NORTH CLOVERDALE WEST

NEIGHBOURHOOD CONCEPT PLAN

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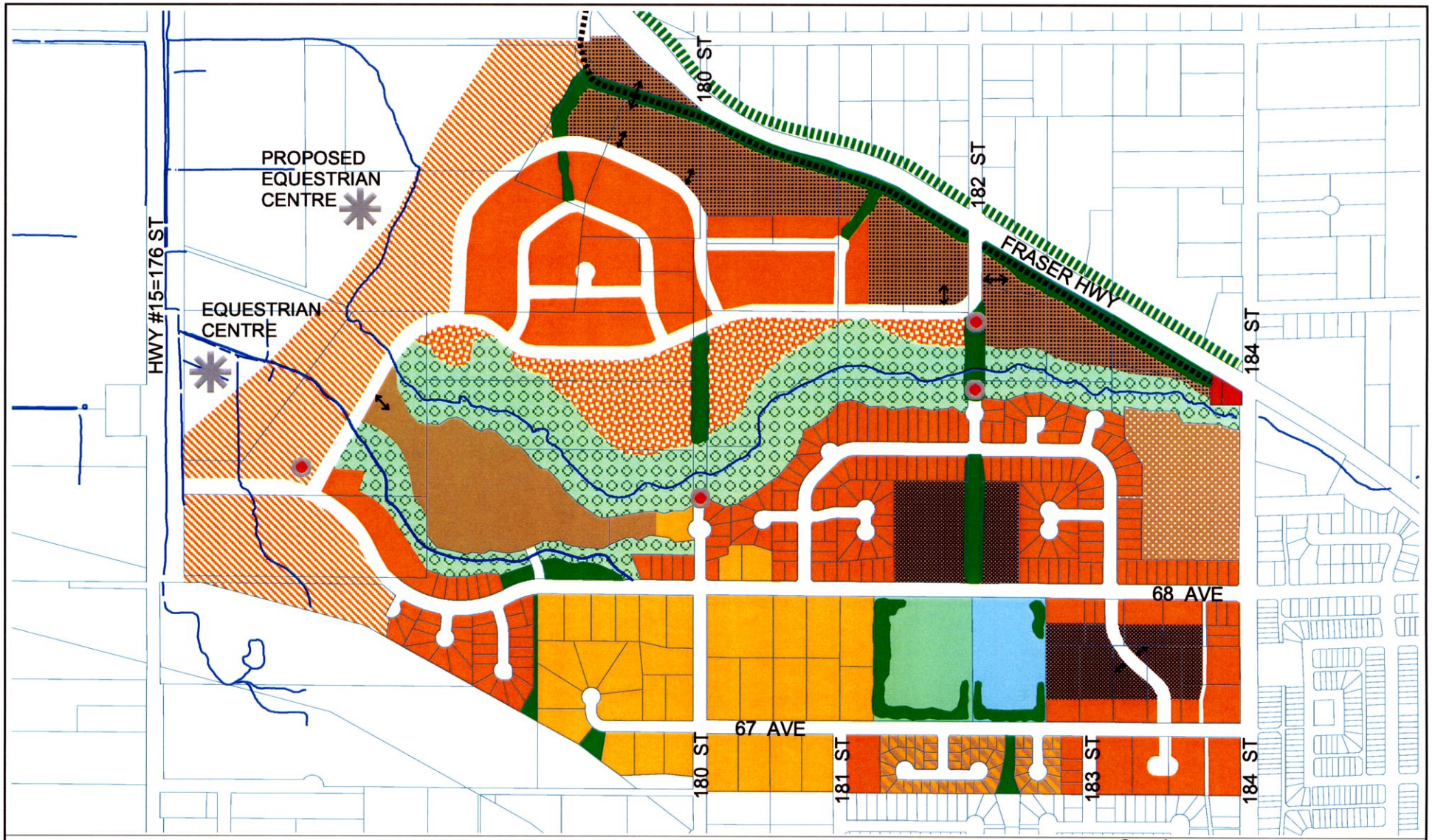


Half Acre Cluster (2 u.p.a.)
Existing Homes
Single Family Residential
Single Family Cluster (6u.p.a.)

Small Lots
Townhouse (9 u.p.a.)
Townhouse Cluster (10 u.p.a.)
Townhouse Cluster (10-12 u.p.a.)
Townhouse (15 u.p.a.)

Commercial
Creek Area
Access Points
View Points

Creeks
Open Space/Linear Park/Buffer
Park
Elementary School
Landscape Buffer & Multi Use Pathway

PHASE II Adopted by Council July 8,1996

NOTE: This plan is conceptual in nature and is only intended to reflect a general pattern of land uses.
These maps are general reference only and all information should be verified by the Surrey Planning and Development Department.

NORTH CLOVERDALE WEST LAND USE PLAN

N

CITY OF SURREY - REGULAR COUNCIL MINUTES 1996 \ Monday, July 8, 1996 \ A. ADOPTION OF MINUTES \ Item No. C304 North Cloverdale West Neighbourhood Concept Plan (NCP): Stage 2 - Final Report

File: 2350-002/2

It was Moved by Councillor Lewin
Seconded by Councillor McCallum
That the second paragraph of Page 33 of Appendix I (North Cloverdale West NCP) of Corporate Report C304 be deleted and replaced with the following:

> "The densities identified on the Land Use Plan & Subdivision Concept (Page 26, and Figure 1) refer to the net density over the developable portion of the site. The Land Use Plan & Subdivision Concept indicates the approximate boundaries of the developable areas of each multi-family (townhouse, cluster and single family cluster) designation."

RES.96-2003 Carried

SURREY
CITY OF PARKS

Corporate Report

NO: C304

COUNCIL DATE: JUN 25 1996

COUNCIL-IN-COMMITTEE

TO:	**Mayor & Council**	DATE:	**June 19, 1996**
FROM:	**General Manager, Planning & Development**	FILE:	**2350-002/2**
SUBJECT:	**North Cloverdale West Neighbourhood Concept Plan (NCP) Stage 2-Final Report**		

RECOMMENDATION

It is recommended that City Council:

1. Approve the final and complete Neighbourhood Concept Plan (NCP) for the west neighbourhood of North Cloverdale (Appendix I).

2. Approve the arrangements, terms and conditions specified in the North Cloverdale West Neighbourhood Concept Plan (Appendix I) as a means of managing the development and general provision of services, amenities and facilities for the new neighbourhood.

3. Amend the Local Area Plan for North Cloverdale to reflect the recommendations contained in the North Cloverdale West Neighbourhood Concept Plan.

4. Authorize staff to draft the following by-laws to implement the provisions of the Neighbourhood Concept Plan:

   (1) An amendment to the Official Community Plan By-law 1996, No. 12900 to adopt the North Cloverdale West Neighbourhood Concept Plan (NCP);
   (2) An amendment to Zoning By-law, 1993, No. 12000, to enact the approved bonus density provision for the North Cloverdale West NCP area; and
   (3) An amendment to the City of Surrey Land Use and Development Applications Fees Imposition By-law, 1993, No. 11631 as amended to require the payment of additional application fees to recover the costs of preparing the Neighbourhood Concept Plan.

INTENT

The intent of this report is:

1. To provide an overview of the complete and final Neighbourhood Concept Plan for the west neighbourhood of North Cloverdale, including a summary of the planning process and methods of implementing the Neighbourhood Concept Plan.

2. To provide City staff's analyses and recommendations on the amenity and financial proposals (Stage 2) of the Neighbourhood Concept Plan.

3. To outline the by-laws necessary for implementing the approved North Cloverdale West Neighbourhood Concept Plan.

BACKGROUND

In March, 1993, City Council approved a Local Area Plan for North Cloverdale . The approved plan identifies two neighbourhoods (east and west), generalized land uses and development policies for this new urban community. A copy of the generalized Land Use Plan showing the boundaries of the two NCP areas is attached in Appendix V.

In June, 1993, City Council approved the Neighbourhood Concept Plan (NCP) approach to implementing Local Area Plans. This is the third complete Neighbourhood Concept Plan to be considered by Council.

In September, 1994, City Council approved the complete NCP for the east neighbourhood of North Cloverdale. Development in this neighbourhood is well underway and occurring smoothly in accordance with the approved Neighbourhood Concept Plan.

In July, 1995 City Council approved the physical plan component (Stage 1) of the North Cloverdale West Neighbourhood Concept Plan and authorized the NCP participants to commence Stage 2 of the NCP based on the type, size, location and densities of the specific land uses, road hierarchy and locations, subdivision concept and general servicing concepts. A copy of the approved Stage 1 Land Use and Subdivision concept is attached in Appendix VI.

DISCUSSION

Overview of the Stage 1 Neighbourhood Concept Plan (Physical Component)

1. Development Summary

This NCP contains approximately 320 acres owned by approximately 90 owners. The plan identifies a subdivision concept, road alignments and open space locations for the entire neighbourhood (see Appendix VI). It provides for approximately 1,334 dwelling units and a projected population of 4,389. The plan identifies areas for suburban "clustered" residential, half acre, single family and townhouse development. It also identifies lands for school and active park

(11.7 acres), open space along the two ravine areas and western slopes (47.3 acres) and existing commercial (0.5 acres).

The Neighbourhood Concept Plan conforms to the spirit and intent of the North Cloverdale Local Area Plan and presents a detailed development pattern that is supported by a majority of the property owners.

2. Resolution of Outstanding Issues

During the preparation of the Stage 2 NCP, the following two issues arose and have been resolved through consultation with City staff and the Ministry of Environment.

(a) Environmental Approvals

The preparation of this NCP involved significant consultation with the Ministry of Environment (MOE) and the Department of Fisheries and Oceans (DFO). A comprehensive environment review was undertaken by an environmental consultant, particularly with respect to issues involving the two ravines which traverse this neighbourhood. Setbacks from the ravines have been established and incorporated into the NCP.

The NCP proposes that environmentally safe pathways be located within the setback area on the north side of the main ravine. The ravine is considered to be a major amenity for this neighbourhood, and a pedestrian pathway system connecting the ravine and other open space/amenity areas is an integral part of the NCP. The Ministry of Environment is prepared to consider these pathways within the setback area adjacent to the ravine. City staff will be working with MOE and DFO staff toward designing and locating pathways that will be sensitive to the environment and achieve adequate protection of the ravine and related habitat during the development review process.

(b) Small Park North of the Ravine

Stage 1 of the NCP included reference to a small park in the north area of the NCP. Consultation with property owners and City staff throughout the planning process resulted in the deletion of this park. The abundant open space adjacent to the ravines is considered to be sufficient to serve the north area of this neighbourhood. The Stage 2 NCP shows the amended plan; the small park has been deleted.

Overview of Stage 2 Neighbourhood Concept Plan (Engineering, Financing and Amenities)

1. Components of the Stage 2 Neighbourhood Concept Plan

The Stage 2 NCP contains an evaluation of the engineering services required for this neighbourhood, an NCP infrastructure financing and funding proposal, development phasing, and amenity/facility contribution proposals. A more detailed review, and staff's recommendations regarding the engineering and infrastructure financing components of the Stage 2 NCP are contained in a report from the General Manager of Engineering, which is to be considered by City Council concurrent with this report.

2. Neighbourhood Amenity/Facility Requirements and Funding

The Neighbourhood Concept Plan process has resulted in the identification of specific amenities/facilities that are required to adequately support this neighbourhood as it develops. These funding options are intended to ensure that the City is not unduly burdened with the capital costs associated with providing the needed amenities.

The amenity funding proposals are based upon a recent review of NCP amenities requirements by the involved departments as well as estimates of park development costs prepared by the Parks & Recreation Department. The funding arrangements are as follows:

(a) Parkland Development

A 11.7-acre site on the south side of 68 Avenue is owned by the City and the School District for the development of a combined elementary school and park. It is estimated that the development of the park will cost $526,000, which corresponds to a per unit contribution of $394.30.

(b) Pathway Development and Creek Crossing

It is estimated that the pathway system along the north side of the ravine which includes a pedestrian crossing of the ravine at the 182 Street alignment will cost $195,000. This corresponds to a per unit contribution of $146.18.

(c) Library Materials, Police and Fire Protection

The NCP proposes contributions to the capital costs associated with library materials, police and fire protection in this NCP area as $112.50, $50.00 and $216.00 respectively.

(d) Total Contributions

The total contribution toward the capital costs of amenities/facilities for this NCP area is proposed to be $1,225,919 which corresponds to a per dwelling unit contribution of $918.98

Property Owner and Public Consultation

There was extensive consultation with the property owners throughout the NCP process, including six public meetings. The majority of the property owners support the NCP as proposed.

Implementation of the Neighbourhood Concept Plan

1. Amendment to Surrey's Official Community Plan

Surrey's proposed new Official Community Plan requires that the Neighbourhood Concept Plan be adopted as part of the OCP and that a public hearing for its inclusion be held prior to final adoption. In accordance with this new initiative and because the new OCP By-law has received first reading (May 27, 1996), an amending by-law is needed to include the physical plan and land use summary of the NCP, and will be introduced in the near future.

2. Amendment to Surrey's Zoning Bylaw

In accordance with Council's approved Zoning By-law approach to implement the provision of amenities in NCP areas (pursuant to Sections 963.1 and 378 of the Municipal Act), the Zoning Bylaw must be amended to accommodate bonus densities in exchange for the specified amenities identified for this NCP area. The Zoning By-law amendment will be introduced in due course.

3. Adjustment of the NCP and ALR Boundaries

On May 29, 1996 Council authorized staff to forward to the Agricultural Land Commission an application to exclude approximately 15.6 acres of property within this NCP area from the Agricultural Land Reserve. This proposed exclusion is located at 6989 176 Street and its boundaries are shown on the map in Appendix II. The location of this exclusion should be identified in the NCP and staff will revise the western boundary of the NCP in conjunction with the OCP Amendment By-law to be introduced as indicated in item 1. above.

4. Recovery of NCP Preparation Costs

The costs of preparing this NCP were borne by a lead developer in the NCP area (Progressive Construction). Progressive Construction has agreed to cover 50% of the preparation costs. An amendment to the Surrey Land Use and Development Application Fees Imposition By-law will be needed to incorporate the per unit NCP preparation cost, which is estimated to be $120.00 per unit. Following the

enactment of the amended fee by-law for this NCP area, 50% of the total cost will be repaid to Progressive as monies are received from the future rezoning applications.

5. Development Applications

There are a number of in-stream development applications in this NCP area which will be evaluated in the context of the approved NCP. If in conformance with the plan, these applications will be submitted to Council for consideration and the processing times for these applications will be substantially decreased as they will be within an approved NCP.

CONCLUSION

The North Cloverdale West Neighbourhood Concept Plan is the result of an all-encompassing analysis of the development and financial requirements for this future urban neighbourhood. The Neighbourhood Concept Plan makes plausible recommendations for developer contributions and financial assistance in providing services and amenities. The NCP illustrates land uses, densities and a development pattern that can be supported within the City's financial capabilities.

The NCP has involved significant input from the affected property owners, the public, the various City Departments and interested outside agencies, and represents a sensible development plan prepared within this partnership framework.

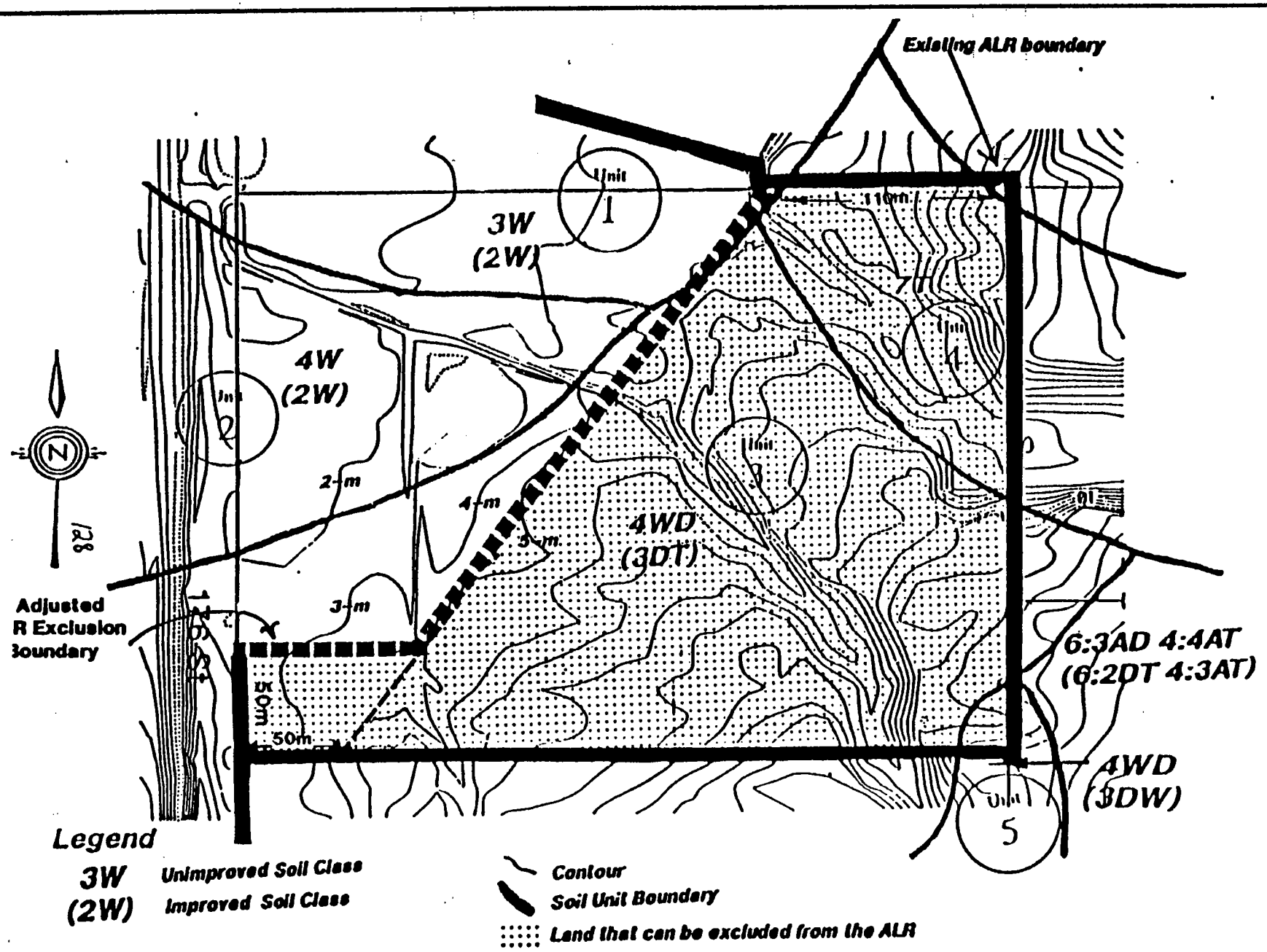
Provided that the recommendations of the General Manager of Engineering regarding servicing and financing issues are approved, it is recommended that City Council endorse the North Cloverdale West Neighbourhood Concept Plan and the associated implementation mechanisms as a means of providing for the logical development of this North Cloverdale neighbourhood.

Lehman O. Walker
General Manager
Planning & Development Department

WW/kms

Appendices:

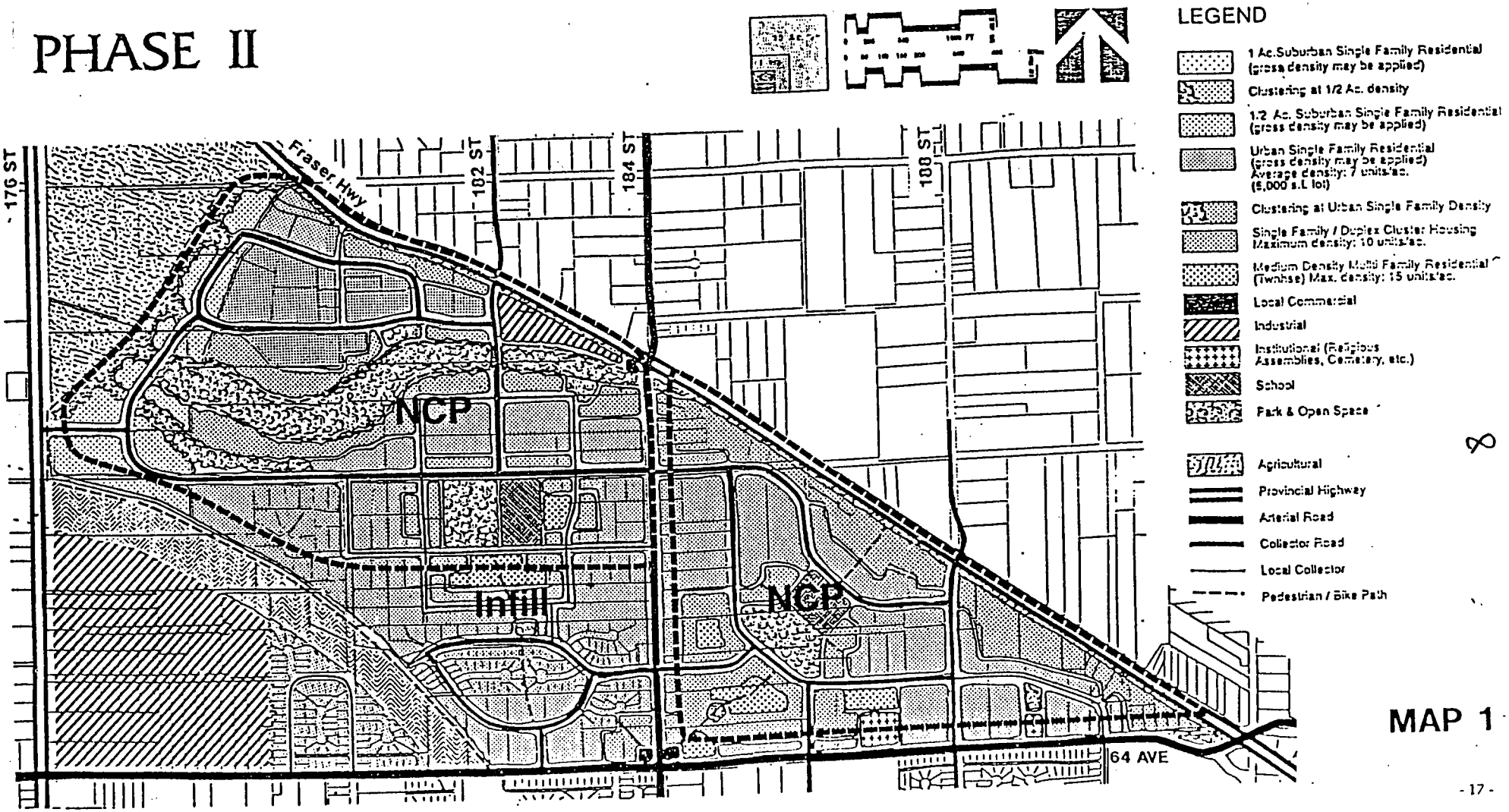
Appendix I: North Cloverdale West Neighborhood Concept Plan (Stage 2 Final NCP)
Appendix II: Proposed Exclusion Boundary - Agricultural Land Reserve
Appendix III: Generalized Land Use from the North Cloverdale Local Area Plan, and NCP Boundaries
Appendix IV: Stage 1 NCP Land Use and Subdivision Concept



PROPOSED ALR EXCLUSION

APPENDIX II

PHASE II



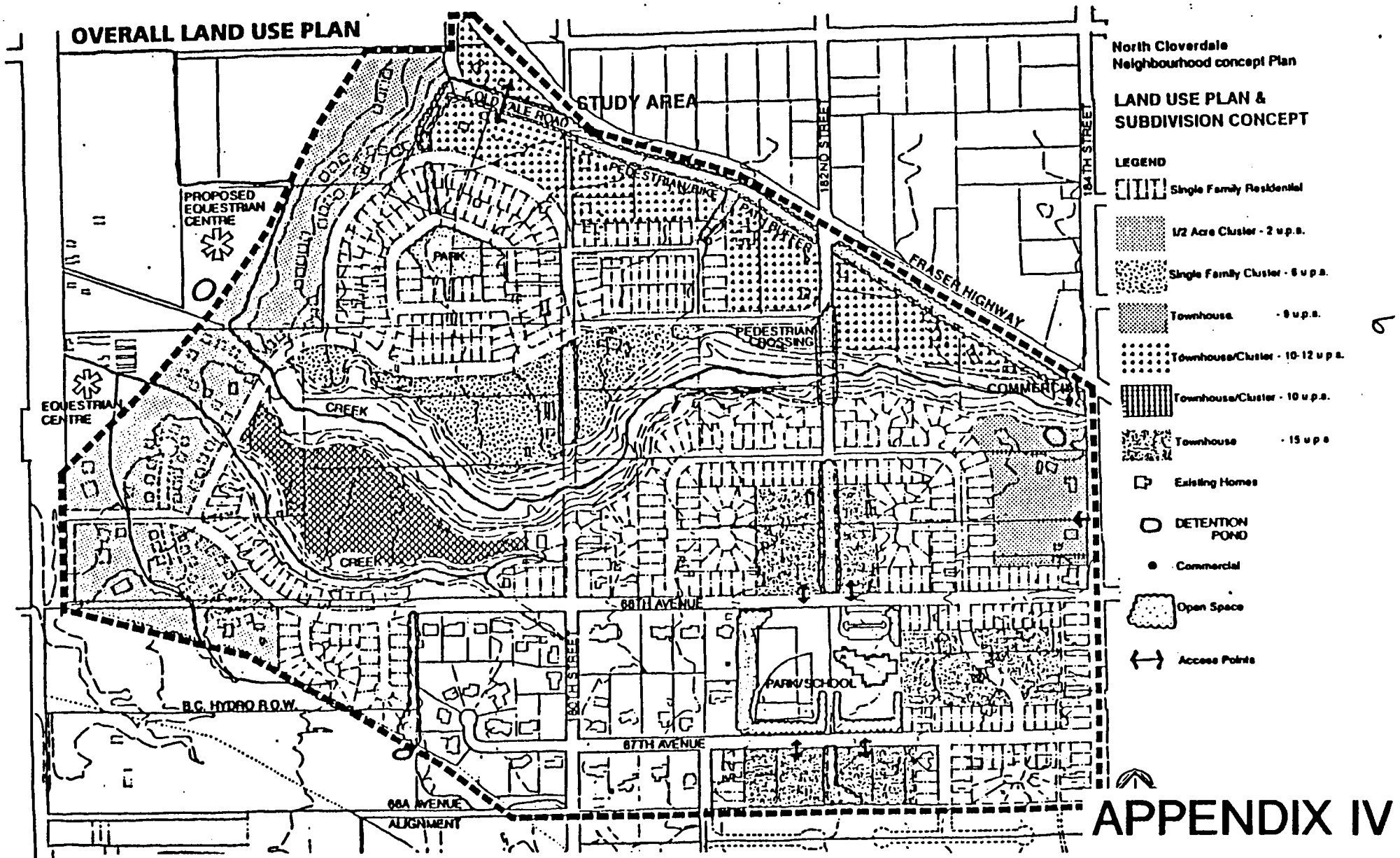
MAP 1

APPENDIX III

LOCAL AREA PLAN & NCP BOUNDARIES

NORTH CLOVERDALE WEST NEIGHBOURHOOD (Stage 1 NCP Report)

NEIGHBOURHOOD • CONCEPT • PLAN



APPENDIX IV

STAGE 1 NCP LAND US AND SUBDIVISION CO CEPT

ACKNOWLEDGEMENTS

This Neighbourhood Concept Plan was prepared jointly by Davidson Yuen Simpson Architects and Coastland Engineering & Surveying Ltd. for the North Cloverdale West Neighbourhood.

The following people have contributed to the preparation of this study and are acknowledged for their contributions.

John Turner	- Project Management
Mike Jorden	- Planning
Greg Sewell, P.Eng.	- Engineering
Ian McGregor	- Engineering
Ron Yorston, P.Eng.	- Engineering
Trevor Ward, P.Eng.	- Traffic
Ian Whyte	- Environmental
Robert Bland, P.Eng.	- Drainage

The

Neighbourhood Concept Plan

for

North Cloverdale

West Neighbourhood
(Stage II NCP Report)

Prepared by:
Davidson Yuen Simpson
and
Coastland Engineering & Surveying Ltd.

May 1996

NORTH CLOVERDALE

NEIGHBOURHOOD CONCEPT PLAN

WEST NEIGHBOURHOOD

SECTION I

LAND USE PLAN
AND SUBDIVISION CONCEPT

MAY 7, 1996

The following report presents a description of the Neighbourhood Concept Plan (Stage 2 N.C.P) for the west neighbourhood of the North Cloverdale area in Surrey.

This report provides:

a) An inventory and analysis of the site context and conditions.
b) A discussion of the issues affecting the development of a N.C.P.
c) A summary of the goals and criteria that have guided the preparation of the land use plan for the site.
d) A summary of the process and results of the community involvement work.
e) A land use plan for the N.C.P area.
f) An empirical comparison of the LAP and NCP land use summaries
g) A general evaluation of the servicing and costing implications of the N.C.P

As defined in the LAP, the North Cloverdale neighbourhood is approximately 534.5 acres. Only a 319.5 acre portion of this constitutes the NCP subject site. The remaining 215.5 acres are composed of existing industrial, urban single family lots and the B.C. Hydro right-of-way.

In terms of a general breakdown of proposed land uses, 141.7 acres are proposed for detached urban single family housing, 14.1 acres for single family cluster and 64.6 acres for multi- family town house. Clustering at two units per acre will apply to 39.6 acres.

47.3 acres are proposed to be set aside as part of the open space system, preserving existing ravines and vegetation. An additional 11.7 acres are proposed for a central school and park site.

It is estimated that the full development of the west neighbourhood will result in the provision of 490 urban single family lots, 79 one half acre lots, up to 85 clustered single family homes, and up to 680 townhouse style housing units for a total of 1334 units depending on specific multi-family densities.

The L.A.P anticipated approximately 1774 dwelling units and a population of 5737 persons in the west neighbourhood area. Based on the land uses proposed in this N.C.P, the west neighbourhood population is anticipated to be approximately 4389 persons

Based on this design population, a neighbourhood school is supportable as specified in the L.A.P. This facility will be adjacent to a community park, and a significant pedestrian circulation system will focus on the school and park, providing convenient safe access to these facilities.

The road layout is based largely on the L.A.P. Some changes have been made as a result of the design process and the contributions of the land owners participating.

The N.C.P is generally consistent with the L.A.P in intent and quantity. The ravines are preserved and contribute a significant amount of green space to the neighbourhood, and although the proportion of housing types differs from the L.A.P the projected number of dwelling units and accompanying population is in close conformity with the L.A.P.

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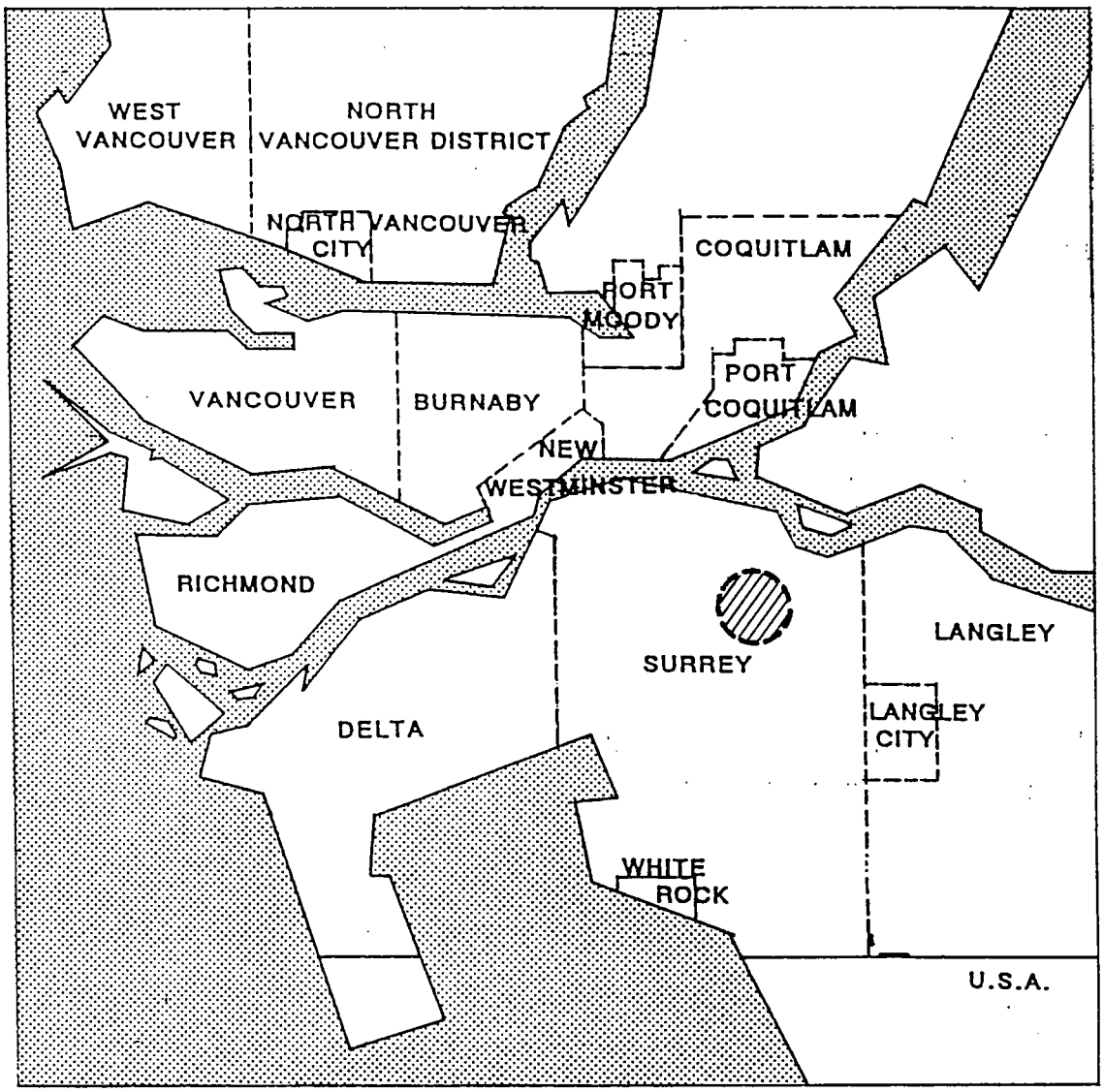
LOCATION MAP



1.0 INTRODUCTION

1.1 Location and Description

The North Cloverdale neighbourhood is located approximately three kilometres to the northeast of the Cloverdale Town Centre.

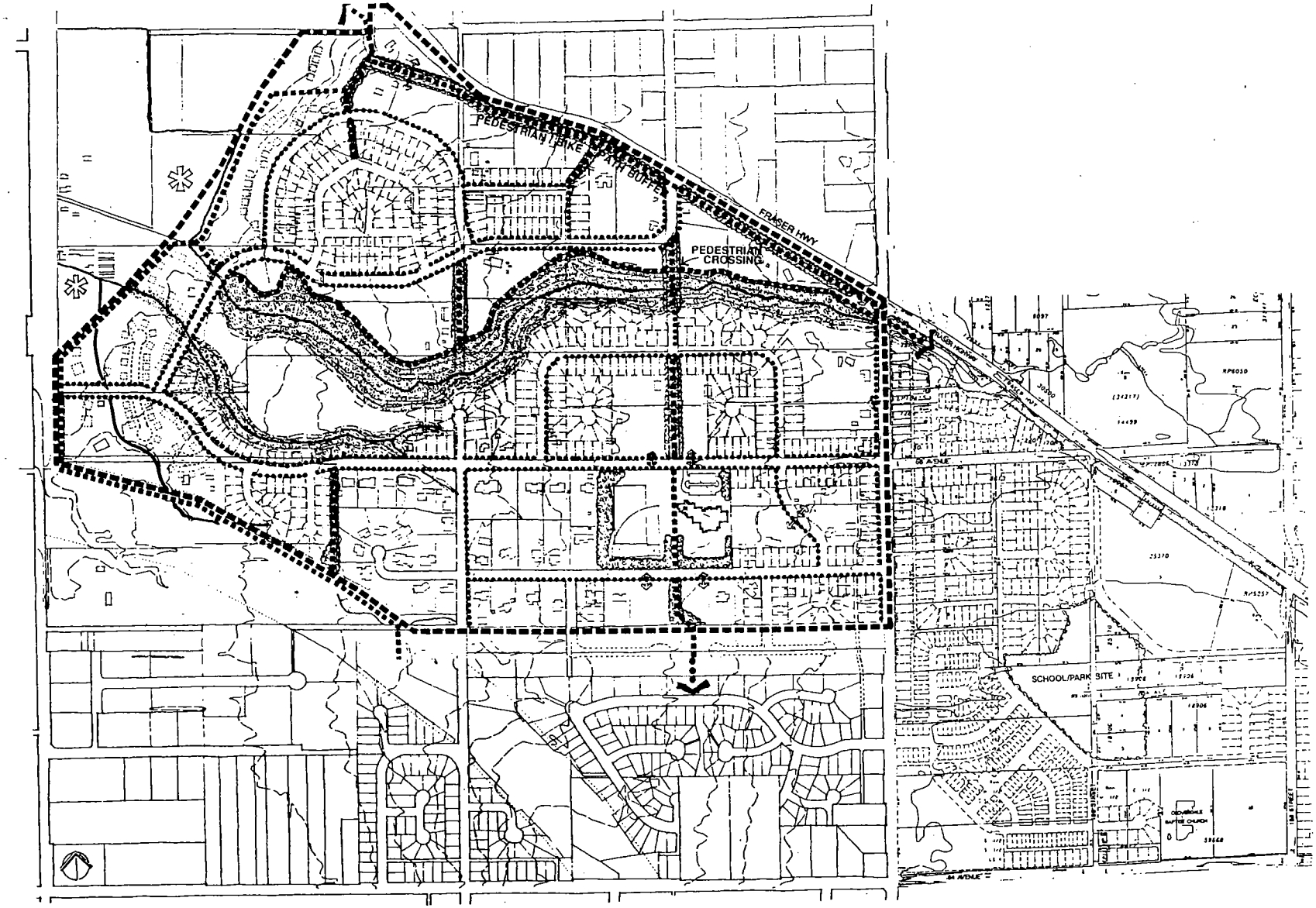
The North Cloverdale Local Area Plan (L.A.P) prepared by City Planning staff was adopted by Council in March of 1993. For the purpose of Neighbourhood Concept Plan (NCP) applications the North Cloverdale area is defined as two neighbourhood areas: one east of 184th Street, which is phase I, and one west of 184th Street, which is phase II. The east neighbourhood has been the subject of a Neighbourhood Concept Plan process and application prepared by Hunter Laird Engineering Ltd. This application was approved by Council in June 1994. The L.A.P breakdown is generally as follows:

Total Local Area Plan Area:	726.5 acres
East Neighbourhood Area:	192.0 acres
West Neighbourhood Area:	534.5 acres
N.C.P Subject Area	**319.0 acres**

The west neighbourhood identified in the Local Area Plan is 534.5 acres. It is bounded generally on the west by 176th Street, on the north by Fraser Highway, on the east by 184th Street and on the south by 64th avenue.

It is important to make the distinction that this N.C.P applies only to a specific portion of the west neighbourhood area of the L.A.P. The 319.5 acre subject site extends south only to the B.C. Hydro right-of-way and to the 66A Avenue alignment. West of 180th Street the N.C.P site boundary is the Hydro right-of-way. East of 180th Street the boundary is a line equivalent in alignment to 66A Avenue. (Unless specifically noted, references in this report shall always refer to this area).

The remaining 215.5 acres in the phase II / west neighbourhood area are composed of existing industrial, urban single family lots and the B.C. Hydro right-of-way. The west portion of the site includes approximately 24.5 acres of land which are part of the Agricultural Land Reserve.



PHASE II - Neighbourhood Concept Plan
NORTH CLOVERDALE B.C.

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1.2 Purpose and Process Overview

The Neighbourhood Concept Plan for North Cloverdale - West Neighbourhood was developed in two stages. The purpose the Stage One document of the Neighbourhood Concept Plan (NCP) was to achieve approval in principle of the physical plan for the study area.

There were several objectives to be realized in the preparation of the Neighbourhood Concept Plan - Stage Two:

- The first was to provide a detailed land use plan for the west neighbourhood area, as a framework with which to guide and evaluate future rezoning and subdivision applications for lands covered by this N.C.P.

- Secondly, the N.C.P was intended to provide a reasonable level of confidence in terms of ultimate population, density and land uses.

- Thirdly, the process was intended to encourage participation by local land owners and to respond honestly to their concerns and work to accommodate their vision for their community.

The plan was developed to respect the spirit and empirical goals of the Local Area Plan for North Cloverdale. The general design and program elements of the local area plan were used as the basis for further refinement of land uses, road layout and design planning. In addition, the standards of appropriate government agencies was incorporated into the overall design.

Both of the N.C.P stages were prepared by a process of informal information and idea meetings with area land owners, formal town hall style presentations, discussions with the affected general public, and reviews by City staff.

The Stage One NCP document provided the background information, the designation of specific land uses by type, size, location, and density, identified land for school, parks and open space, defined road hierachy, local road locations and provided servicing concepts.

This Stage Two NCP document, based on the framework established in stage one, includes servicing details, phasing, development guidelines, contributions, owner's agreements and cost sharing arrangements for services, social amenities and neighbourhood facilities. This stage demonstrates how neighbourhood facilities and services are provided without undue financial burden on the community at large.

2.0 PHYSICAL DESCRIPTION OF SITE

2.1 Topography

The site slopes generally to the west, with overall gradients of approximately five percent. The west edge is steeper, with an elevation drop of approximately twenty five metres at a slope of approximately 15 percent.

The most prominent feature of the site is the major ravine which begins near the northeast corner of the site, near the intersection of Fraser Highway and 184th Street. Water flow is variable but present year round.

Two smaller ravines exist on the site, and are primarily present in the west bank which slopes to the Agricultural Reserve Lands.

These secondary ravines are shallower than the larger ravine. Water flow is intermittent, and results primarily from runoff of adjacent lands. Drainage from these ravines is directed ultimately to the Serpentine River. It is felt that the value of these two smaller ravines is primarily in the existing vegetation.

2.2 Soils

Three broad classes of soils may be found on the site. The first area is the western fringe of the site at the base of the slope, which is within the ALR. Bog, swamp or lake deposits of peat overlay sand and silt loam, which may overlay outwash deposits of sand and gravel.

The second area includes the western slope and western third of the site, and, in addition, follows the largest ravine east to 184th Street. Soils are

lake edge deposits composed of sand and gravel, with some silt and clay pockets.

The remaining portion of the site, generally above the 35 metre contour line and extending east to 184th Street and beyond is the largest area of the three soil and surficial geology areas. This is glacial till of sandy and gravelly material stratified with lenses of stony silt.

It is not anticipated that soil conditions will create an obstacle to any of the land uses proposed in this N.C.P. A thorough soils analysis and report has been completed for lot 2 NW 1/4, section 17, township 8, Plan 30085. This property straddles this N.C.P. boundary and is within the ALR.

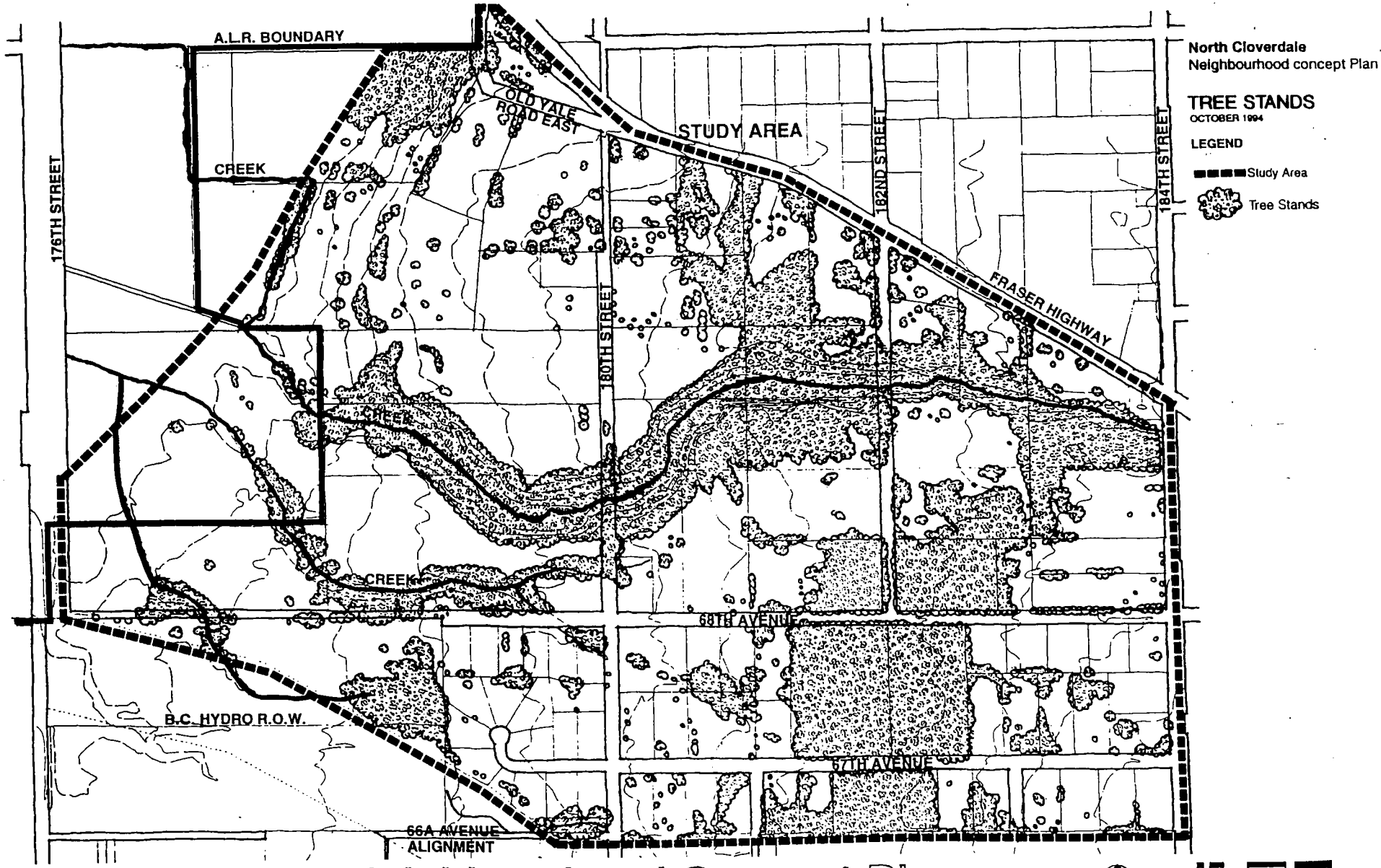
2.3 Vegetation

The site is currently a mixture of cleared pasture land and some rural woodlot and mixed forest stands. Vegetation in and adjacent to the ravines is considered important as habitat and watercourse protection, and is recommended for protection. An opportunity exists to utilize these wooded areas as established natural buffers to help define sub-areas within the neighbourhood and provide permanent, wooded natural corridors.

Tree species observed in the area include cedar, Douglas fir, big leaf maple and alder. Significant tree stands were mapped from aerial photography and considered in road layout deliberations. The land use plan for the western edge and slope of the neighbourhood will encourage residential cluster housing to preserve important areas of existing vegetation and to ensure a transition from urban to rural uses through a landscaped edge.

