998	1999	2000	TOTAL
# of units								
SF	290	54	54	54	54	54	53	613
TH/CL	125	125	125	125	125	125	135	885
Parkland Assembly	2.27 Ac	1.02 Ac	1.123 Ac					4.413 Ac
Parkland/ Neighbourhood House Development					280,000		225,000	505,000
Library Books	38,180	16,468	16,468	16,468	16,468	16,468	17,296	137,460

- Note:**
- Parkland areas are those in addition to the statutory dedications required.
 - 1994 estimates based on current applications being reviewed.
 - 1995-2000 assumed an average equal creation of units over the six years. This number may vary according to market conditions and landowners' schedules.
 - Parkland development should be done concurrent with construction of the Elementary School provided that sufficient contributions are collected from future development. Timing of School construction will be determined by School District #36 and the Ministry of Education.
 - City may redirect Neighbourhood House funding to Parkland development as appropriate.
 - The timing indicated is an estimate and will be decided upon by the City.