During the detailed site planning and development review process, trees worthy of retention should be retained in accordance with provisions of the Tree Removal and Replacement By-law.

As rezoning and development permit applications are submitted, the City may require tree surveys for specific parcels of land. Tree retention was an important consideration during site planning.



PHASE II - Neighbourhood Concept Plan

NORTH CLOVERDALE B.C.

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3.0 LAND STATUS

3.1 Current Land Zoning

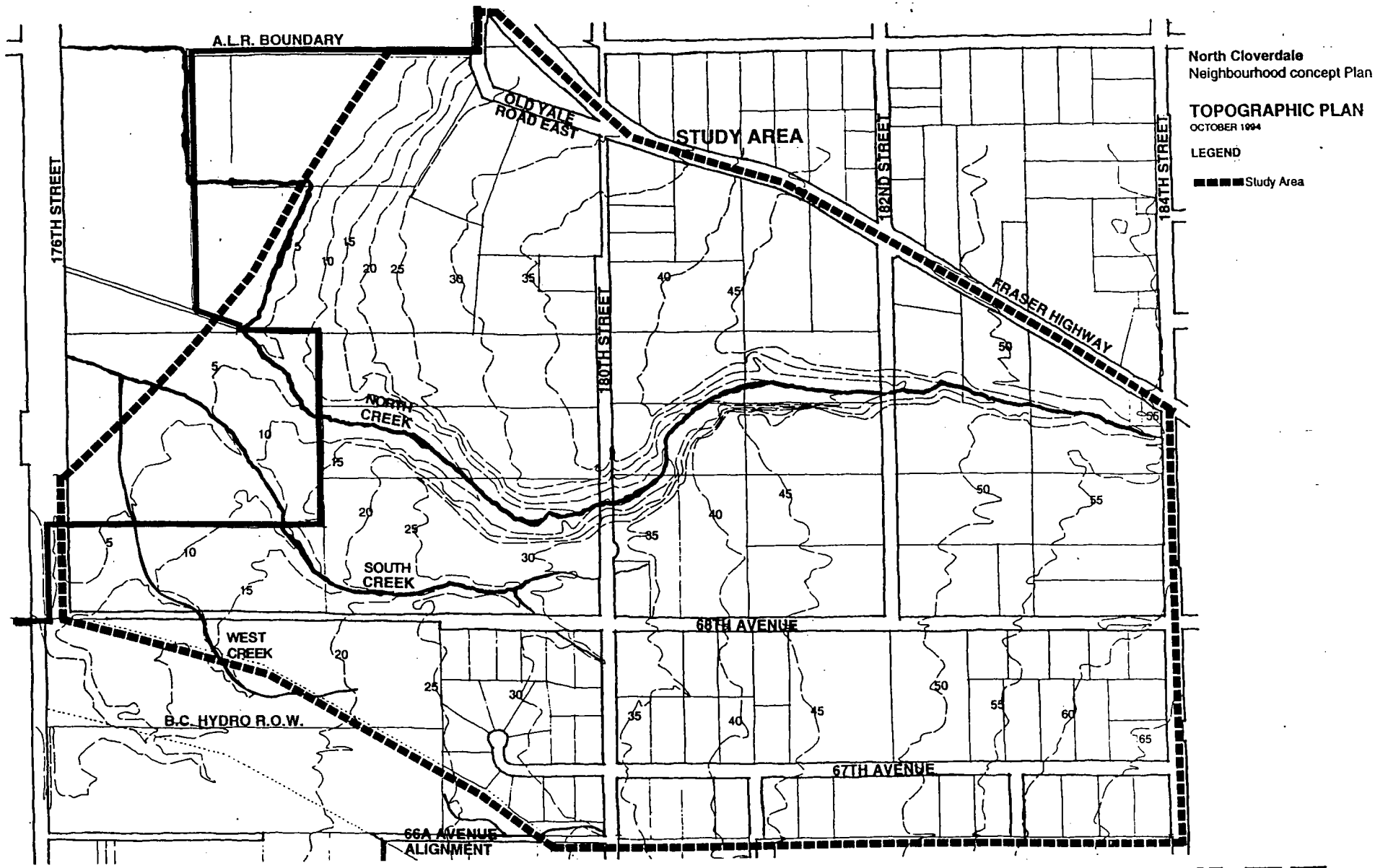
The L.A.P designates the west neighbourhood as suburban during the first phase of rezoning and urban for the long term. It was initially thought that sanitary sewer would be many years in the future for the west neighbourhood because of the considerable capital expense required. Subsequently, it was determined that the east neighbourhood could only be fully serviced through the west neighbourhood and that an interm sanitary solution involving a pump made sense. Therefore, it is logical that both neighbourhoods proceed concurrently.

The N.C.P site contains land zoned as general agricultural, A-1, one acre residential RA, one acre gross residential RA-G, and one parcel is suburban residential under by-law 5942. In the northeast corner of the study area is the C-4 commercial site and adjacent to it is a gas station, zone C-G 2 under land use contract 515. (See Current Zoning Plan). Zoning information is current to 28 March 1994.

3.2 Existing Land Use

The lands covered by this N.C.P proposal are generally rural residential with varying lot sizes. Sections of existing vegetation remain on many of the properties, and casual agriculture and pasture uses are present. A portion of the N.C.P area is within the Agricultural Land Reserve. The Consultant and client team met with the Agricultural Land Commission regarding the possibility of a re-alignment of the ALR boundary to the base of the slope. This re-alignment is essential to the overall plan as it affects servicing and access, and therefore land use in the west side of the L.A.P area. Realignment of the ALR boundary is expected to occur upon application by an affected property owner as one of the components of rezoning and development approval.

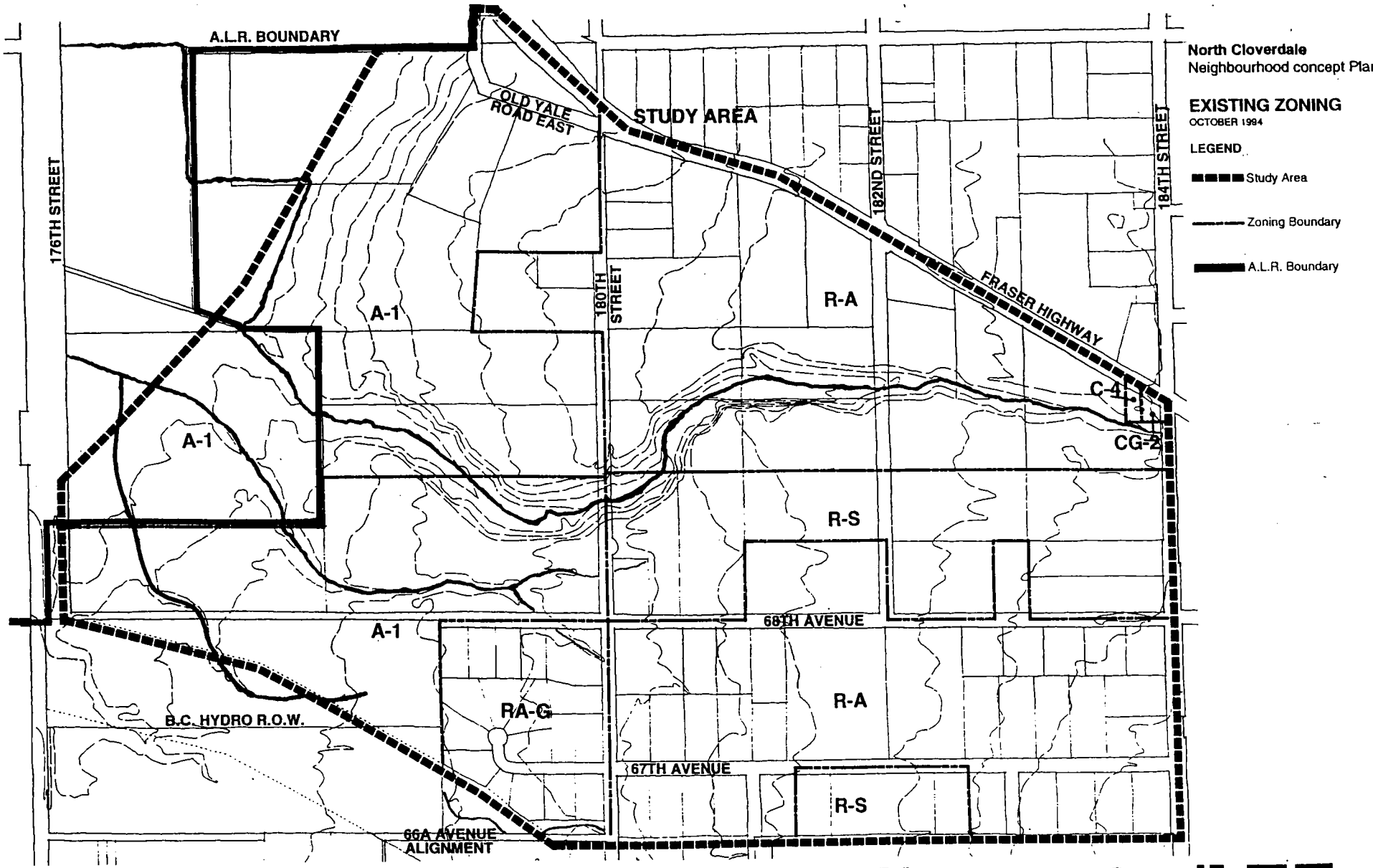
The lands south of 66A Avenue are outside the N.C.P subject area and are scheduled to remain in their current use. Current uses include residential, industrial and agricultural. Two residential subdivisions exist, one west and one east of the B.C. Hydro R.O.W. A proposed residential subdivision south of 66A Avenue and west of 184th Street is in the process of rezoning. The southwest portion of the LAP area is industrial.



PHASE II - Neighbourhood Concept Plan

NORTH CLOVERDALE B.C.

PROGRESSIVE CONSTRUCTION LIMITED



PHASE II - Neighbourhood Concept Plan

NORTH CLOVERDALE B.C.

PROGRESSIVE CONSTRUCTION LIMITED

The B.C. Hydro transmission line right-of-way is primarily covered by the general agricultural zone A-1, with a small portion of the right-of-way included in the one acre gross density residential area.

4.0 PLANNING AND DESIGN PROCESS: ISSUES AND GOALS.

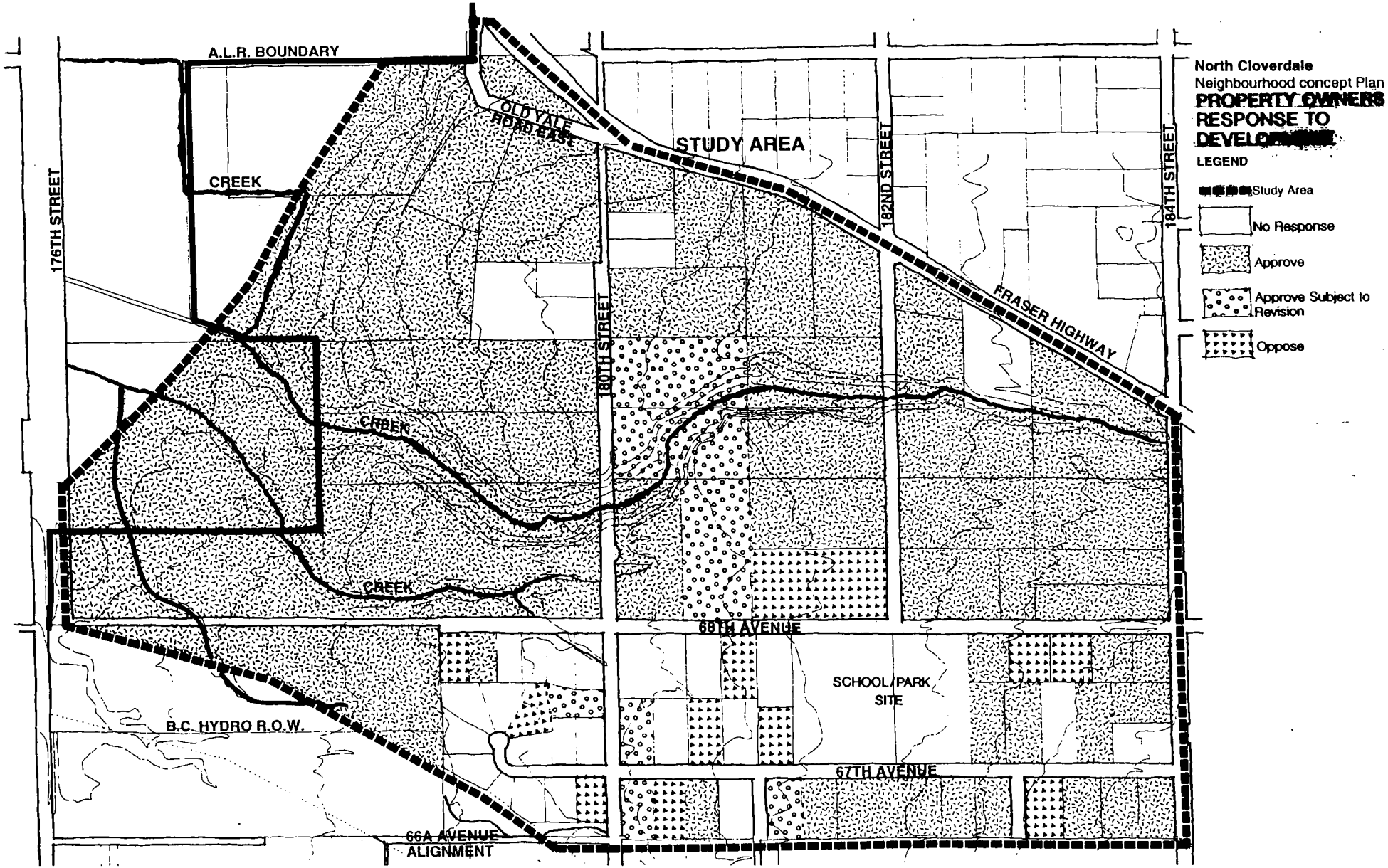
4.1 Public Participation Process

As required by the City of Surrey, the client has worked to obtain the support and participation of as many of the land owners as possible. To this end, all of the registered owners were contacted and invited to participate in the process.

Summary of Public Meetings

Meetings were held with the land owners and client group on the following dates:

- December 20, 1993 — Initiation of NCP Process.
- February 2, 1994 — Achieved 50% support of registered land owners in NCP to proceed with NCP. (72 total property owners responded with 53 positive and 19 negative).
- May 24, 1994 — Presentation of preliminary land use plans.
- June 14, 1994 — Land use plan presented for ratification. (48 total property owners responded with 44 positive and 4 negative. See plan for graphic representation of landowners support)
- November 24, 1994 — Open House to review plan schedules for the final land use plan.
- May 7, 1996 — Public Information Meeting



PHASE II - Neighbourhood Concept Plan

NORTH CLOVERDALE B.C.

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Opinions and Concerns
(Raised at the June public meeting.)

- Owners of larger lots and property within ALR would like to have option to increase density of their property.
- Retention of green spaces and existing tree cover as well as the addition of green space desired by some owners.
- Traffic concerns
  - concern that 68th Avenue will become a feeder to 176th Street.
  - curve 68th Avenue through Progressive site.
  - do not want 182nd to be a through road toFraser Hwy.
- Ensure all owners have input into the process and a means to communicate with consultants.
- Change industrial to commercial use.

Comments of the owners and the replies of the consultant team were recorded. This information is attached as Appendix 2.

Planning Response to Concerns

The Neighbourhood Concept Plan for the west neighbourhood area is the result of a balanced design and consultation process. Continued participation by the neighbourhood property owners has ensured that their interests and opinions have been considered in this land use planning work as well. The plan responds to concerns raised in the following way:

- The plan increased the density for the owners of larger lots within the ALR to 1/2 acre cluster. This area is important in that it provides the westerly access point from 176th Street. (This approach is generally consistent with the LAP).

- The plan recognized the aspirations of the residents of the recently constructed homes on RA-G and one acre lots who wish to remain designated as acreage residential.

- 68th Avenue would appear to provide the most efficient access to both 184th Street and 176th Street. This route however should not appear so direct as to encourage through traffic to bypass arterial routes such as Fraser Highway. The plan proposes a curved entry from176th to join up with the existing 68th right-of-way to achieve this objective.

- To retain green spaces and existing tree cover, the plan responds in the following way:
  - Density averaging or clustering is proposed to ensure a transition from urban to rural uses through a landscaped edge and preserve vegetation on the western edge.
  - The three wooded ravines are seen as significant to the character of the area and are preserved in the plan. They will help to define sub-areas within the neighbourhood and provide permanent, wooded natural corridors.
  - Retention of existing right-of-ways as green connections through the neighbourhood to the ravines.
  - The proposed plan has a second play area / park for the northwest area.
  - Creation of a tree buffer strip / bike way along Fraser Highway.

4.2 Development Objectives

The intent, spirit and guidelines set forth in the LAP as refined and supported by the landowners provide the general framework for the NCP.

This N.C.P represents the successful accommodation of the following major program elements for the phase II area:

Physical Site Response Goals

- Identify and protect environmentally important and sensitive areas, and significant existing vegetation.
- Respond to potential impacts and conflicts with traffic along Fraser Highway.
- Investigate opportunities for innovative land uses along the west slope area of the site.
- Identify physical features unique to the subject area, and work to emphasize these features during the neighbourhood design process.

Housing and Community Structure Goals

- Plan for a variety of housing types and styles to accommodate and integrate a variety of income and housing needs.
- Provide a realistic arrangement of housing types to promote interaction between age and income groups, while maintaining an identifiable neighbourhood character.
- Plan for adequate family oriented housing to support a community park and school.
- Locate family oriented housing in close proximity to central community facilities, such as the school and park.

Movement and Circulation Goals

- Provide a logical road system which will allow for easy circulation through the neighbourhoodwithout encouraging through-traffic.

- Lay out roads and housing areas to work with the variations in topography, thus reinforcing the goal of respect for the natural character of the area.
- Develop a series of pedestrian paths to encourage walking as a reasonable alternative to vehicles for movement within the neighbourhood. This should include a focus on the school and park facility, with secondary emphasis on the planned ravine open spaces.
- Ensure that new pedestrian paths are coordinated with pedestrian paths in the existing development south of the N.C.P area.

Servicing Objectives

- Provide centrally located and accessible school facilities, and plan for a population to sustain the operation of a school.
- Provide a realistic cost estimate and service schedule for hard service costs: roads, sidewalks, street lighting, water, storm and sanitary sewers, and hydro.
- Provide an engineering-based assessment of options for servicing special needs areas. The west portion of the N.C.P area may require extra consideration in this respect.

This section has focused on value objectives developed by both City staff and the local land owners. The following section will discuss the site specific analysis in relation to achieving the goals reported above.

4.3 Summary of Site Opportunities and Constraints

Our analysis of the site suggests that the characteristics that impose some constraints on the possibilities for organization and layout also provide opportunities that could contribute to the identity of the neighbourhood. Unlike the east neighbourhood (Phase I) which has relatively homogeneous terrain, the west neighbourhood area is more undulating in topography. The west edge of the site slopes to the agricultural land to the west. View opportunities from both open space areas and residential areas, through street ends, should be considered (See Section 5.4 for more detail).

The three wooded ravines are seen as significant to the character of the west neighbourhood area. These should be given special consideration in the siting of roads and housing parcels. An opportunity exists to utilize these wooded areas as established natural buffers, rather than consider them as barriers to development. As such, they will help to define sub-areas within the neighbourhood and provide permanent, wooded natural corridors.

The northern portion of the neighbourhood is far enough away from the central school/park facility that a small, local park is desirable as a neighbourhood focal point.

The Fraser Highway is a source of vehicular noise and disturbance that could affect residential land uses in this area. A landscaped buffer is suggested to provide a barrier between the road and residential uses. This buffer may also be used to accommodate a pedestrian / cycle path, connecting to the planned path of the phase I / east neighbourhood N.C.P area.

Pedestrian circulation and open spaces which are required to access the N.C.P area school must be accommodated in the circulation planning of the new path system.

Finally, the west portion of the N.C.P area includes some lands in the ALR. Review of a soils report for a parcel of this area suggests that a rationalization of the ALR boundary in this area is logical. To comply with the density of the LAP this portion must be removed from the ALR.

The applicant should apply for ALR exclusion and it should be supported by the City of Surrey.

The following section describes the N.C.P and land use plan that have resulted from the process described to this point.

5.0 NEIGHBOURHOOD CONCEPT DESIGN PROPOSAL

5.1 Overall Design Principles

The land use plan proposes the highest and best use for areas of development while respecting the physical characteristics of the site and areas of environmental interest.

Following are the overall design principles used to guide the development of the land use plan for the N.C.P area:

- Identify significant tree stands from aerial photography mapping and consider them in road and housing layout deliberations. During the detailed site planning and development review process, trees worthy of retention should be retained in accordance with provisions of the Tree Removal and Replacement By-law.

- Locate urban single family lots adjacent to existing areas of urban single family lots

- Recognize the aspirations of the residents of the recently constructed homes on RA-G and one acre lots who wish to remain designated as acreage residential.

- Locate some parcels of land designated as multi-family or cluster housing in close proximity to school and park facilities.

- Minimize the number of proposed crossings of the main ravine to reduce intrusions into this area.

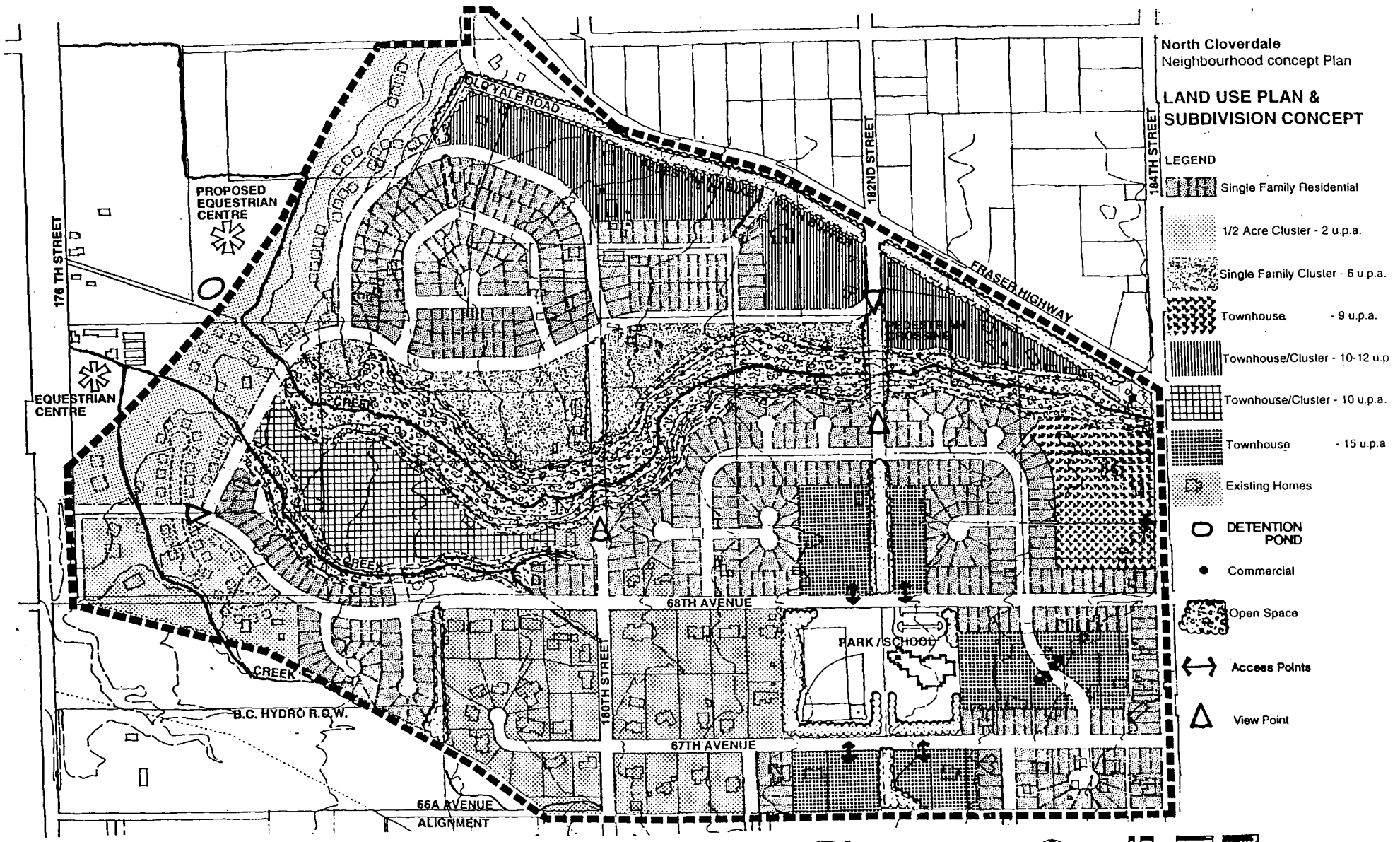
- Propose a land use for the western edge and slope of the neighbourhood that will encourage residential cluster housing to preserve important areas of existing vegetation and ensure a transition from urban to rural uses through a landscaped edge.

- Create a system of roads to allow logical vehicular access and circulation to all areas of the neighbourhood. 68th Avenue would appear to provide the most efficient access to both 184th Street and 176th Street. This route however should not appear so direct as to

encourage through traffic to bypass arterial routes such as Fraser Highway.

- Propose an additional setback along the Fraser Highway as well as the ravines to create an extensive system of walking trails in addition to the paths which focus on the school and parks

- It is recommended that a common standard for walkways, landscape and fencing be developed for public walkways / linkages in the neighbourhood.


North Cloverdale
Neighbourhood concept Plan
LAND USE PLAN &
SUBDIVISION CONCEPT
LEGEND
Single Family Residential
1/2 Acre Cluster - 2 u.p.a.
Single Family Cluster - 6 u.p.a.
Townhouse - 9 u.p.a.
Townhouse/Cluster - 10-12 u.p
Townhouse/Cluster - 10 u.p.a.
Townhouse - 15 u.p.a
Existing Homes
DETENTION POND
Commercial
Open Space
Access Points
View Point
CLAYTON ROAD
182ND STREET
184TH STREET
176 TH STREET
FRASER HIGHWAY
PROPOSED EQUESTRIAN CENTRE
EQUESTRIAN CENTRE
CREEK
CREEK
CREEK
68TH AVENUE
67TH AVENUE
66A AVENUE ALIGNMENT
180TH STREET
PARK / SCHOOL
B.C. HYDRO R.O.W.
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5.2 L.A.P. Land Use Summary

The following table is a statistical summary of land uses and density contained in the LAP. It predicts the population outcome anticipated by the LAP. Some of the density assumptions contained in the LAP were found to be unachievable, in particular the urban single family density of 6 u.p.a. with 560 square metre lots.

LAP LAND USE	Area (acres)	Units	Projected Population*
1/2 acre cluster	49.5	85	280
urban single family	132.5	795	2615
single family cluster	37.4	374	1230
multi family residential	32.7	490	1612
Sub Total	**252.1**	**1744**	**5737**
commercial	0.5	n/a	
industrial	8	n/a	
open space	47.2	n/a	
school / park	11.7	n/a	
Sub Total	**67.4**	n/a	
TOTAL	**319.5**	**1744**	**5737*** **
Est. School Population			512**

* Based upon household average used in the North Cloverdale L.A.P.

** Based upon Surrey School District projections of .35 students per single family household and .15 students per townhouse household.

*** Existing and proposed households outside the NCP area total 269 dwelling units and would add 888 persons to these figures.

5.3 N.C.P. Land Use Summary

The reduced yield in the urban single family area results in a reduced projected single family population of approximately 1000 persons. A 35 acre area designated urban single family has been retained as acreage for reasons outlined in section 5.4. The amount of multi-family / affordable housing has been increased in the N.C.P. yet the overall population is still lower than that projected in the LAP because of the lower density in the NCP single family area.

NCP LAND USE	Area (acres)	Units	Projected Population*
1/2 acre cluster	39.6	79	260
urban single family	141.7	490	1612
single family cluster	14.1	85	280
multi family residential	64.6	680	2237
Sub Total	**260**	**1334**	**4389**
commercial	0.5	n/a	
industrial	0	n/a	
open space	47.3	n/a	
school / park	11.7	n/a	
Sub Total	**59.5**	n/a	
TOTAL	**319.5**	**1334**	**4389*** **
Est. School Population			331**

* Based upon household average used in the North Cloverdale L.A.P.

** Based upon Surrey School District projections of .35 students per single family household and .15 students per townhouse household.

*** Existing and proposed households outside the NCP area total 269 dwelling units and would add 888 persons to these figures.

5.4 Urban Single Family Residential

Urban single family lots are proposed as the primary form of land use. These are defined by Surrey as having an area of 560 square metres, and a lot width of 15 metres. This form of housing is designated for approximately 143 acres which includes the area south of the ravine, north of 68th Avenue and between 180th Street and 184th Street. The layout of the urban single family residential areas is designed with several specific strategies to maintain or create a traditional neighbourhood streetscape.

Single family lots will front onto roads, thus retaining a traditional neighbourhood character. In some locations single family lots will enclose an internal 'pocket' of multi-family housing. This locates the transition between land uses at adjoining rear property lines. Again, this will allow a traditional neighbourhood streetscape in areas that have mixed building types.

Urban single family lots will also enclose a small 'neighbourhood green' park space in the northwest area. This park is intended for children's play activities, passive recreation use for the north neighbourhood and as a focal point for the pedestrian / bicycle network in the neighbourhood. This would be a low maintenance park with limited grass cutting areas.

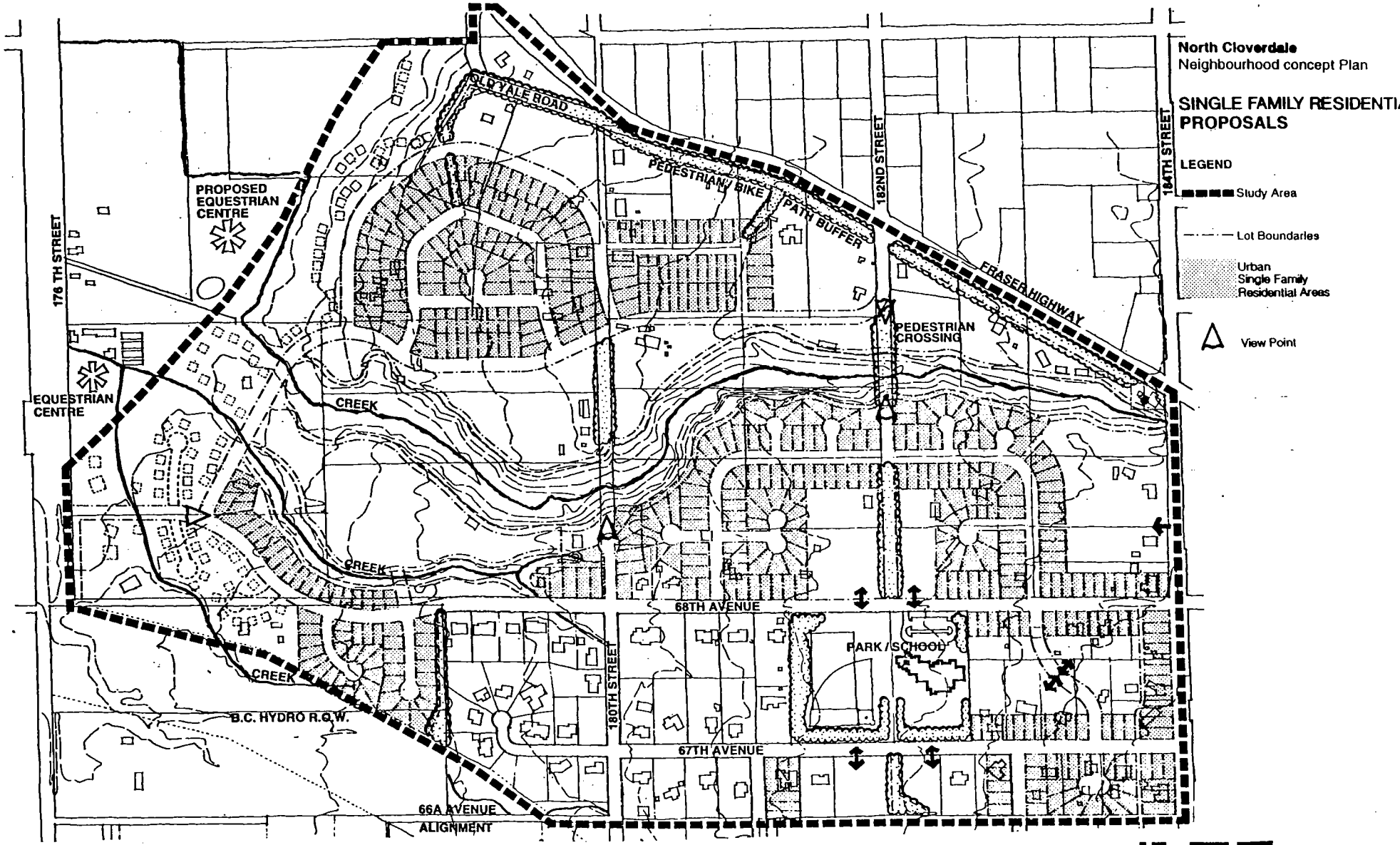
The entrance to the neighbourhood from 176th Street accents the unique character of this neighbourhood by permitting a view corridor toward the ravine at the bend in 68th Avenue. The single family lots at this point will be wider and have a tree convenant to preserve the existing vegetation.

Where lots are proposed to front onto 184th Street, lane access is provided as parking will not be permitted on 184th Street. The layout provides direct and through access from lanes to roadways. On the southerly boundary the lane will tie into the future extension of the existing lane north from Claytonhill Drive.

A 35 acre area bounded by the park / school site on the east, 66A Avenue on the south, 68th Avenue on the north and the boundary of existing 1 acre subdivision on the west has been exempted from the urban single family category at the request of residents. This area - zoned R-A and

RA-G - has been recently developed to a very high standard. Little opportunity or incentive for redevelopment to any density appears to exist for this area in the foreseeable future. The residents of the 31 affected lots were nearly unanimous in their position that no change of land use designation or zoning be proposed for this area and the statistics for single family residential reflect no subdivision of these lots. The R-A 1 acre lots may however be subdivided at some future time subject to rezoning should the concensus of the neighbourhood change.

Minor changes in access / ingress points and road layout configuration may occur as a result of detailed design considerations at the time of subdivision.



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5.5 Multi-family Residential Areas

In most cases, the land use plan proposes multi-family housing close to pedestrian areas. These pedestrian links provide access to the school and park facilities, the natural ravine areas or the landscape buffer along Fraser Highway. In many situations it is anticipated that the combination of private green space and public areas will create substantial areas of open green space.

Parcels of land designated as ground oriented multi-family are proposed in keeping with the following design ideas:

- Multi-family townhousing at 15 u.p.a. is proposed north, south, and east of the school and park site. These areas, close to the school, are suitable for affordable and special needs housing particularly for families with children.

- Multi-family townhouse is proposed along 184th. This site, like every multi-family area in the NCP, is potentially a family oriented site. The townhouse units should be developed with a single family character.

- Multi-family townhouse / clustering is proposed in internal pockets of land bordered by existing vegetation in and adjacent to the ravines. The intent of using townhouse/clustering on this site, which is adjacent to the ravine, is to preserve and enhance the ravine and take advantage of the natural features of the site to create discrete housing areas of various size and character.

- Multi-family townhouse / clustering is proposed on lands adjacent to the Fraser Highway. This area is separated from the Fraser Highway by a landscape buffer strip. The intent of using townhouse / clustering relates to the need for a strong landscape buffer adjacent to the highway. The triangular parcel north of the Old Yale Road public R.O.W. is to be developed concurrently with the lands to the south of it to ensure the triangle site access from south of the R.O.W. No access to the Fraser Highway is intended. The northeast sector of the site between the northern ravine and Fraser Highway is designated in the L.A.P as eight acres of industrial and one acre of local commercial use. Due to access concerns, the proposed Business Park Industrial area has been changed to townhouse clustering at 10 - 12 u.p.a. The entire

multi-family townhouse / clustering area adjacent to the Fraser Highway is suitable as an area for affordable and special needs housing. The commercial area is intended to continue.

Designated densities on the land use concept plan refer in all cases to the gross lot area. The 'cluster' designation on certain sites implies the use of density transfer to retain an optimum amount of open space. All multi-family sites are assumed to use the RM-15 zone and the net developable site area of 'cluster' sites may not exceed 15 units per acre allowed by this zone. In the RM-15 zone, development may be duplexes in areas designated 9 to 10 (u.p.a.) and townhouse / cluster sites with 10 -15 u.p.a. In addition to development permits, restrictive covenants could be used for design or density control if these are viewed necessary.

Precise unit counts for the multifamily residential sites will be determined at the detailed site planning and zoning stage when respective applications are processed and staff and design panel comments are considered.

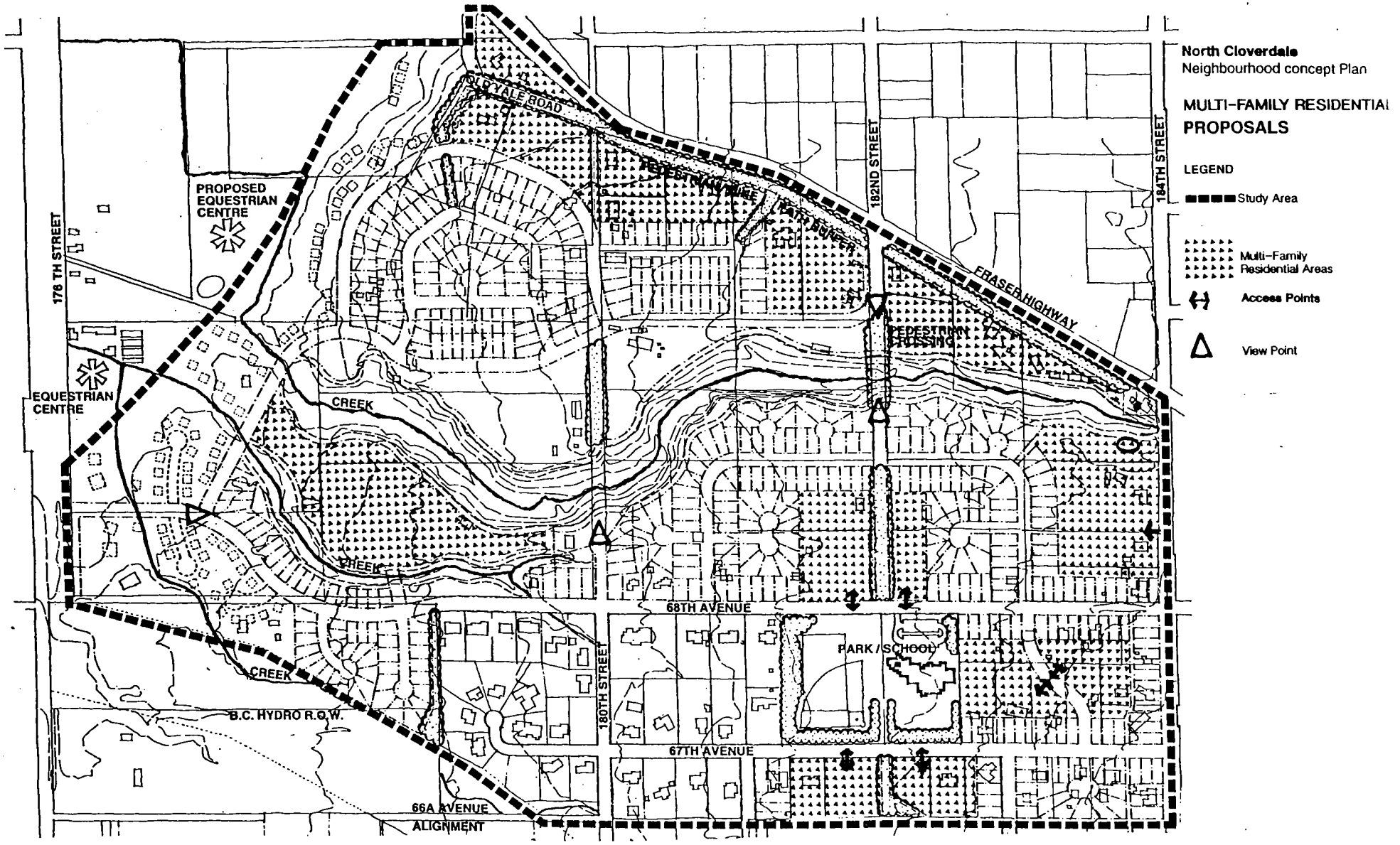
There are at least three sites suitable for affordable housing within this neighbourhood. The sites are located to the north, south and east of the school / park site. A brief analysis of the suitability of these sites for affordable housing is as follows:

AFFORDABLE HOUSING SITES

SITE	Adequate Site Area?	Multi-family Designation on L.A.P.	Walking Distance to Elem. School / Park (1/2 km)
A	Yes	Yes	Yes
B	Yes	Yes	Yes
C	Yes	Yes	Yes

AFFORDABLE HOUSING SITES

SITE	Walking Distance to Neighbourhood Commercial (1/2 km)	Interface with Single Family Development	No. of Property Owners
A	No	1 or 2	2
B	No	2	4
C	No	2	2



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5.6 Single Family Cluster Areas

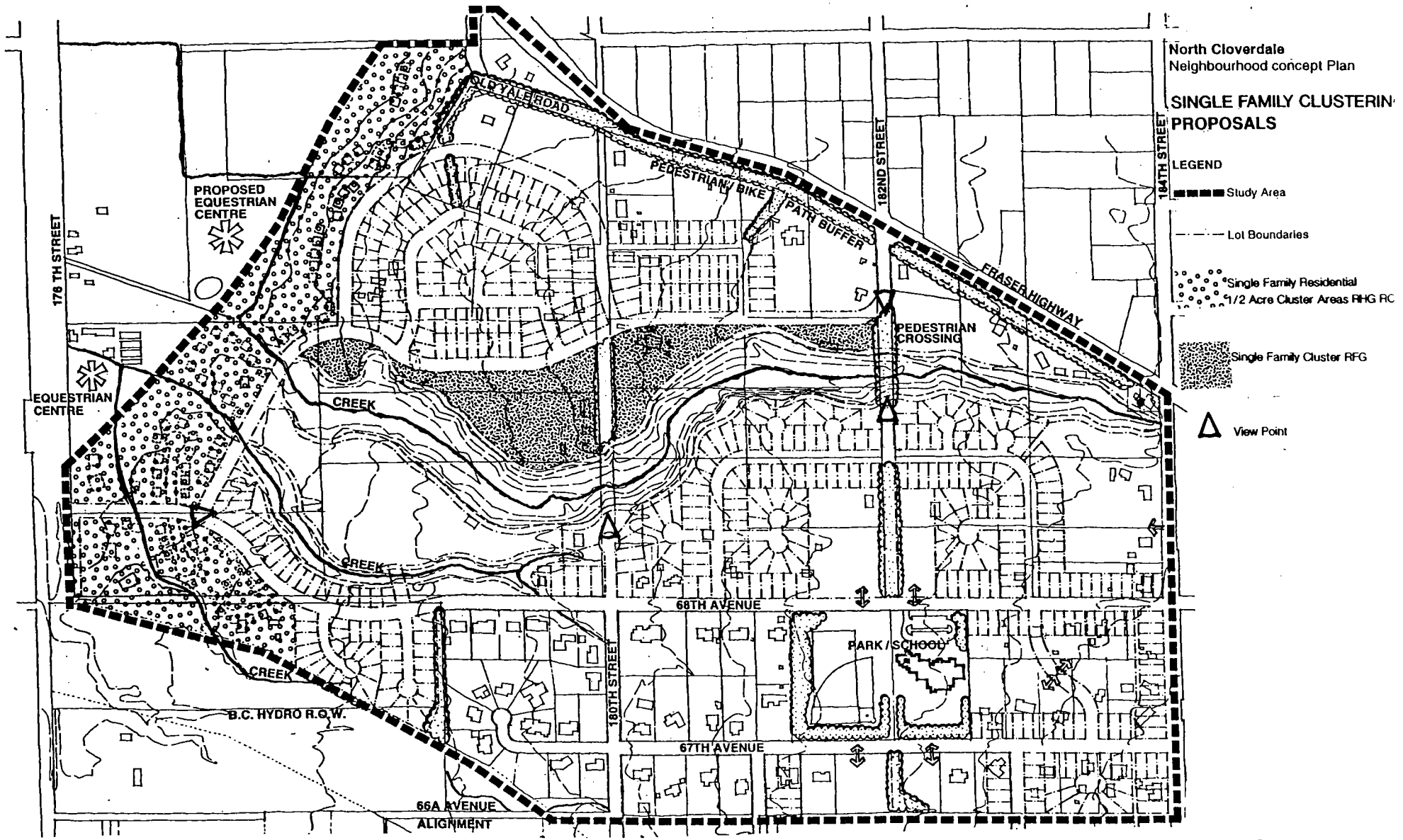
The objective of using clustering is to retain and protect the natural conditions of the western edge and slope of the neighbourhood, and the ravine that runs through the study area. Within both cluster areas, detached single family homes are proposed.

The west portion of the site is designated as clustering at two units per acre (RHG and/or RC). Covering the transition from relatively level to moderately steep sloping, this area of the site offers both pleasing aspects and topographic relief. Suburban density or residential clustering is proposed to ensure a transition from urban to rural uses through a landscaped edge.

The proposed road alignment will separate the urban single family lots to the east from the clustering proposed here. The location of the road is planned to allow for gravity flow sanitary sewer to be located within this right-of-way.

The North Cloverdale L.A.P calls for rationalization of the ALR boundary at the toe of the slope. The soils report covering lands in this area clearly supports alternative uses of this ALR land. It is proposed that an application for ALR exclusion be made by the affected landowner at the time of development application and that this application have the active endorsement of the City of Surrey.

The area north of the ravine is proposed as urban single family clustering (6 u.p.a. but not necessarily RF-G) to preserve the ravine corridor through the required 15% open space dedication. It is anticipated that this designation will allow for more flexible building patterns that will allow for effective protection of the ravine edges, while enabling an equitable potential for redevelopment of these lands. It is felt that this will benefit both the land owner and the City of Surrey.



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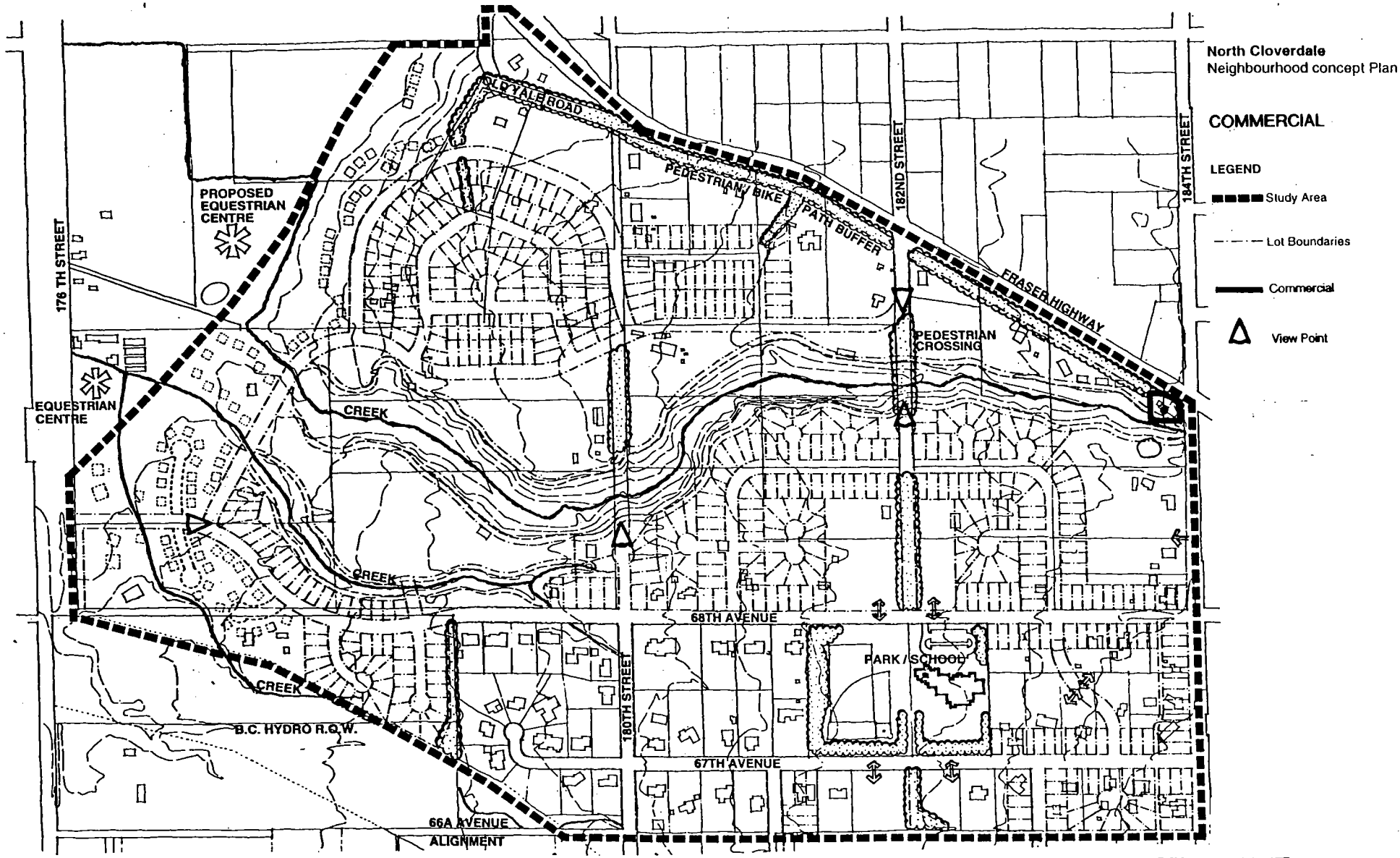
5.7 Commercial

The existing commercial site at the corner of 184th and Fraser Highway is assumed to be viable and continue to exist in the future however no expansion of the current commercial use of this site is permitted. The realignment of 184th Street should not interfere with the existing commercial area and should make use of, as much as possible, the creek crossing of 184th over the ravine. This would be the most environmentally responsible and cost effective way to approach the realignment. Preliminary designs indicate that the realignment can be accommodated but will result in most of the realignment of 184th to occur north of Fraser Highway.



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5.8 Road System

The roads are located to provide efficient access to each of the residential areas while avoiding the concentration of vehicular traffic in front of the school / park site.

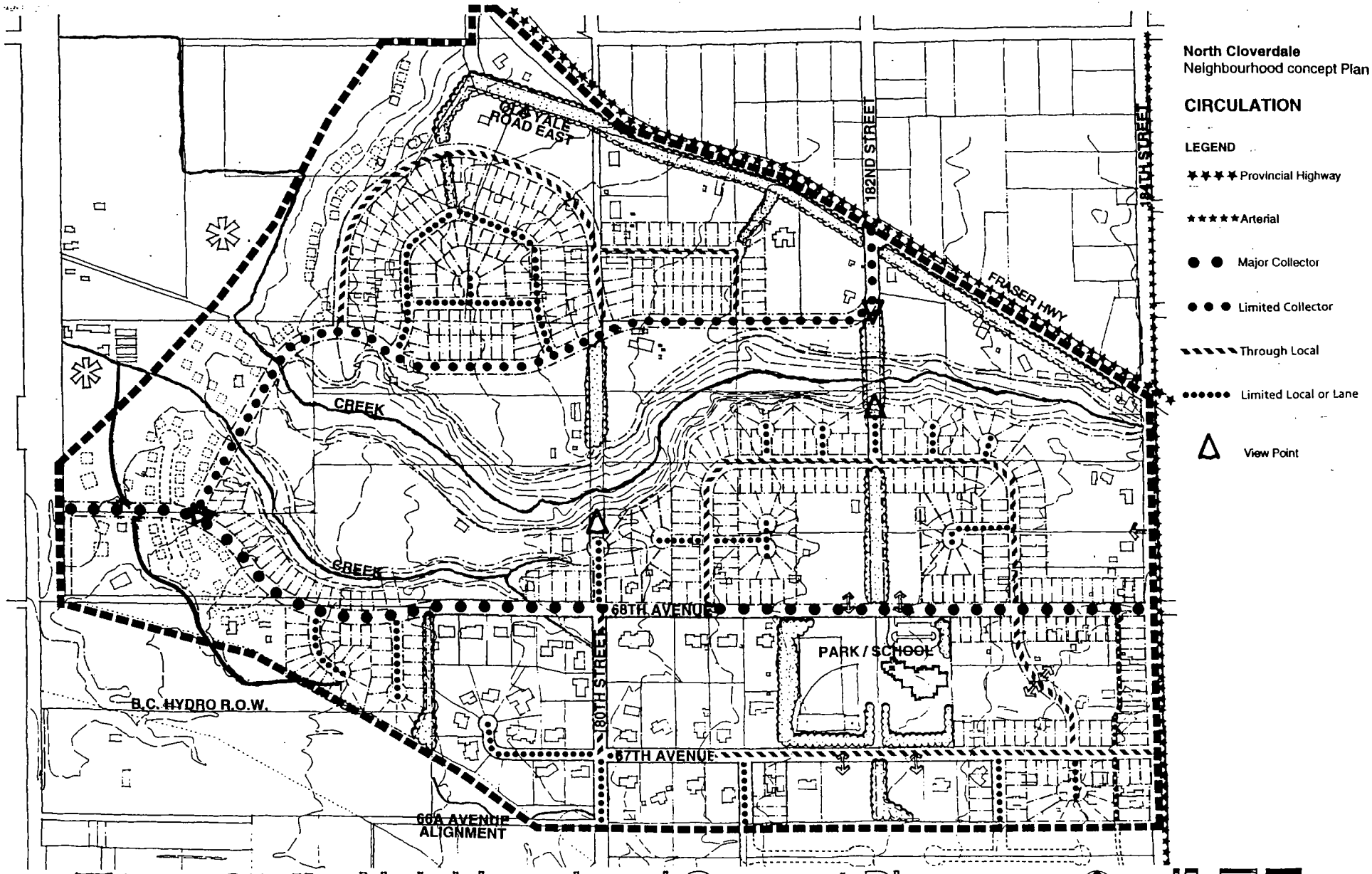
Primary access points to the west neighbourhood are from 176th Street tying into 68th Avenue, to 68th Avenue from 184th Street, and 182nd Street from Fraser Highway.

Old Yale Road at the northwest corner of the site is to be closed permanently. This will simplify vehicular access to the site. In addition, some of this land will become part of the fifteen metre landscape buffer and pedestrian and cycle path.

One special feature of the planned road system is the treatment of 68th Avenue in the blocks adjoining the school and park. The width of the paving should be reduced, and the frequency of street tree planting increased. In addition, the intersections at 180th Street and 182nd R.O.W. pedestrian linkage are to be marked with a contrasting, textured paving. It is anticipated that these changes will contribute to making lower vehicular speeds intuitively more appropriate, and making the school and park zone safer.

Road crossings of the ravine are limited to one approximately in alignment with 178th Street.

Minor variations to the road layout and standards shown may be permitted based upon detailed subdivision evaluation. For road classification and standards refer to section 7.2


North Cloverdale
Neighbourhood concept Plan
CIRCULATION
LEGEND
Provincial Highway
Arterial
Major Collector
Limited Collector
Through Local
Limited Local or Lane
View Point
OLD YALE ROAD EAST
182ND STREET
184TH STREET
FRASER HWY
CREEK
CREEK
68TH AVENUE
PARK / SCHOOL
B.C. HYDRO R.O.W.
80TH STREET
67TH AVENUE
66A AVENUE ALIGNMENT
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5.9 Pedestrian Circulation System

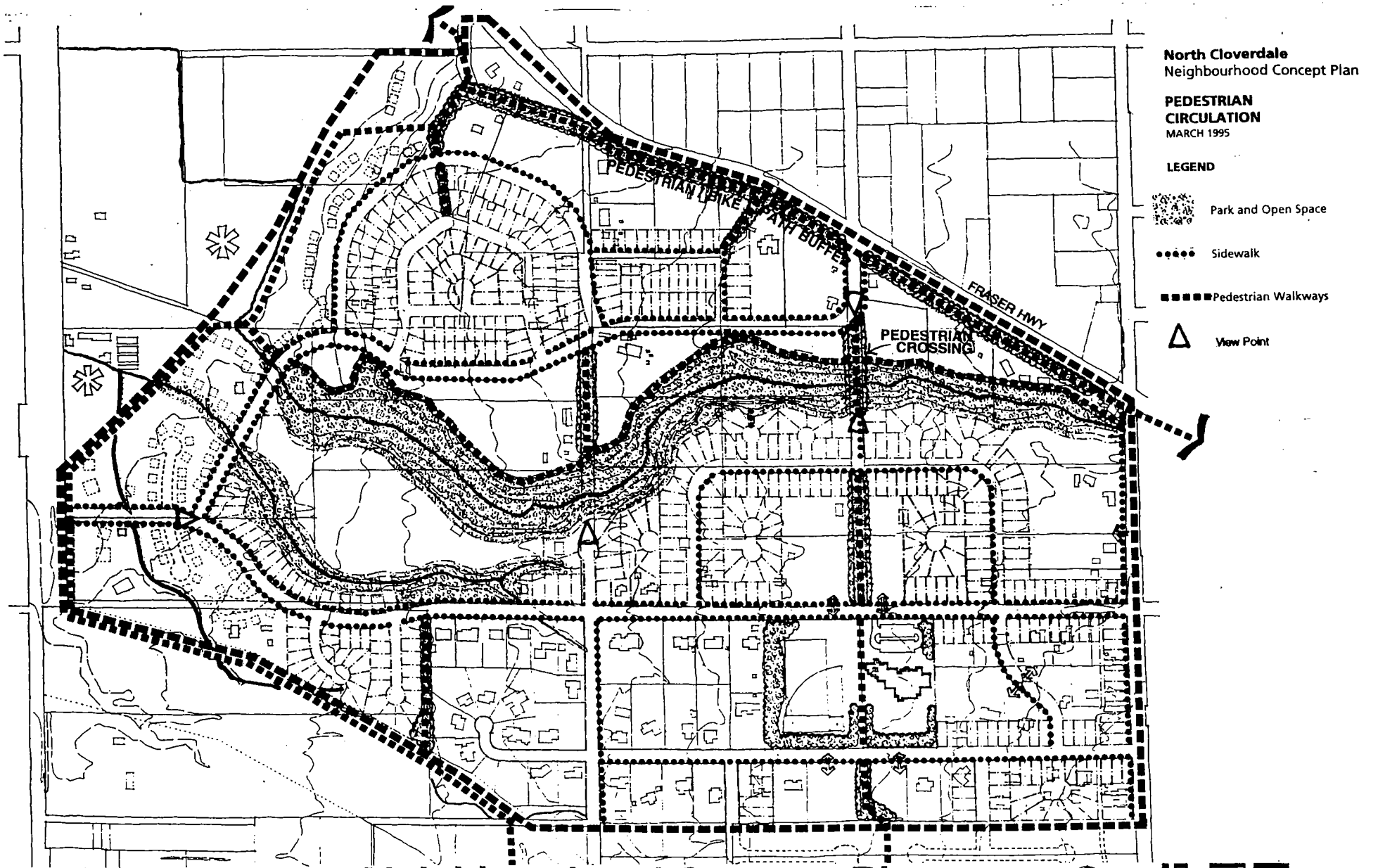
The opportunity to achieve a comprehensive pedestrian circulation system in this neighbourhood is central to its character and is considered a main feature of the new neighbourhood. Pedestrian circulation within the proposed plan is encouraged through the development of generous pedestrian paths which will enable walking access to natural areas, parks and the school.

Specifically, there are four components to be incorporated into this system. The first is to provide access to the natural areas of the ravines, creating an accessible natural amenity for the neighbourhood.

The second is to coordinate road and pedestrian paths to provide logical access to the school and park site which straddles 182nd street. It is very important to connect with the existing pedestrian path system created as part of the subdivision south of 66A Avenue alignment. This will provide easy access for children from this area to walk to the new school planned as part of this N.C.P.

Third, linkages that may support an equestrian / community centre are proposed at the west edge of the site. As identified in the LAP, pathways are proposed along the ALR border to the west and the hydro right of way to the southwest. This pathway, which should in part be an equestrian riding trail, is important for integrating the equestrian / community centre into the community plan.

Fourth, provision is made for a fifteen metre wide landscape buffer and pedestrian path system along Fraser Highway as proposed in the L.A.P. This will form a substantial walkway when considered in conjunction with the proposal for the east neighbourhood N.C.P. A portions of the Old Yale Road is to be included in the pedestrian network. The intent is to retain the existing pavement in its current condition.


North Cloverdale
Neighbourhood Concept Plan
PEDESTRIAN
CIRCULATION
MARCH 1995
LEGEND
Park and Open Space
Sidewalk
Pedestrian Walkways
View Point
PEDESTRIAN/BIKE PATH BUFFER
FRASER HWY
PEDESTRIAN
CROSSING
PHASE II - Neighbourhood Concept Plan
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PROGRESSIVE
CONSTRUCTION
LIMITED
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5.10 School and Neighbourhood Park

The N.C.P proposes a school site of 5.0 acres and neighborhood park of 7.0 acres.

The park and school will span the property between 67th Avenue and 68th Avenue, centered approximately on the 182nd Street alignment.

Good and safe connections to the school and park are fundamental to the pedestrian circulation system within the proposed NCP. Adjacent neighbourhood areas to the south are connected by a substantial pedestrian path to the school / park site.

5.11 Equestrian Centre

An equestrian centre is suggested for land that is outside the NCP but is a portion of a parcel of land within the study area. This land is in the floodplain but out of the ALR. This suggestion is intended to assist in integrating non-urban uses on the floodplain portion of property with the upland residential proposed.

5.12 Daycare Facilities

Private sector daycare facilities should be encouraged to locate within the neighbourhood especially next to or near the neighbourhood park. It is recommended that the City encourage the private sector to provide daycare spaces by supporting zoning applications from individuals as the neighbourhood develops.

5.13 Environmental Considerations

The majority of the watercourses in the study area are contained within a significant ravine system. The ravine slopes are for the most part densely vegetated with native riparian shrub and canopy species, severely restricting access to the watercourses. Substrates within the ravine system range from sands and organic fines to boulders and in some areas have been completely overgrown by reed canary grass and other wetland species. Reaches of the watercourse upstream of the ravine (i.e., upstream of 68th Avenue) are surrounded by low density residential development. Portions of the watercourse within this area are protected by restrictive covenants.

Two aspects of the site are considered as potential environmental concerns: tree retention and the ravine areas. Prior to any land clearing and grubbing, setbacks for non-disturbance areas are to be established and clearly marked.

Tree retention outside the ravine areas would be best accomplished through the current Tree Removal and Replacement Bylaw, or specific covenant action. Application for this type of control will likely require a tree survey. This is most appropriate during the rezoning and subdivision permit application process.

Each of the ravines is considered an important feature of the west neighbourhood. The inclusion of a pedestrian network within the setbacks is proposed. The Ministry of Environment "Land Use Guidelines" indicate that trails may be allowed in the setback area, if they are designed and constructed so as not to adversely affect fish habitat. The path location will be located close to the fence but the location will vary to preserve trees and habitat features. Existing vegetation within the setback will be retained and protected in addition to the areas of the ravines.

The west slope area, proposed to be developed with residential lots at two U.P.A clusters and a neighbourhood amenity facility allows a substantial portion of land in this area to be retained in a natural state. It is hoped that flexibility in site design will allow for creative and sensitive land use on these properties.

Use of the RH(G) RF(G) and proposed R(C) Cluster residential zones where warranted as well as density transfer through the RM-10 and RM-15 zones will enable a significantly greater contribution to the neighbourhood of preserved open space.

Guidelines for protection of the aquatic habitat require a "non-disturbance" strip be maintained from the top-of-bank of designated ravines or watercourses as follows:

1) Multi-family greater than 6 upa will require 30 m (no disturbance) plus 7.5 m to building. This is reduceable to 20 m plus 7.5 m with compensation to the satisfaction of the federal Department of Fisheries and Oceans.

2) Multi-family less than or equal to 6 upa will require 20m (no disturbance) plus 7.5 m to building. This is reduceable to 15 m plus 7.5 m with compensation to the satisfaction of the Ministry of Environment Lands and Parks

3) Single family will require 15 m (no disturbance) plus 7.5 m to building.

Developers/property owners, at the time of development application, will be encouraged to organize and support community programs for protecting and maintaining lands and pathways adjacent to the ravines, and to work with the Ministry of Environment in developing educational and watercourse protection initiatives.

6.0 SERVICING

This report depicts roads and services that would be constructed if the NCP developed as one integral project. However, "Interim" roads and services may be required to support the applications as they develop in order to maintain access and design criteria requirements for each and every application.

6.1 Sanitary Sewer

Except for 12 existing services lots on the 67 Avenue cul-de-sac West of 180th Street, the entire study area is ultimately tributary to the large diameter (Ø) sanitary trunk main proposed between 176A Street/60 Avenue and Fraser Highway/179 Street/72 Avenue (Reference #3594, 10 year servicing plan). The area north of the east/west creek will be connected directly to this large Ø trunk, while the area south of the creek will connect by way of a 450mm Ø sanitary sewer along 68 Avenue. The 1/2 acre cluster residential area planned west of the large Ø trunk sewer will require private on-site pumping systems to connect to that trunk, provided each of the legal lots fronts on the trunk sewer.

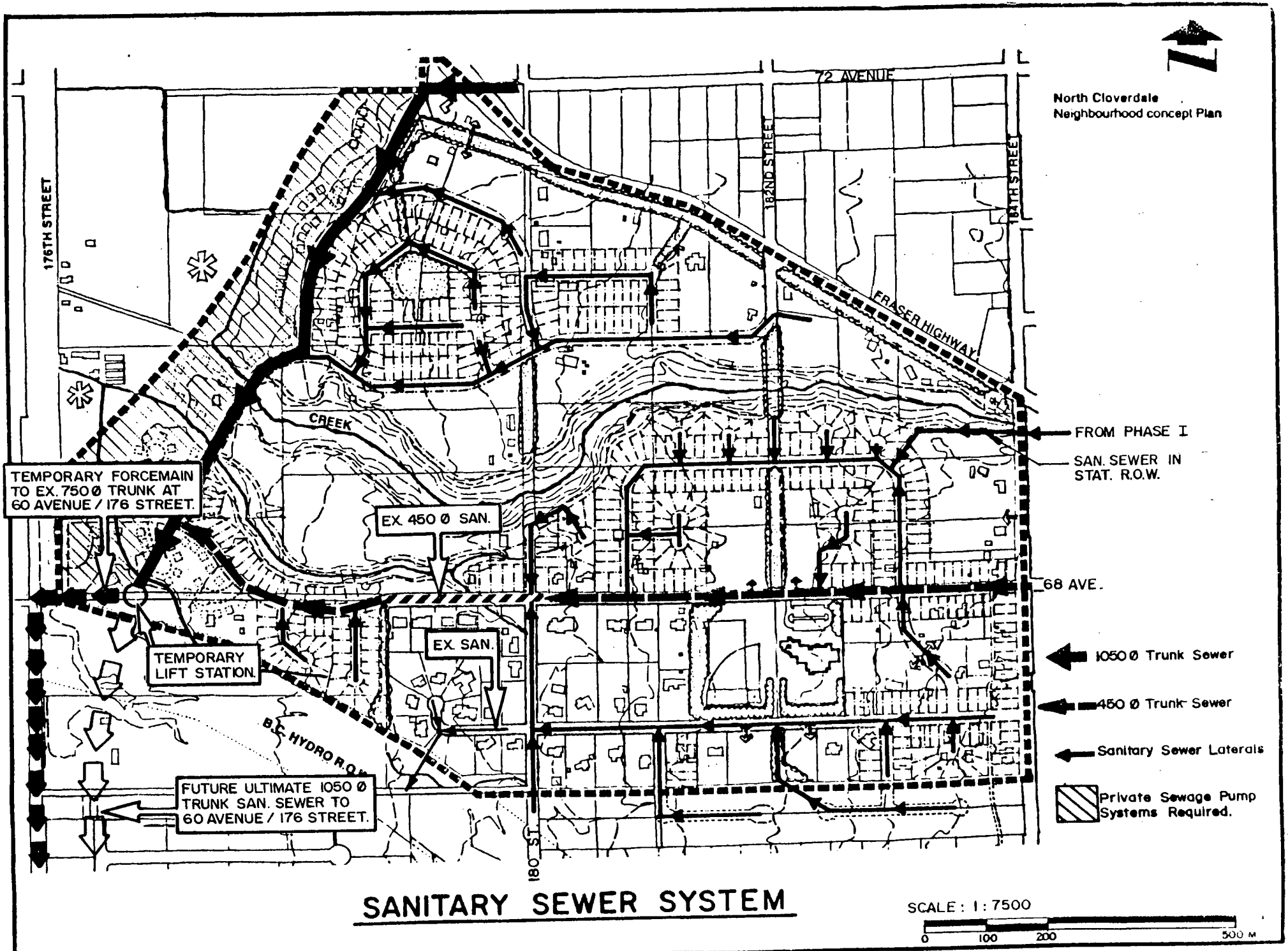
As an interim solution, until the large Ø trunk is completed south to 176 Street and 60 Avenue, a temporary sanitary sewer lift station is proposed in the vicinity of 176A Street and 68 Avenue.

The 450 Ø sewer on 68 Avenue and the temporary lift station and force main are to be constructed as part of the Phase I East Neighbourhood.

The large Ø trunk is part of the 10 year servicing plan with reimbursement to developers constructing the trunk by way of DCC rebates and/or development coordinated works. The 450 Ø sewer on 68 Avenue is to be constructed by Surrey, with Surrey acting as the frontender in a latecomer agreement scenario with oversizing paid by the sewer utility. The temporary lift station and force main is to be funded by Surrey with repayment to Surrey by way of an area based latecomer agreement.

Ultimately, the large Ø trunk main will be constructed from the temporary lift station location to 60 Avenue & 176 Street and the lift station can be removed.

The Sanitary Sewer System Plan shows the proposed servicing for 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.



SANITARY SEWER SYSTEM

6.2 Roads

The Neighbourhood Phase II Study Area is served by a high quality regional and municipal road network since it is fronted by two provincial highways, these being Fraser Highway to the north and Highway 15 (176 Street) to the west. The other two sides are fronted by 184 Street on the east and 64 Avenue on the south. Both are designated municipal arterial roads. It is evident that no expansion of the arterial road network is required in order to service the proposed Neighbourhood Concept Plan.

As per the City R-91 Plan, a major collector road will cross the site, starting at 184 Street on the east, travelling directly west through the site and connecting to 176 Street. A limited collector starts at this east-west collector at approximately 178 Street, and heads north and then east before connecting to Fraser Highway at 182 Street. These two collector roads provide good circulation through the study area and at the same time ensure that there is little cut through traffic.

Provision has been made in the Neighbourhood Concept Plan for the necessary road designation to permit the future widening of Fraser Highway to a six lane standard of MOTH (34.8 metres), including any additional widening to accommodate turning movements at the intersection of 182 Street. This is similar to what was proposed in Neighbourhood I. The plan provides for the protection of necessary right-of-way widths for 184 Street and 64 Avenue to Surrey's arterial road standards 13.5 metres from centre line. The right of way width for all collectors is 22 metres.

To accommodate the additional traffic generated by the development of North Cloverdale Neighbourhood II, new traffic signals and channelization will be required at the intersection of 68A Avenue and 176 Street. Given the proximity of the 182 Street intersection on Fraser Highway to the adjacent signalized intersection at 184 Street, this intersection will not be signalized but instead will be restricted to right-in/right-out movements only. In addition, the angle of intersection of 184 Street with Fraser Highway will be improved with the intersection being realigned to the east. New left-turn lanes will be required off 184 Street at both 67 Avenue and 68 Avenue.

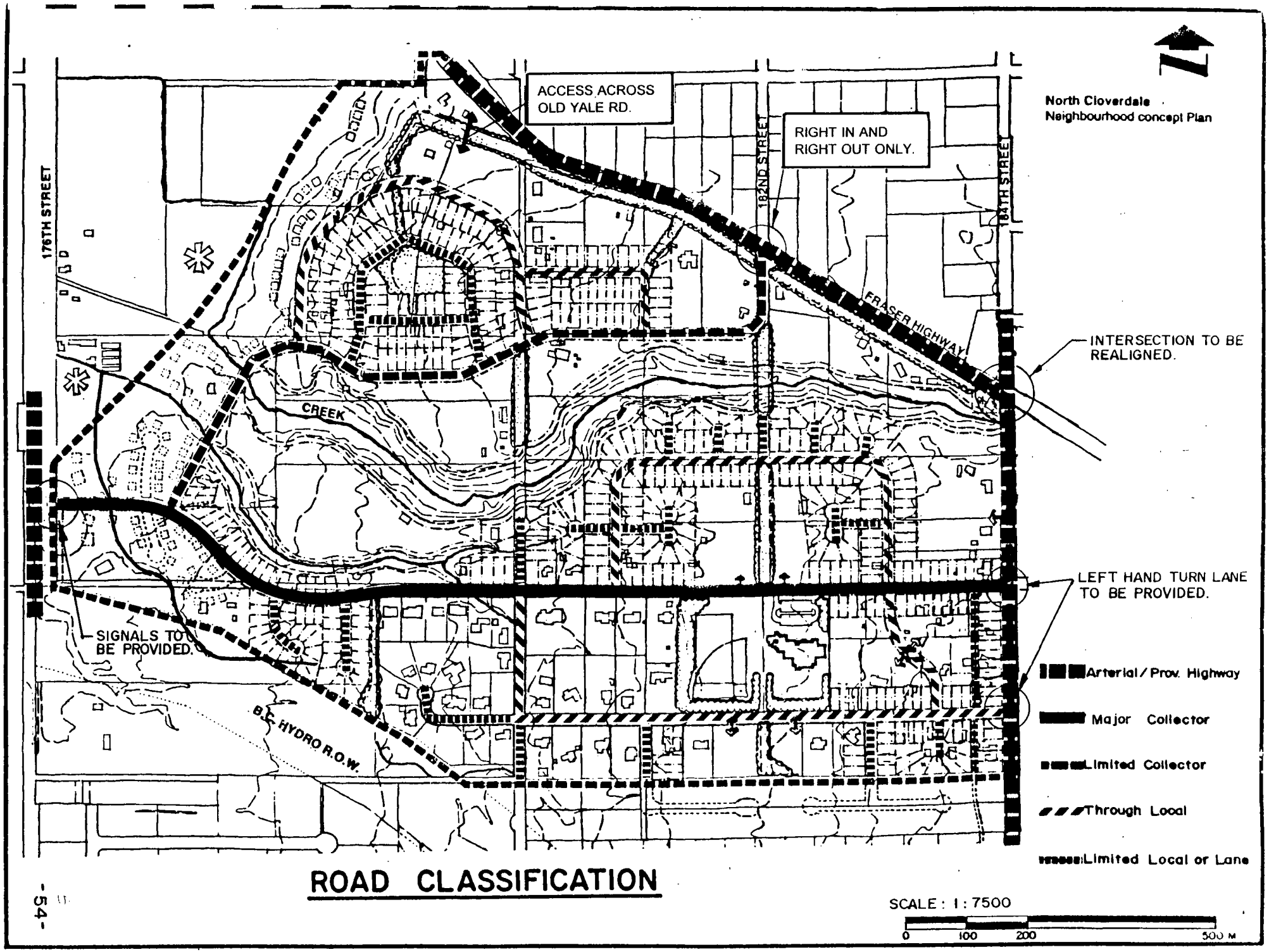
These works and the traffic signalization are arterial road related and should be provided for in an amended 10 year servicing plan to be funded out of development cost charges.

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. Minor variations to the local road layout may be permitted based upon detailed subdivision evaluation. Emergency access to projects may be required depending on timing. 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.


North Cloverdale
Neighbourhood concept Plan
ACCESS ACROSS
OLD YALE RD.
RIGHT IN AND
RIGHT OUT ONLY.
176TH STREET
182ND STREET
184TH STREET
FRASER HIGHWAY
CREEK
INTERSECTION TO BE
REALIGNED.
LEFT HAND TURN LANE
TO BE PROVIDED.
SIGNALS TO
BE PROVIDED.
B.C. HYDRO R.O.W.
Arterial / Prov. Highway
Major Collector
Limited Collector
Through Local
Limited Local or Lane
ROAD CLASSIFICATION
SCALE : 1 : 7500
0
100
200
500 M

6.3 Water

The majority of the study area lies within the 90m H.G.L. pressure zone with a small area adjacent to 184 Street, above the 55 meter contour, in the higher 115m H.G.L. pressure zone. A series of pressure reducing values and shut valves will be utilized to separate the two zones.

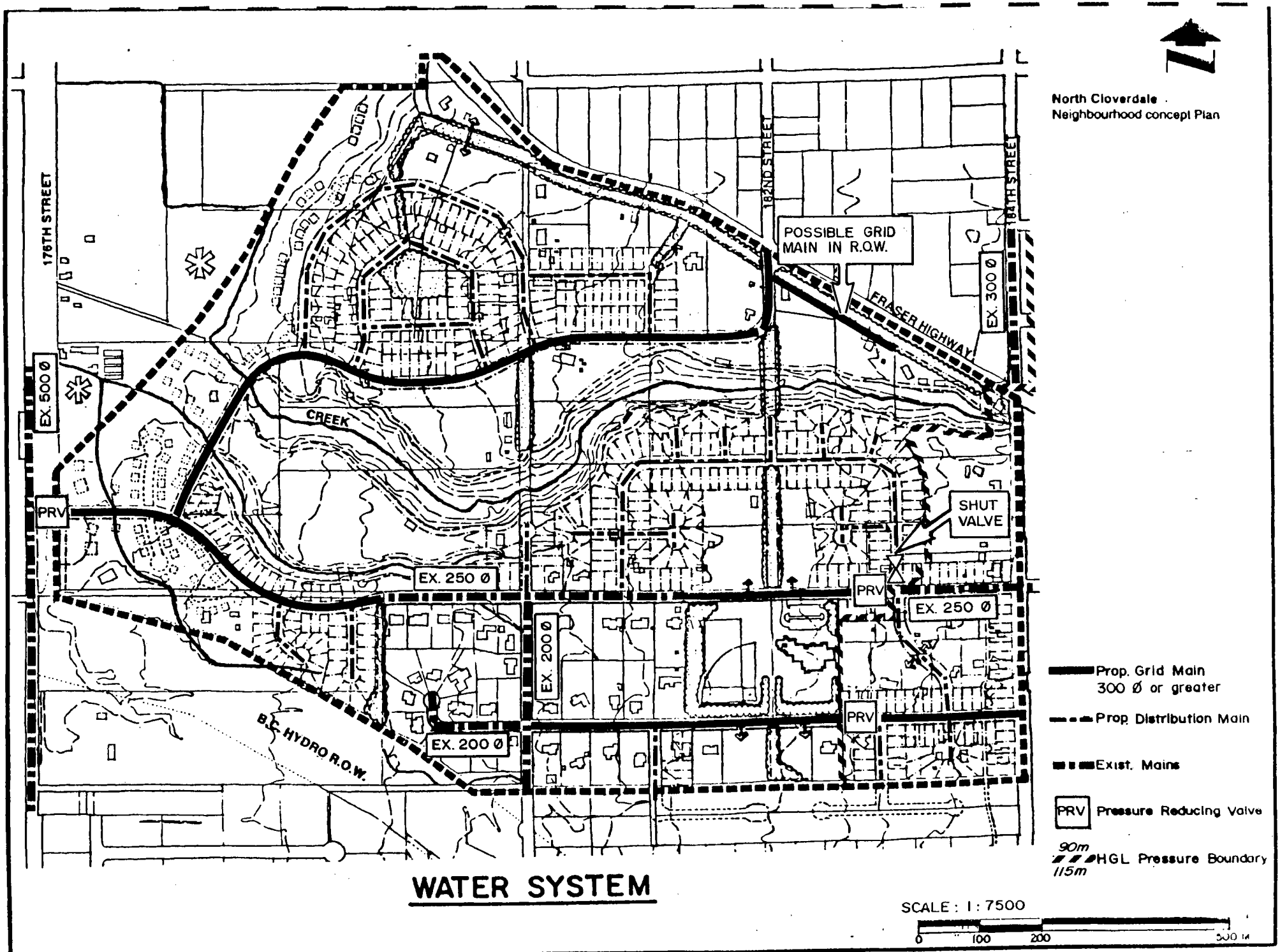
The existing 300mm diameter grid main south of the Fraser Highway on 184 Street will be extended to the study area along 68 Avenue and 67 Avenue with pressure reducing valves at about the 55 meter contour.

A grid main connection, complete with pressure reducing valve, to the existing 500mm diameter feeder main on 176 Street will provide a system adequate to meet domestic and fire flow demands generated by the land uses proposed by the Neighbourhood Concept Plan. The water system map shows the proposed grid mains and internal network servicing the study area in accordance with the neighbourhood concept plan.

The 10 year servicing plan has identified waterworks upgrading within the study area on 68 Avenue, 180 Street and 182 Street (Reference #s 1463, 2412, 3600 and 3601 for a total works value of $791,000).

Watermains will be extended in accordance with the proposed Plan by each developer as required.

The oversizing cost for the proposed grid main above that required by the developer, would be refundable from development cost charges and development coordinated works where applicable. Upsizing of the watermains will not be paid, however, if the system is incomplete and fire flows at maximum velocities are not attainable by extension of the minimum main size. 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.



WATER SYSTEM

6.4 Storm Drainage

The north, south and west creeks comprise the main drainage system for the west neighbourhood. Erosion is not evident except for a small portion of the north creek, however it is not considered desirable to increase their flood flow regimes within the steeply sloping gullies. Buried pipe storm drainage systems are proposed, which will discharge into the creeks on the lowlands.

Catchment boundaries and flow directions are to be similar before and after development. The principal change is a reduction in catchments contributing to the steeply sloping gully sides, thus minimizing potential erosion.

It is understood that the east neighbourhood will be provided with a storm detention facility which will control flood flows and maintain base flows in the gully reach of the north creek. The north creek also drains an area directly north of the east neighbourhood, north of the Fraser Highway and east of 184 Street. It is recommended that when this area develops, it is provided with a separate storm detention facility upstream of the gully.

The storm drainage system from a small portion of the west neighbourhood catchment adjacent to Fraser Highway and 72 Avenue is proposed to drain to the lowland ditch on the south side of the Fraser Highway. This ditch is a tributary of the north creek.

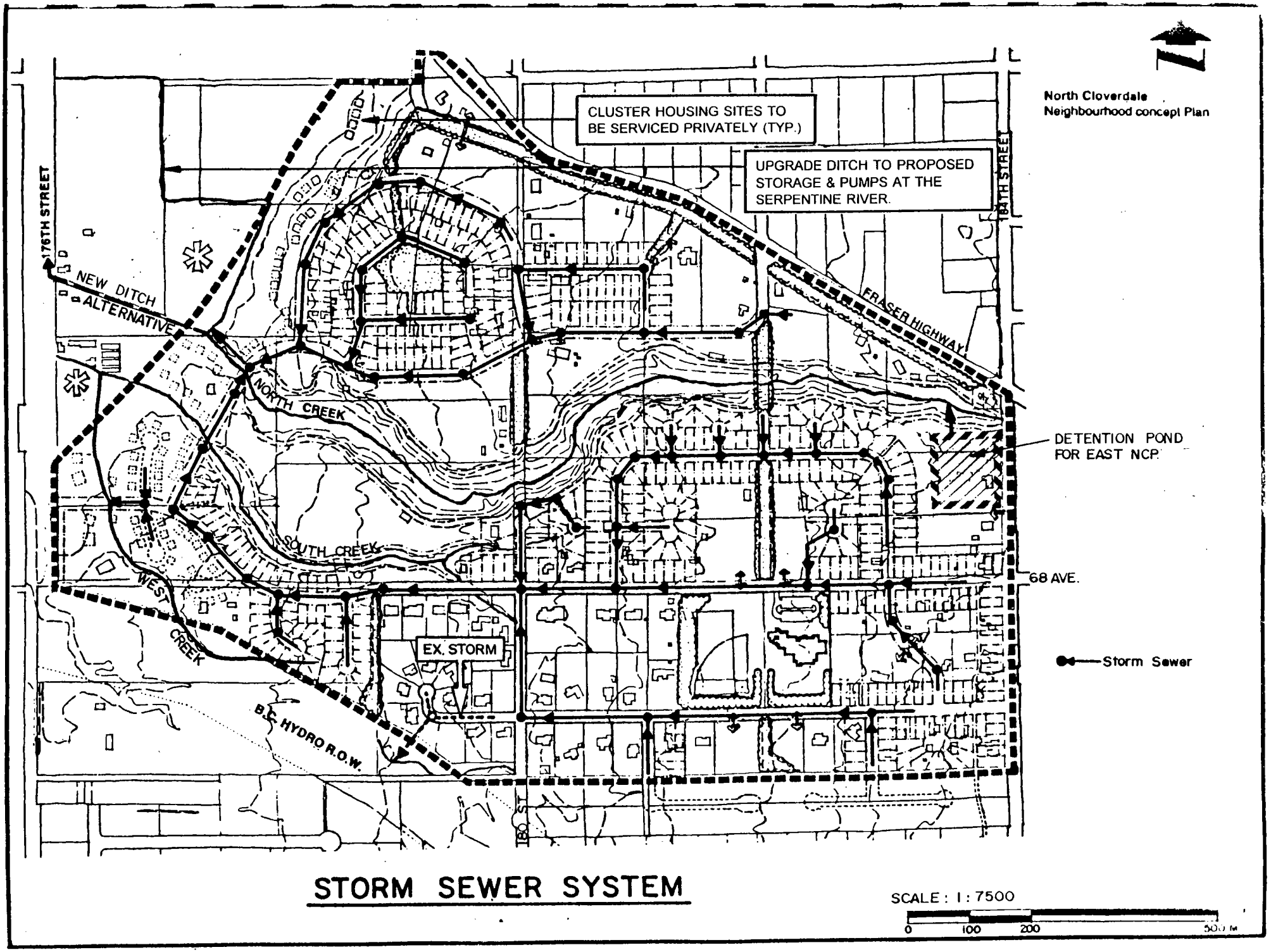
The storm drainage system is to be provided with a controlled outlet into the south creek so that base flows can be maintained.

As well as increasing storm peak flows, development increases storm runoff volumes. The Serpentine River drainage is the subject of a separate ongoing study. It is understood that the existing dyke system is inadequate north of the Fraser Highway and 176 Street intersection. The increased runoff volume due to development of the west neighbourhood and other developments within the catchment should not be discharged directly to the river since it could contribute to flooding of the Serpentine River lowland areas upstream. The lowland cell directly affected by the north, south and west creeks is currently drained through a floodbox without any pumping.

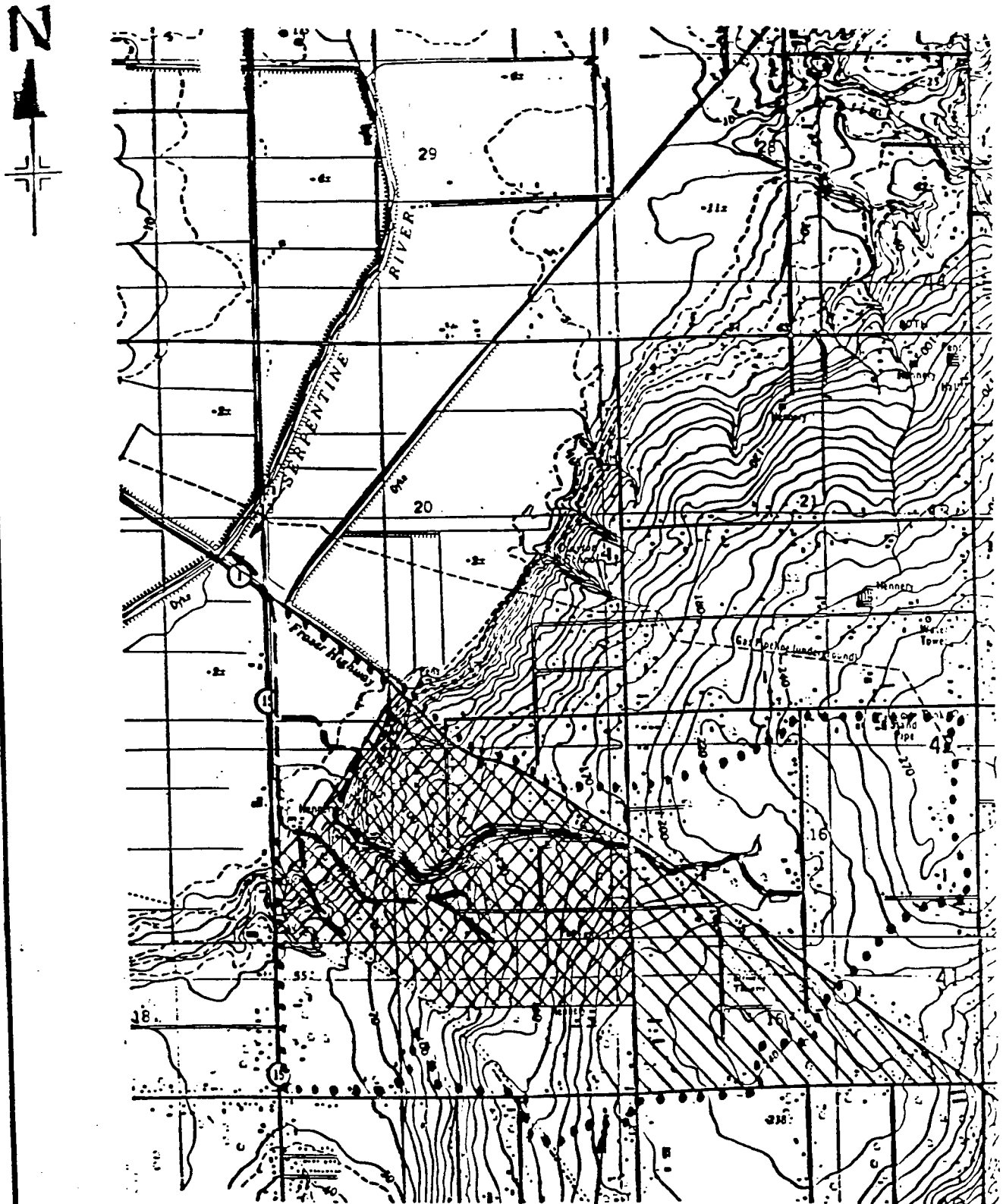
The favoured approach is to discharge the creeks into the lowland ditches (as at present), and provide pumping capacity from the lowlands into the river. One new pump station is proposed which will discharge into the river adjacent to the Fraser Highway. Its capacity is to be determined during the Stage 2 study, and is to meet the accepted standard for agricultural land. It is expected that this will result in improved drainage conditions in the lowlands for winter storms up to about 5-10 years return period. The Stage 2 study is to include an analysis of the lowland ditches, and whether improvements are necessary.

This approach does not rule out the construction of dyke tie-ins, and eventual discharge of upland runoff by gravity into the river should this be desired in the future if the river dyke and floodbox system has been upgraded.

The buried storm drainage system is to be designed for 5 year storm conditions. Major flows are generally to be conveyed within the road system either piped or on the surface, and be released to the lowland ditches.



STORM SEWER SYSTEM



N CLOVERDALE NCP II LOCATION PLAN

C. Robert Bland. P. Eng.. consulting engineer

6.5 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.

NORTH CLOVERDALE

NEIGHBOURHOOD CONCEPT PLAN

WEST NEIGHBOURHOOD

SECTION II

EVALUATION OF ENGINEERING SERVICES

JUNE 7, 1996

COASTLAND ENGINEERING & SURVEYING LTD.

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APPENDIX V - Agency Comments

1.0 INTRODUCTION

The Engineering Services Report forms Section II of the North Cloverdale West Neighbourhood (Phase II) Concept Plan. This report is in addition to, and supercedes, the Stage I engineering report included in Section I, Land Use Plan and Subdivision Concept as "6.0 Servicing". This document has been prepared as required by Surrey Council as a condition of development approval for Lands in the North Cloverdale area. The parcel of Land bounded by 184 Street to the east, 66 'A' Avenue alignment and the existing B.C. Hydro right of way to the south, 176 Street and the bottom of escarpment to the west, and Fraser Highway to the north, herein referred to as the "Study Area", has been designated as the second phase of the North Cloverdale Neighbourhood Concept Plan area. Servicing requirements of the Land Uses proposed in the Concept Plan, and the identification of works required to adequately service these uses, are addressed in this Engineering Services Report. Services include Roads and Traffic, Water Supply and Distribution, Sanitary Sewer, and Drainage.

This report has been prepared in accordance with the engineering terms of reference for the North Cloverdale Phase II Neighbourhood Concept Plan, issued by the Land Development, Environment and Research Division of the City of Surrey Engineering Department and which are contained in Appendix I.

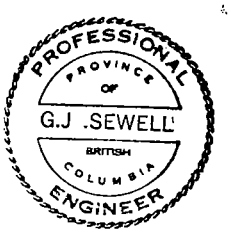
Preparation of this report included regular meetings and consultations with representatives of the Study Area property owners, outside agencies, as well as the City of Surrey Engineering Department Staff. The conclusions and recommendations of the Report are endorsed by the above groups.

COASTLAND ENGINEERING & SURVEYING LTD.

Greg Sewell

Greg Sewell, P.Eng.

June 7, 1996



2.0 LAND USE PLAN

2.1 Proposed Land Uses & Development Pattern

The North Cloverdale West Neighbourhood Concept Plan document prepared by Davidson Yuen Simpson Architects outlines the land uses proposed and provides for a variety of housing types in the form of moderate and high density multiple family townhouse as well as traditional single family development. The Neighbourhood Plan provides for significant green space and includes an Elementary School and Neighbourhood Park as shown on Figure 1.

The areas designated as single family are to be conventional sized lots with front driveway access, except where those lots front arterial roads in which case lanes are to be provided. Multi family developments in the Study Area will provide for cluster housing and townhome developments with densities ranging from two 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
½ Acre Cluster	39.6	79
Urban Single Family	141.7	490
Single Family Cluster	14.1	85
Multi Family Residential	64.6	680
Commercial	0.5	-
School/Park	11.7	-
TOTAL	272.2	1,334

2.0 LAND USE PLAN

2.2 Population Projections

The Neighbourhood Concept Plan suggests that every multi-family area within the N.C.P. is potentially a family oriented site. The following table summarizes the ultimate population projections for the Study Area based on estimates of average household population per housing type as identified in the North Cloverdale Local Area Plan.

LAND USE	PERSONS PER DWELLING UNIT	NO. OF DWELLING UNITS	POPULATION
½ Acre Cluster	3.29	79	260
Urban Single Family	3.29	490	1612
Single Family Cluster	3.29	85	280
Multi Family Residential	3.29	680	2238
Commercial	-	-	-
School/Park	-	-	-
TOTAL		1334	4390

In evaluating service requirements, for the purposes of this report, design populations have been generated from land uses in accordance with the higher of either the North Cloverdale Local Area Plan, or the City Engineering Department Design Criteria Manual (January, 1995).

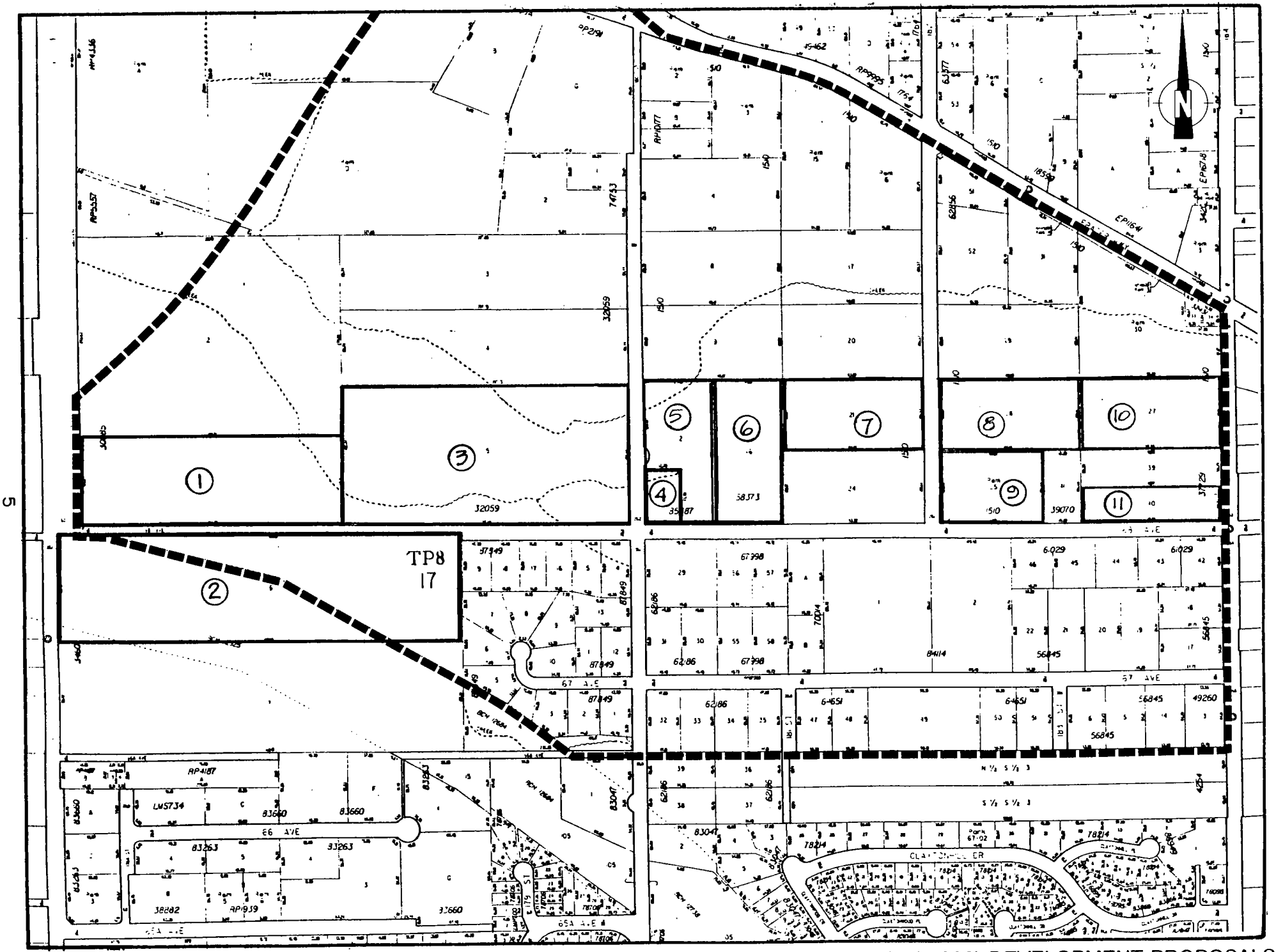
2.3 Development Phasing

The development of the Study Area is expected to proceed generally west from 184 Street. Figure 2 identifies the proposed construction stages as Developments Stages 1, 2A, 2B & 3. The Stages shown are consistent with the logical

extension of services into the Study Area. The development of Stage I will provide a solid foundation for the development of successive stages.

Although Development Stage 2A & 2B could proceed prior to, or concurrent with, Stage 1, it is not expected to do so. These stages are not likely to proceed until Stage 1 has been completed so as to take advantage of the extension and installation of services required by Stage 1 and identified in subsequent sections of this report. Further, the nature of Development Stage 3 and its location in the Study Area requires the involvement of one or more major development "players". Individual land owners may find piecemeal development of this area onerous given the relative distance of the main development area from existing roads and services even with previous stages complete.

In support of this staging proposal, development applications for several parcels within Development Stage I are pending. It is the intent of the applicant(s) with significant holdings in Stage I, to proceed with development as soon as approvals are obtained. Other holdings within this first development area may proceed simply by extending basic services provided by these initial applications. Map 1 on page 5, extracted from the Neighbourhood Concept Plan, shows the current applications proposed.



PHASE II - NEIGHBOURHOOD CONCEPT PLAN, NORTH CLOVERDALE, B.C. CURRENT (JAN 1996) DEVELOPMENT PROPOSALS.

3.0 ROADS AND 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 and 176 Street to the west. 184 Street, which defines the Study Area on the east, is a designated Municipal arterial road and provides access to both Regional and Municipal road networks. Although not immediately adjacent to the Study Area, 64 Avenue is also a designated Municipal arterial road providing additional access to the major networks. This existing grid network of roads provides good access to the Study Area. There are no additional arterial road requirements designated for the Study Area on the City R91 Grid Road Map (1993) and no expansion of the arterial road network is required in order to service the proposed Neighbourhood Concept Plan.

The existing road on 184 Street has two lanes north/south with signalization at both the intersection with Fraser Highway and with 64 Avenue. 176 Street is a regional 2 lane highway with left turn lanes and signalization at both 64 Avenue and Fraser Highway.

68 Avenue in the Study Area is a two lane east/west roadway which is paved to a rural standard between 184 Street and approximately 179 Street. It has a typical right-of-way width of 20 metres but some segments of the unopened road, ie. between 176 Street and 179 Street, have a width of only 10 metres. This roadway is classified as a major collector from 184 Street to 176 Street on Surrey's R91 Grid Road Map (1993).

Other road dedications existing within the neighbourhood include the following:

- 67 Avenue is a two lane east/west roadway paved to a rural standard between 184 Street and 180 Street within a 20m right-of-way, and extends 200 metres west of 180 Street where it terminates in a cul-de-sac.

- 181 Street is a two lane north/south roadway paved to a rural standard south of 67 Avenue to the Study Area boundary within a 20m right-of-way.

- 180 Street is a 20m dedication width from the Study Area boundary south of 67 Avenue to approximately 500 metres north of 68 Avenue, with a 10m dedication extending north an additional 170 metres to Old Yale Road.

Roadworks exist as a two lane north/south extension from 170 metres south of 67 Avenue to 68 Avenue. A narrow paved local access roadway extends approximately 100 metres north of 68 Avenue. A narrow paved local access extends south from Fraser Highway at Old Yale Road approximately 200 metres. A significant portion of this dedication will not be part of the development road pattern and will, therefore, require closure and/or exchanged with proposed road dedication.

- 182 Street is a 20m dedication width from 68 Avenue to Fraser Highway with portions of roadway north from 68 Avenue and south from Fraser Highway paved for local access. Portions of this road are to be included in the development road patterns (at Fraser Highway and north of 69 Avenue). However, sections crossing the existing North Creek ravine and extending from 68 Avenue approximately 200 metres north will not be part of the development road pattern and may require closure and/or exchange or can be left open as walkway.

- Old Yale Road exists as a 20m dedication, two lane dead-end roadway paved to a rural standard across the north corner of the Study Area connecting to Fraser Highway at 180 Street. Since this connection to Fraser Highway is to be eliminated as part of this NCP, Old Yale Road is to be closed permanently, with some of the land becoming part of the landscape buffer and pedestrian and cycle path.

3.2 Traffic Study

The Traffic Study required as part of the terms of reference for the Engineering Services component of the Neighbourhood Concept Plan, was undertaken by Ward Consulting Group, Traffic Engineering Consultants, and is submitted as a separate document. This report evaluates the area road network under increasing traffic volumes over a nominal 10 year period, estimating normal traffic growth and its resultant impact on the road network as it relates to proposed improvements identified in the current 10 Year Servicing Plan, and by the Ministry of Transportation and Highways (M.O.T.H.). The report then projects the additional increase in traffic volumes generated by the West Neighbourhood (Phase II) Study Area onto these results and identifies the additional improvements required as a result.

3.3 Fraser Highway

Fraser Highway (Highway 1A) is generally a two-lane highway which runs in a south-east to north-west direction and connects Abbotsford and Langley in the east, to the Whalley area of Surrey in the west. In the vicinity of the site, Fraser Highway has a posted speed of 80 km/h with some segments at 60 km/h. Turn lanes are generally provided at key intersections and there are traffic signals at 176 Street, 184 Street, and 192 Street. Within the West Neighbourhood limits, there are unsignalized intersections at 180 Street/Old Yale Road, and at 182 Street. The existing right-of-way varies from 24.4 metres to 39.8 metres wide between 176 Street and 184 Street while increasing to 48.1 metres immediately west of 176 Street. Provision is made in the Neighbourhood Concept Plan for the necessary road dedication to provide an ultimate dedicated right-of-way width of 34.8 metres throughout to facilitate future widening of the road to a full four lane standard (including any additional widening to accommodate turning movements at the 182 Street intersection) by the Ministry of Transportation and Highways.

The development plan provides for the closing off of the existing access to Fraser Highway at Old Yale Road/180 Street, as well as a restructuring of the access at 182 Street to permit right-in/right-out traffic movements only. The Old Yale/180 Street access configuration is currently unsafe and is not necessary to support the land use. The 182 Street access is located less than 500 metres from the controlled intersection at 184 Street and Fraser Highway and, as a result, does not meet M.O.T.H. requirements for intersections with left turn and crossing traffic movements. Access to Fraser Highway from 184 Street is to be maintained under the proposed plan with a future realignment of 184 Street recommended to provide a better angle of intersection with Fraser Highway. For conceptual plans of the proposed realignment refer to Figure 3, and for the proposed access control at 182 Street refer to Figure 4.

3.4 176 Street

176 Street (Highway 15) is a north-south provincial highway which connects Highway 1 to the U.S. Border. It is generally a two-lane rural facility with 2.0 metre gravel shoulders except as it passes through the urbanized area of Cloverdale where it has been widened to a four lane urban cross-section. The posted speed north of 64 Avenue is generally 80 km/h with signalized intersections at Highway 10, 60 Avenue, 64 Avenue and Fraser Highway, and with

channelization at the major intersections with Highway 10, 64 Avenue, and Fraser Highway. South of 68 Avenue the right-of-way varies between 20.1 and 25.7 metres, however north of 68 Avenue adjacent to the Study Area, it is 55.9 metres for most of the length to Fraser Highway. No additional dedication is required or proposed for this roadway adjacent to the Study Area.

3.5 Development Road Pattern

The proposed Concept Plan provides for access roads to the Study Area from 184 Street at 68 Avenue and 67 Avenue, from 176 Street at 68'A' Avenue, and from Fraser Highway at 182 Street (which will be the terminal point for one of the local collector roads that starts at 68 Avenue). 68 Avenue will connect 184 Street and 176 Street and is designated as a major collector road on Surrey's R.91 Grid Road Map (1993).

There is only one internal limited collector road proposed for the Study Area. This road runs briefly north-south as 182 Street from Fraser Highway to 70 Avenue, then east-west as 70 Avenue from 182 Street to 177 Street, and then north-east to south-west as 177 Street to the major collector at 68'A' Avenue. This connection provides local access to and from Fraser Highway for the Development Stage 3 area, as well as access to the park and school on 68 Avenue while ensuring that there is little cut-through traffic.

Completing the road hierarchy, access from the collector road system is provided by an arrangement of through local roads and cul-de-sacs, providing an efficient and balanced layout creating graduated access to the collector, arterial road and highway systems.

Direct access to single family and residential lots is not permitted from Fraser Highway and 184 Street. Lots fronting onto arterial roads will be provided access by means of rear lanes or frontage roads in accordance with Surrey standards.

As described herein, the development of the land use plan for the Study Area does not include the extension of 182 Street north from 68 Avenue to 70 Avenue. In support of the above, a review was undertaken to determine the feasibility of maintaining the concept of 182 Street as a through road across the North Creek. Figure 5 shows a preliminary plot of the existing cross-section on this alignment across North Creek with existing road grades north and south of the existing ravine extended to provide approximate crossing elevations for a proposed road.

The top of bank separation at this location is approximately 70 metres, with an elevation differential of approximately 13 metres from the proposed finished road surface to the bottom of the creek bed.

Two alternatives were reviewed to determine the range of costs and resultant impacts to extend 182 Street across this barrier. Alternative One included the placement of a Superspan® or a Multi-Plate® style arch across the creek, with compacted granular fill above the arch to road subgrade elevations. A variety of culvert/headwall, versus fill slope extension combinations were reviewed in an effort to maximize cost efficiency and minimize impacts to the creek and adjacent riparian corridor. Figure 6, shows road fill extending to the full extent of the right-of-way, then sloping downward at a rate of 2m horizontal for each 1m vertical (2:1).

Although representing the most cost effective construction at $850,000, this alternative requires the enclosure of approximately 55 metres of existing creek bottom and the elimination of approximately 2000 sq.m. of riparian zone. The actual creek enclosure can be reduced somewhat by installing higher arch and headwall combinations, however, the maximum decrease in creek enclosure (23%) requires a 300% increase in arch size resulting in a 40% increase in construction costs to $1,200,000, with minimal benefit to the riparian corridor. Notwithstanding the above, the Ministry of Environment has advised that they are not prepared to accept this degree of loss resulting from this form of crossing alternative at this location.

Alternative Two included the construction of a 69 metre long free span bridge across the ravine from top of bank to top of bank. Typically, this bridge would meet all applicable standards for highway loading and include a 8.5 metre roadway (through local) with 2.0 metre pedestrian walkways on both sides for a minimum total section width of 12.5 metres. The cost of a structure of this type is estimated to be a minimum of 1.6 million dollars.

Notwithstanding cost and environmental considerations, this connection should be left out as shown in the Concept Plan as it ensures that cut-through traffic is discouraged from using it. Internally generated traffic originating from the vicinity of 182 Street/70 Avenue, and travelling to the park and school is still expected to use the internal collector road in order to avoid traffic volumes on Fraser Highway and 184 Street, and delays at the critical arterial intersections. Further, since the M.O.T.H.'s position requires that the 182 Street intersection be restricted to right-

in/right-out only, it becomes desireable to reduce the use of this intersection. Eliminating the 182 Street crossing and direct access to 68 Avenue will effectively limit the use of this intersection.

In view of the above, the Study Area cannot support planning alternatives which include crossing the North Creek with 182 Street.

It should, however, be noted that the proposed arch crossings on both North Creek and South Creek at 177 Street and on a culvert crossing on West Creek at 68A Avenue are consistent with Ministry of Environment policy. On 177 Street, road elevations are proposed at less than 6 metres (see Figure 15) above the existing creek beds which, combined with appropriate arch and headwall heights will minimize the lengths of creek to be enclosed. These lower, shorter crossings also significantly reduce the impact of construction on the adjacent riparian zone. On 68A Avenue the existing creek will be fully enclosed with an arch of appropriate size with Storm and Sanitary sewers passing underneath the crossing. Also note that the existing culvert crossing on 68 Avenue between 179 Street and 180 Street will be extended to facilitate road widening at this location.

All internal roads, including 68 Avenue, will be the responsibility of developers to construct as required through the rezoning and subdivision approval process. Minor variations to the road layout and standards shown may be permitted based on detailed subdivision evaluation. Developers will be required to ensure that subdivision submissions recognize the subdivision potential of adjacent property owners.

3.6 Surrey Capital Works - 10 Year Servicing Plan

A program of major works, intended to facilitate the construction of municipal engineering services required to accommodate existing and projected growth, is provided in the City of Surrey's current 10 Year Servicing Plan. This plan covers the time period from 1993 to 2002 and identifies the following road and highway improvements relevant to the Study Area.

PLAN REF. NO.	ITEM	DESCRIPTION OF WORKS
1007	176 Street - 60 Ave to 64 Ave	Urban Features
1412	64 Avenue - 176 St. to 184 St.	Widen to 4 Lanes
4000	Fraser Hwy - 138 St. to 176 St.	Urban Features
4006	Fraser Hwy - 176 St. to 196 St.	Urban Features
4012	68 Avenue - 180 St. to 184 St.	Ultimate 12.2
4559*	60 Avenue @ 184 St.	Traffic Signal Replacement

* indicates that the works have been completed.

Works noted above have been planned in response to projected growth in the region including the Study Area. Where designated, Urban Features include all road works beyond the limits of the ultimate paved road surface to full urban standard including concrete curb and gutter, sidewalks, boulevard landscaping, and ornamental streetlights. Not included in these works are noise attenuation or landscaping associated with development of adjacent buffer zones.

3.7 External Improvements

The Traffic Study identifies several system improvements necessary to mitigate the impact of traffic growth on the adjacent network resulting directly from development of the Study Area. These improvements are expected to provide safe and efficient access for the larger volume of traffic generated, and are summarized as follows:

ITEM	DESCRIPTION
Intersection of Fraser Highway & 182 St.	Provide right-in/right-out access control for restricted entrance/exit movement and reduction of cut-through traffic.
Intersection of Fraser Highway & 184 St.	Provide widening on 184 Street to accommodate channelization for full turning movements.
184 Street - West Side	Provide sidewalk and streetlighting as development proceeds along Study Area frontage to accommodate the future widening to 4 lanes of this arterial road.
184 Street	Provide widening and painted channel-ization for left turn lanes into the Study Area at 68 Avenue and 67 Avenue.
Intersection of 176 St. & 68'A' Avenue	Provide traffic signals to accommodate controlled access to the Study Area from 176 St. and to allow for safe north and south access to 176 Street from 68'A' Avenue includes widening of 176 Street and southbound left turn lane east onto 68'A' Avenue.

In addition to the works noted above, the Traffic Study identifies several regional improvements required for background traffic needs with recommendations for construction by 2004. The timing of these works coincides approximately with the projected completion of development within the Study Area, and, where appropriate, consideration should be given to the inclusion of these works in subsequent 10 Year Plan revisions. These works include:

- Additional westbound and eastbound through lanes at the Fraser Highway/168 Street intersection. The current 10 Year Plan includes urban features for a section of Fraser Highway from 138 Street to 176 Street as Ref. No. 4000. Widening to accommodate requirements would be

undertaken by M.O.T.H. in conjunction with the construction of these Urban Features;

- Additional northbound and southbound through lanes on 176 Street at 60 Avenue. The current 10 Year Plan includes Urban Features on 176 Street from 60 Avenue to 64 Avenue as Ref. No. 1007. Widening on 176 Street by M.O.T.H. to be completed in conjunction with Urban Features;

- Additional left-turn lanes on 176 Street north and south of Fraser Highway. To be undertaken by M.O.T.H. in conjunction with Urban Features on Fraser Highway referenced as No.'s 4000 & 4006 in the current plan; and

- Second eastbound and westbound through lanes on 64 Avenue at 184 Street. To be completed by the City of Surrey as part of 10 Year Plan Ref. No. 1412 which provides for the construction of 64 Avenue from 176 Street to 184 Street to ultimate 19 metres in width.

Works noted herein that relate to Ministry of Transportation and Highways improvements are not proposed for, and are not eligible for addition to the 10 year plan.

The works identified in this section are in addition to improvements proposed as part of the North Cloverdale East Neighbourhood Stage II report. No changes are proposed or forecast for the timing of works suggested in that document.

3.8 Internal Road Classification & Design Standards

Road classifications proposed for the internal road network are shown in Figure 7, and are grouped into the following categories:

ROAD CLASSIFICATION	DEDICATION REQUIREMENTS(M)	PAVEMENT WIDTH (M)	SIDEWALKS
ARTERIAL	27	19 (includes 4.4 median)	2
MAJOR COLLECTOR	20	12.2	2
COLLECTOR	20	11	1
THROUGH LOCAL	20	8.5	1
LIMITED LOCAL	16.5	8	0

As previously referenced, the Concept Plan provides for the protection of a dedicated width along 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 184 Street. This is consistent with proposed dedication requirements noted in the East Neighbourhood Stage II Report. A conceptual layout for the Fraser Highway and 184 Street intersection, illustrating a potential configuration within the proposed road dedication, is shown in Figure 3. Confirmation of final roadway alignment and dedication requirements for Fraser Highway, as well as 184 Street immediately north and south of the intersection, will be required at the time of detailed design.

The Concept Plan also provides for the future widening of 184 Street to full arterial standards along the site frontage and allows for a dedicated width requirement from existing centre line of 13.5 metres. Combined with a similar requirement proposed for the East Neighbourhood Study Area, this will permit a full four lane divided arterial road standard including turning movements at designated intersections. Dedications and design cross-sections are to be in accordance with the City of Surrey Engineering Department book of Standard Drawings, specifically Supplementary Standard Drawing SSD-R11 for arterial roads and Supplementary Standard Drawing SSD-R9 for the major collector, through and limited local roads. All proposed roadways within the Study Area are to accommodate the City's "urban forest" road standard. Where development is required to construct half-roads, these works shall be in accordance with Supplementary Standard Drawing SSD-R14, and, where existing roads are to be widened, these works shall be in accordance with current City of Surrey widening policy.

One exception to the above criteria is the proposed treatment of 68 Avenue adjacent to the school and park. The width of paving through this area is proposed to be reduced to 9.0 metres and the frequency of street tree planting is to be increased. However, this proposal must be reviewed with the School District and Surrey's Traffic Engineering Department prior to the commencement of detailed design, as ultimate parking arrangements and traffic circulation for the future school should be addressed at that time. Further, pedestrian crossings through this area, including the intersections at 181 Street, 182 Street right-of-way, and 183 Street are to be identified with a contrasting textured paving. It is anticipated that these changes will contribute to reduced vehicular speeds making the school and park zone safer as noted in the Traffic Study. For typical cross section and textured paving details refer to pages 18 and 19.

Proposed residential lots fronting 184 Street will not be permitted front access as per Surrey criteria governing arterial roads. These lots will be serviced by rear lanes in accordance with City Supplementary Standard Drawing SSD-R17. Any variation of this standard will require a Development Variance Permit prior to subdivision. Proposed multi-family lots fronting Fraser Highway will not be granted direct highway access and will require consolidation or reciprocal access easements in order to provide frontage to non-arterial roadways. Multi-family access points are shown conceptually on Figure 1. The construction of 184 Street to 19.0 metre arterial standard may preclude the conceptual location shown on Figure 1 for access to the proposed multi-family site north of 68 Avenue. It is suggested that this access would be better suited approximately 45 metres north of its present alignment. This will permit full directional access and egress for the site once left-turn channelization has been completed on 184 Street northbound at Fraser Highway, and southbound at 68 Avenue. In order to permit safe left-turn movements into the proposed site a northbound left turn bay must be provided on 184 Street in conformance with the ultimate divided arterial standard. Costs associated with this work, including rights-of-way if necessary, will be the responsibility of the developer of this site. Minimum criteria for back-to-back left turn channelization and storage requirements, to be confirmed at the time of application for building permit and/or servicing agreement, will determine the final location of this access. Some flexibility exists such that minor shifts in location of the access north or south are possible. However, the final location must conform to Surrey requirements for the ultimate channelization of 184 Street. Locations significantly removed from the alignment suggested above may be subject to right-in/right-out turning movement restrictions.

The Concept Plan identifies one through local road (70B Avenue/181 Street) with a right-angle alignment, typically permitted only for limited local roadways. This road is intended to provide access to local traffic only, servicing less than 30 lots, and this alignment should result in reduced traffic and vehicular speeds through this area. Otherwise, roadway design standards shall conform to Table 2.5.1.4 of the Design Criteria Manual, Roadway Design Standards, of Surrey Subdivision Bylaw. Where through local roads front multi-family designated land uses, Schedule A of the Surrey Subdivision Bylaw requires that these roads have a minimum 11.0 metre pavement within a 20.0 metre dedicated roadway. The only exception to this requirement may apply to the 68 Avenue school/park zone narrowing as it fronts proposed multi-family land use between 181A Street and the 182 Street pedestrian walkway alignment, as identified above.

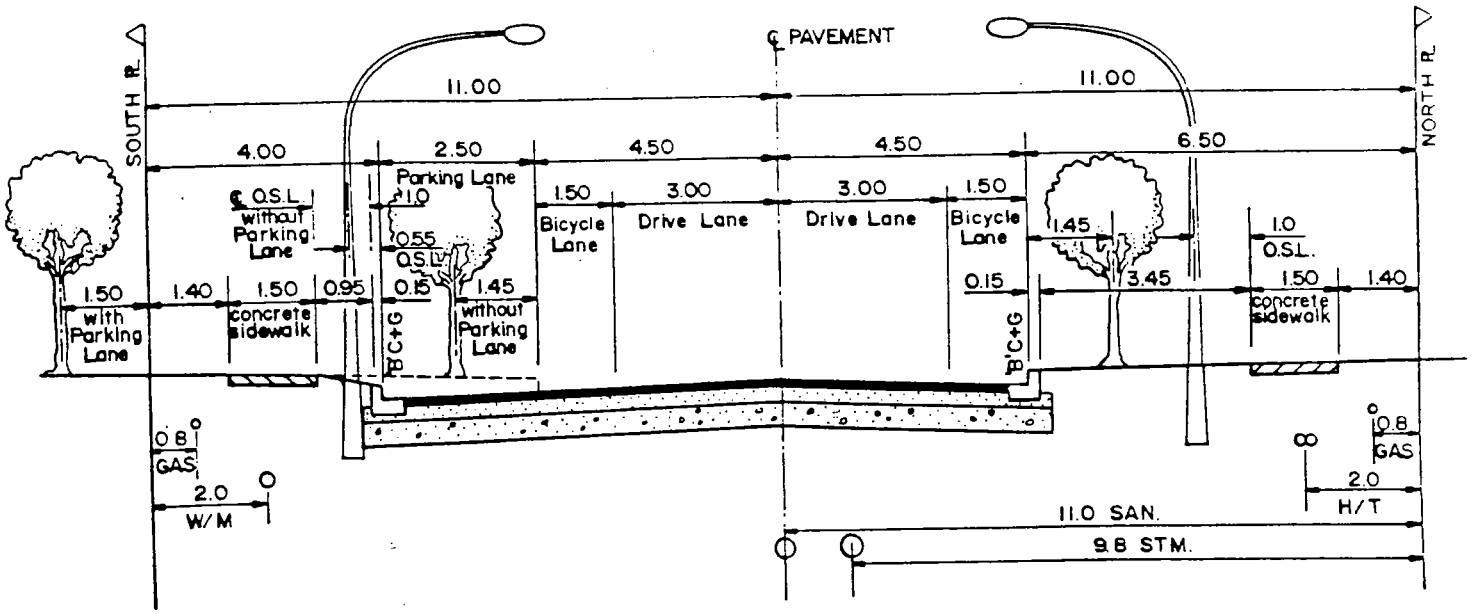
All lighting levels are to conform to Table 2.7.1 Street Light Spacing, as noted in the Design Criteria Manual.

3.9 Public Transit

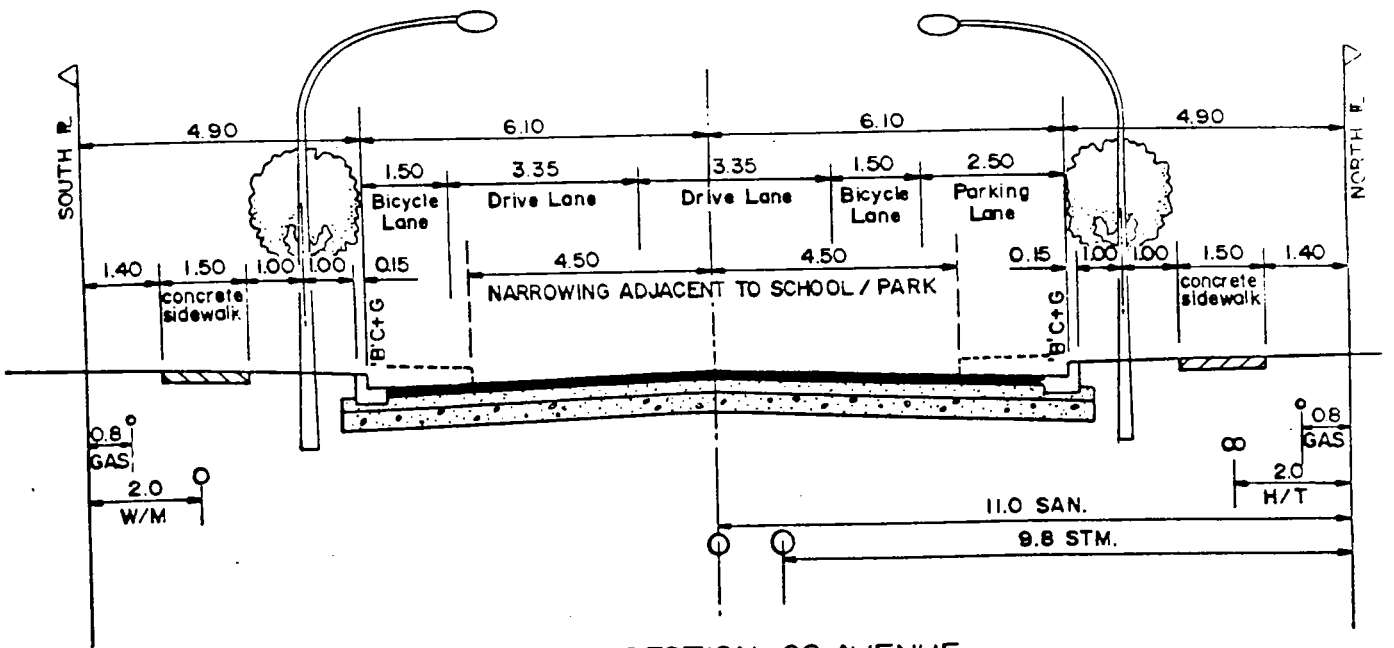
As described in the Traffic Study the Concept Plan has been reviewed in the context of B.C. Transit's publication *LAND USE PLANNING* and is considered to be compatible with any future transit routes that may be proposed in the Study Area. B.C. Transit has indicated that they have no current plans for any new or modified routes. The Concept Plan provides for sufficient pedestrian corridors within the Study Area to permit easy access to possible future transit routes from any region of the Neighbourhood. If Transit chooses to expand it's present level of service once the Study Area has been completed, the 68/68'A' Avenue Corridor would make an appropriate transit route.

3.10 Hydro, Tel, and Gas

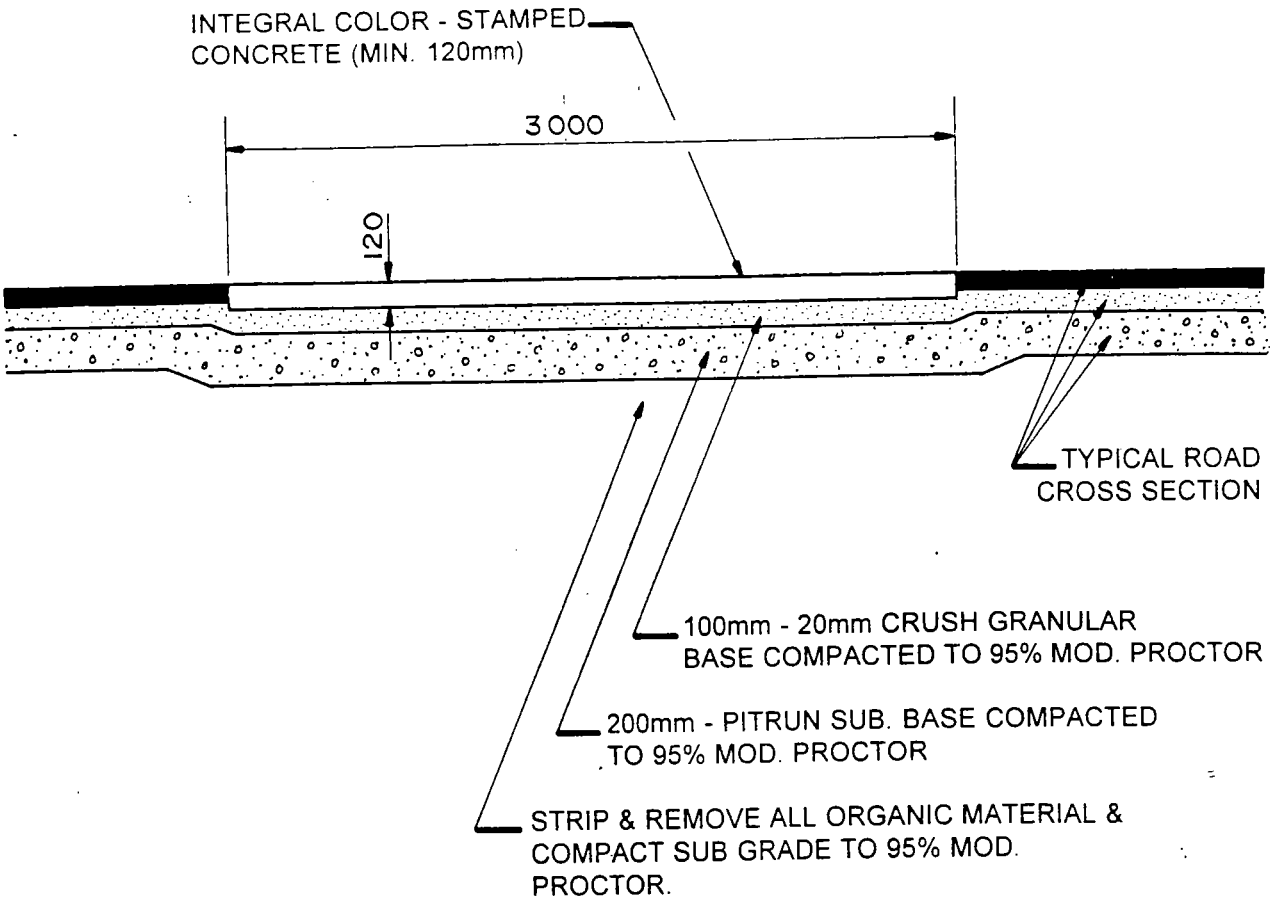
Expansion of development into the Study Area from 184 Street is consistent with existing B.C. Hydro, B.C. Tel and B.C. Gas. long range planning for infrastructure expansion associated with the North Cloverdale, West Neighbourhood NCP.



TYPICAL SECTION 68 AVENUE ADJACENT TO SCHOOL / PARK



TYPICAL SECTION 68 AVENUE



CONCRETE PAVEMENT CROSSING DETAIL
N.T.S.

1) GRADE SUBGRADE TO ALLOW FOR FULL DEPTH OF GRANULAR UNDER COLOR STAMPED CONC.

2) BASE ASPHALT AND FINAL ASPHALT TO BE PLACED CONTINUOUSLY THROUGH PROPOSED PAVEMENT CROSSING. ONCE FINAL LIFT PLACED & PRIOR TO FINAL APPROVAL, CONTRACTOR TO SAW CUT & REMOVE ASPHALT AT CROSSING, AND GRADE BASE TO PROVIDE FULL 120mm DEPTH COLOR STAMPED CONC. PAVEMENT CROSSING.

3) INTEGRAL COLOR-STAMPED CONC. TO BE 30M.P.A. FIBRE MESH REINFORCED BROWN COLORED CONC. PER "KEM-TECH. CONC. SYSTEMS LTD." (TYP) STND. COLOR BROWN AND TEXTURE CONFORMING TO "LONDON COBBLESTONE", OR APPROVED EQUIVALENT.

4) FINISHED SURFACE TO HAVE SURFACE TREATMENT OF SILICON CARBIDE AND BE SEALED WITH WATER BASED SEAL COAT - "BARRIER PRODUCTS LTD." OR APPROVED EQUIVALENT.

B.C. Tel has advised that they will require a secured site in order to place a 56 square metre (600 sq.ft.) building as required to facilitate the extension of telephone servicing into the Study Area. The preferred locations provided by B.C. Tel coincide with the park/school site frontages on 68 Avenue. We have identified a suggested site on Figure 8, however, final site determination is subject to approval at the time of subdivision application. B.C. Tel has also indicated they would prefer to install their underground support structure (conduit system) prior to any development in the Study Area. However, existing roads and rights-of-way do not facilitate the pre-installation of these works in their ultimate location, and these installations will be deferred until development permits.

B.C. Gas has advised that they have no immediate concerns with servicing the proposed area. Additions or improvements to their distribution system will be designed as development occurs and will consider the requirements of the overall Study Area.

Single phase overhead Hydro distribution service exists on the north side of Fraser Highway west of 184 Street to approximately 177A Street, and three phase overhead feeder service exists on the east sides of both 176 Street and 184 Street adjacent to the Study Area. B.C. Hydro has confirmed that this existing infrastructure is adequate to service the future needs of the Study Area and, except for the requirement for both Feeder and Distribution mains on 68 Avenue (from 176 - 184 Street), have no immediate concerns. All extensions of service into the N.C.P. area for both single and three phase power will be underground. Further, existing overhead single phase Distribution fronting proposed development, within the Study Area, will be converted to underground at the time of development of the affected frontage. Developments fronting the perimeter arterial roads will also be required to install secondary underground distribution service along the developed frontage however, the existing overhead Feeder and Distribution networks on 176 Street, Fraser Highway, and 184 Street are to remain. This is consistent with current B.C. Hydro policy, and City of Surrey practice, in this regard.

In order to accommodate the installation of the 68 Avenue system, two options are available. The first requires that the ultimate dedication on 68 Avenue be increased by a minimum of 0.6m on the north side for a total dedicated width of 22.6m. This would allow installation of proposed surface hardware by maintaining a 2.0 metre separation between the future sidewalk and the property line. The

second option reuqires that "cut-outs" be provided approximately every fourth (4) lot to accommodate this same hardware. This alternative does not require further dedication in addition to the 22 metres noted in Section 3.8, with placement of the underground conduit system consistent with Surrey Standard drawings (refer to page 18).

B.C. Hydro has also advised that the provision of service to the Study Area will require the installation of a major switching station. This surface structure will require a right-of-way approximately 5m long by 3.5m wide. One suggested location for this structure is on the west side of 184 Street approximately 35-40 metres north of 68 Avenue at the interface of the proposed residential and multi-family lots. Alternatively, this facility could be located on 68 Avenue at the eastern limit of the proposed school frontage. Both are shown conceptually on Figure 7. Planning associated with applications fronting 68 Avenue must account for these requirements. Calculated plans submitted in support of affected development applications must be prepared in consultation with B.C. Hydro to ensure that these issues have been resolved.

3.11 Pedestrian & Cyclist Circulation

Pedestrian circulation within the proposed plan is encouraged through the development of generous pedestrian paths which will permit walking access to natural areas, parks and schools, as well as easy access from the local road network to possible transit routes, Fraser Highway, and the arterial road system. The Concept Plan for the Study Area identifies a number of continuous pedestrian walkways throughout the Neighbourhood as well as bicycle paths (Figure 9). As proposed in the L.A.P., the plan provides for a fifteen metre wide landscape buffer and pedestrian path system along Fraser Highway. This pedestrian/cyclist pathway proposed is a 3.0 metre wide asphalt walk which is consistent with the proposal for the East Neighbourhood NCP. Detailed design of these pathways should incorporate adequate access through the buffer to the NCP lands and to Fraser Highway. A portion of the Old Yale Road is to be included in this network with the existing pavement retained in current condition.

The existing pedestrian system created as part of the subdivision south of the 66A Avenue alignment will be connected to the Study Area at the 182 Street alignment through to 67 Avenue. This will provide easy access for children from this area to walk or bike to the new school proposed as part of this NCP. Linkages are also proposed at the west edge of the Study Area that may support an

equestrian/community centre. Pathways are proposed along the ALR border to the west, and the B.C. Hydro right-of-way to the south-west. The pathway within the Hydro corridor is a part of the Core Network identified in the Bicycle Blueprint. These pathways should also form, in part, an equestrian riding trail and provide a means of integration of the proposed equestrian/community centre into the community plan. All pathways in the Hydro right-of-way, along the ravine, and in dedicated areas associated with the cluster developments, are proposed as crushed limestone surfaces, and are proposed to be 3.0 metres wide.

The Concept Plan also provides for a walkway link on the 182 Street alignment north from 68 Avenue to 70 Avenue, and continuously along the North Creek north top of bank from 184 Street at Fraser Highway through to the ALR perimeter walkway in the west. The 182 Street walkway will require a pedestrian bridge crossing of the North Creek ravine. The scope of this crossing will require that a series of stairs and landings be constructed down the ravine banks to a suitable crossing elevation to both minimize disruption to the ravine environment, and provide a means of passive access to this natural area. The cost of this structure and approach is estimated to be $195,000, and is detailed in the amenities report prepared and submitted as Section 8. This crossing will not be required until Development Stage 3 proceeds in approximately 2001. As indicated in Section 8, "NCP Preparation Costs and Amenities", the crossing will benefit the entire neighbourhood as a park amenity and, as a result, construction funding will be a neighbourhood responsibility. The estimated cost of $195,000 represents a per unit cost of $146.18, to be provided by each separate applicant at the time of subdivision approval. A preliminary profile of this crossing is shown on Figure 10.

The top of bank trail along the north watercourse is proposed to be located within the setback area. In order to keep this trail as unobtrusive as possible, it is proposed to be constructed as a 3.0 metre wide crushed limestone walkway. Although the Ministry of Environment (M.O.E.) does not consider extensive trail systems within no-disturbance setbacks as complimentary land use, the narrower width will permit easier meanderings of the walkway, avoiding existing trees and providing a more natural walking environment. However, the possibility does exist that the location of this walkway may require rights-of-way to be registered beyond the restrictive covenant boundary required by M.O.E. Applications adjacent to the proposed walkway may be required to facilitate these requirements at the time of approval by the M.O.E.

Walkways linking perimeter and top of bank walks to the neighbourhood road system, and which pass between residential lots, or through designated walkways will be constructed in accordance with standard walkway detail drawing C10 of the Master Municipal Specifications. It is suggested that lighting be installed along walkways in those areas that are not serviced by roadway streetlights.

3.12 Cost Estimates - Major Works

The construction costs of the major works for the external improvements identified in Section 3.7 as resulting from development of the Study Area are estimated as follows:

ITEM	DESCRIPTION	COST
1.	Add sidewalk and streetlighting Frontage 184 Street.	$ 148,000
2.	Add widening and painted channel-zation for left turn lane on 184 Street west to 68 Avenue.	$ 150,000
3.	Add widening and painted channel-ization for left turn lane on 184 Street west to 67 Avenue.	$ 150,000
*4.	Add traffic signals and southbound left turn lane on 176 Street at intersection of 176 Street and 68'A' Avenue.	$ 467,000
*5.	Add right-in/right-out access control on 182 Street at Fraser Highway.	$ 325,000
6.	Add widening on 184 Street to accommodate channelization for full turning movements. (Approx. 69 Ave - F. Hwy.) (Full cost of Realignment - 850,000)	$ 340,000
	TOTAL	$1,580,000

* Denotes items that are not 10 Year Plan Elements, and are not eligible for cost sharing by Surrey. Item 5 is the responsibility of the N.C.P. Study Area as detailed in Section 3.13 "Phasing and Implementation".

These preliminary estimates are expressed in current dollars and include allowances for contingency, engineering, Surrey overhead and administration and "net" G.S.T. as detailed in Section 7 of this report.

Item 3 does not include the road widening on 184 Street as this has not been identified in the Traffic Study as a requirement necessitated by development of the Study Area.

3.13 Phasing and Implementation

As noted throughout various sections of this report, development is expected to proceed according to the stages shown in Figure 2. Although the site is bounded on three sides by arterial and regional network roads, initial stages of development will require the construction and widening of major segments of 68 Avenue west from 184 Street. These roadworks will be undertaken by each developer as required. Section 3.6, Surrey Capital Works - 10 Year Servicing Plan, identifies an element of this road from 184 Street to 180 Street as included in the current Servicing Plan with widening proposed to the ultimate 12.2m pavement section. As developers undertake this construction, they will be eligible for Development Cost Charge (D.C.C.) rebates for widening in accordance with current Surrey policy. A section of 68 Avenue between 180 Street and 179 Street, which exists as a standard 6m half-road is proposed to be included in Surrey's current 10 Year Plan review and reflected in a new D.C.C. Bylaw in early 1996. Once included, this element will also be eligible for D.C.C. Rebate. The portion of the 68 Avenue/68A Avenue major collector from the 179 Street alignment to 176 Street, scheduled for construction as a part of Development Stage 2B, is not presently eligible for Surrey cost sharing.

It must be noted that, as a requirement of this NCP, 68 Avenue must be constructed to a minimum half-road City standard from 180 Street to 176 Street prior to, or as a condition of, the commencement of any development in the areas defined as Development Stage 2B and Development Stage 3. The extension of 68 Avenue west of 178 Street is not required for Development Stages 1 or 2A.

For those existing sections of 68 Avenue east of 179 Street, fronting developers must, in all cases, prove the adequacy of a minimum 6m existing road. Widening, curb and gutter, sidewalks and streetlights to 12.2m is accepted for D.C.C. rebate up to the value of the works, or major collector D.C.C. paid, whichever is lower. These requirements apply to both sides of 68 Avenue.

As 68 Avenue is gradually extended west beyond 180 Street, it may become necessary for individual developers to provide secondary access where development requirements exceed the maximum allowable road lengths for single access. Costs associated with any interim secondary access provisions are the responsibility of the developer, with no compensation implied or forthcoming from the City. Where secondary access is provided in the form of either a full or half-road along the ultimate alignment, these works would be eligible for cost recoveries through the standard Latecomer process.

At this time there is a major development application within the Study Area which is being processed through the Surrey Planning and Development Department. This application encompasses a significant portion of the area defined as Development Stage I, and development is expected to proceed on a phased basis through 1996 and 1997. The Traffic Study has concluded that the existing external road system, with improvements as noted, will accommodate development of the lands. Assuming that current and proposed development applications proceed as anticipated, the following table summarizes the projected scheduling of construction for external Roadworks improvements:

ITEM	DESCRIPTION	DEVELOPMENT STAGE	YEAR
1	Sidewalk and streetlighting - Frontage 184 Street.	1 & 2A	1996 to 1999
2	Left turn lane on 184 Street west onto 68 Avenue.	1	1997
3	Left turn lane on 184 Street west onto 67 Avenue.	2A	2000
4	Traffic signals and left turn lane on 176 Street at 68'A' Avenue.	2B	1999
5	Access control on 182 Street at Fraser Highway.	3	2001
6	Widening on 184 Street intersection south of Fraser Highway.	3+	2005 +

Notwithstanding the above, warrants will be established by the Traffic Consultant which would establish a threshold for implementation of the above-noted works with the rate of development monitored to provide a more accurate forecast of the timing of each item.

Works noted above as Item 1 include sidewalks and streetlighting on the west side of 184 Street from Fraser Highway south to the Study Area boundary. Development applications in Stages 1 and 2A fronting 184 Street will construct these works at Surrey's request funded by Development Coordinated Works and concurrent with construction associated with site development for each application. However, since ultimate road widening will eventually be required on 184 Street, these works could be done by the Capital Program at Surrey's discretion.

The left-turn bays noted for 184 Street at 68 Avenue (Item 2) and at 67 Avenue (Item 3) are,subject to Council approval, proposed as an addition to the current 10 Year Plan to be reflected in a new D.C.C. Bylaw in early 1996. Should an interim solution be required by the Study Area before the City has funding in

place, costs associated with interim construction will be the responsibility of developers within the N.C.P.

Left-turn bay construction on 176 Street at 68A Avenue (Item 4) is to be undertaken by the Ministry of Transportation and Highways since these works are not included as 10 Year Plan elements and, as a result, not eligible for cost sharing by Surrey. However, the signalization component of this work is available for cost sharing between MOTH and the City. Additional works that may be required on 68A Avenue at this location will be the responsibility of the development constructing 68A Avenue. These works will not be required until the completion of Development Stage 2B, estimated for 1999. MOTH has given verbal approval to a signalized intersection at 176 Street and 68'A' Avenue, and advised that care must be taken to ensure that adequate sight lines and safe stopping distances are applied to the design of this intersection.

The suggested realignment of 184 Street at the Fraser Highway intersection as shown in Figure 3 is not a required element for Phase II (West Neighbourhood) but may be required once both Phase I (East Neighbourhood) and Phase II Study Areas have been completed, and once development is initiated north of Fraser Highway. Ultimate development of the arterial intersection will include 4 travel lanes plus north and south left turn lanes, with realignment to reduce the angle of deviation of this crossing to a maximum of 15 ° from the perpendicular, per MOTH guidelines. Improvements at this intersection were not identified in the North Cloverdale East Neighbourhood NCP, and it is expected that they would not be required until both NCP Study Areas have been completed and development commences north of the Highway. However, the completion of Development Stages 1 through 3 would trigger the widening on 184 Street south of Fraser Highway to accommodate ultimate channelization for full turning movements and future realignment at this intersection. The major impact of this proposal is to properties north of the Highway. The alignment shown in Figure 3 was chosen to minimize the impact of construction on the existing north watercourse and, east of 184 Street, on the proposed community detention pond. Widening and realignment (Item 6) south of the highway can be accomplished without an immediate major restructuring north of the intersection. The use of interim through and turning lane markings will allow construction south of the highway and permit construction north of the highway to be deferred until that area developes. In this way, dedications and road exchanges become a part of the development process, eliminating the requirement for costly and protracted negotiations for land acquisition. These arterial works should be included in the revised 10 Year Plan for future construction so that they are provided for in an amended Development Cost Charge Bylaw.

Item 5 includes the construction of right-in/right-out access control and deceleration lane for the 182 Street/Fraser Highway intersection and is shown conceptually in Figure 4. These works are the responsibility of the NCP and the Ministry of Transportation and Highways, and as such, are not 10 Year Plan elements, and are not eligible for cost sharing by Surrey. These works will not be required until Development Stage 3 initiates construction of the local collector link from 68A Avenue to Fraser Highway. As noted elsewhere in this report, the area defined as Development Stage 3 will require a major player(s) in order to proceed given the relative distance of the main development area from both 68'A' Avenue and Fraser Highway. Further, to provide adequate access to this area in conformance with current Surrey criteria governing the maximum length of single access roadways, the access control at Fraser Highway and 182 Street must be constructed by the "first-in" developer. The estimated cost of $325,000 is to be pro-rated equally over the total benefitting units (573) in Stage 3, resulting in a contribution of $570 per unit. This contribution is payable by each individual applicant within Development Stage 3 as a condition of Servicing Agreement. Funds collected are to be administered by the City and refunded to the front ender as available.

The current 10 Year Plan also identifies urban features on Fraser Highway. The scope and timing of these works will be addressed by Surrey. However, landscaping and noise attenuation/buffering elements are not included in Surrey works and are the responsibility of the NCP, to be constructed by development as adjacent applications proceed to construction.

In the event that development proceeds to a point where the implementation of any of the works is required prior to an amendment to the 10 Year Servicing Plan, individual developers would have to consider the impact of constructing works at their cost in advance of eligibility for D.C.C. rebates.

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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 on 72nd Avenue west of 192nd Street. This station pumps from the Clayton Hill Reservoir, which is fed by the GVRD bulk regional water system. The Study Area is mainly within the 90 metre HGL pressure zone, with a portion of the site fronting 184th Street within the 115 metre pressure zone. The area is serviced from the pump station by an existing 300mm diameter grid main on 184th Street, as well as a 500mm diameter feeder main on 176th Street. There is an existing 250mm diameter watermain extended west on 68th Avenue approximately 260 metres from 184th Street, as well as 200mm and 250mm diameter mains on 68th Avenue, 180th Street, and 67th Avenue which are extensions of the existing local network on Clayton Hill Drive, south of the Study Area. The City has advised that an upgrading of the Clayton Hill Pump Station has been provided for from the DCC anticipation from other projects. Also proposed for immediate construction is a major PRV station on the 500mm diameter steel watermain on 176 Street at the proposed 68'A' Avenue alignment. This will result in the elimination of the proposed PRV station shown in the Stage I report on 68'A' Avenue immediately east of 176 Street.

The existing water distribution system servicing the Study Area is shown on Figure 11.

4.2 Development Demands

The land use designations identified in the Neighbourhood Concept Plan will impose additional water supply demands on the existing municipal water supply system. These demands were calculated based on the proposed land uses with saturation population projected from the North Cloverdale West Neighbourhood (Phase II), Stage I NCP Report, and fire flow requirements consistent with the City of Surrey, Engineering Department, "Design Criteria Manual" as follows:

A. Domestic

Average Daily Demand	23.8 litres/second
Maximum Peak Demand	47.6 litres/second
Peak Hour Demand	95.2 litres/second

B. Fire Flow

Traditional Single Family	60 litres/second
Multiple Family Townhouse	120 litres/second
School	120 litres/second

Although fire flows are based upon the Design Criteria, individual applicants for multi-family sites may find that Surrey Building Division and Fire Department requirements for on-site fire protection exceed the capacity of the proposed watermain to supply. Prior to submission for Building Permit, the applicant must confirm the on-site fire flow requirements that are triggered by the proposed building layout, materials, and construction. In those cases when the grid system cannot provide sufficient flow volumes to conform to the "*Fire Underwriters Survey Guide to Recommended Practice*", the applicant shall demonstrate through alternative construction techniques, materials, or secondary on-site fire suppression systems (ie. building sprinklers) that the proposed development can be made to conform to these guidelines.

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 projects. This schedule includes four (4) significant improvements within the Study Area.

The City has anticipated the service requirements of saturation development and has designated a grid network within each supply zone of all mains 250mm diameter and larger. The ultimate grid map identifies the requirement for a 250mm diameter main on 68 Avenue to connect the existing 500mm diameter watermain on 176 Street to the existing 300mm diameter watermain on 184 Street. This grid map serves as a guideline that provides the minimum acceptable requirements for development. The City of Surrey, through preparation of the 10 Year Plan, has identified grid mains within the Study Area that exceed the guidelines noted above as follows:

Plan Ref. No.	Item	Description of Works
1463	68 Avenue: 182 - 183 St.	250mm dia main
2412	68 Avenue: 176 - 180 St.	350 mm dia main (40% SHARE)
3600	180 Street: 66 - 72 Ave	300mm dia main
3601	182 Street: 68 - 72 Ave	350mm dia main

4.4 Proposed Distribution System

In conformance with the City grid map and current 10 Year Servicing Plan elements, grid mains will be extended west from the existing 300mm diameter grid main on 184 Street through to the existing 500mm diameter feeder main on 176 Street, providing a system adequate to meet domestic and fire flow demands in the Study Area.

The proposed system identified on Figure 11 shows the conceptual layout of the water distribution system within the Study Area based on the land use and road patterns as provided in the Neighbourhood Concept Plan. This layout provides for grid mains generally in conformance with both the grid map and the 10 Year Plan, including new 350mm and 300mm diameter mains on 68'A' Avenue/68 Avenue from 176 Street to 179 Street; a 350mm diameter watermain along the 177 Street/70 Avenue corridor from 68'A' Avenue to Fraser Highway; 300mm and 350mm diameter watermains along the north site perimeter on Fraser Highway east and west of 182 Street. Pressure zones will be separated through the use of pressure reducing valves (P.R.V.'s) and closed valves.

Local mains range in size from 200mm to 250mm diameter, depending upon the governing land use being served.

4.5 Hydraulic Network Analysis

The design criteria established by the City of Surrey for watermain design requires that the proposed mains be capable of operating under the following conditions:

Demand Condition	Residual Head	Maximum Main Velocity
Peak Hour Demand	28 metres	--
Maximum Day Demand plus Fire Flow	14 metres	2 metres/second

The distribution system proposed for this study area was analyzed in accordance with the above criteria. Critical locations on the network were assigned node numbers as shown on Figure 11. System analysis was initiated based on the City's simplifying assumption, as permitted in the Design Criteria, which allows calculation of the starting hydraulic grade level at 70% of the available static head

in the off site grid mains on 176 Street and 184 Street. Where feeder or major grid mains start from a pump station or PRV station, the input head is the discharge head at the station.

Since the fire flow condition is the determining criteria for watermain design in this application, fire flows were allocated at critical locations throughout the system and the residual head at these nodes was verified. Nodes have typically been located adjacent to Multi Family sites which have the highest fire flow requirements within the Study Area. Details and results of the network analysis are included in Appendix II.

4.6 Cost Estimates - Grid System

Of the four (4) major grid watermains identified in the 10 Year Plan that are scheduled for construction and fall within the Phase II Study Area, three are proposed for construction through roadways that will no longer exist in their present form once development proceeds. Since the phasing of the Study Area is expected to proceed in a manner consistent with the timing and intent of the current 10 Year Plan, it is proposed that three of the references identified in Section 4.3 (#2412, 3601, and 3600) be discharged from the current plan and replaced with new items identifying oversizing and/or DCC rebates for the revised grid system. Typically, where mains do not exist within existing road dedications (either improved or unimproved), the 10 Year Plan should be revised to reflect oversizing costs associated with the extension of grid mains in these areas. Where proposed development is serviced by an existing watersystem, the construction of grid mains should be included as DCC rebatable items.

The fourth reference noted (1463) identifies the construction of a 250mm diameter grid watermain to complete the section of main on 68 Avenue between approximately 181'A' Street and 183 Street. This item should remain in the 10 Year Plan as construction of this section of main will be required during the early phases of Development Stage I and, if initial applications do not include multi-family or other high demand components, could be eligible for upsizing.

The method of allocation of funds would depend upon the existing and future requirements for water improvements in the Study Area. There are three initial conditions that will determine the manner in which funding is applied.

4. WATER SUPPLY & DISTRIBUTION

1. Road allowances with existing development identified in the NCP as exempted from the urban single family category (exist R-A and RA-G): These developments are currently serviced with watermains sized to accommodate an RF zone. Any installation of grid mains in these areas would be fully rebatable, as adequate water exists for the current use (including 180 Street from 66A Avenue to 68 Avenue, 67 Avenue from 180 Street to 181 Street, and the south side of 68 Avenue from 181 'A' Street to ± 179 Street).

2. Road allowances with proposed development already serviced by adequate water supply: The installation of grid mains in these areas would also be fully rebatable since, based on current Surrey Design Criteria Manual requirements, existing mains will accommodate the proposed zoning at these locations (including the north side of 68 Avenue from 181 'A' Street to ± 179 Street, and 68 Avenue from ± 183 Street to 184 Street).

3. New road allowances with proposed development and no existing watermains: Funding for the installation of grid mains in these areas would be based on current Surrey policy for oversizing from a nominal 200mm diameter to the grid main size proposed as part of the overall system. Reimbursements will not be considered for incomplete systems with interim conditions requiring mains larger than the nominal requirement. Any upsizing to accommodate development based on interim flows would be at the developers expense.

Where mains have been identified as "fully rebatable" (ie. items 1 and 2), it is understood that, in accordance with Surrey policy, these costs are refunded to developers from Development Cost Charges, provided that main size is not a requirement to deliver interim fire flow to a specific development. It is further understood, that the recovery of D.C.C.s by development cannot exceed the total of D.C.C.s paid for that particular utility under each separate application and that costs incurred in excess of this recovery are the responsibility of the development.

The estimated costs for these works in excess of the costs of the construction of the nominal size main, or in addition to existing network mains are as follows:

DEVELOPMENT STAGE	ESTIMATED UPSIZING COSTS	DEVELOPMENT COST CHARGE REBATES	TOTAL EACH STAGE	PROJECTED CONSTRUCTION
STAGE 1	$ 4,950	$ 50,000	$ 54,950	1996 To 1999
STAGE 2 (2A & 2B)	$ 6,600	$ 50,000	$ 56,600	1999 To 2000
STAGE 3	$ 26,550	$ 361,350	$ 387,900	2001 To 2005
TOTALS	$ 38,100	$ 461,350	$ 499,450	

It must be noted that, as mains are extended progressively within the Study Area without looping, individual developments may require mains larger than the nominal size to meet fire flow demands. In these instances, upsizing contributions would be based upon the difference between the larger size and the ultimate size so that total upsizing costs may be less than the values noted herein once servicing has been completed.

Conversely, where individual applications do not include multi-family or other high demand components, upsizing would be based on the difference between a smaller size and the ultimate size such that total upsizing costs may be greater than the values noted herein on completion of servicing.

4.7 Phasing & Implementation

Although the Study Area is bounded by existing grid and feeder mains on 184 and 176 Streets respectively, development phasing is expected to proceed westerly from 184 Street along 68 Avenue. Watermain will be extended in accordance with the conceptual layout plan shown in Figure 11 by each developer as required. As each application proceeds through the process, it will be required to prove 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.

There are several applications pending for properties within the area identified as Development Stage I, which will extend along 68 Avenue from 183 Street to approximately 179 Street. These applications will be required to extend and upgrade the ultimate system west from 183 Street and it is anticipated that these works will be installed by the appropriate Developers during 1996 and 1997.

4. WATER SUPPLY & DISTRIBUTION

As development continues through Development Stages 2A & 2B, the 68 Avenue watermain will be extended west to connect to the existing feeder main on 176 Street. Mains will also be installed along 67 Avenue as development extends west from 184 Street and on 180 Street to connect the Stage 2A and Stage 1 systems, thus completing the ultimate network for the southern half of the NCP area. These works are projected to be installed by development from 1997 to 1999. In order to encourage these initial Development Stages, it is recommended that the current 10 Year Plan be amended to include works identified as upsizing or DCC rebatable components on Figure 12. Further, the two Pressure Reducing Valve (P.R.V.) stations located in the Study Area (Figure 11) are considered to be a part of the trunk facility, and, as they are both 250mm or greater, are to be included in the current 10 Year Plan review and, subject to Council approval, be reflected in a new D.C.C. Bylaw in early 1996. These facilities will be cost-shared through D.C.C. rebates up to the cost of the station, not to exceed the value of the D.C.C. paid by the applicant.

The development of Stage 3 is not expected to proceed until 2001 when the grid main installation on 68 Avenue has been completed through to 176 Street. At that time, the extension of the 350mm watermain north on 177 Street from 68'A' Avenue to 70 Avenue at 178 Street will be required. This grid main will eventually be extended from this point along 70 Avenue to 182 street at Fraser Highway; and east and west along Fraser Highway to 180 Street at 184 Street respectively. In the same manner in which 10 Year Plan amendments were proposed for Stages 1, 2A & 2B, plan references within the Study Area should be redefined to apply to upsizing and DCC rebates in Stage 3.

In those instances where existing distribution mains would otherwise provide adequate service under the Surrey design criteria for existing and proposed zoning, developers will be eligible for recovering full construction costs through D.C.C. rebates for any duplicate, parallel, or replacement watermains constructed at the City's request. These rebates will not, however, be permitted to exceed the total D.C.C.s paid by the applicant, and may not be sufficient to cover the full cost of construction.

4. WATER SUPPLY & DISTRIBUTION

In reviewing those areas where existing watermains are to remain in place, and based upon current Surrey Engineering Design Criteria, the hydraulic analysis has confirmed that when the network is completed, the existing mains are adequate for the intended use. A full summary of major servicing costs has been provided in Section 7.

5. SANITARY SEWER

5.1 Existing Sewer System

There is only one existing gravity sanitary sewer within the Study Area. This local sewer provides service to (18 existing lots on 67 Avenue west of 180 Street) and discharges to the southwest out of the Study Area. There are, however, plans by the City, as a result of the servicing requirements of the North Cloverdale, East Neighbourhood, N.C.P.Study Area, to construct a long term temporary pump station on 68'A' Avenue at 176 Street with a combination of force main and gravity sewer south on 176 Street from 68'A' Avenue to connect to the Surrey sanitary trunk sewer on 60 Avenue. These works will be extended to include a new gravity sewer from 176 Street to 184 Street through the Phase II Study Area on the proposed alignment of 68 Avenue, as detailed in the North Cloverdale NCP Phase I report prepared by Hunter Laird Engineering Ltd.

These new facilities will be capable of providing service to both the West Neighbourhood (Phase II) Study Area and the contributing catchment from the East Neighbourhood (Phase I) NCP Study Area.

5.2 Sewer Catchments - Internal & External

.1 Internal

The topography of the Study Area will allow the entire Neighbourhood, except for 12 existing serviced lots on the 67 Avenue cul-de-sac west of 180th Street, to be serviced by extending local sewers from the new 68 Avenue gravity trunk sewermain. For sanitary purposes, the Study Area will have two (2) sub-catchments; Catchment 1 draining proposed Development Stages 1, 2A & 2B directly to the 68 Avenue sewer; and Catchment 2 draining the northerly Development Stage 3 across the North and South Creek crossings to 68'A' Avenue at 177 Street. These catchment areas are shown on Figure 13. The half-acre cluster residential area planned west of 177 Street will require private on-site pumping systems to connect to gravity sewer on 177 Street, provided each legal lot fronts on a gravity sewer.

Catchment 1 also encompasses a parcel of land south of the Study Area as shown on Figures 13 and 16, and includes an estimated 80 future lots.

5. SANITARY SEWER

In order to service Development Stage 3, the sanitary sewer must be extended north from 68'A' Avenue on 177 Street. This alignment approximates the schematic alignment of the North Cloverdale Trunk sanitary sewer as shown in the North Cloverdale N.C.P. Phase I Stage II report. As a result, the opportunity exists to extend service into this development area and install a section of the proposed trunk sewer as a concurrent operation. Each applicant within the Study Area will be responsible for extending sanitary sewers as required in accordance with the City's Subdivision Control Bylaw. Where gravity sewer mains may be required to be located within a Right of Way along the side yards of individual lots, and, where a manhole is required, a pedestrian walkway will have to be constructed within the Right of Way to provide access to the sewer. It may be possible, however, during the subdivision application process, for individual developments to redirect or relocate short sections of sewer mains in order to avoid this type of alignment. Each affected applicant will be required to resolve this issue with the City as part of the approvals process. Where it is feasible to reroute those sewers, the applicant will be required to demonstrate to the City that there are no detrimental impacts to the downstream system resulting from any such redirection. Figure 16 shows a conceptual layout for the sanitary sewer system internal to the Study Area. This sewer arrangement is consistent with the internal sanitary catchment boundaries noted above.

.2 External

The sewer system servicing the portion of Development Stage I between 180 Street and 183 Street will also provide service to a small triangular section of land within the Phase I Study Area located east of 184 Street and south of Fraser Highway (Figure 14). All other external catchment areas contributory to the 68 Avenue sanitary trunk sewer, identified and defined per the North Cloverdale Neighbourhood Concept Plan, East Neighbourhood as prepared by Hunter-Laird, have no impact on the Study Area and remain unchanged. For calculations and flows relating to these external basins, as well as the impact on existing downstream systems, refer to the East Neighbourhood report.

5.3 Designated Trunk Sewers & Surrey 10 Year Servicing Plan

As identified in the North Cloverdale Local Area Plan, and referred to above, a new large diameter (1050mm diameter) trunk sewer will ultimately be required through the North Cloverdale, West Neighbourhood N.C.P. Study Area to service the long term development of the Clayton Area north of Fraser Highway (10 Year Plan Ref #3594). It should be noted that, although the portion of this trunk sewer

running from 68'A' Avenue to Fraser Highway is intended primarily to service the future Clayton area, it is imperative that the "first-in" developer coordinate the development layout, as well as the design and construction of this proposed sewer with The City of Surrey. Frontenders extending services north on 177 Street from 68'A' Avenue will be required, as a condition of approval, to satisfy the above criteria. A preliminary profile for this sewer is shown on Figure 15.

It will be required to combine the construction of this trunk sewer and local sewer requirements for the Development Stage 3 area into a single operation. This sewer is shown in Figure 16 as following the road alignment to approximately 70 Avenue and then 178 Street, through a walkway, and across Old Yale Road to Fraser Highway. The final alignment could be revised at the final design stage to more closely follow the 15 metre contour through to Fraser Highway if depths and costs associated with a road alignment were determined to be excessive. As part of the current 10 year servicing plan, this trunk can be constructed by developers with reimbursement by way of D.C.C. rebates and/or development coordinated works.

5.4 Development Sewage Flows

Section 2 of this Report identifies the land uses designated within the internal sewer sub-catchment boundaries. Using this data, and the City of Surrey Design Criteria for the calculation of sewage flows, the following peak flows are contributory to the 68 Avenue sewer and temporary pump station.

Development Stages 1, 2A & 2B	42.4 lps (litres per second)
Development Stage 3	25.8 lps

These flows, totalling 68.2 lps, are in addition to the 40.3 lps generated by Catchment A as defined in the East Neighbourhood Stage II Report representing the system design flow at 68 Avenue and 184 Street. The combined total flow of the contributing West and East Neighbourhood Study areas through the 68 Avenue sewer to the pump station at 176 Street is 108.5 lps. It should be noted that, although the 68 Avenue sewer is designed to also provide service to the area defined as "Upstream Catchment 'A'", this area has not been provided for in the design flows contributing to the temporary pump station.

5.5 Phasing and Implementation

With development applications pending on several properties located within the area described as Development Stage I (Figure 2), the construction of the 68A Avenue pump station and forcemain, as well as the installation of the 68 Avenue Trunk sanitary sewer as planned by Surrey in 1996, is both appropriate and timely. These facilities have been included in the 1996 Capital program to be funded by the Sewer Utility with recoveries expected on a latecomer basis. The City of Surrey will construct the pump station, including the forcemain/gravity sewer south on 176 Street to 60A Avenue. Surrey will recover costs associated with this construction by means of an area latecomer to include all contributing lots in both the East and West North Cloverdale NCP Study Areas on an equal, pro-rata basis. In addition, the City of Surrey Engineering Department has advised that they will be upgrading the existing 176 Street gravity sewer system by installing a 600mm diameter gravity main from 60 Avenue to 65A Avenue. These works are proposed to be included in the 1996 Capital Works program. The recovery of costs associated with this sewer will be through the accumulation of DCC's from the benefitting lands.

The 68 Avenue trunk sanitary sewer is to be constructed on the City's behalf by the "first-in" developer in the Study Area. The extension of this sewer from 176 Street to 184 Street is estimated to cost $670,000. These works will be 100% rebatable with the City recovering costs through both the latecomer process, and the 100% pre-payment of Sanitary DCC's by each application at the time of servicing agreement. Lands within the catchment area defined by Development Stages 1, 2A & 2B will be able to extend service directly from this main in accordance with the conceptual Sanitary Sewer System Servicing plan (Figure 16). As each development proceeds to the Servicing Agreement stage, Area Latecomer charges associated with the pump station and forcemain will become payable. Further, although there are no additional facilities required specifically to service these development areas, developers will be required to pay up-front, the full amount of the sanitary sewer component of the Development Cost Charges. This will help the City recover a portion of the costs incurred resulting from the construction of the 68 Avenue Trunk, and accumulate "seed monies" for the construction of the 1050mm trunk sewer.

Development Stage 3 may extend local service directly from the 68 Avenue trunk main, or, depending on timing and funding, may install a portion of the 1050mm trunk north from 68 Avenue, and connect directly to this trunk with lateral sewers

and services. This construction does not include the extension of this main south of the existing 68 Avenue right of way as this section of main would be constructed by the City at such time as the extension is warranted to service the Clayton Neighbourhood. Flows in the large trunk sewer would be diverted at 68'A' Avenue to the pump station until future construction of the trunk south to 60 Avenue at 176 Street. Since this stage of development can be serviced by a 200mm diameter sanitary sewer, the construction of the 1050mm trunk by development would be D.C.C. rebatable based on current Surrey oversizing policy. A review of design alternatives for this trunk should be undertaken in detail concurrent with the first development application in Development Stage 3. This will allow any required non-road alignment for this trunk to be protected from future construction.

Based on the anticipated rate of development, it is estimated that the full recovery by Surrey of area latecomers for the Study Area, as well as full prepayment of sanitary DCC's will be achieved within 5 to 6 years from the initiation of development within the Study Area as follows:

Development Stage	Contributing Units	Latecomer Payments	D.C.C. Payments	Year
STAGE 1	444	$ 199,800	$ 380,040	1996 to 1999
STAGE 2 (2A & 2B)	321	144,450	277,890	1999 to 2000
STAGE 3	573	257,850	488,730	2001 to 2005
TOTALS	1338	$ 602,100	$1,146,660	

NOTE: The 286 Agreement payments noted above are based on $450 per unit per the current estimate of construction costs ($1,150,000) as provided by the Surrey Corporate Report No. R856 approved by Council April 1, 1996. It is clearly understood that the actual unit rates and total amounts to be paid by developers in the Study Area, will be based on final construction costs pro-rated over the total contributing units from the combined East and West Study areas, and may exceed the totals noted above per a Section 286 Agreement.

6. DRAINAGE

6.1 Existing Storm Drainage System

The Study Area topography slopes generally to the west with an average gradient of approximately five percent. The west site limits are steeper, with an elevation drop of twenty-five metres at an average slope of 15 percent. The most prominent site feature is the north watercourse ravine crossing the site from 184 Street in the north-east corner near Fraser Highway, to a lowland discharge at the west escarpment near 176 Street with flows ultimately discharged to the Serpentine River. Water flow is variable but present all year round.

Two smaller ravines also exist within the Study Area, and are mainly present in the west bank sloping to the Agricultural Land Reserve properties. Smaller than the north watercourse, these secondary ravines, referred to as the south watercourse and west watercourse, have intermittent flow resulting primarily from run-off of adjacent lands. Drainage from these ravines is also directed ultimately to the Serpentine River.

There are few storm sewers within the Study Area except along the periphery on 184 Street at the intersections of existing Study Area roads with Fraser Highway and within the existing suburban residential subdivision located southwest of 68 Avenue and 180 Street. The existing system on 184 Street discharges to the north watercourse just south of Fraser Highway. There is also an existing storm sewer system on 67 Avenue west of 184 Street to 180 Street (including lateral sewers on 181 Street and 183 Street) which does not have capacity to provide service to the proposed development. This sewer will require replacement by an appropriately sized storm sewer at the time of adjacent development in the Stage 2A area.

The existing ditches and culverts on Fraser Highway west of 184 Street direct run-off along the Highway discharging eventually to the Agricultural Lowlands near Fry's Corner east of 176 Street.

The existing topography, watercourse and drainage boundaries are shown on Figure 17.

6. DRAINAGE

6.2 Drainage Catchments - External and Internal

The entire Study Area lands lie within a single drainage catchment which discharges to the Agricultural Lowlands east of 176 Street and south of Fraser Highway. Three major ravines identified within the lands divide the site into sub-catchments, with local surface flows contributing to each creek as defined by topography. However, the north watercourse drains an area directly north of the East Neighbourhood (north of Fraser Highway and east of 184 Street) as well as an area defined in the East Neighbourhood NCP Stage II Report as the "west catchment". It is understood that drainage impacts from this latter catchment will be mitigated for minor events by a storm water detention facility within the existing ravine immediately east of 184 Street as determined in the East Neighbourhood N.C.P. Stage II Report. As part of this facility, a control structure will regulate release rates for minor event flood flows and maintain base flows in the upper reach of the north watercourse.

It is also recommended that, when the area north of the east neighbourhood, as identified herein, develops it also be provided with separate storm detention upstream of the existing watercourse. External and internal catchment areas are shown on Figure 18.

6.3 Neighbourhood Development Drainage System

Drainage issues contained herein have, with the approval of Surrey Staff, been reviewed in accordance with City Drainage Criteria in effect prior to the recent "Interim Storm Drainage Criteria Update", as well as with the "North & West Cloverdale Master Drainage Plan" prepared by UMA Environmental Ltd., and are consistent with the criteria upon which the adjacent and contributory North Cloverdale East Neighbourhood N.C.P. Study Areas has been designed and approved.

A Conceptual Layout Plan for the proposed storm sewer system servicing the Neighbourhood is included as Figure 19. Although post-development catchment boundaries and flow directions are consistent with pre-development conditions, local surface run-off is, where possible, redirected to piped storm systems. This will reduce the catchment area contributing directly to the steeply sloping ravine sides, with a resultant decrease in the potential for erosion.

6. DRAINAGE

As part of this proposal, storm trunk sewers have been identified on 68'A'/68 Avenue from 176 Street to 181 Street, and on 177 Street, from the north watercourse outfall to 70 Avenue. Trunk sewers are defined as those sewers that either require a capacity equal to or greater than 1.0 cubic metre per second, or are equal to, or greater than 600mm diameter (or both), based on the requirements for the design 5 year return storm. Calculations for these sewers have been included in Appendix IV.

Discharge from the 68'A'/68 Avenue trunk storm sewer will be directly to the existing ditch along the east side of 176 Street, while the 177 Street trunk will discharge into the north watercourse. Both outfalls eventually contribute to the lowlands at 176 Street and Fraser Highway. The capacity of existing culverts along 176 Street at local access points is to be reviewed at the time of detailed design for the 68 Avenue Trunk. Upgrading required to accommodate the post-development flow is to be completed as part of the construction of this trunk facility.

In order to maintain base flows in the south watercourse, the 68 Avenue storm trunk is to be provided with a controlled outlet flow diversion, or equivalent, in the vicinity of 179 Street to 180 Street. This will ensure that, even though direct surface flows have been intercepted by the development drainage system, stream dynamics and morphology are maintained during normal storm events. Consistent with Ministry of Environment and Department of Fisheries and Oceans requirements, base flows are to be maintained at the 2 year pre-development flow rates of the existing contributing drainage area.

The underground storm drainage system shown in Figure 19 is to be designed for the 5 year storm conditions as required by the City of Surrey Engineering Department Design Criteria Manual. A conceptual storm water management plan should be developed to provide for the orderly extention of new storm sewers into the developing areas. In addition, lot grading within the Study Area should include the following BMPs (Best Management Practices) as a means of mitigating the impact of development on the downstream system: the discharge of roof drainage onto splash pads; the use of infiltration trenches or sodded swales for minor drainage; and the preservation of topsoil and natural vegetation on building sites to the greatest extent possible.

6.4 Hydrologic Analysis

In order to assess the impact of the development of the Phase II NCP Lands on downstream facilities, the "North Cloverdale NCP Phase II Drainage Study" was prepared by Robert Bland, P.Eng. a summary of which has been included as Appendix IV. Catchments were modeled using the MIDUSS Computer Model which provided synthetic runoff hydrographs for the existing and post-development conditions. The model allows for variations in soil characteristics and the amount of impervious area, and routes sub-catchment runoff hydrographs throughout the drainage system. "Existing" development conditions were based on the May 1993 photogrammetric base maps prepared by the City of Surrey Engineering Department. "Future" conditions correspond to the LAP and Land Use plans prepared as part of the NCP. Model setup, calibration parameters and routing are included in the appended Drainage Study.

6.5 Major System Flood Routing

As part of the City of Surrey Design Criteria Manual requirements, stormwater analysis must include two components; a minor system designed to convey runoff for a five year return period flow; and a major system designed to convey runoff from a hundred year period flow. The minor system includes underground pipes, open channels, and watercourses, and the major system includes surface flow paths, roadways and watercourses. Major flows are generally conveyed within the road system, either piped or on the surface, and are released to the lowland ditch and storage areas. Where these flows are contained within the roadway, the maximum depth of flooding should not exceed the lesser of 200mm or the design ground elevation at the roadway right-of-way boundary. Arterial roads may be permitted to flood to depths equal to, but not exceeding the road crown.

The three watercourses identified in Section 6.1 are major system flow paths. Development of the Study Area road patterns requires that the north, south and west watercourses be provided with crossing structures that are capable of passing the major flood. Estimates of major system, post-development peak flows, as identified in the "North Cloverdale NCP Phase II Drainage Study", were calculated for these watercourses as follows:

North watercourse at 177 Street crossing - 9.0 cms.
South watercourse at 177 Street crossing - 1.8 cms.
West watercourse at 68'A' Avenue crossing - 0.8 cms.
South watercourse at 68 Avenue crossing - 1.4 cms.

The construction of 177 Street may require the installation of arch style crossings on both the north and south watercourses. Arch crossings are preferred by the Ministry of Environment over traditional culverts, or other fully enclosed conduits, as they make it possible to retain or improve the existing stream bed through the crossing area. Further, in areas where the major flow is not contained within the defined stream bed, the wider end section of a typical Superspan® style arch, combined with suitable headwall and entrance wall configurations, permits a less turbulent transition from stream flow to culvert flow at the crossing, with lower water velocities, less disruption to the creek, and less probability of blockage.

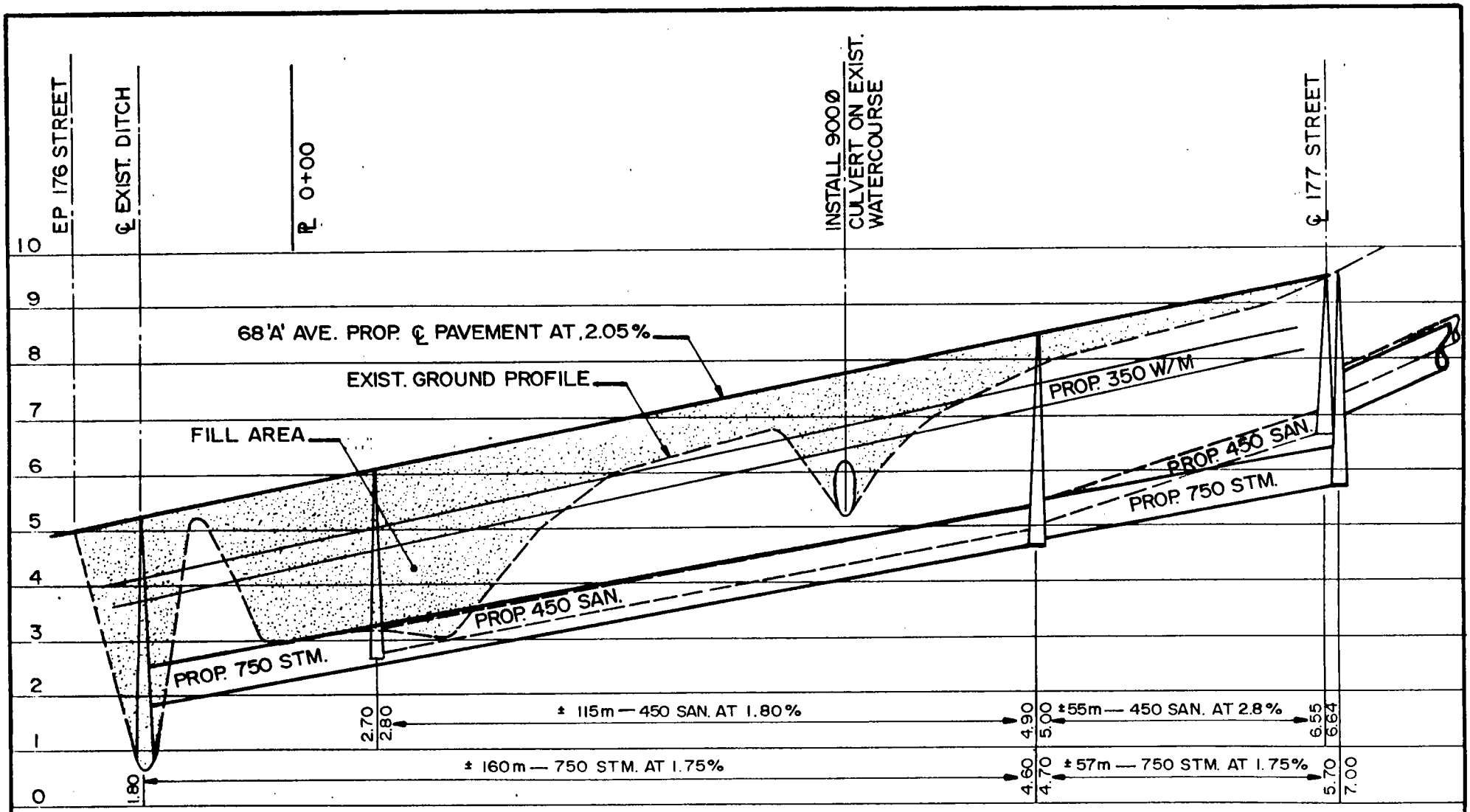
68'A' Avenue crosses the west watercourse approximately 135 metres east of 176 Street. This watercourse drains a small cleared area under the B.C. Hydro transmission line along the south side boundary. The ground in this area is relatively flat, and the crossing at 68'A' Avenue is shallow. This crossing must be fully enclosed with a culvert of appropriate size to pass the major flow, while allowing for clearance for the proposed road and watermain to pass over the crossing. Development area storm and sanitary trunk sewers will be required to pass underneath the crossing as shown on page 48.

The widening of 68 Avenue between 179 Street and 180 Street will require the extension of the existing culvert crossing on a tributary ravine to the south watercourse. This 600mm diameter culvert was sized to accommodate the contributing 100 year flow at this location as part of the development of existing lots on the south side of 68 Avenue west of 180 Street.

In all cases, creek culvert crossings should be capable of conveying the major flows without exceeding design inlet headwall heights. It is expected that bank armoring and erosion protection measures will be required at inlet and discharge locations to mitigate the effects of transitional flows for the major event.

Some recent development proposals in the North Cloverdale area have included the requirement for full inground basements. To provide for this feature, the

major system hydraulic grade line must be maintained below proposed basement elevations. Developers considering basements can meet this criteria by either increasing the size of the piped storm drainage system to accommodate the greater flow, or by installing a "third pipe" system to a downstream gravity outfall above the major system hydraulic grade line. Where practical for Phases 1, 2A and 2B, the "third pipe" system should discharge to the south creek to help maintain dry weather base flows. Costs associated with major system oversizing or a "third pipe" system will be the responsibility of individual developers. Although the proposed storm sewer drainage systems on 68'A'/68 Avenue and on 177 Street/70 Avenue should be designed to accommodate the post-development major system peak flow condition without surcharging, individual applicants will be required to evaluate the feasibility of these alternatives at the time of development. Trunk sewer pipe sizes noted in Figure 19 are based on the 5 year peak flow. Regardless of which system is ultimately constructed, roof drains are not to be connected, but must discharge to splash pads.



PRELIMINARY STORM, SANITARY & WATER PROFILES TO ACCOMMODATE 68'A' AVENUE CULVERT CROSSING

N.T.S.

6.6 Drainage System Evaluation

.1 North Watercourse

This watercourse flows west from the existing culvert crossing on 184 Street within a well defined natural ravine to discharge to the lowland drainage ditch/canal system at 176 Street.

The ravine increases from approximately 5m deep at 184 Street, to a maximum of approximately 20m deep at 180 Street before exiting from the gully onto the lowlands approximately 0.6km downstream of 180 Street. The streambed slope varies gradually from moderately steep to moderate and the natural ravine slopes are well treed, steep to moderately steep, and appear stable. Degredation of the stream bed down to the underlying till has occurred along some sections of the watercourse with bed materials collected to form a weir (see Plate 1) approximately 150m downstream of 184 Street. The weir should be dismantled and the bed materials redistributed on the bed. There are also locations where deadfalls and other debris cross the watercourse providing further opportunities for stabilization of the bed gravels. These deadfalls should, therefore, remain undisturbed.

The section from 100 metres downstream of 184 Street to 182 Street has also lost bed material in several places exposing the underlying till to erosion. In several areas undercutting of the stream bed is occurring with a number of areas showing minor bank erosion. Although the movement of bed materials downstream, down cutting and bank erosion are all natural processes, these processes are accelerated by increased flows due to development. In this case, it is likely that the principal cause of loss of bed material is the increased flood flows resulting from the present rural development from the original forested condition. In a few isolated areas, loss of bed materials has led to recent downcutting up to 0.5m in depth. Recent erosion (freshly exposed erosion faces within the last few years) is also evident on the south side of the ravine approximately 100 metres upstream from 180 Street. A 100mm drain tile initially discharging at the top of slope (see Plate 2) has caused this problem indicating that portions of the ravine bank may be highly susceptible to erosion. This is an ongoing problem that requires remedial action. No erosion is evident downstream from 180 Street (see Plate 3). Each applicant with properties through which this watercourse and ravine runs will be required to perform remedial works in areas

showing evidence of erosion or displacement of bed materials as a condition of development. Remedial works by the applicant in this regard will be DCC rebatable and funded from the existing DCC Bylaw per reference No. 4075 in the current Ten Year Plan.

As development applications adjacent to this watercourse proceed, lands within the ravine and Ministry of Environment designated covenant boundaries should either be dedicated to Surrey as park, or protected by statutory right-of-way to permit the City to monitor and maintain erosion protection. The City of Surrey Drainage Department requires a 7.5m right-of-way from the top of bank for all lots adjacent to a creek where individual lot lines extend to the top of bank. Individual applicants are to provide site specific mitigation, as noted above. Since the City has included erosion protection in this area in the current 10 Year Plan, these works will be DCC rebatable. Notwithstanding the foregoing, individual projects that border on this ravine shall be required to undertake a slope stability study as part of the development approval process, and a restrictive covenant is to be registered against all lots adjacent to a creek to save the City of Surrey harmless from flooding, changes in flow, or erosion in the watercourse.

The proposed crossing at 177 Street is to be sized to accommodate a major flow of approximately 9.0 cms, as discussed in Section 6.5. The sizing of this crossing will be governed not only by inlet flows and stream dynamics, but also by the elevation requirements of the 1050mm diameter sanitary trunk sewer that will pass over top of the arch (see Figure 15). It is recommended that storm flows in this watercourse upstream of 177 Street not be further increased due to development of the Phase II Study Area.

.2 South Watercourse

This creek roughly parallels the north watercourse running generally east to north-west from 68 Avenue at 180 Street, exiting from the gully onto the lowland 0.1km south of the north watercourse and approximately 0.23km upstream of 176 Street. The ravine varies from 2-4m in depth and has ample capacity for major flood flows. There is no evidence of recent erosion in this watercourse and there is no proposal to discharge post-development storm flows into this creek. However, both Provincial and Federal Fisheries Ministries generally require that

base flows equivalent to the pre-development 2 year flow are maintained in existing creeks after development of the contributing lands (see Plate 3). Since overland drainage currently tributary to this watercourse will be redirected to the underground storm drainage system as a result of development, an alternative method of maintaining base flows will be required. A controlled outlet flow diversion (splitter or equivalent) is to be provided on the storm system to direct flows into either (or both) of the terminal branches of the south watercourses in the vicinity of 68 Avenue and 180 Street. The final sizing and location of this diversion is to be determined at the time of detailed design of the trunk storm sewer system.

The proposed crossing at 177 Street will be designed to pass major flows of approximately 1.8cms. The criteria governing the north watercourse crossing apply equally at this location. There are also four existing culverts providing private access across this watercourse. Three of these culverts are beyond the Study Area boundary with the fourth located within the future ½ acre cluster development west of 177 Street. All are slightly undersized for the major flows identified in Section 6.5. It should be noted, however, that these flows are based on the post-development condition with the existing tributary area discharging through this creek. Redirection of overland flows to the underground storm drainage system as described herein will significantly reduce flows directed to this watercourse. Further reduction will result through the use of proposed roadways or, should development elect, a larger underground storm drainage system, as conduits for the major flow (refer to Section 6.5). Both systems will discharge directly into the 176 Street ditch/canal system with base flows only directed to this watercourse. Operating under inlet control, these culverts are capable of passing base flows with minimal headwater depths.

As a result, existing culverts in this watercourse will not require replacement to accommodate development of the contributory Study Area. The three culverts shown beyond the Study Area boundary will continue to provide local access. The fourth culvert, located within the proposed ½ acre cluster development can either be left in place to provide pedestrian crossing access between cluster areas, or can be removed to allow restoration of the creek to its original condition as a site amenity. All costs associated with the upgrading, replacement, or removal of this culvert, as well as creek restoration at this location, will be the responsibility of the developer.

.4 Lowland Drainage

The Study Area watercourses discharge to a lowland ditch and canal system at 176 Street. These ditches flow by gravity into the Serpentine River during periods of low tide through flood boxes at the dyke adjacent to Fraser Highway. The upland catchment area and flood box location is shown on Figure 18.

The City has commissioned a study of the lowland drainage in the Serpentine and Nicomekl River basins entitled "Serpentine Nicomekl Strategic Flood Control Study" as well as a study intended to provide a Master Drainage Plan for the catchments contributing to this lowland area entitled "North & West Cloverdale Master Drainage Plan". These studies include the North Cloverdale lowland catchment.

At the City's request, UMA Environmental expanded upon the terms of reference of the "North & West Cloverdale Master Drainage Plan" to include data relative to incremental increases in lowland flooding resulting from the progressive development of both the Phase I and Phase II North Cloverdale N.C.P. Study Areas. The results of this exercise follow on pages 52-57 inclusive and are included as "North and West Cloverdale-Staged Development Summary". This data shows that, as each development phase in the Study Area is completed, there is a resultant increase in the depth and duration of flooding in the lowland areas. Each development stage in the North Cloverdale contributory catchment is identified in this data as follows:

Stage (per summary)	**Description**
0	PRE DEVELOPMENT CONDITION
1	NORTH CLOVERDALE PHASE I NCP STUDY AREA ("WEST" CATCHMENT)
2	NORTH CLOVERDALE PHASE II NCP STUDY AREA (DEVELOPMENT STAGE 1)
3	NORTH CLOVERDALE PHASE II NCP STUDY AREA (DEVELOPMENT STAGES 2A & 2B)

4 NORTH CLOVERDALE PHASE II NCP STUDY AREA (DEVELOPMENT STAGE 3)

The largest incremental changes in runoff volume occur as a result of changes in land use in the North Cloverdale Phase I (East Neighbourhood) NCP Study Area (from the original, largely rural pre-development condition, to full, post-development urban status) and are evident for the shorter duration 5 and 10 year design storms. As durations approach the 5 year storm, incremental changes diminish as a percentage of the total volume.

North & West Cloverdale -- Staged Development Summary
FILENAME: D:\NWCLOVER\LOTUS\STAGEDEV.WK4

10 year 2 hour storm. Rainfall 26.4 mm.
176 Street Dyke
NHYD=4001 Area=462.2 ha.

Stage	Runoff Volume (mm)	Runoff Volume (ha*m)	Incremental Change (ha*m)	High Discharge Storage Used Qpeak = 5.2 m3/s (ha*m)	Med. Discharge Storage Used Q = 1.5 m3/s (ha*m)	Low Discharge Storage Used Q = 0.3 m3/s (ha*m)	No Discharge Volume in Excess Smax = 1.788 ha*m (ha*m)
EXIST 0	5.27	2.436	0.000	0.521			0.648
E. 184th 1	6.57	3.037	0.601	0.860			1.249
STAGE 1 2	7.66	3.540	1.105	1.118			1.752
STAGE 2 3	8.02	3.707	1.271	1.200			1.919
STAGE 3 4	9.10	4.206	1.770	1.413			2.418

10 year 6 hour storm. Rainfall 41.7 mm.
176 Street Dyke
NHYD=4001 Area=462.2 ha.

Stage	Runoff Volume (mm)	Runoff Volume (ha*m)	Incremental Change (ha*m)	High Discharge Storage Used Qpeak = 5.2 m3/s (ha*m)	Med. Discharge Storage Used Q = 1.5 m3/s (ha*m)	Low Discharge Storage Used Q = 0.3 m3/s (ha*m)	No Discharge Volume in Excess Smax = 1.788 ha*m (ha*m)
0	10.78	4.983	0.000	0.795	1.001	3.568	3.195
1	12.31	5.690	0.707	1.037	1.805	4.399	3.902
2	13.57	6.272	1.290	1.219	2.332	4.985	4.484
3	14.00	6.471	1.488	1.277	2.500	5.175	4.683
4	15.25	7.049	2.066	1.424	2.983	5.746	5.261

10 year 12 hour storm. Rainfall 57.6 mm.
176 Street Dyke
NHYD=4001 Area=462.2 ha.

Stage	Runoff Volume (mm)	Runoff Volume (ha*m)	Incremental Change (ha*m)	High Discharge Storage Used Qpeak = 5.2 m3/s (ha*m)	Med. Discharge Storage Used Q = 1.5 m3/s (ha*m)	Low Discharge Storage Used Q = 0.3 m3/s (ha*m)	No Discharge Volume in Excess Smax = 1.788 ha*m (ha*m)
0	17.57	8.121	0.000	0.790			6.333
1	18.90	8.736	0.615	1.012			6.948
2	19.93	9.212	1.091	1.180			7.424
3	20.30	9.383	1.262	1.233			7.595
4	21.34	9.863	1.742	1.370			8.075

10 year 24 hour storm. Rainfall 79.2 mm.
176 Street Dyke
NHYD=4001 Area=462.2 ha.

Stage	Runoff Volume (mm)	Runoff Volume (ha*m)	Incremental Change (ha*m)	High Discharge Storage Used Qpeak = 5.2 m3/s (ha*m)	Med. Discharge Storage Used Q = 1.5 m3/s (ha*m)	Low Discharge Storage Used Q = 0.3 m3/s (ha*m)	No Discharge Volume in Excess Smax = 1.788 ha*m (ha*m)
0	27.95	12.918	0.000	0.801	2.293	9.907	11.130
1	28.37	13.113	0.194	0.911	2.610	10.154	11.325
2	28.51	13.177	0.259	1.009	2.716	10.188	11.389
3	28.59	13.214	0.296	1.039	2.760	10.214	11.426
4	28.83	13.325	0.407	1.111	2.870	10.300	11.537

10 year 5 day storm. Rainfall 143.36 mm.
176 Street Dyke
NHYD=4001 Area=462.2 ha.

Stage	Runoff Volume (mm)	Runoff Volume (ha*m)	Incremental Change (ha*m)	High Discharge Storage Used Qpeak = 5.2 m3/s (ha*m)	Med. Discharge Storage Used Q = 1.5 m3/s (ha*m)	Low Discharge Storage Used Q = 0.3 m3/s (ha*m)	No Discharge Volume in Excess Smax = 1.788 ha*m (ha*m)
0	50.59	23.383	0.000	1.564	1.252	9.897	21.595
1	51.19	23.660	0.277	1.718	1.471	10.401	21.872
2	51.28	23.702	0.319	1.737	1.495	10.578	21.914
3	51.80	23.942	0.559	1.745	1.511	10.837	22.154
4	53.12	24.552	1.169	1.685	1.478	11.586	22.764

North & West Cloverdale – Staged Development Summary
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5 year 2 hour storm. Rainfall 22.0 mm.
176 Street Dyke
NHYD=4001 Area=462.2 ha.

Stage	Runoff Volume (mm)	Runoff Volume (ha*m)	Incremental Change (ha*m)	High Discharge Storage Used Qpeak = 5.2 m3/s (ha*m)	Med. Discharge Storage Used Q = 1.5 m3/s (ha*m)	Low Discharge Storage Used Q = 0.3 m3/s (ha*m)	No Discharge Volume in Excess Smax = 1.788 ha*m (ha*m)
0	3.54	1.636	0.000	0.334			n/a
1	4.41	2.038	0.402	0.554			0.250
2	5.12	2.366	0.730	0.701			0.578
3	5.36	2.477	0.841	0.750			0.689
4	6.09	2.815	1.179	0.884			1.027

5 year 6 hour storm. Rainfall 36.6 mm.
176 Street Dyke
NHYD=4001 Area=462.2 ha.

Stage	Runoff Volume (mm)	Runoff Volume (ha*m)	Incremental Change (ha*m)	High Discharge Storage Used Qpeak = 5.2 m3/s (ha*m)	Med. Discharge Storage Used Q = 1.5 m3/s (ha*m)	Low Discharge Storage Used Q = 0.3 m3/s (ha*m)	No Discharge Volume in Excess Smax = 1.788 ha*m (ha*m)
0	8.33	3.850	0.000	0.611	0.426	2.531	2.062
1	9.51	4.396	0.545	0.786	0.932	3.189	2.608
2	10.45	4.830	0.980	0.917	1.281	3.634	3.042
3	10.77	4.978	1.128	0.957	1.391	3.774	3.190
4	11.74	5.426	1.576	1.064	1.719	4.215	3.638

5 year 12 hour storm. Rainfall 51.6 mm.
176 Street Dyke
NHYD=4001 Area=462.2 ha.

Stage	Runoff Volume (mm)	Runoff Volume (ha*m)	Incremental Change (ha*m)	High Discharge Storage Used Qpeak = 5.2 m3/s (ha*m)	Med. Discharge Storage Used Q = 1.5 m3/s (ha*m)	Low Discharge Storage Used Q = 0.3 m3/s (ha*m)	No Discharge Volume in Excess Smax = 1.788 ha*m (ha*m)
0	14.36	6.637	0.000	0.640			4.849
1	15.46	7.146	0.508	0.806			5.358
2	16.29	7.529	0.892	0.937			5.741
3	16.58	7.663	1.026	0.978			5.875
4	17.45	8.065	1.428	1.058			6.277

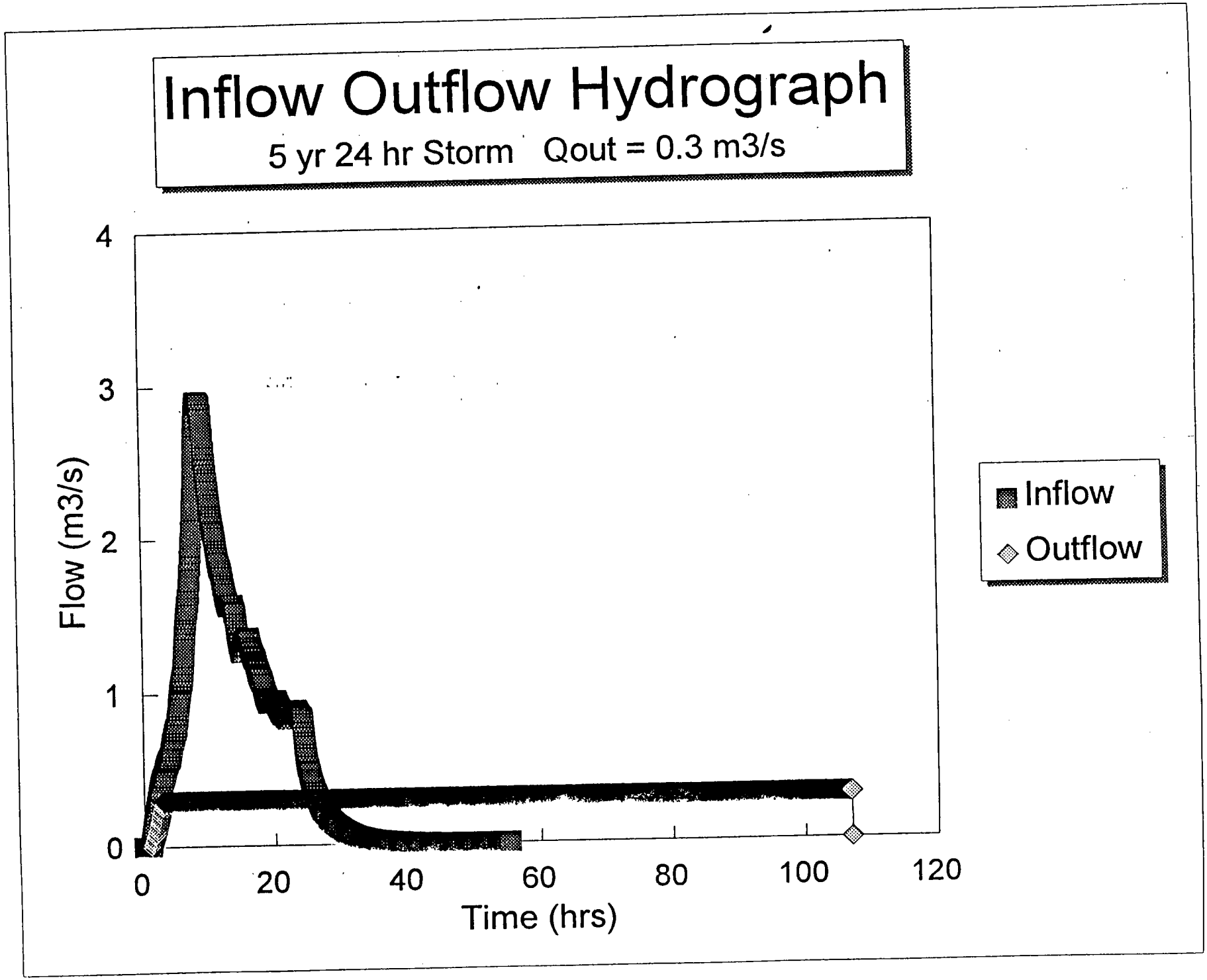
5 year 24 hour storm. Rainfall 72.0 mm.
176 Street Dyke
NHYD=4001 Area=462.2 ha.

Stage	Runoff Volume (mm)	Runoff Volume (ha*m)	Incremental Change (ha*m)	High Discharge Storage Used Qpeak = 5.2 m3/s (ha*m)	Med. Discharge Storage Used Q = 1.5 m3/s (ha*m)	Low Discharge Storage Used Q = 0.3 m3/s (ha*m)	No Discharge Volume in Excess Smax = 1.788 ha*m (ha*m)
0	23.71	10.959	0.000	0.672	1.068	8.041	9.171
1	24.08	11.130	0.171	0.753	1.341	8.245	9.342
2	24.19	11.181	0.222	0.822	1.466	8.263	9.393
3	24.26	11.213	0.254	0.843	1.506	8.281	9.425
4	24.48	11.315	0.356	0.895	1.615	8.355	9.527

5 year 5 day storm. Rainfall 129.9 mm.
176 Street Dyke
NHYD=4001 Area=462.2 ha.

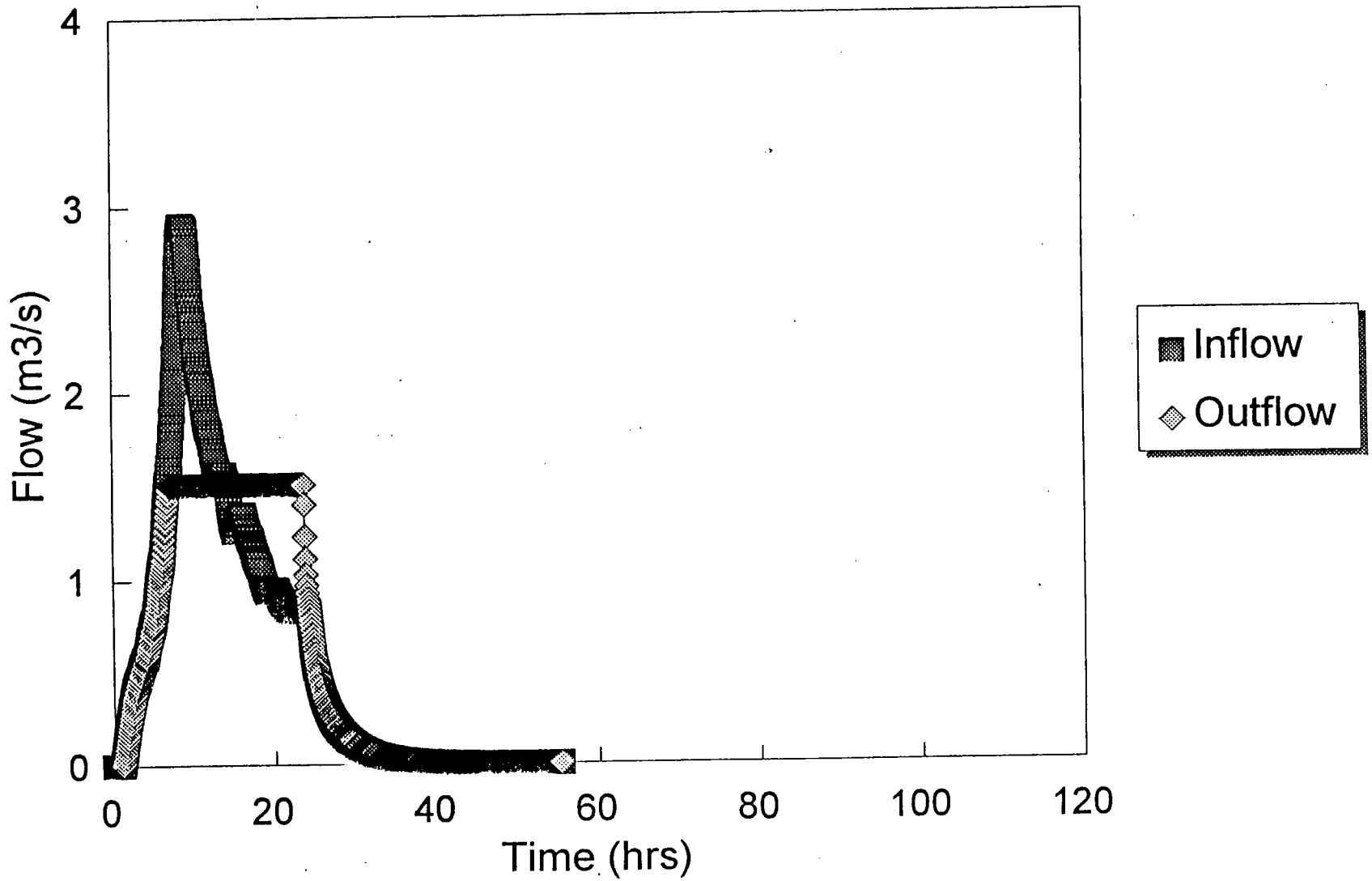
Stage	Runoff Volume (mm)	Runoff Volume (ha*m)	Incremental Change (ha*m)	High Discharge Storage Used Qpeak = 5.2 m3/s (ha*m)	Med. Discharge Storage Used Q = 1.5 m3/s (ha*m)	Low Discharge Storage Used Q = 0.3 m3/s (ha*m)	No Discharge Volume in Excess Smax = 1.788 ha*m (ha*m)
0	42.27	19.537	0.000	1.430	0.861	6.248	17.749
1	43.17	19.953	0.416	1.579	1.077	6.770	18.165
2	43.38	20.050	0.513	1.595	1.114	6.944	18.262
3	44.10	20.383	0.846	1.609	1.135	7.243	18.595
4	45.58	21.067	1.530	1.562	1.200	7.974	19.279

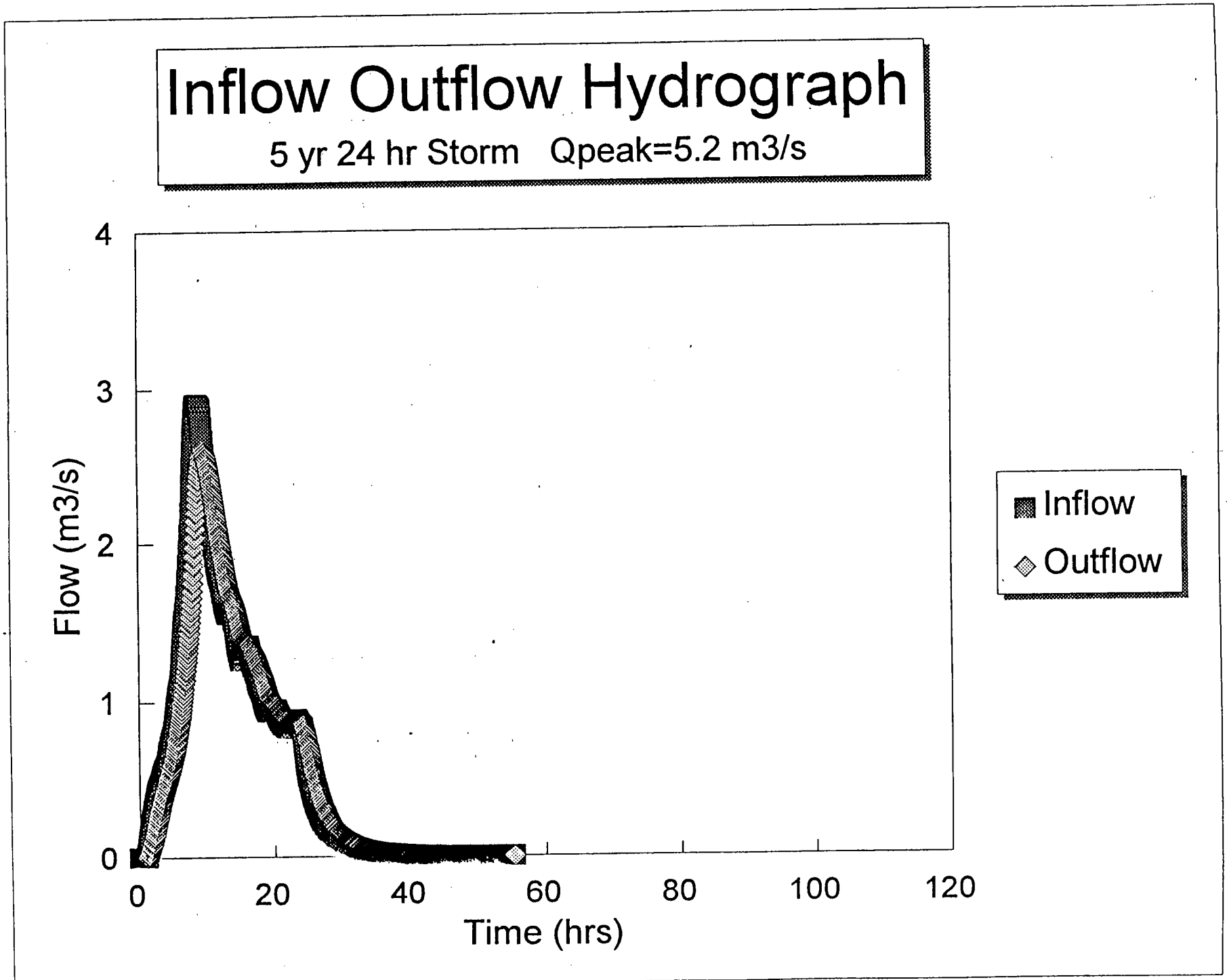
	Stage	Med. Discharge Storage Used (ha-m)	Field Storage (ha-m)	Field Depth (m)	No Discharge (ha-m)	Field Depth (m)	
10 yr 6 hr							
	0	1.00			3.20	0.45	
	1	1.81			3.90	0.55	
	2	2.33	0.54	0.08	4.48	0.63	
	3	2.50	0.71	0.10	4.68	0.66	
	4	2.98	1.19	0.17	5.26	0.74	
10 yr 24 hr							
	0	2.29	0.50	0.07	11.10	0.65	
	1	2.61	0.82	0.12	11.32	0.67	
	2	2.71	0.92	0.13	11.39	0.67	
	3	2.76	0.97	0.14	11.42	0.67	
	4	2.87	1.08	0.15	11.53	0.68	
10 yr 5 day							
	0	1.25			21.59	0.77	
	1	1.47			21.87	0.78	
	2	1.49			21.91	0.79	
	3	1.51			22.15	0.79	
	4	1.48			22.76	0.82	


Inflow Outflow Hydrograph
5 yr 24 hr Storm Qout = 0.3 m3/s
Flow (m3/s)
0
1
2
3
4
0
20
40
60
80
100
120
Time (hrs)
Inflow
Outflow

Inflow Outflow Hydrograph

5 yr 24 hr Storm Qout = 1.5 m3/s




Inflow Outflow Hydrograph
5 yr 24 hr Storm Qpeak=5.2 m3/s
Flow (m3/s)
0
1
2
3
4
0
20
40
60
80
100
120
Time (hrs)
Inflow
Outflow

6. DRAINAGE

Development of the uplands will increase the peak run-off and the volume of run-off from a storm. The upland detention pond proposed for the Phase I NCP Study Area, at Fraser Highway and 184 Street, will reduce the peak flow and spread the hydrograph over a longer period, however, it will do little to mitigate lowland flooding. Tidal cycles have a long duration compared to many storm hydrographs and the increased volumes cause more water to be ponded while the sea dyke flood box is closed. The primary benefit of this pond is in the mitigation of the impact of minor flows directed into the north watercourse from the Phase I Study Area at 184 Street. Included with this document in Appendix IV, "Hydrology & Drainage", is KPA Engineering Ltd. Figure 2 "Drainage Basin and Subbasins Boundaries" which forms a part of the "Serpentine Nicomekl Strategic Flood Control Study." This figure shows the North Cloverdale Catchments and lowland cell relative to the entire Serpentine flood plain. It should be recognized that the lowland areas have always been subjected to frequent flooding due to the tidal effects and the low elevations of the fields. The dyke system has a limited capability to discharge flows to Mud Bay primarily because dyke elevations are limited upstream of Fry's Corner. As a result, flows tend to spill out and around the dykes upstream of Fry's Corner, while flows are confined within the channel downstream of Fry's Corner. Development in all areas tributary to the Serpentine lowland will make this situation marginally worse because runoff volumes are increased. It is difficult to mitigate this impact on a site specific basis, rather an overall flood plain strategy is needed to define acceptable flood standards with individual developments contributing towards a share of the cost of the flood control works.

It is proposed that the Phase II Study Area discharge directly into the 176 Street ditch/canal system with storage to be provided in the lowland cell east of 176 Street and south of Fraser Highway. During the course of this review, consideration had been given to the construction of a community detention pond within the B.C. Hydro right-of-way near 176 Street to service the Phase II Study Area. Further, the current 10 Year Servicing Plan includes a proposal for a community pond to be located near 180 Street. However, since the neighbourhood development drainage scheme does not discharge into the watercourse ravine areas and, since the 176 Street system has sufficient capacity for the undetained post-development flows for this system, additional detention was determined to have little or no value. The level of storage provided by a detention facility in comparison to the lowland system is minimal and, for

development lands close to lowland drainage systems, funding which might be generated to provide a storm detention facility could more appropriately be directed to lowland drainage improvement works.

The north watercourse is linked to the 176 Street ditch system by an existing overland ditch following the bottom of the escarpment north, and then along property boundaries first west, then north, and then west again to 176 Street, as shown on Figure 19. Development of Stage 3 of the Phase II Study Area will require that this ditch be upgraded. The upper reaches of this ditch, near the exit of the North Watercourse onto the lowland are at elevations of approximately 3.5 to 4.0 metres. These elevations are above the floodplain. Although sufficient capacity exists for the present undeveloped flows, it has insufficient capacity for the major flows. The Phase II Drainage Study (Figure 2 - Appendix IV) shows that the major component of the 100 year flow in this watercourse enters the creek at 184 Street. Of the total 9.0 cms noted in this system at the proposed 177 Street crossing, 7.2 cms (or 80%) is from the contributing basin upstream of 184 Street, and includes the "west" catchment from the Phase I Study Area, as well as a portion of the largely undeveloped Clayton area.

As long as the Clayton area remains undeveloped, and, had the Phase I Study Area not proceeded to development, the upgrading of this ditch would not be required until the area shown as Development Stage 3 proceeds. However, development is well underway in several areas of the Phase I Study Area contributory to the North Watercourse. Although detention (interim and ultimate) can control flood peaks up to 5 year floods, higher return period flood peaks will be increased due to development. As a result, the incidence with which the flows exceed the capacity of this ditch will increase.

Until such time as development within the Phase II Study Area impacts on this ditch, applicants within the Phase I Study Area should be required to demonstrate to the City that peak flows from the combined level of development proposed, will not exceed the capacity of this ditch.

6.7 Surrey Capital Works - 10 Year Servicing Plan

The current 10 Year Servicing Plan includes allowances for several Capital Works of relevance to the North Cloverdale NCP West Neighbourhood as follows:

SURREY REF. NO.	DESCRIPTION	ESTIMATE
3109	Community Detention - 184 St. (69 Ave - 69A Ave)	$ 1,350,000
3121	Dyke Tie-in & Storage N. Clov. (73 Ave @ 176 St.)	$ 980,000
3192	New trunk sewer - 184 St. (68 Ave - 69A Ave)	$ 150,000
3218	New trunk sewer - 68 Ave (180 St. - 182 St.)	$ 200,000
3266	Ditch elimination - 184 St. (64 Ave - Fraser Hwy.)	$ 110,000
3976	New Pump Stn. (Lowland & ditch) Fraser Hwy. (75 Ave - S15)	$ 530,000
4075	Erosion protection - 69 Ave (178 St. - 184 St.)	$ 350,000
4084	Community Detention - 180 St. @ 68 Ave	$ 430,000

6.8 Lowland Improvements

Previous sections of this report have acknowledged that development of the Study Area will impact on the long term flooding of the lowlands. Two studies that are proceeding concurrent with this submission have provided a preliminary indication of the issues to be addressed in providing relief from the additional run-off volumes to be directed to this area. Preliminary information provided by Surrey staff reveals that the existing Serpentine River dyke north of 62 Avenue is too low to accommodate the 10 year return design storm once this basin has been fully developed. Long range solution options currently under review include: a lowering of the hydraulic grade line in this existing dyke by pumping into the Serpentine south of 62 Avenue where sufficient capacity exists; or raising the dykes on the existing system north of 62 Avenue to accommodate the ultimate flows.

In the interim, the studies indicate that there is capacity within the existing dyke system to accommodate the additional 10 year flows expected from the North Cloverdale Phase I and II NCP Study Areas. This capacity is available up to, and including high tide events in the Serpentine. As noted in the previously referenced "North & West Cloverdale Master Drainage Plan", it is recommended that a drainage pump system, capable of pumping the 10 year volumes from these neighbourhoods, be installed adjacent to the Serpentine dyke near the flood box at Fraser Highway. This system is to be capable of pumping 0.3 cms (300 litres per second), and of drawing down the lowland storage volume to pre-development limits within the time frame of the design storm duration. These pumps would be set up to discharge the design volume based upon the difference in pre and post run-off volumes resulting from development of the Study Areas, and to repeat the cycle based on the design storm duration. The intent is to maintain the level of flooding in lowland cells contributing to the adjacent flood box to pre-development levels resulting in a "no-change" condition.

This pump is proposed to be installed within the existing Fraser Highway right-of-way in the south bank of the existing ditch and east of the existing floodgate. Fish movement will not be affected since the existing floodgate is to remain operational and continue to function at frequencies consistent with the existing condition. The pump station would form the first phase of a permanent, fish friendly, screw type drainage pumping facility, which will ultimately provide relief from existing agricultural and ditch flooding, as well as from future post-development flows originating in the West Clayton drainage basin. Three phase Hydro is available on Fraser Highway to this location, and additional rights-of-way are not required.

The overland ditch containing existing flows from the north watercourse is undersized for flows exceeding the pre-development condition. The NCP Phase II Drainage Study proposes that a grassed floodway be constructed west from the 177 Street crossing directly to the 176 Street ditch system as shown on Figure 18. In this way, detained minor and base flows from this watercourse can continue to utilize the existing ditch, while major flows will pass overland directly to the ditch/canal system and lowland storage areas. Floodway banks should be gently sloped so as to allow its use as pasture. A floodway bed width of 10m, and depth of 1m will be sufficient for the 100 year flows. A right-of-way will be required to accommodate this floodway through to 176 Street. This floodway is **not** required for Development Stages 1, 2A, or 2B, as drainage from these areas discharges directly to the existing ditch/canal system on 176 Street. It will only be required by the Study Area prior to, or concurrent with, the initiation of development in the

area defined as Development Stage 3. However, planning for the construction of this floodway should be considered as a priority in order to offset the impact of peak flows originating east of 184 Street. These flows will exceed the capacity of existing ditch **with or without** development proceeding in Development Stage 3. As a result, this floodway is shown in Section 7, Summary of Major Servicing Works and Funding, for construction in 1996. This is only a suggested construction schedule for this work. Based upon field observations, there appears to be no immediate impact resulting from the present (May 1996) level of development on downstream properties affected by the occasional overtopping of the overland ditch. Existing flows, which may now overtop this system along its length, follow the existing ground slope generally west-northwest, and are eventually added to the 176 Street ditch/canal system. At some point, however, the increases in both the incidence and degree with which post-development flows exceed the capacity of this ditch will warrant construction of the floodway. It is anticipated that the continued development of the East Neighbourhood will precipitate construction of the floodway well before initiation of development with Stage 3 of the Study Area, currently projected for 2001. Areas dependent on this floodway cannot proceed until such time as floodway rights-of-way, or an acceptable alternative are in place.

Both the pump station and floodway include significant contributing flows from the catchment areas upstream of 184 Street. The North Cloverdale Phase I NCP concluded that the development of their "west" catchment would not have "any appreciable impact" on present lowland flooding elevations. As noted previously herein, the data excerpt from the UMA Master Drainage Study included on pages 52-57 inclusive, clearly shows that there is a measureable impact on the lowland storage volumes resulting from development in this area. Further, undetained minor flows may, and ultimate major flows will certainly, exceed the capacity of the north watercourse outfall ditch.

Development of the Phase II Study Area will require that these issues be resolved, however, it is not reasonable to assume that this NCP provide facilities in excess of those required by the West Neighbourhood. Since the contributing catchment north of Fraser Highway is likely to remain in its pre-developed state for the foreseeable future, and, since the Phase I NCP has been approved since the fall of 1994, the West Neighbourhood Study Area must rely on the City to provide the proportionate share for these works.

The first phase of the proposed drainage pump system is to be sized to accommodate only the Phase I and Phase II Study Areas, making no allowance for future development in the West Clayton catchment, north of Fraser Highway. The City share for the cost of this system would be based pro-rata on the ratio of

contributing areas of Phases I and II only. Similarly, the proposed floodway is required by the entire basin upstream of 184 Street as well as Development Stage 3 of the Phase II Study Area. The Surrey share for these works should be based pro-rata on the ratio of contributing flow at 184 Street (7.2 cms) to the total flow at the floodway (9.0 cms).

The combination of these two improvements will permit the full development of the Phase I and II Study Areas while maintaining the existing condition for the lowlands.

6.9 Cost Estimates -Trunk Sewers & Lowland Improvements

Based on the foregoing assumptions and conclusions, we have prepared a summary of the major storm drainage items and recommended lowland improvements and their corresponding preliminary cost estimates as follows:

1.	68 Avenue Trunk Sewer - 181 Street to 178 Street (Limit of Dev. Stage I)		$402,000
2.	68'A' Avenue/68Avenue Trunk Sewer - 178 Street to 176 Street & Outfall (Limit of Dev. Stage 2B)		$377,100
3.	177 Street Trunk Sewer - 70 Avenue @ 178 Street to Outfall (Dev. Stage 3)		$ 92,000
4.	Overflow Floodway - 177 Street Outfall to 176 Street (Dev. Stage 3) (Full cost = $75,000 Phase II Share = 20%)		$ 60,000
5.	Serpentine River Drainage Pump (Fraser Highway Dyke Crossing) (Dev. Stage 2) (Full cost = $600,000 Phase II Share = 66%)		$200,000
6.	North Watercourse Erosion Protection (Full Cost = $350,000 Phase II Share = 5%)		332,500
		TOTAL	$1,463,600

6.10 Phasing & Implementation

Individual developments within the Study Area will be proceeding as soon as development approvals are obtained, and the market dictates. As discussed in previous sections of this submission, development phasing is expected to proceed westerly along 68 Avenue from 184 Street. Initial applications currently in the approval process with the City include significant portions of Development Stage I, up to and including the multi-family site fronting 68 Avenue between 178'A' Street and 180 Street. As part of this application, the developer is proposing to construct the complete 68'A' Avenue/68 Avenue trunk storm sewer identified in Section 6.9 as items 1 and 2. The City has acquired the necessary rights-of-way to permit the construction of the parallel trunk sanitary sewer west of 179 Street, and discussions are presently underway aimed at expanding the use of these rights-of-way to include this storm sewer. This sewer is proposed to be included in Surrey's current 10 Year Plan review and reflected in a new D.C.C. Bylaw in early 1996. Developer construction of this trunk will be D.C.C. rebatable under current Surrey D.C.C. rebate policy. Trunk sewer identified in the current 10 Year Plan on 68 Avenue from 180 Street to 182 Street as Ref. #3218 will no longer be required.

As development extends through Development Stages 1, 2A & 2B, service can be provided simply by extending the existing trunk, and/or lateral mains from this trunk. Costs for these non-trunk mains are the responsibility of the development extending the service, although partial recovery may be possible under the latecomer process.

As initial stages of the Study Area proceed through to construction, and as the East Neighbourhood NCP continues to develop, the First Phase of the lowlands drainage pump station will be required. This initial phase is to be constructed in 1998. The total contributing area for the Phase I (East Neighbourhood) "west" catchment is 64 hectares (ha.) (per the North Cloverdale East Neighbourhood NCP Stage II Report, Section 6.2 Drainage Catchments - External and Internal), and the total contributing area for the Phase II (West Neighbourhood) catchment is 127 ha. for a total contributing area of 191 ha. The Phase II Study Area is, therefore, responsible for 66% of the total estimated costs of $600,000, with the remainder to be the responsibility of the City. This will result in a total cost to the City of $200,000, with the balance of $400,000 payable as a per unit pump station levy of $300.00/unit for the 1338 contributing units of the Study Area.

Since DCC's collected during 1996 are to be rebated to the developer frontending the construction of the 68 Avenue trunk sewer (from 176 - 181 Street), only those

Since the station is proposed for construction prior to the full collection of this levy, the initial funding shortfall will be made up by area DCC contributions. This will permit construction of this facility early in the West Neighbourhood construction staging process without burdening initial applications with the full costs associated with facilities benefitting catchment areas external to the Study Area.

As development continues, levies will continue to be collected from the remainder of the Study Area to the full share of $400,000. This will compensate for the initial use of of DCCs for the construction of this station by the City, and, in conjunction with the continued collection of DCC's from subsequent Study Area developments, will contribute towards the future funding of the 2nd phase of construction for this facility.

In addition to the above, flows contributing to the north watercourse at 184 Street account for 80% of the total flows discharging to the proposed floodway at the 177 Street/north watercourse outfall. The total estimated cost for this floodway is $75,000 with an 80% cost to the City of $60,000 and the balance of $15,000 payable as a per unit levy of $25.17 for the 596 contributing units of Development Stage 3.

As noted in the "North and West Cloverdale Master Drainage Plan", it is expected that the first developments to proceed in the Study Area will have a minimal impact on lowland flooding, and the pump station will not be required prior to its planned construction in 1998. However, this station should be operational before the completion of development in Stage 2A, when increases in run-off volume and storage requirements dictate. Further, as noted on page 61 and 64, the overflow floodway should be planned for construction as flows dictate in order to mitigate the impact of increasing upstream flows contributing to the north watercourse.

The completion of Development Stage I, will provide easier access to most of the north watercourse for works relating to erosion protection. The current 10 Year Servicing Plan includes these works in the north watercourse from 178 Street to 184 Street as Reference No. 4075. This element should remain in the current plan so that, as applications adjacent to the ravine proceed to development, areas within the ravine can be dedicated to the City as Park, and areas within the Ministry of Environment set-back limits can be protected by a statutory right-of-way. This will provide the City with the means to access this watercourse and maintain remedial works undertaken by individual applicants. However, except

for local bank erosion resulting from a drain tile referenced in Section 6.6, erosion in this watercourse results primarily from flows originating east of 184 Street. The Study Area is responsible for the cost of remedial works associated with restoring this local erosion with costs estimated to be $17,500. These works are specific to Development Stage I totalling 444 units resulting in a levy of $39.41/unit from this area only. In the interim, since access to this ravine is difficult, it is strongly recommended that development applications contributory to this system at 184 Street be permitted to proceed only if interim measures are incorporated into their drainage system designs. These measures should include, as a minimum, interim on-site detention, with release rates consistent with pre-development flows and remain operational until such time as the 184 Street/Fraser Highway community detention pond is constructed and operational.

The payment of Levies identified in Sections 6.8 and 6.10 will be required as a condition of Servicing Agreement for each individual application within the contributing catchment.

The extension of services into Development Stage 3 is not expected to proceed until Development Stages 1, 2A & 2B have been completed. As part of this stage of development, the 177 Street Trunk Sewer from 70 Avenue at 178 Street to the outfall west of 177 Street will be required, as will the overflow floodway. This sewer and floodway are proposed to be included in the revised 10 Year Plan and reflected in a new 1996 D.C.C. Bylaw. The floodway provides an overflow path not only for the Study Area but, more significantly, for the ultimate major flow from the contributing basin east of 184 Street including the East Neighbourhood Study Area. Inclusion in the plan will allow for the collection of "seed monies" from initial stages of both NCP areas and, as a result, the rebate of construction costs for both construction components through D.C.C. rebates.

Based on the assumption that current and proposed development applications proceed as anticipated, the following table summarizes the projected scheduling for completion of the major work items identified.

6. DRAINAGE

ITEM	DESCRIPTION	DEV. STAGE	YEAR
1.	68 Avenue Trunk Sewer (181 Street to 178 Street)	1	1996 to 1997
2.	68'A' Avenue/68 Avenue Trunk Sewer (178 Street to 176 Street & Outfall)	1	1996 to 1997
3.	Overflow Floodway (177 Street Outfall to 176 Street)	1 - 2A	1997
4.	Serpentine Drainage Pumps (Fraser Highway west of 176 Street)	2A	1998
5.	North Watercourse Erosion Protection (184 Street to 178 Street)	1	1997 to 1999
6.	177 Street Trunk Sewer (70 Avenue @ 178 Street to Outfall)	3	2000

Where noted in the text, each developer would be assessed a charge as his share of items specified as development cost items. The unit cost assessed would be the cost of the Study Area share divided by the number of units in the West Neighbourhood as provided by the Neighbourhood Plan.

7. SUMMARY OF MAJOR SERVICING WORKS & FUNDING

The following tables summarize the major servicing works that have been identified as necessary to provide trunk engineering services for the North Cloverdale West Neighbourhood Concept Plan. Each table identifies the projected construction completion year and provides a preliminary estimate of costs. The intention herein is to provide servicing cost projections and recoveries as they relate not only to the Study Area as a whole, but also to individual construction stages currently proposed per Figure No. 2. The tables identify items which are eligible for inclusion in Development Cost Charge funded works once the proposed amendments to the Development Cost Charge Bylaw and 10 Year Servicing Plan, as recommended in previous sections of this document, are adopted by Council. Costs provided have been based on the current City of Surrey "Unit Rates for Roads/Utilities Within NCP Areas", as provided by the Engineering Department on February 16, 1996. These unit rates are included in Appendix I following the Terms of Reference. D.C.C. contributions indicated throughout this proposal are based on rates set under current By-Law 12618, May 30, 1995. Please note that, unless specifically shown otherwise, no land costs have been included in these figures, since the required lands would be dedicated as roads and R.O.W.'s as development proceeds.

NCP INFRASTRUCTURE FINANCING AND FUNDING
ROADS

(Estimates) (Location)	Type of Work	Current or Addition	ID# Current 10 Year Plan	Amount Current Program ($)	Additions to Program ($)	Eligible for DCC Program (Y/N)	Refinement of DCC Program	Addition to DCC Program	Type of Funding		Construction by (Surrey/Dev.)	Year Requested
									Existing Method(1)	Proposed Method		
68 AVENUE 180 ST-184 ST	Rd - MAJOR COLLECTOR	CURRENT	4012	592,000	0	Y	N	N	DCW		DEV	1996
68 AVENUE 179 ST-180 ST	Rd - MAJOR COLLECTOR	ADDITION	N/A	0	156,000	Y	N	Y		DCW	DEV	1996
FRASER HWY. 176 ST - 196 ST	URBAN FEATURES	CURRENT	4006	PRO RATA SHARE 360,000	0	Y	N	N	CAPITAL WORKS		SURREY	2005
184 STREET @ 68 AVENUE	Rd - ARTERIAL LEFT TURN LANE	ADDITION	N/A	0	150,000	Y	N	Y		DCW	DEV	1997
184 STREET 66A - F. HWY.	Rd - ARTERIAL SW & ST.LIGHTS	ADDITION	N/A	0	148,000	Y	N	Y		DCW	DEV	1996-1998
184 STREET @ 67 AVENUE	Rd - ARTERIAL LEFT TURN LANE	ADDITION	N/A	0	150,000	Y	N	Y		DCW	DEV	2000
176 STREET @ 68'A' AVE	Rd - ARTERIAL SIGNALIZATION	ADDITION	N/A	0	(50% SHARE) 60,000	Y	N	Y		DCW	DEV	1999
184 STREET 69 AVE-F.HWY.	Rd - ARTERIAL WIDENING	ADDITION	N/A	0	340,000	Y	N	Y		CAPITAL WORKS	SURREY	2005+
TOTALS				952,000	514,000							

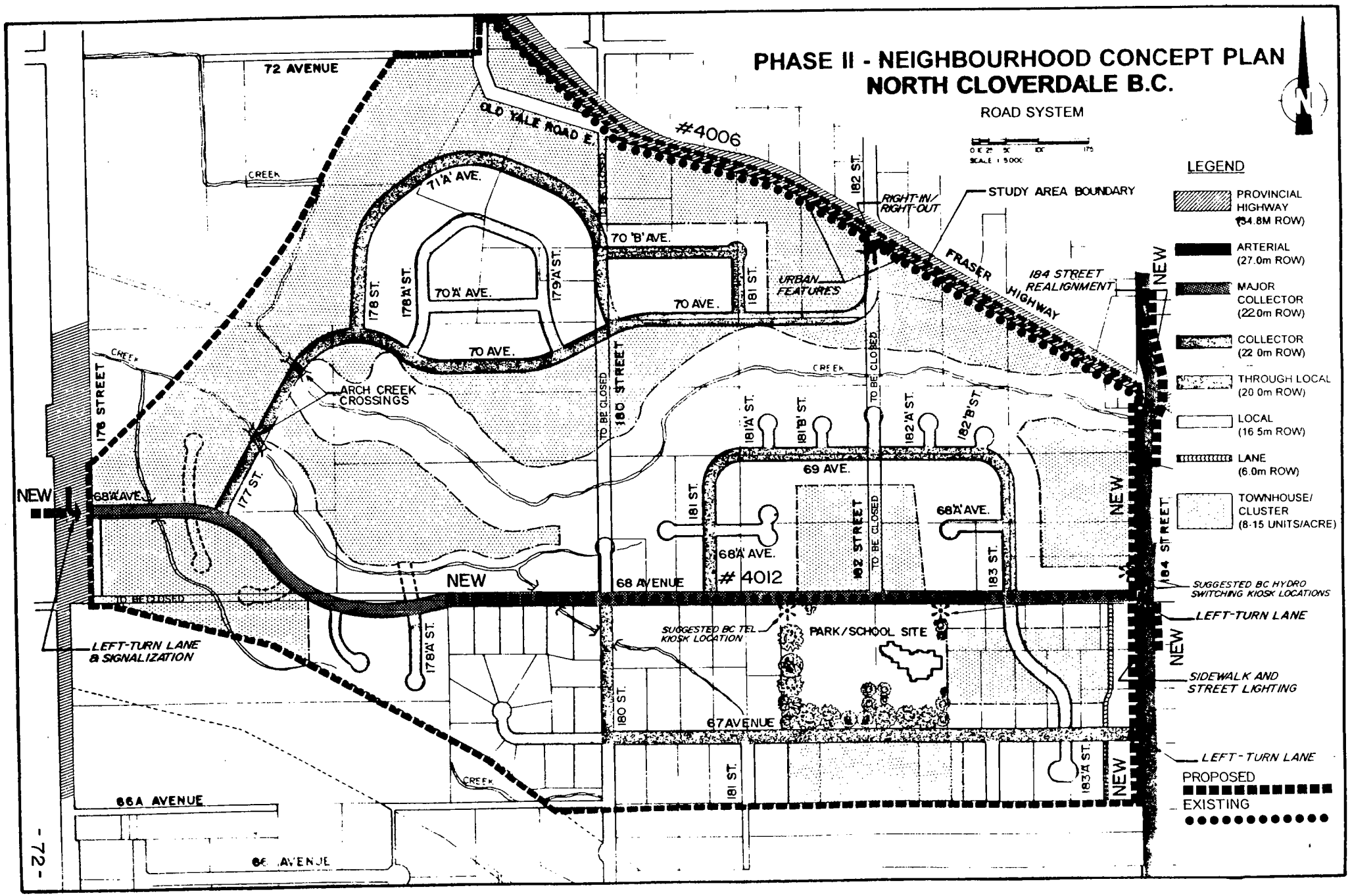
NOTE: (1) Funding Methods (Current):

- DCC Rebate
- Development Coordinated Works (Drainage, Arterial, Non-Arterial)
- Upsizing (Water, Sanitary)

(2) 184 Street Arterial Realignment @ Fraser Highway is not a required element for the Study Area and has NOT been included in this table. The estimated cost of $850,000 to be considered in future Ten Year Plan amendments per "Roads & Traffic, Section 3.13, Phasing and Implementation."

DCCR
DCW
UPS

- Frontage Latecomer FLAT
- Area Latecomer (Sanitary Pump Station and Force Main) ALAT


PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE B.C.
ROAD SYSTEM
SCALE 1:5000
72 AVENUE
OLD YALE ROAD E.
#4006
CREEK
71'A' AVE.
178 ST.
178'A' ST.
70'A' AVE.
179'A' ST.
70 'B' AVE.
70 AVE.
181 ST.
182 ST.
RIGHT-IN/ RIGHT-OUT
STUDY AREA BOUNDARY
URBAN FEATURES
FRASER HIGHWAY
184 STREET REALIGNMENT
NEW
TO BE CLOSED
180 STREET
ARCH CREEK CROSSINGS
177 ST.
181'A' ST.
181'B' ST.
182'A' ST.
182'B' ST.
69 AVE.
68'A' AVE.
183 ST.
184 STREET
NEW
68 AVENUE
#4012
SUGGESTED BC HYDRO SWITCHING KIOSK LOCATIONS
LEFT-TURN LANE
SUGGESTED BC TEL KIOSK LOCATION
PARK/SCHOOL SITE
LEFT-TURN LANE & SIGNALIZATION
SIDEWALK AND STREET LIGHTING
67 AVENUE
183'A' ST.
66A AVENUE
66 AVENUE
LEGEND
PROVINCIAL HIGHWAY (34.8M ROW)
ARTERIAL (27.0m ROW)
MAJOR COLLECTOR (22.0m ROW)
COLLECTOR (22.0m ROW)
THROUGH LOCAL (20.0m ROW)
LOCAL (16.5m ROW)
LANE (6.0m ROW)
TOWNHOUSE/ CLUSTER (8-15 UNITS/ACRE)
PROPOSED
EXISTING

NCP INFRASTRUCTURE FINANCING AND FUNDING
SANITARY SEWER

(Estimates) (Location)	Type of Work	Current or Addition	ID# Current 10 Year Plan	Amount Current Program ($)	Additions to Program ($)	Eligible for DCC Program (Y/N)	Refinement of DCC Program	Addition to DCC Program	Type of Funding		Construction by (Surrey/Dev.)	Year Requested
									Existing Method(1)	Proposed Method		
177 STREET 68 AVE- F.HWY	SANITARY TRUNK	CURRENT	3594	STUDY AREA ONLY (22.7%) 1,134,000	0	Y	N	N	DCW		DEV	2002
68'A' AVENUE @ 176 STREET	SANITARY PUMP STN. & FORCE MAIN	ADDITION	N/A	0	1,150,000 (2)	Y	N	Y		ALAT	SURREY	1996
68 AVENUE 176 ST-184 ST.	SANITARY TRUNK	ADDITION	N/A	0	670,000	Y	N	Y		DCW	DEV	1996
TOTALS				1,134,000	1,820,000							

NOTE: (1) Funding Methods (Current):

- DCC Rebate — DCCR
- Development Coordinated Works (Drainage, Arterial, Non-Arterial) — DCW
- Upsizing (Water, Sanitary) — UPS
- Frontage Latecomer — FLAT
- Area Latecomer (Sanitary Pump Station and Force Main) — ALAT

(2) Per Surrey Corporate Report No. R856 as approved by Council April 1, 1996.

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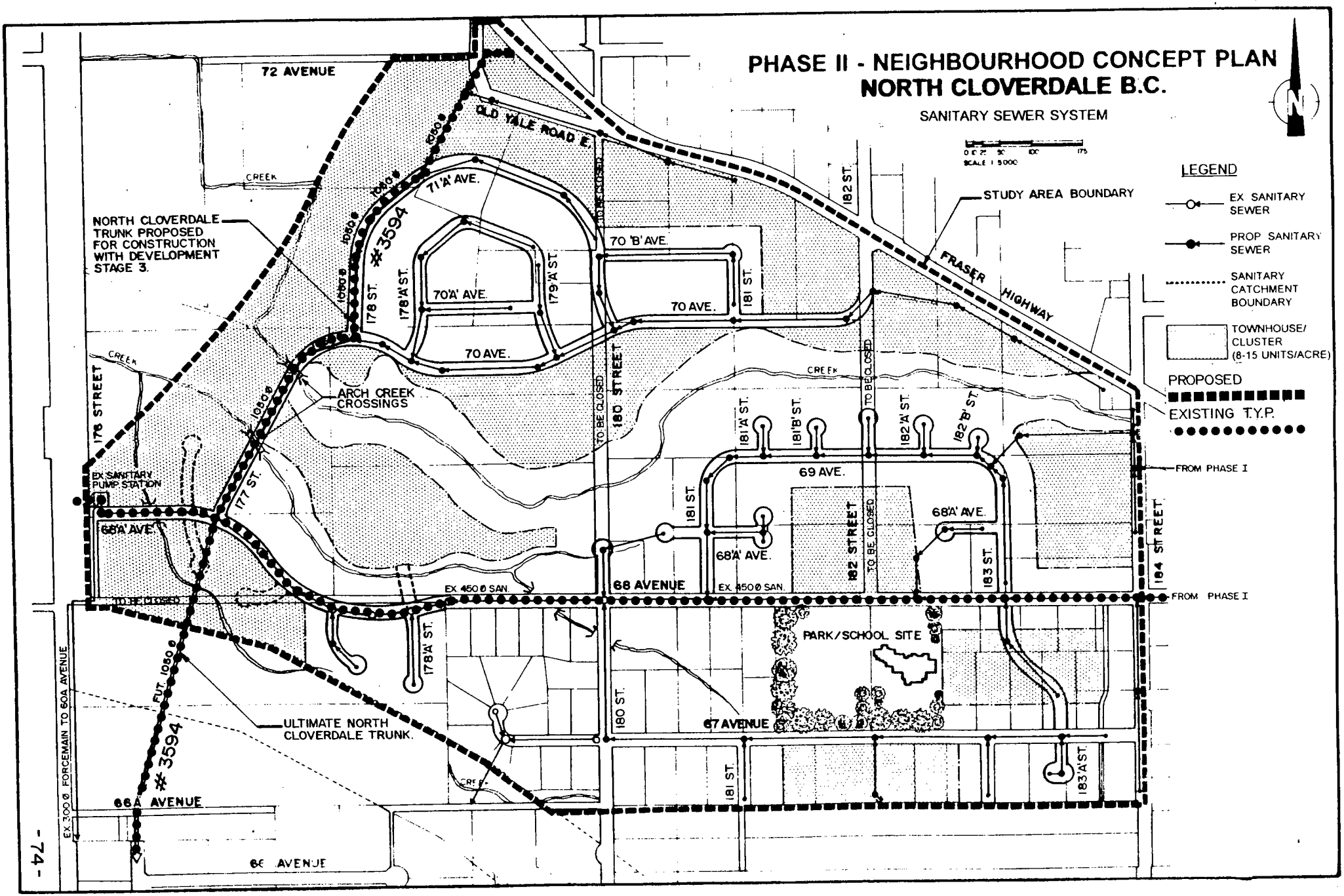

PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE B.C.
SANITARY SEWER SYSTEM
SCALE 1:5000
LEGEND
STUDY AREA BOUNDARY
EX SANITARY SEWER
PROP SANITARY SEWER
SANITARY CATCHMENT BOUNDARY
TOWNHOUSE/ CLUSTER (8-15 UNITS/ACRE)
PROPOSED
EXISTING T.Y.P.
72 AVENUE
OLD YALE ROAD E.
CREEK
NORTH CLOVERDALE TRUNK PROPOSED FOR CONSTRUCTION WITH DEVELOPMENT STAGE 3.
1050 ø
#3594
71'A' AVE.
178 ST.
178'A' ST.
179'A' ST.
70'A' AVE.
70 'B' AVE.
70 AVE.
181 ST.
182 ST.
FRASER HIGHWAY
TO BE CLOSED
180 STREET
176 STREET
ARCH CREEK CROSSINGS
177 ST.
EX SANITARY PUMP STATION
68'A' AVE.
181'A' ST.
181'B' ST.
182'A' ST.
182'B' ST.
69 AVE.
68'A' AVE.
182 STREET
183 ST.
184 STREET
FROM PHASE I
EX 450ø SAN.
68 AVENUE
178'A' ST.
PARK/SCHOOL SITE
FUT. 1050 ø
ULTIMATE NORTH CLOVERDALE TRUNK.
67 AVENUE
183'A' ST.
EX 300 ø FORCEMAIN TO 60A AVENUE
66A AVENUE
66 AVENUE

NCP INFRASTRUCTURE FINANCING AND FUNDING
WATER - MAJOR GRID

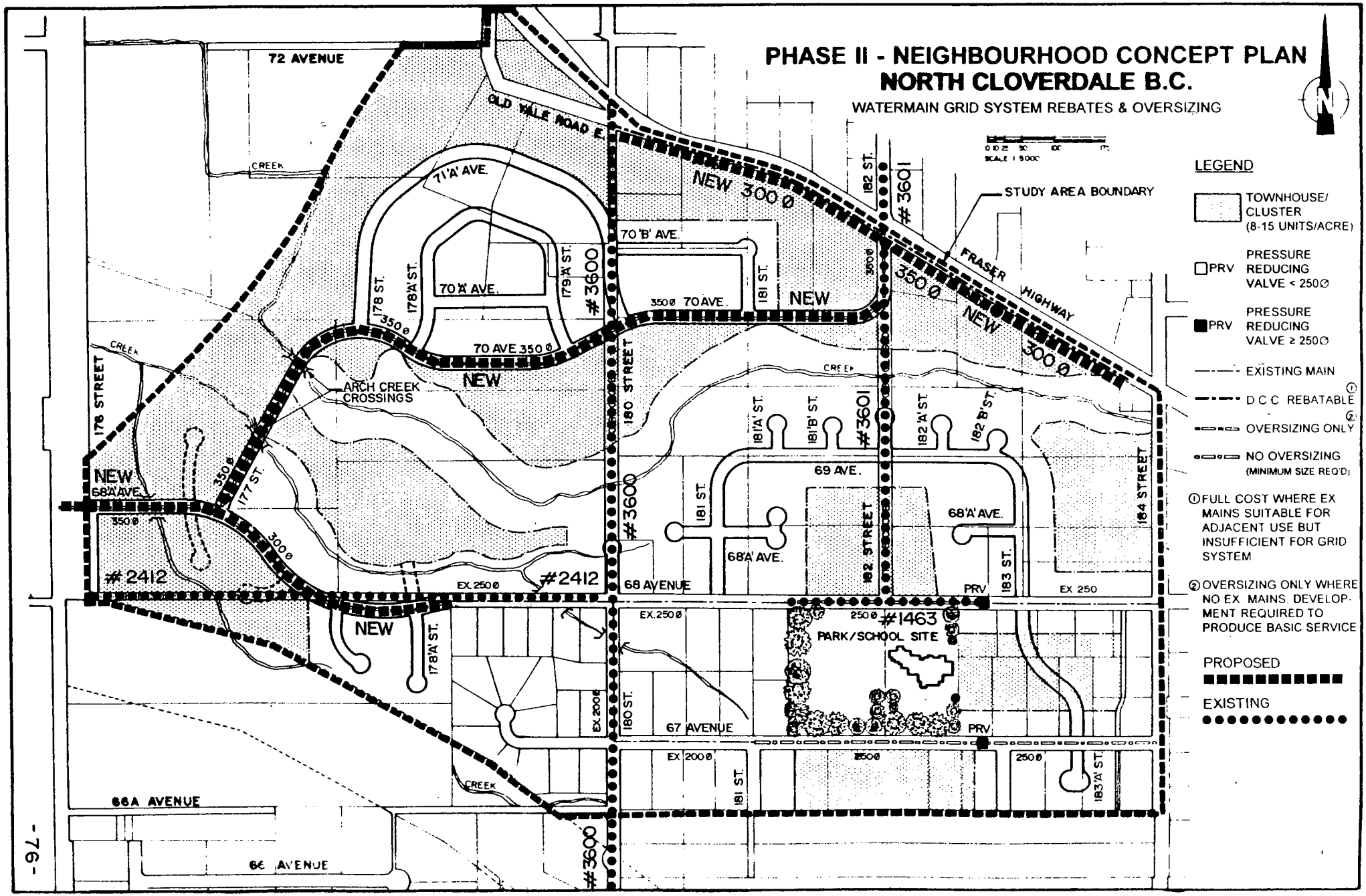
(Estimates) (Location)	Type of Work	Current or Addition	ID# Current 10 Year Plan	Amount Current Program ($)	Additions to Program ($)	Eligible for DCC Program (Y/N)	Refinement of DCC Program	Addition to DCC Program	Type of Funding Existing Method(1)	Type of Funding Proposed Method	Construction by (Surrey/Dev)	Year Requested
68 AVENUE 182 - 183 ST.	WATER - MAJOR GRID	CURRENT	1463	55,000	0	Y	Y	N	DCCR		DEV	1996
68 AVENUE 176 - 180 ST.	WATER - MAJOR GRID	CURRENT	2412	96,000 (2) (40% SHARE)	0	Y	Y	N	UPS		DEV	NOT REQUIRED
180 STREET 66 - 72 AVE	WATER - MAJOR GRID	CURRENT	3600	360,000 (2)	0	Y	Y	N	DCCR		DEV	NOT REQUIRED
182 STREET 68 - 72 AVE	WATER - MAJOR GRID	CURRENT	3601	350,000 (2)	0	Y	Y	N	DCCR		DEV	NOT REQUIRED
68 AVENUE @ 182A ST.	P.R.V.	ADDITION	N/A	0	50,000	Y	N	Y		DCCR	DEV	1996
68 AVENUE 178 - 179 ST.	WATER - MAJOR GRID	ADDITION	N/A	0	4,950	Y	N	Y		UPS	DEV	1997
67 AVENUE @ 182A ST.	P.R.V.	ADDITION	N/A	0	50,000	Y	N	Y		DCCR	DEV	1999
68/68A AVE 177 - 178 ST.	WATER - MAJOR GRID	ADDITION	N/A	0	6,600	Y	N	Y		UPS	DEV	1999
70 AVENUE 178 - 181 ST.	WATER - MAJOR GRID	ADDITION	N/A	0	26,550	Y	N	Y		UPS	DEV	2001-2002
FRASER HWY 180 - 182 ST.	WATER - MAJOR GRID	ADDITION	N/A	0	180,600	Y	N	Y		DCCR	DEV	2003-2005
FRASER HWY 182 - 182B ST	WATER - MAJOR GRID	ADDITION	N/A	0	88,350	Y	N	Y		DCCR	DEV	2003-2005
FRASER HWY 182b-184 ST.	WATER - MAJOR GRID	ADDITION	N/A	0	92,400	Y	N	Y		DCCR	DEV	2003-2005
TOTALS				55,000 (2)	499,450							

NOTE (1) Funding Methods (Current).

- DCC Rebate
- Development Coordinated Works (Drainage, Arterial, Non-Arterial)
- Upsizing (Water, Sanitary)
- Frontage Latecomer
- Area Latecomer (Sanitary Pump Station and Force M...

DCCR
DCW
UPS
FLAT

(2) Total does not included elements noted as "Not Required."


PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE B.C.
WATERMAIN GRID SYSTEM REBATES & OVERSIZING
SCALE 1:5000
LEGEND
STUDY AREA BOUNDARY
TOWNHOUSE/ CLUSTER (8-15 UNITS/ACRE)
PRV PRESSURE REDUCING VALVE < 250Ø
PRV PRESSURE REDUCING VALVE ≥ 250Ø
EXISTING MAIN
D C C REBATABLE ①
OVERSIZING ONLY ②
NO OVERSIZING (MINIMUM SIZE REQ'D)
① FULL COST WHERE EX MAINS SUITABLE FOR ADJACENT USE BUT INSUFFICIENT FOR GRID SYSTEM
② OVERSIZING ONLY WHERE NO EX. MAINS. DEVELOPMENT REQUIRED TO PRODUCE BASIC SERVICE
PROPOSED
EXISTING
72 AVENUE
OLD HALE ROAD E.
CREEK
71'A' AVE.
NEW 300Ø
182 ST.
#3601
FRASER HIGHWAY
70'B' AVE.
70'A' AVE.
178 ST.
178'A' ST.
179'A' ST.
#3600
350Ø 70 AVE.
181 ST.
NEW
350Ø
70 AVE 350Ø
NEW
ARCH CREEK CROSSINGS
180 STREET
176 STREET
181'A' ST.
181'B' ST.
182'A' ST.
182'B' ST.
69 AVE.
184 STREET
NEW 68'A' AVE.
177 ST.
68'A' AVE.
#2412
EX 250Ø
68 AVENUE
182 STREET
183 ST.
EX 250
PRV
#1463
PARK/SCHOOL SITE
NEW
178'A' ST.
EX 200Ø
180 ST.
67 AVENUE
EX 200Ø
183'A' ST.
66A AVENUE
66 AVENUE
-76-

NCP INFRASTRUCTURE FINANCING AND FUNDING
DRAINAGE

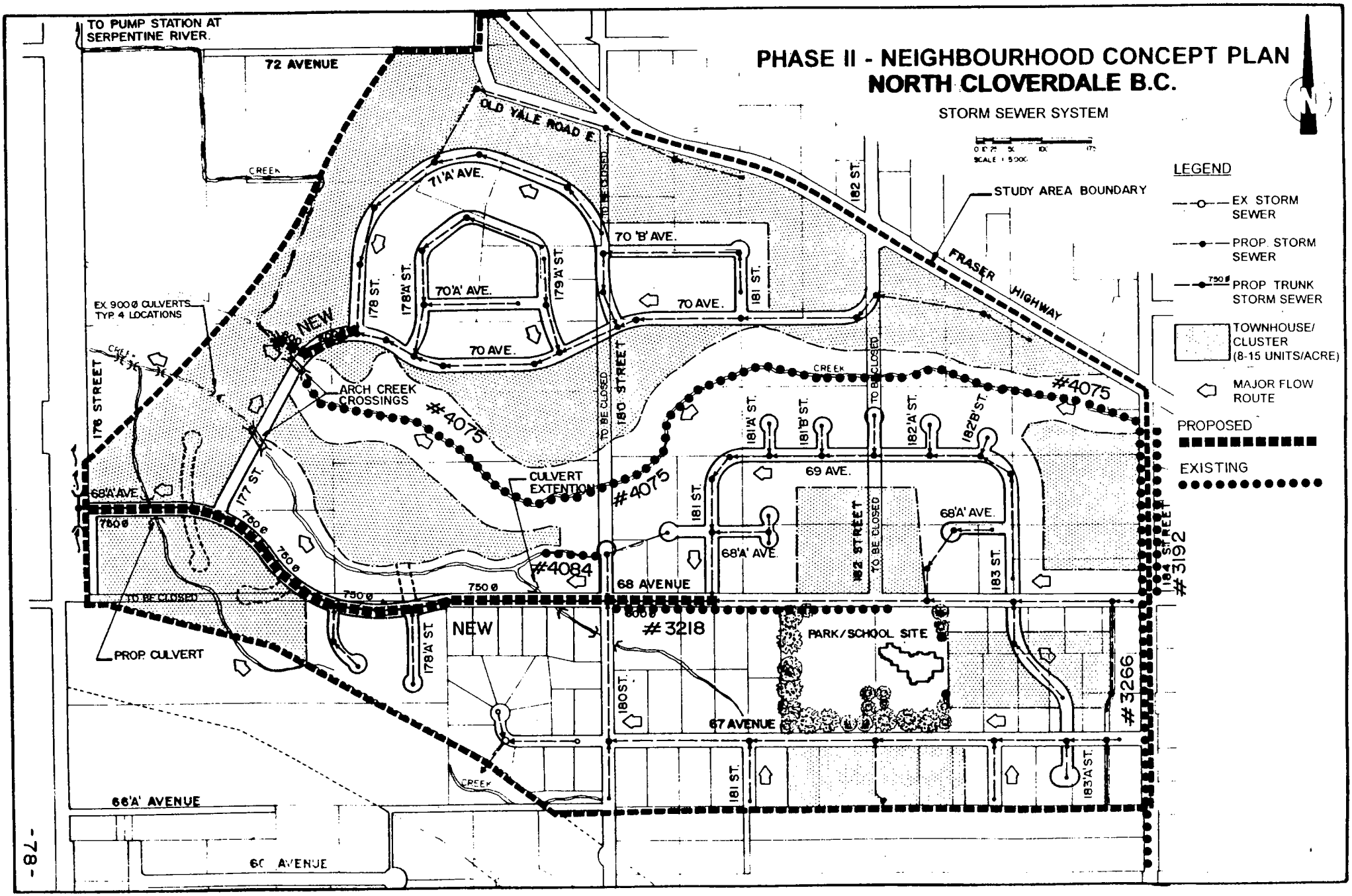
(Estimates) (Location)	Type of Work	Current or Addition	ID# Current 10 Year Plan	Amount Current Program ($)	Additions to Program ($)	Eligible for DCC Program (Y/N)	Refinement of DCC Program	Addition to DCC Program	Type of Funding		Construction by (Surrey/Dev.)	Year Requested
									Existing Method(1)	Proposed Method		
68 AVENUE 180 - 182 ST.	DRAINAGE TRUNK	CURRENT	3218	200,000 (3)	0	Y	Y	N	DCW		SURREY	NOT REQUIRED
69 AVENUE 178 - 184 ST.	EROSION PROTECTION	CURRENT	4075	350,000	0	Y	N	N	DCCR		DEV	1996-1999
180 STREET @ 68 AVE	COMMUNITY DETENTION	CURRENT	4084	430,000 (3)	0	Y	Y	N	DCW		SURREY	NOT REQUIRED
184 STREET 64 AVE - F.HWY.	DITCH ELIMINATION	CURRENT	3266	110,000 (3)	0	Y	N	N	DCW		DEV	NOT REQUIRED
68 AVENUE 176 - 181 ST.	DRAINAGE TRUNK	ADDITION	N/A	0	779,100	Y	N	Y		DCCR	DEV	1996
177 STREET @ 69A AVENUE	OVERFLOW FLOODWAY	ADDITION	N/A	0	(80% share) 60,000	Y	N	Y		DCW	SURREY	1996
FRASER HWY.@ SERPENTINE R.	DRAINAGE PUMP	ADDITION	N/A	0	(82% share) 489,640	Y	N	Y		DCW	SURREY	1998
177 STREET 70 AVE TO OUTFALL	DRAINAGE TRUNK	ADDITION	N/A	0	92,000	Y	N	Y		DCCR	DEV	2001
TOTALS				350,000 (3)	1,326,140							

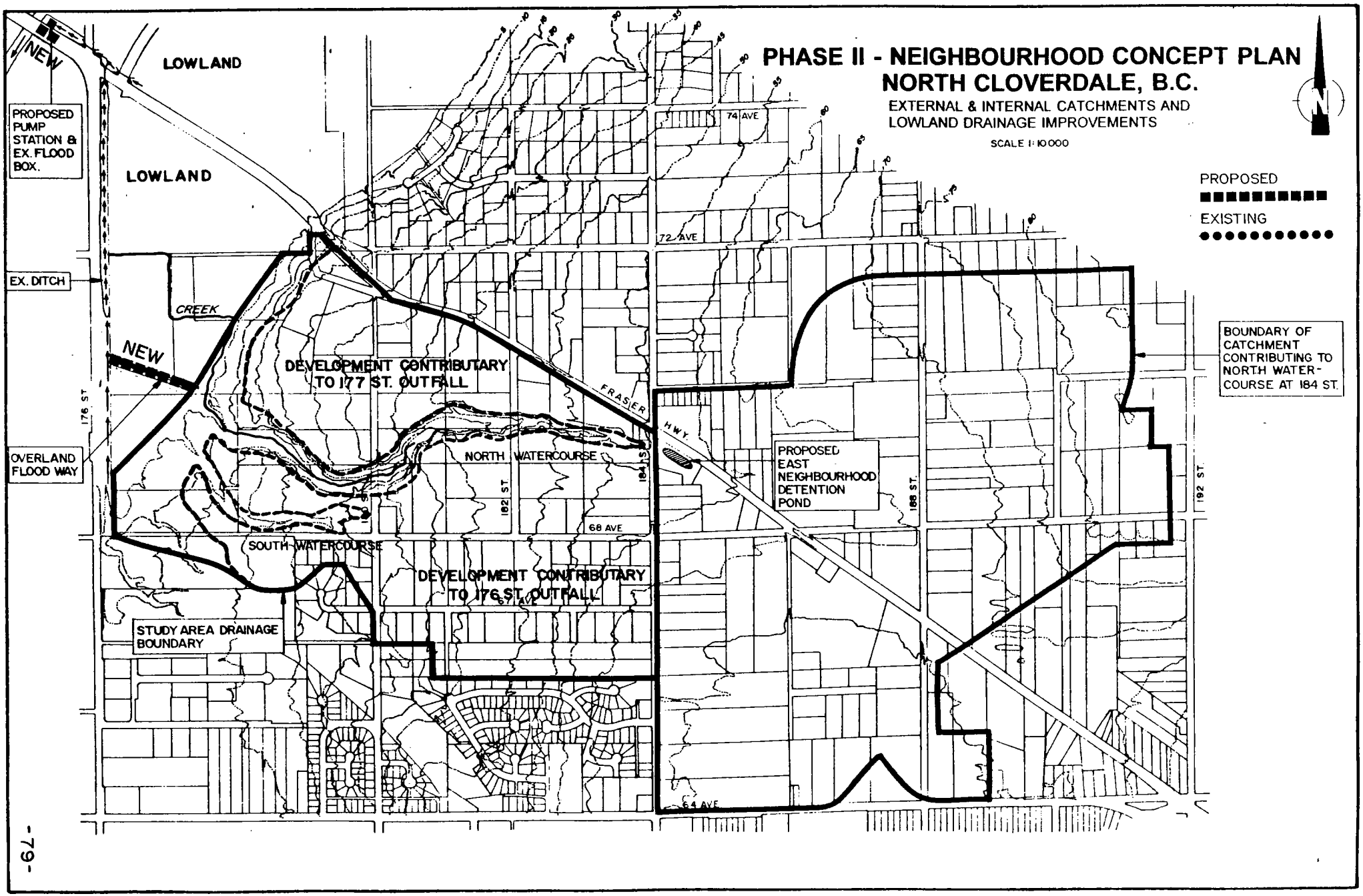
NOTE: (1) Funding Methods (Current):

- DCC Rebate — DCCR
- Development Coordinated Works (Drainage, Arterial, Non-Arterial) — DCW
- Upsizing (Water, Sanitary) — UPS
- Frontage Latecomer — FLAT
- Area Latecomer (Sa

(2) Current T.Y.P. element #3976, "New Pumps and Lowland Ditch" is not a required element for the Study Area and has NOT been included in this table.

(3) Total does not include elements noted as "Not Required."


PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE B.C.
STORM SEWER SYSTEM
SCALE 1:5000
LEGEND
STUDY AREA BOUNDARY
EX STORM SEWER
PROP. STORM SEWER
PROP. TRUNK STORM SEWER
TOWNHOUSE/ CLUSTER (8-15 UNITS/ACRE)
MAJOR FLOW ROUTE
PROPOSED
EXISTING
TO PUMP STATION AT SERPENTINE RIVER.
72 AVENUE
OLD YALE ROAD E.
CREEK
71'A' AVE.
70 'B' AVE.
70'A' AVE.
70 AVE.
178 ST.
178'A' ST.
179'A' ST.
181 ST.
182 ST.
FRASER HIGHWAY
EX. 900Ø CULVERTS TYP. 4 LOCATIONS
NEW
178 STREET
ARCH CREEK CROSSINGS
#4075
180 STREET
TO BE CLOSED
CULVERT EXTENTION
181'A' ST.
181'B' ST.
182'A' ST.
182'B' ST.
69 AVE.
68'A' AVE.
177 ST.
750Ø
#4084
181 ST.
182 STREET
183 ST.
184 STREET
#3192
68 AVENUE
#3218
PARK/SCHOOL SITE
PROP. CULVERT
178'A' ST.
180 ST.
67 AVENUE
#3266
183'A' ST.
66'A' AVENUE
60 AVENUE


PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE, B.C.
EXTERNAL & INTERNAL CATCHMENTS AND
LOWLAND DRAINAGE IMPROVEMENTS
SCALE 1:10000
PROPOSED
EXISTING
NEW
LOWLAND
PROPOSED PUMP STATION & EX. FLOOD BOX.
LOWLAND
74 AVE
72 AVE
EX. DITCH
CREEK
NEW
DEVELOPMENT CONTRIBUTARY TO 177 ST. OUTFALL
FRASER
HWY
BOUNDARY OF CATCHMENT CONTRIBUTING TO NORTH WATER-COURSE AT 184 ST.
176 ST
OVERLAND FLOOD WAY
NORTH WATERCOURSE
184 ST
182 ST
PROPOSED EAST NEIGHBOURHOOD DETENTION POND
188 ST
192 ST
68 AVE
SOUTH WATERCOURSE
DEVELOPMENT CONTRIBUTARY TO 176 ST. OUTFALL
STUDY AREA DRAINAGE BOUNDARY
64 AVE

PROPOSED NCP FINANCIAL PHASING AND POPULATION PROJECTIONS

Phase	Year	Items & Location	Cost	Funding Method	Population Projection	Lot or Unit Projection (as per DCC By-law)
1	1996	68 AVENUE - MAJOR COLLECTOR (WIDENING) - 179 ST. - 184 ST.	748,000	DCW	PHASE 1 - 1465	444 UNITS
	1996	184 STREET - ARTERIAL - 68 AVE - FRASER HWY. (SW & LIGHTING)	74,000 (½ of 148,000)	DCW	"	"
	1997	184 STREET @ 68 AVENUE - ARTERIAL - LEFT TURN LANE	150,000	DCW	"	
	1996	SANITARY TRUNK - 68 AVE: 176 ST - 184 ST.	670,000	DCW	PHASE 1 - 1465	444 UNITS
	1996	SANITARY PUMP STATION & FORCE MAIN (INT)	1,150,000	ALAT	PHASE 1 - PHASE 3 - 4416	1338 UNITS
	1996	P.R.V. - 68 AVENUE @ 182'A' ST.	50,000	DCCR	PHASE 1 - 1465	444 UNITS
	1996	WATERMAIN - 68 AVE: 182 - 183 ST.	55,000	DCCR	"	"
	1997	WATERMAIN - 68 AVE: 178 - 179 ST.	4,950	UPS	"	"
	1996-99	EROSION PROTECTION 69 AVE: 178 - 184 ST.	(95% SHARE) 332,500	DCCR	PHASE 1 - 1465	444 UNITS
	1996	DR. TRUNK - 68 AVE: 176 - 181 ST.	779,100	DCCR	"	"
	1996	FLOODWAY - 70 AVE: 176 - 177 ST.	(80% SHARE) 60,000	DCCR	"	"
TOTAL 1			4,073,550			

PROPOSED NCP FINANCIAL PHASING AND POPULATION PROJECTIONS

Phase	Year	Items & Location	Cost	Funding Method	Population Projection	Lot or Unit Projection (as per DCC By-law)
2A	1999	P.R.V. - 67 AVE @ 182'A' ST.	50,000	DCCR	PHASE 2A - 815	247 UNITS
	1998	184 STREET ARTERIAL - 66A - 68 ST. (SW & S/L)	74,000 (½ of 148,000)	DCW	PHASE 2A - 815	247 UNITS
	2000	184 STREET @ 67 AVENUE - ARTERIAL - LEFT TURN LANE	150,000			
2B	1999	SIGNALIZATION - 176 ST @ 68 AVE	60,000	DCW	PHASE 2B - 244	74 UNITS
	2000	WATERMAIN - 68 AVE: 177 - 178 ST.	6,600	UPS	PHASE 2B - 244	74 UNITS
	1998	DRAINAGE PUMP - F. HYW @ SERPENTINE	(34 % SHARE) 200,000	DCW	PHASE 2B - 244	74 UNITS
TOTAL 2			540,600			

PROPOSED NCP FINANCIAL PHASING AND POPULATION PROJECTIONS

Phase	Year	Items & Location	Cost	Funding Method	Population Projection	Lot or Unit Projection (as per DCC By-law)
3	2005	URBAN FEATURES - F.HWY: 179-184 ST.	PRO-RATA SHARE 360,000	DCW	PHASE 3 - 1891	573 UNITS
	2002	SANITARY TRUNK - 177 ST: 68 - F.HWY.	1,134,000	DCW	PHASE 3 - 1891	573 UNITS
	2001	WATERMAIN - 70 AVE: 178 - 181 ST.	26,550	UPS	PHASE 3 - 1891	573 UNITS
3	2003	WATERMAIN - F.HWY: 180 - 182 ST.	180,600	DCCR	PHASE 3 - 1891	573 UNITS
	2003	WATERMAIN - F.HWY: 182 - 182'B' ST.	88,350	DCCR	"	"
	2003	WATERMAIN - F.HWY: 182'B' - 184 ST.	92,400	DCCR	"	"
	2001	DR. TRUNK - 177 ST; 70 AVE - OUTFALL	92,000	DCCR	PHASE 3 - 1891	573 UNITS
TOTAL 3			1,973,900			

SUMMARY

NCP INFRASTRUCTURE FINANCING & FUNDING

MAY 7, 1996

SUMMARY: ROADS - ARTERIAL
NCP INFRASTRUCTURE FINANCING & FUNDING

Development Stage	Year	Units & Rates	DCC Contributions	Construction	Current T.Y.P.	Balance
Stage 1	1996	121 S.F. @ $1220 150 M.F. @ $1220	(+) $1,300,800	(-) $ 74,000 184 ST - SW & ST. LTS. F. HWY - 68 AVE.	-	(+) $1,226,800
	1997	54 S.F. @ $1220 31 M.F.@ $1220	(+) $ 408,000	(-) $150,000 184 ST - LEFT TURN LANE @ 68 AVE.	-	(+) $ 258,000
Stage 1 & 2A	1998	31 S.F.@ $1220 65 M.F.@ $1220	(+) $ 460,800	(-) $ 74,000 184 ST - SW & ST. LTS 68 AVE - 66'A' AVE.	-	(+) $ 386,800
Stage 2A & 2B	1999	80 S.F.@ $1220 Ø M.F. --	(+) $ 384,000	(-) $ 60,000 176 ST @ 68 AVE SIGNALIZATION 50% SHARE	-	(+) $ 324,000
	2000	38 S.F.@ $1220 172 M.F @ $1220	(+) $1,008,000	(-) $150,000 184 ST - LEFT TURN LANE @ 67 AVE		(+) $ 858,000
Stage 3	2001	245 S.F. @ $1220 25 M.F. @ $1220	(+) $ 235,200	-	-	(+) $ 235,200
	2002	26 S.F. @ $1220 82 M.F. @ $1220	(+) $ 518,400	-	-	(+) $ 518,400
	2003	25 S.F. @ $1220 58 M.F. @ $1220	(+) $ 398,400	-	-	(+) $ 398,400
	2004	8 S.F. @ $1220 60 M.F. @ $1220	(+) $ 326,400	-	-	(+) $ 326,400
	2005	Ø S.F. – 67 M.F. @ $1220	(+) $ 321,600		PRO RATE SHARE REF. #4006 (-) $ 360,000*	(+) $ 321,600*
TOTALS		1338 units	(+)$5,361,600	(-) $508,000	N/A*	(+)$4,853,600*

NOTE: *REF. #4006 in current T.Y.P. and funded from exist DCC Bylaw
and includes Urban Features along F. Hwy Frontage
- Amount has not been included in summary or balance.

SUMMARY: ROADS - MAJOR COLLECTOR
NCP INFRASTRUCTURE FINANCING & FUNDING

Development Stage	Year	Units & Rates	DCC Contributions	Construction	Current T.Y.P.	Balance
Stage 1	1996	121 S.F. @ $1220 150 M.F. @ $1220	(+) $330,620	(-) $156,000 WIDENING - 68 AVE 179 - 180 ST.	Ref. #4012 (-) $592,000	(+) $174,620*
	1997	54 S.F. @ $1220 31 M.F.@ $1220	(+) $103,700	-	-	(+) $103,700
Stage 1 & 2A	1998	31 S.F.@ $1220 65 M.F.@ $1220	(+) $117,120	-	-	(+) $117,120
Stage 2A & 2B	1999	80 S.F.@ $1220 Ø M.F. –	(+) $ 97,600	-	-	(+) $ 97,600
	2000	38 S.F.@ $1220 172 M.F @ $1220	(+) $256,200	-	-	(+) $256,200
Stage 3	2001	245 S.F. @ $1220 25 M.F. @ $1220	(+) $329,400	-	-	(+) $329,400
	2002	26 S.F. @ $1220 82 M.F. @ $1220	(+) $131,760	-	-	(+) $131,760
	2003	25 S.F. @ $1220 58 M.F. @ $1220	(+) $101,260	-	-	(+) $101,260
	2004	8 S.F. @ $1220 60 M.F. @ $1220	(+) $ 82,960	-	-	(+) $ 82,960
	2005	Ø S.F. -- 67 M.F. @ $1220	(+) $ 81,740	-	-	(+) $ 81,740
TOTALS		1338 units	(+)$1,632,360	(-) $156,000	N/A*	(+)$1,476,360*

NOTE: *REF. #4012 in current T.Y.P. and funded from exist DCC Bylaw
and includes widening on 68 Ave from 180 - 184 St.
- Amount has not been included in summary or balance

SUMMARY: SANITARY
NCP INFRASTRUCTURE FINANCING & FUNDING

DEVELOPMENT STAGE	YEAR	UNITS & RATES	D.C.C. CONTRIBUTIONS	AREA LATECOMER CONTRIBUTIONS	SANITARY PUMP, STN. & F.M. STUDY AREA SHARE @ 450/UNIT	68 AVENUE TRUNK (176 - 184 ST.)	CURRENT T.Y.P. 1050 Ø TRUNK	BALANCE
Stage 1	1996	121 S.F. @ $930 150 M.F. @ $810	(+)$ 234,030	(+) $ 121,950	(-)$ 602,100	(-) $ 670,000		(-) $ 916,120
	1997	54 S.F. @ $930 31 M.F. @ $810	(+) $ 75,330	(+) $ 38,250				(+) $ 113,580
Stage 1 & 2A	1998	31 S.F. @ $930 65 M.F. @ $810	(+) $ 81,480	(+) $ 43,200				(+) $ 124,680
Stage 2A & 2B	1999	80 S.F. @ $930 Ø M.F.	(+) $ 74,400	(+) $ 36,000				(+) $ 110,400
	2000	38 S.F. @ $930 172 M.F.@ $810	(+) $ 174,600	(+) $ 94,500				(+) $ 269,160
Stage 3	2001	245 S.F.@ $930 25 M.F. @ $810	(+) $ 248,100	(+) $ 121,500			FUNDED FROM EXIST DCC BY-LAW (-)$ 1,134,000*	(+) $ 369,600
	2002	26 S.F. @ $930 82 M.F. @ $810	(+) $ 90,600	(+) $ 48,600				(+) $ 139,200
	2003	25 S.F. @ $930 58 M.F. @ $810	(+) $ 70,230	(+) $ 37,350				(+) $ 107,580
	2004	8 S.F. @ $930 60 M.F. @ $810	(+) $ 56,040	(+) $ 30,600				(+) $ 86,640
	2005	Ø S.F. 67 M.F.@ $810	(+) $ 54,270	(+) $ 30,150				(+) $ 84,420
TOTALS		1338 units	(+) $ 1,159,140	(+) $ 602,100	(-) $ 602,100	(-) $ 670,000	N/A*	(+) $ 489,140

NOTE: The 1050Ø sanitary "Clayton" trunk sewer is NOT an NCP item and has been included above only to confirm estimated construction timing. This sewer is included in the current T.Y.P. and has not, therefore, been included in the Summary or extended into the Balance column.

SUMMARY: WATER
NCP INFRASTRUCTURE FINANCING & FUNDING

DEVELOPMENT STAGE	YEAR	UNITS & RATES	D.C.C. CONTRIBUTIONS	GRID WATERMAIN CONSTRUCTION	CURRENT T.Y.P.	BALANCE
Stage 1	1996	121 S.F. @ $1070 150 M.F.@ $ 940	(+) $ 270,470	(-) $ 50,000 PRV - 68 AVE @ 182'A' ST.	(-) $ 55,000* Ref. #1463	(+) $220,470*
	1997	54 S.F. @ $1070 31 M.F @ $ 940	(+) $ 86,940	(-) $ 4,950 68 AVE - MAJOR GRID 178 - 179 ST.	-	(+) $ 81,990
Stage 1 & 2A	1998	31 S.F. @ $1070 65 M.F.@ $ 940	(+) $ 94,270	-	-	(+) $ 94,270
Stage 2A & 2B	1999	80 S.F. @ $1070 Ø M.F. --	(+) $ 85,600	(-) $ 56,600 PRV -67 AVE @ 182'A' ST. 68 AVE - MAJOR GRID 177 - 178 ST.	-	(+) $ 29,000
	2000	38 S.F. @ $1070 172 M.F.@ $ 940	(+) $ 202,340	-	-	(+) $202,340
Stage 3	2001	245 S.F. @ $1070 25 M.F. @ $ 940	(+) $ 285,650	(-) $ 26,550 70 AVE - MAJOR GRID 178 - 181 ST.	-	(+) $259,100
	2002	26 S.F. @ $1070 82 M.F. @ $ 940	(+) $ 104,900	-	-	(+) $104,900
	2003	25 S.F. @ $1070 58 M.F. @ $ 940	(+) $ 81,270	(-) $ 180,600 F. HWY. - MAJOR GRID 180 - 182 ST.	-	(-) $ 99,330
	2004	8 S.F. @ $1070 60 M.F. @ $ 940	(+) $ 64,960	-	-	(+) $ 64,960
	2005	Ø S.F. -- 67 M.F. @ $ 940	(+) $ 62,980	(-) $ 180,750 F. HWY. - MAJOR GRID 182 - 184 ST.	-	(-) $ 117,770
TOTALS		1338 units	(+) $1,339,380	(-) $ 499,450	N/A*	(+) $ 839,930*

NOTE: Ref #1463 in current T.Y.P. & funded from exist D C C Bylaw
and includes 68 Avenue - Major Grid - 182 to 183 Street
- amount has not been included in Summary or Balance

SUMMARY: DRAINAGE
NCP INFRASTRUCTURE FINANCING AND FUNDING

Development Stage	Year	Units & Rates	D.C.C. Contributions	Pump Stn., Floodway & Erosion Levies[1]	Construction	Current T.Y.P.	Balance
Stage 1	1996	121 S.F.@ $2120 150 M.F.@ $1140	(+) $427,520	(+) $91,980	(-) $839,100 68 AVE - TRUNK 176-181 ST. & FLOODWAY - 80% SHARE	-	(-) $ 358,980
	1997	54 S.F.@ $2120 31 M.F.@ $1140	(+) $149,820	(+) $28,850	-	PORTION OF REF. #4075 (-) $ 166,250*	(+) $ 166,320*
Stage 1 & 2A	1998	31 S.F.@ $2120 65 M.F.@ $1140	(+) $139,820	(+) $32,270	(-) $105,400 DRAINAGE PUMP - F.HWY. @ SERPENTINE - 34% SHARE	-	(+) $ 51,940
Stage 2A & 2B	1999	80 S.F. @ $2120 Ø M.F. --	(+) $169,600	(+) $24,000	-	PORTION OF REF. #4075 (-) $ 166,250	(+) $ 181,830*
	2000	38 S.F. @ $2120 172 M.F. @ $1140	(+) $276,640	(+) $63,000	-	-	(+) $ 308,750
Stage 3	2001	245 S.F. @ $2120 25 M.F. @ $1140	(+) $547,900	(+) $87,795	(-) $ 92,000 177 ST - TRUNK 70 AVE - OUTFALL	-	(+) $ 503,980
	2002	26 S.F. @ $2120 82 M.F. @ $1140	(+) $148,600	(+) $35,120	-	-	(+) $ 167,830
	2003	25 S.F. @ $2120 58 M.F. @ $1140	(+) $119,120	(+) $26,990	-	-	(+) $ 133,910
	2004	8 S.F. @ $2120 60 M.F. @ $1140	(+) $ 85,360	(+) $22,110	-	-	(+) $ 97,470
	2005	Ø S.F. -- 67 M.F. @ $1140	(+) $ 76,380	(+) $21,785	-	-	(+) $ 88,310
TOTALS		1338 units	(+)$2,140,760	(+)$433,900	(-) $1,036,500	N/A*	(+)$1,237,480*

NOTES 1 Pump Station Levy $300.00/unit x 1338 units
- Floodway Levy $ 25.17/unit x 596 units (Dev Stage 3 only)
- Erosion Levy of $39.42/unit x 444 units (Dev Stage 1 only)
The payment of levies will be required as a condition of Servicing Agreement for each application in the contributing catchment

2* Ref. #4075 in current T.Y.P. & funded from exist DCC Bylaw and includes North Watercourse erosion protection 95% share - amount has not been included in Summary of Balance

PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE B.C.

DEVELOPMENT STAGING

0 10 25 50 100 175
SCALE 1 5000

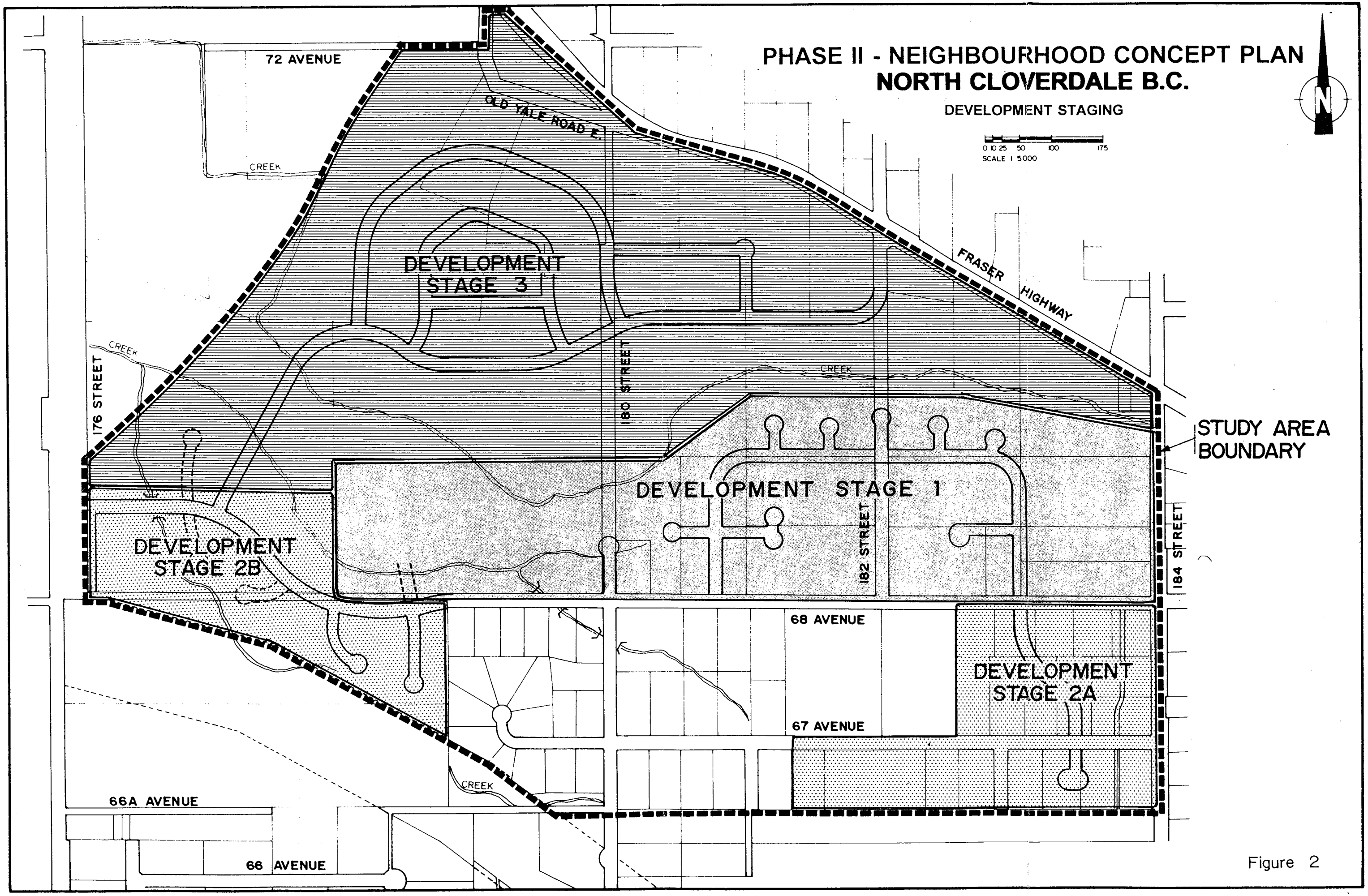
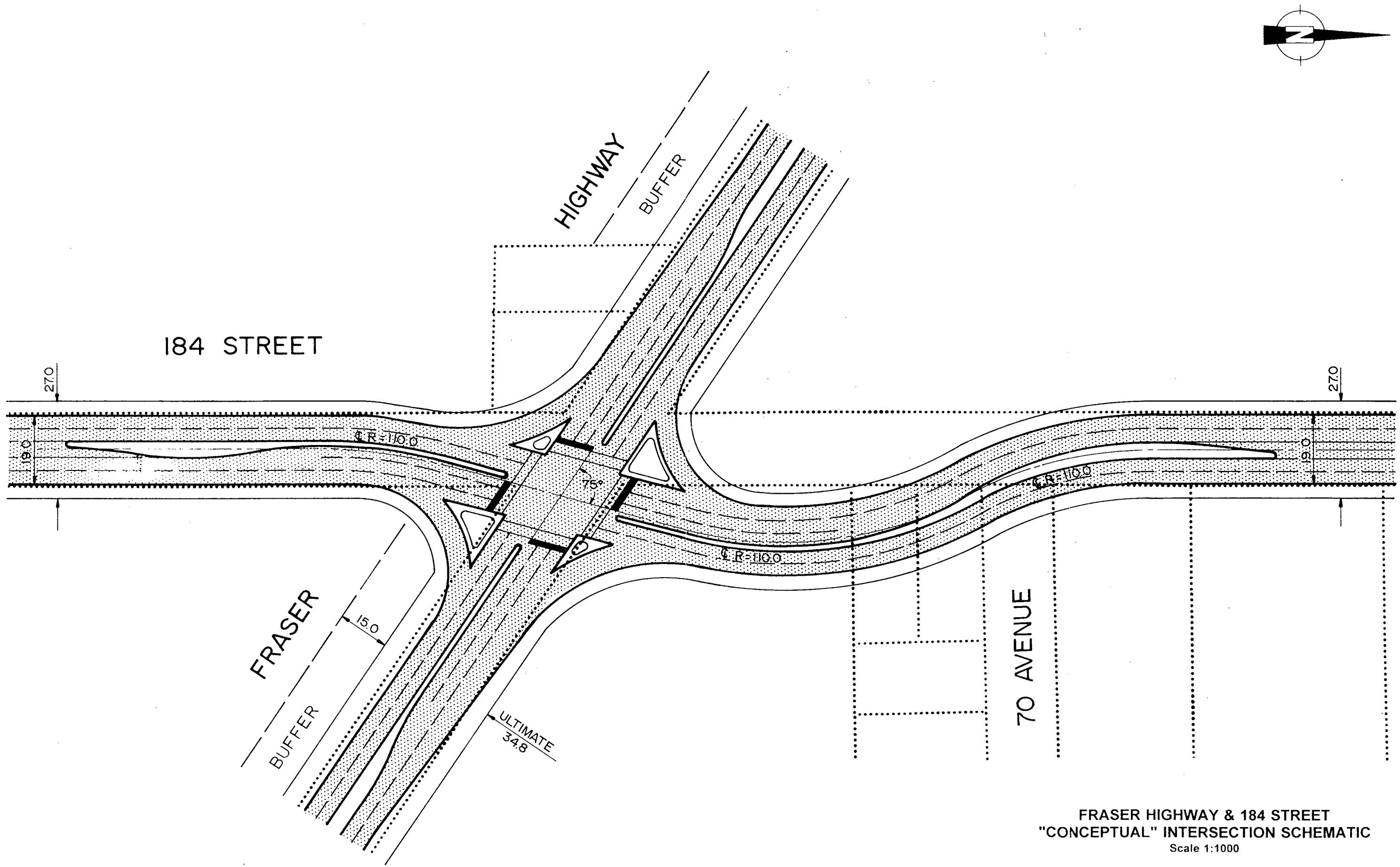
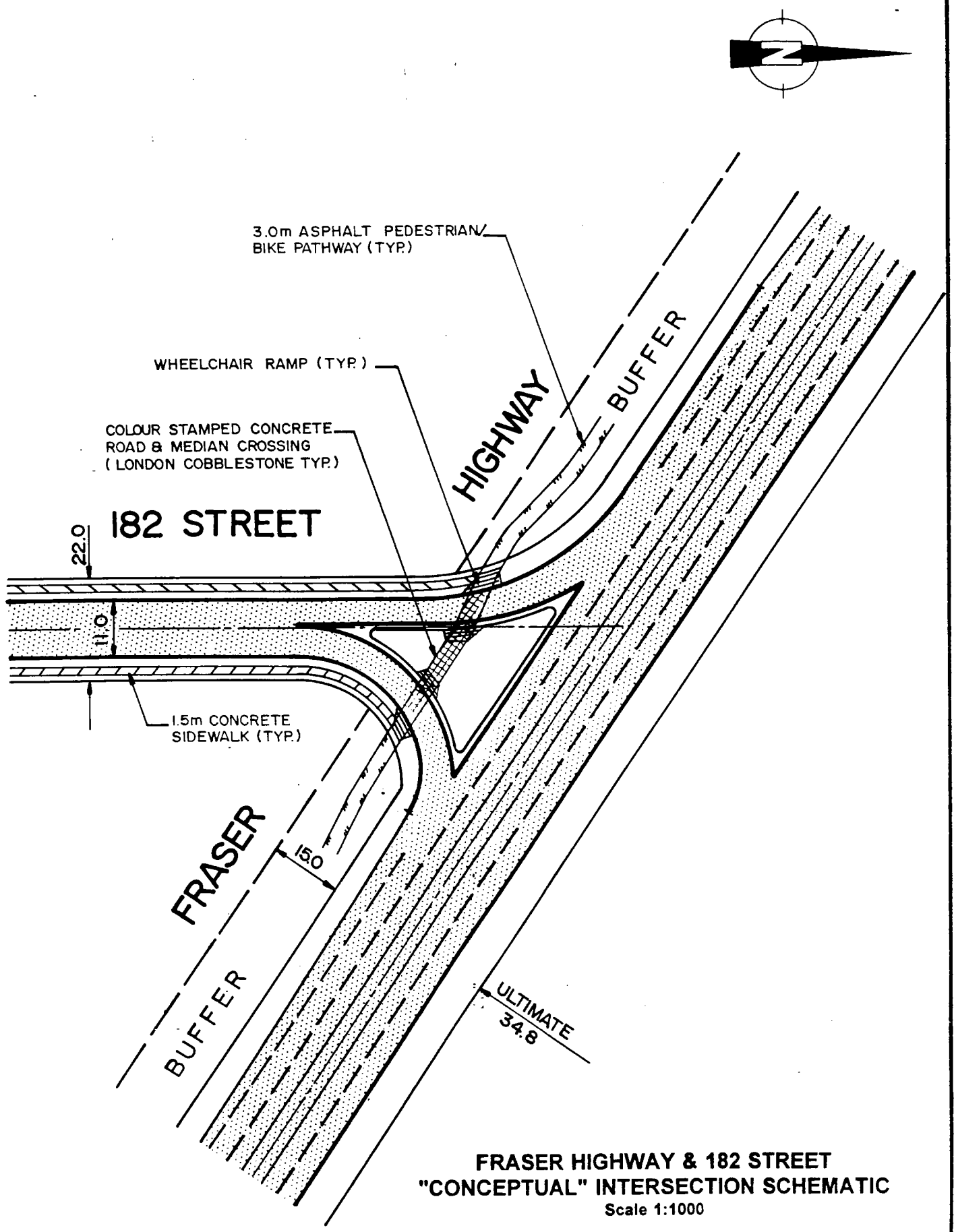


Figure 2



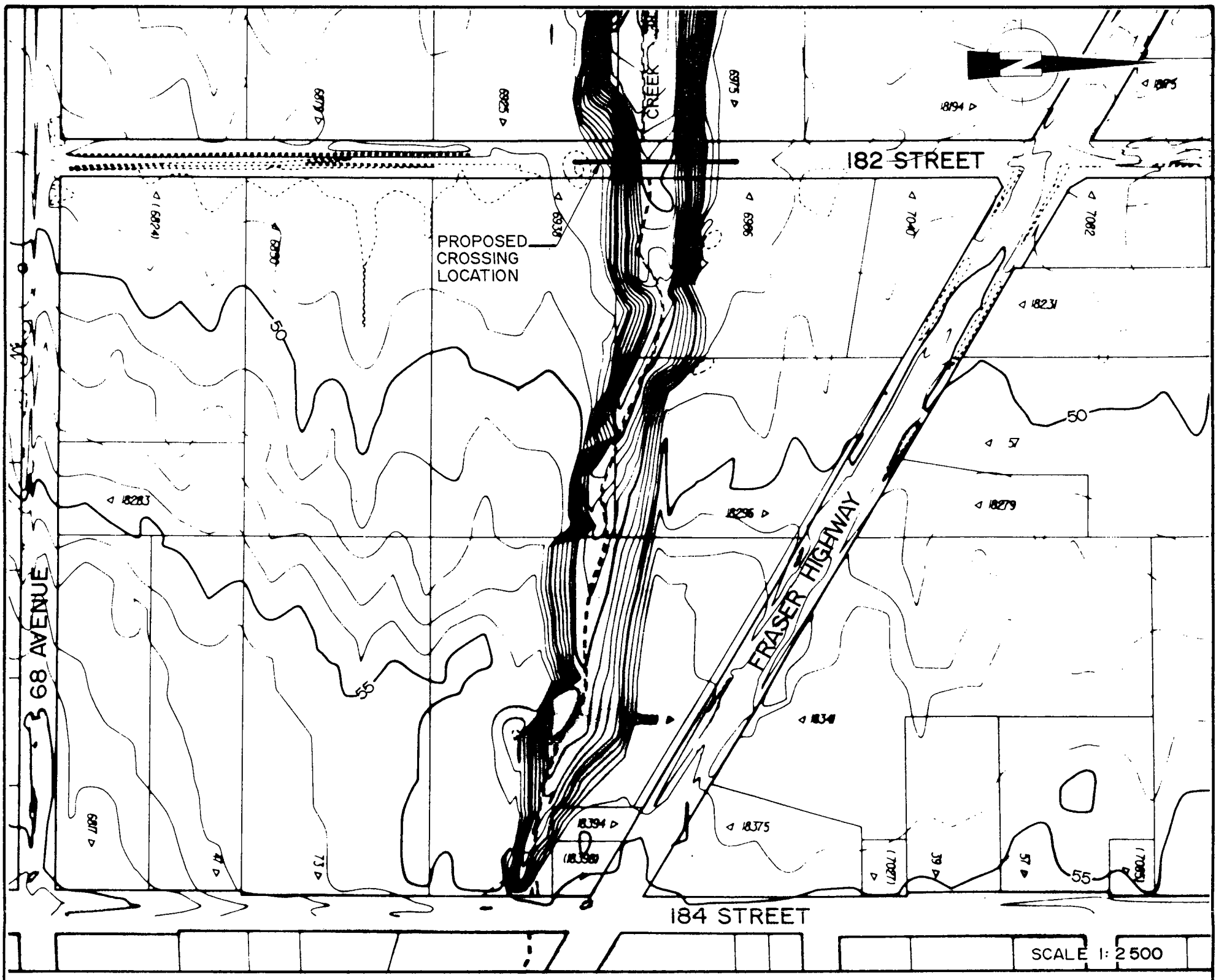
FRASER HIGHWAY & 184 STREET
"CONCEPTUAL" INTERSECTION SCHEMATIC
Scale 1:1000

Figure 3



FRASER HIGHWAY & 182 STREET
"CONCEPTUAL" INTERSECTION SCHEMATIC
Scale 1:1000

Figure 4



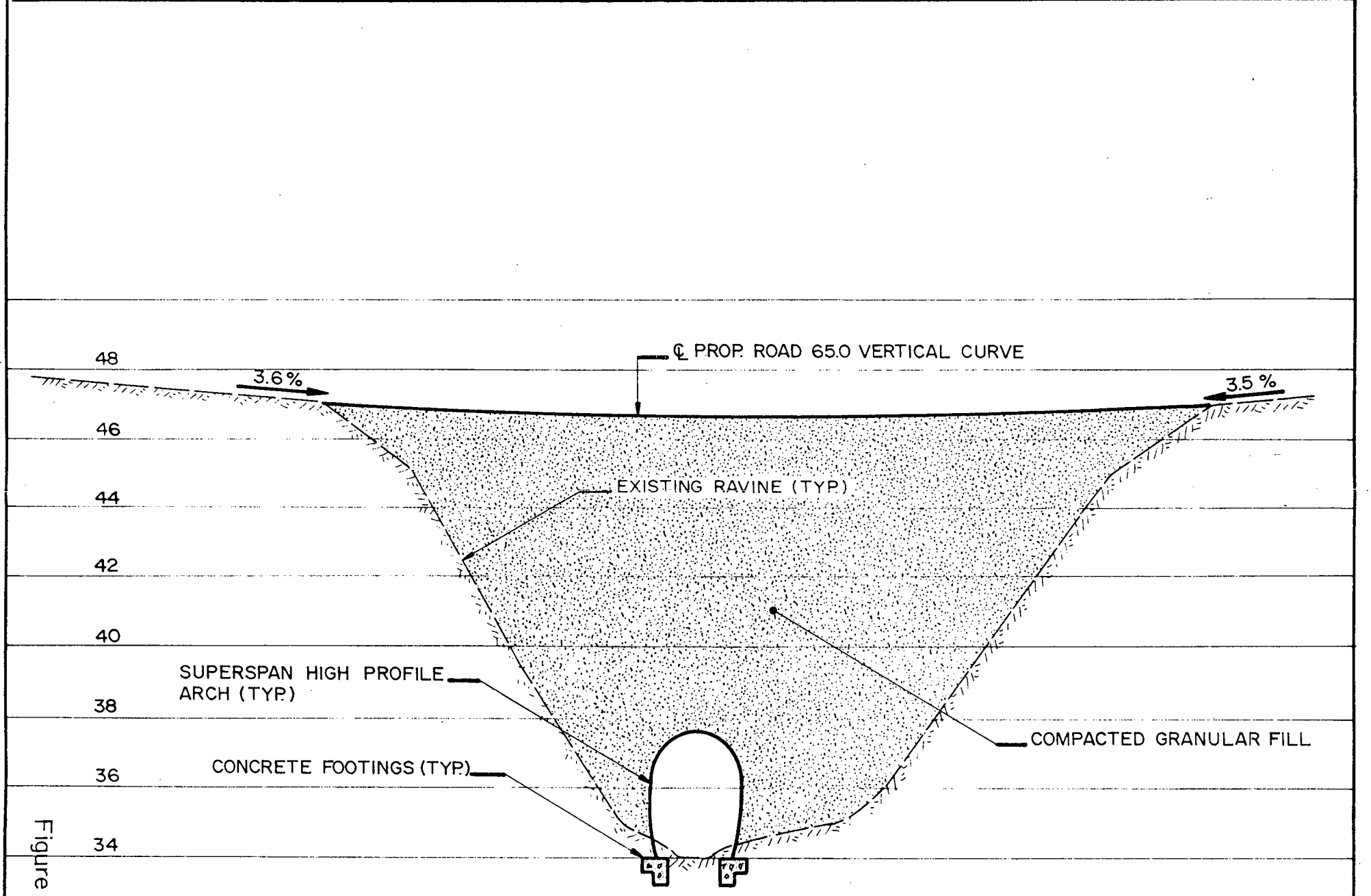
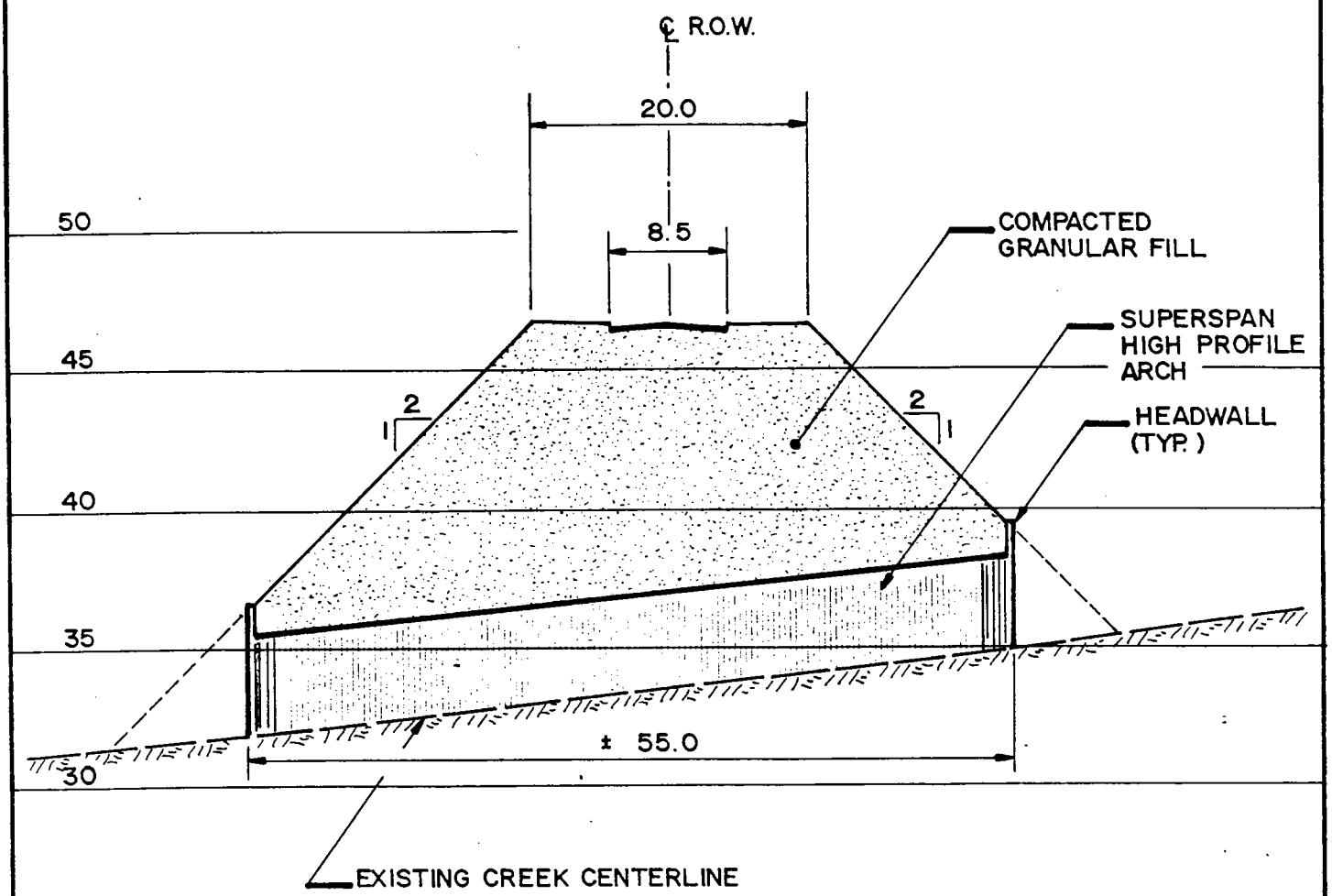


Figure 5

TYPICAL DETAIL 182 STREET ROAD CROSSING

N.T.S.



DETAIL 'A' NORTH CREEK

TYPICAL ROAD CROSSING SECTION AT 182 STREET

N.T.S.

Figure 6

PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE B.C.

ROAD SYSTEM

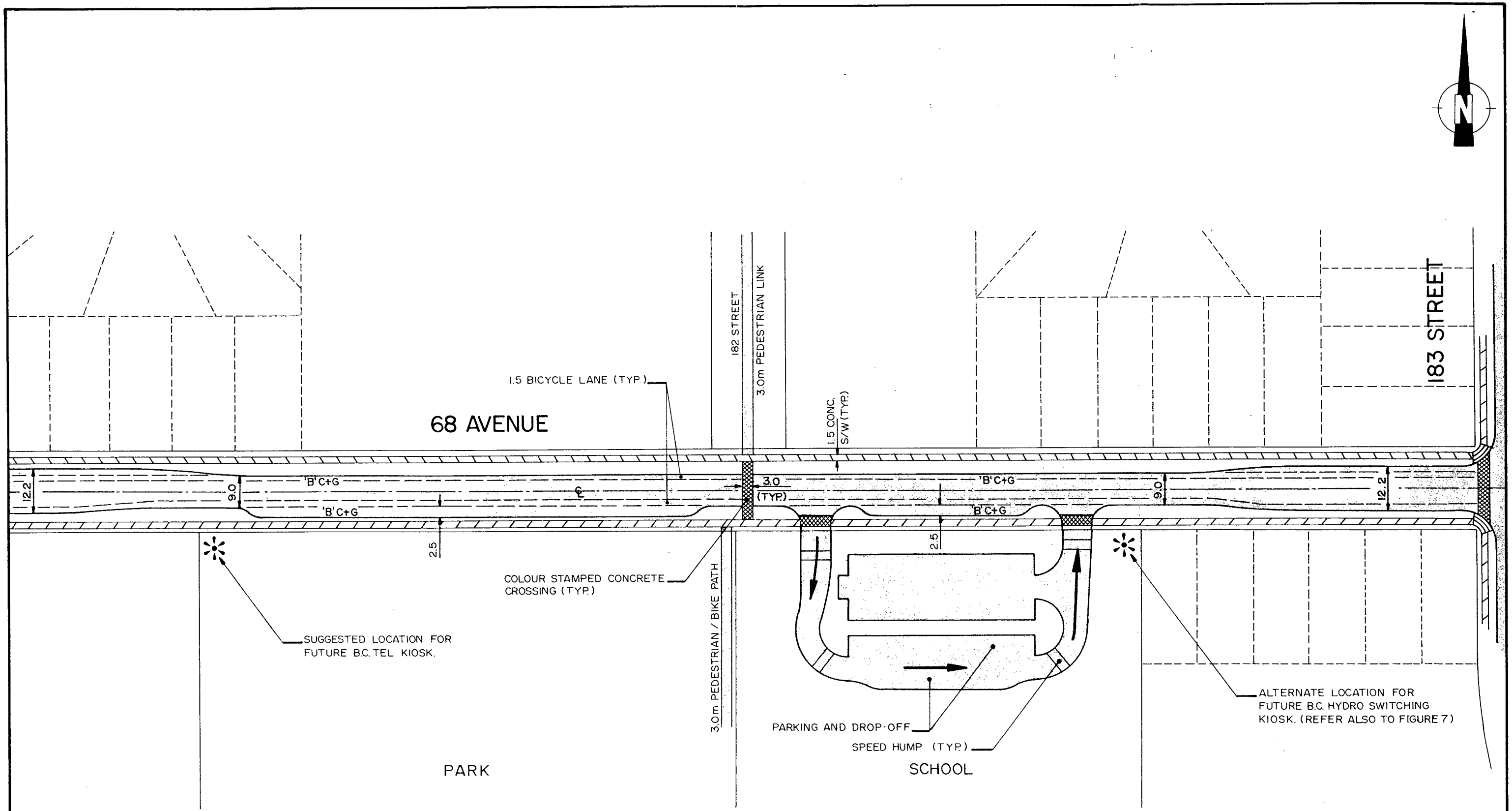
0 10 25 50 100 175
SCALE 1:5000

72 AVENUE
OLD YALE ROAD E.
CREEK
71'A' AVE.
178 ST.
178'A' ST.
179'A' ST.
70'A' AVE.
70 AVE.
70 'B' AVE.
181 ST.
182 ST.
RIGHT-IN/ RIGHT-OUT
STUDY AREA BOUNDARY
URBAN FEATURES
FRASER HIGHWAY
184 STREET REALIGNMENT
TO BE CLOSED
180 STREET
ARCH CREEK CROSSINGS
176 STREET
177 ST.
68'A' AVE.
68 AVENUE
TO BE CLOSED
LEFT-TURN LANE & SIGNALIZATION
178'A' ST.
180 ST.
181'A' ST.
181'B' ST.
182'A' ST.
182'B' ST.
69 AVE.
181 ST.
68'A' AVE.
182 STREET
TO BE CLOSED
183 ST.
184 STREET
SUGGESTED BC HYDRO SWITCHING KIOSK LOCATIONS
LEFT-TURN LANE
SUGGESTED BC TEL KIOSK LOCATION
PARK/SCHOOL SITE
67 AVENUE
SIDEWALK AND STREET LIGHTING
183'A' ST.
LEFT-TURN LANE
66A AVENUE
66 AVENUE

LEGEND

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

Figure 7



68 AVENUE WEST OF 183 STREET - CONCEPTUAL NARROWING & PARKING SCHEMATIC
SCALE 1:1000

Figure 8

PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE B.C.

PEDESTRIAN & CYCLIST ROUTES

0 10 25 50 100 175
SCALE 1:5000

N

LEGEND

- STUDY AREA BOUNDARY
- SIDEWALKS
- PEDESTRIAN/ BIKE PATH

176 TH STREET

PROPOSED EQUESTRIAN CENTRE

EQUESTRIAN CENTRE

PEDESTRIAN/ BIKE PATH BUFFER

182ND STREET

FRASER HIGHWAY

PEDESTRIAN CROSSING

CREEK

CREEK

CREEK

B.C. HYDRO R.O.W.

68TH AVENUE

180TH STREET

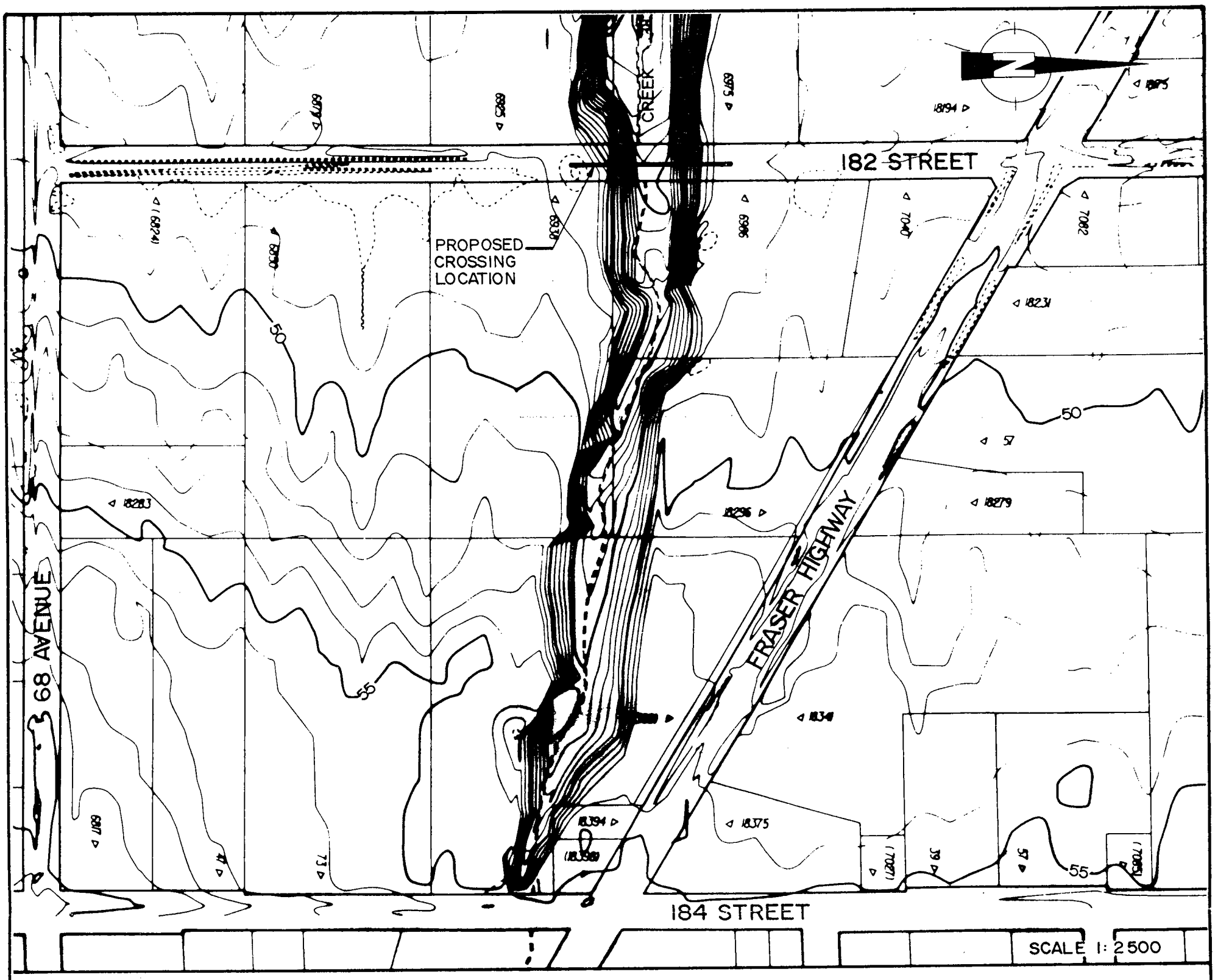
PARK / SCHOOL

67TH AVENUE

66A AVENUE ALIGNMENT

ST

Figure 9



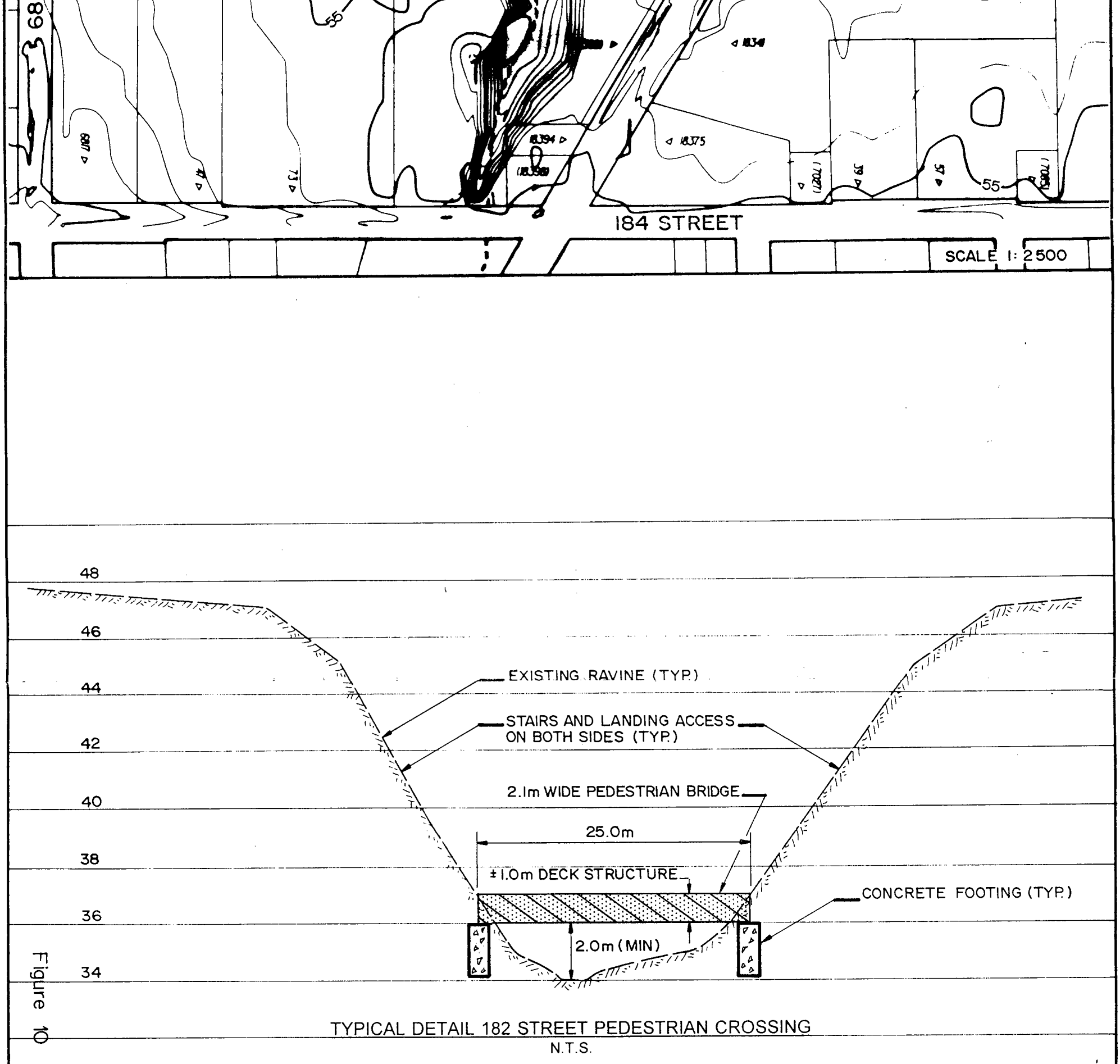


Figure 10

TYPICAL DETAIL 182 STREET PEDESTRIAN CROSSING
N.T.S.

PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE B.C.

WATER DISTRIBUTION SYSTEM

SCALE 1:5000

TO FRASER HWY.
72 AVENUE
TO 176 ST.
EX. 500Ø W/M
FUT. 300Ø
250Ø W/M
OLD YALE ROAD E
CREEK
71'A' AVE.
178'A' ST.
179'A' ST.
70'A' AVE.
70 AVE.
350 W/M
250 Ø W/M
TO BE CLOSED
180 STREET
70'B' AVE.
181 ST.
300Ø W/M
TO 72 AVE.
182 ST.
FUT. 350Ø W/M
350Ø W/M
FRASER HIGHWAY
EX. 300 Ø W/M
176 STREET
EX 500 Ø W/M
ARCH CREEK CROSSINGS
EXIST. P.R.V.
350 W/M
350Ø W/M
300 Ø W/M
TO BE CLOSED
68 AVENUE
178'A' ST.
EX. 250 Ø W/M
EX. 200 Ø W/M
67 AVENUE
66A AVENUE
66 AVENUE
CREEK
181'A' ST.
181'B' ST.
182'A' ST.
182'B' ST.
69 AVE.
181 ST.
68'A' AVE.
182 STREET
183 ST.
PRESSURE ZONE BOUNDARY
CLOSED VALVE
250Ø W/M
PRV
PARK/SCHOOL SITE
EX. 250Ø W/M
EX. 300 Ø W/M
183'A' ST.
184 STREET
250Ø

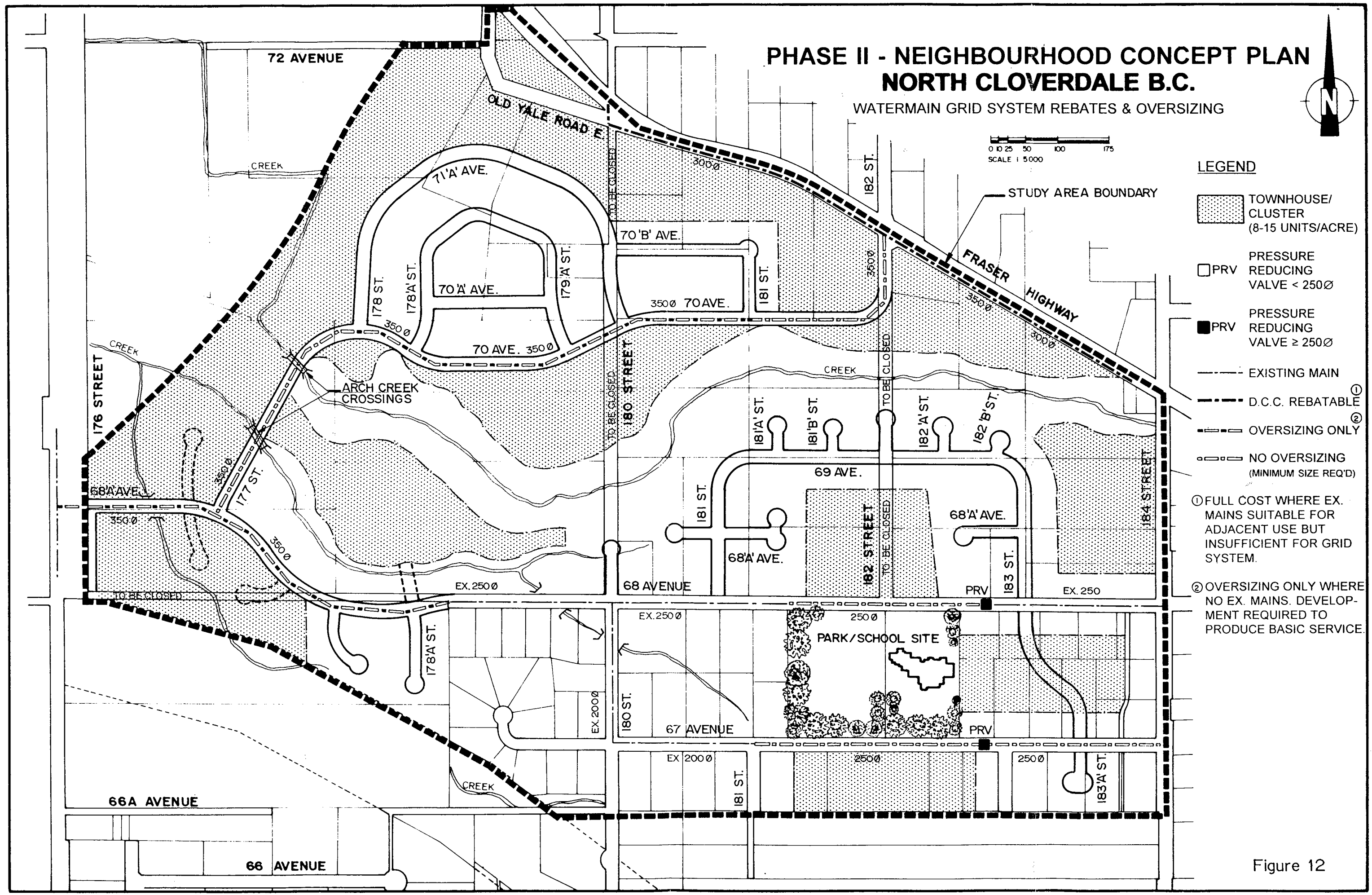
LEGEND

- STUDY AREA BOUNDARY
- EX. GRID
- PROP. GRID
- EX. LOCAL
- 200Ø (TYP.) PROP. LOCAL
- 15 PIPE NUMBER
- 2 NODE NUMBER
- TOWNHOUSE/ CLUSTER (8-15 UNITS/ACRE)
- PRV PRESSURE REDUCING VALVE
- PRV EX. PRESSURE REDUCING VALVE

Figure 11

PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE B.C.

WATERMAIN GRID SYSTEM REBATES & OVERSIZING



LEGEND

- STUDY AREA BOUNDARY
- TOWNHOUSE/ CLUSTER (8-15 UNITS/ACRE)
- PRV PRESSURE REDUCING VALVE < 250Ø
- PRV PRESSURE REDUCING VALVE ≥ 250Ø
- EXISTING MAIN
- D.C.C. REBATABLE ①
- OVERSIZING ONLY ②
- NO OVERSIZING (MINIMUM SIZE REQ'D)

① FULL COST WHERE EX. MAINS SUITABLE FOR ADJACENT USE BUT INSUFFICIENT FOR GRID SYSTEM.

② OVERSIZING ONLY WHERE NO EX. MAINS. DEVELOPMENT REQUIRED TO PRODUCE BASIC SERVICE.

Figure 12

PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE B.C.

ON-SITE SANITARY SEWER CATCHMENTS

0 10 25 50 100 175
SCALE 1:5000

72 AVENUE
OLD YALE ROAD E.
CREEK
CATCHMENT 2
STUDY AREA BOUNDARY
FRASER HIGHWAY
176 STREET
CREEK
NORTH WATERCOURSE
180 STREET
CREEK
182 STREET
184 STREET
68 AVENUE
CATCHMENT 1
67 AVENUE
CREEK
66A AVENUE
66 AVENUE

Figure 13

PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE, B.C.

NEIGHBOURHOOD SANITARY SEWER CATCHMENTS

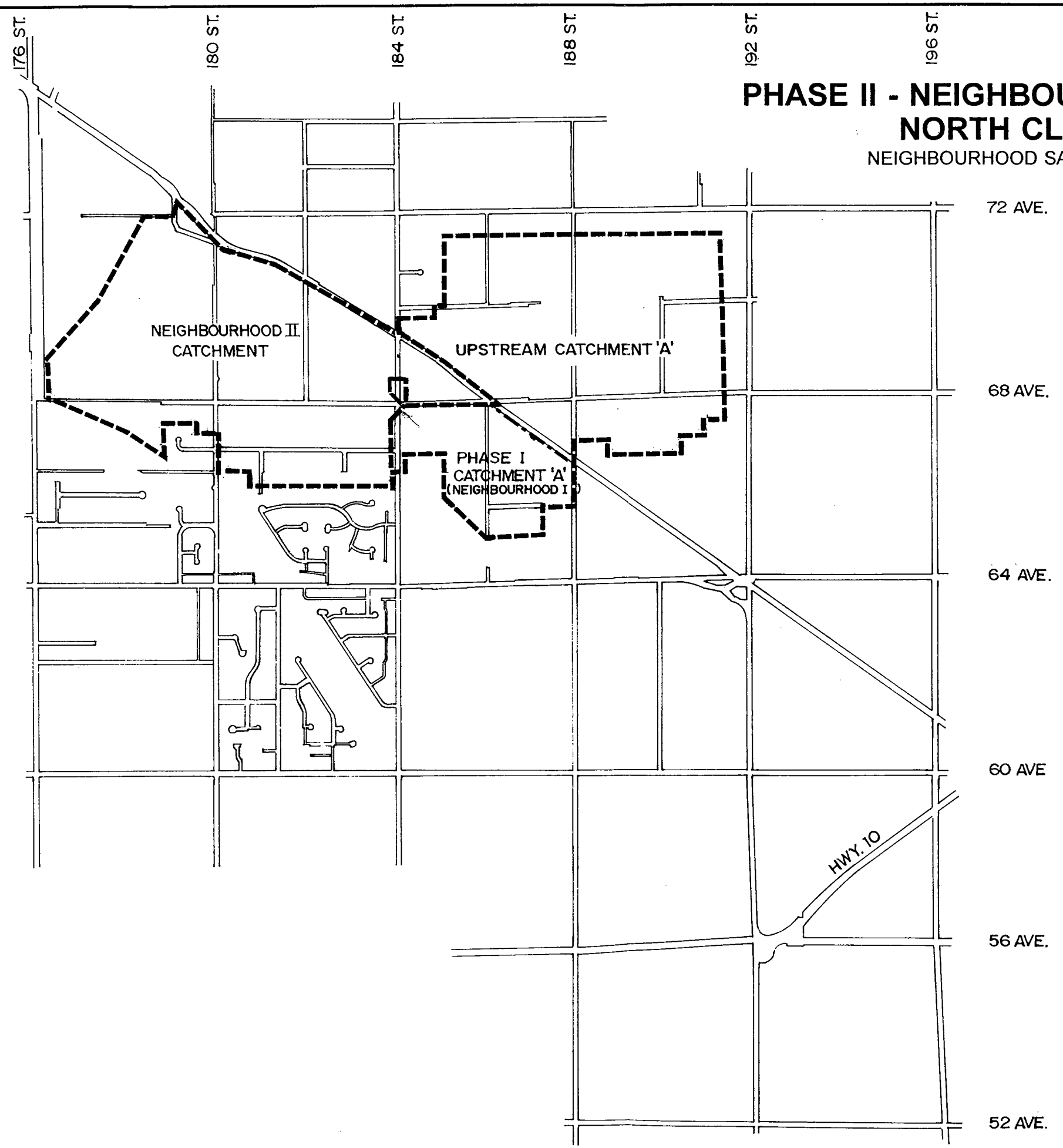


Figure 14

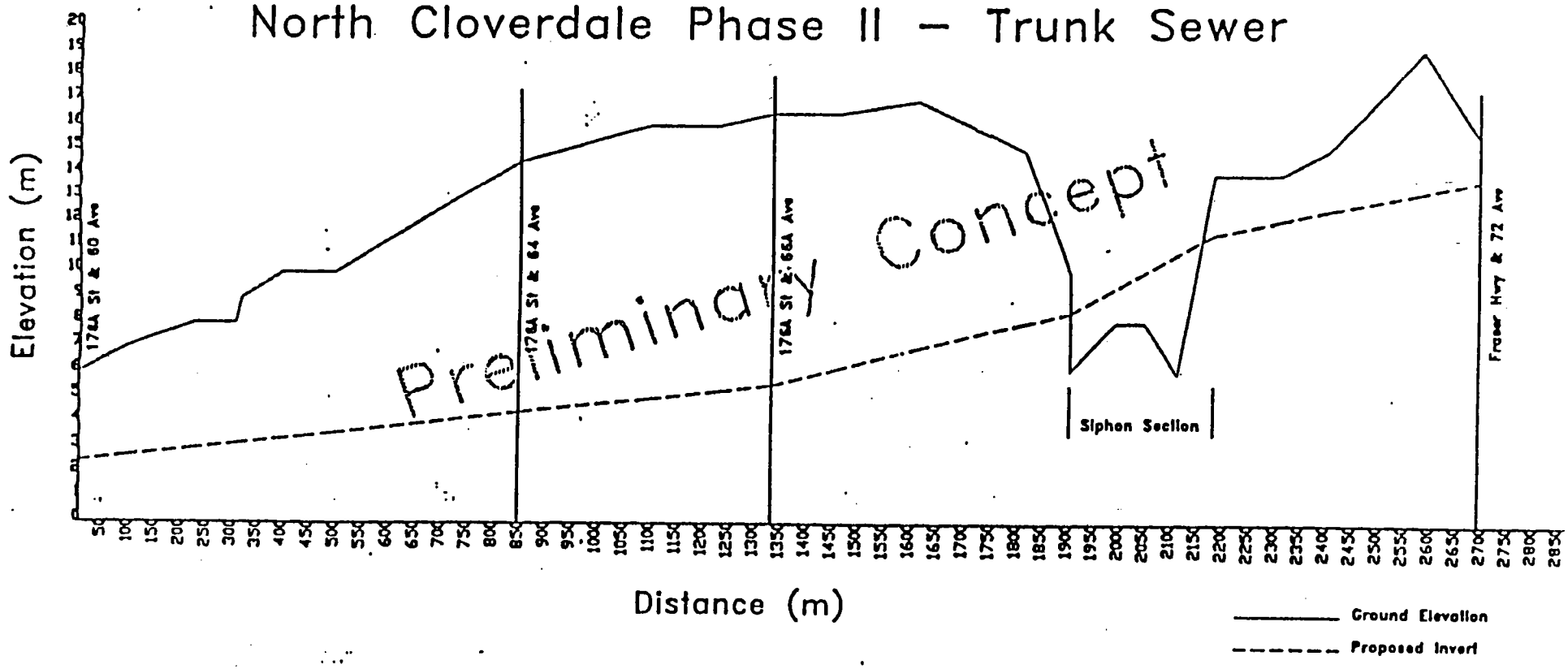
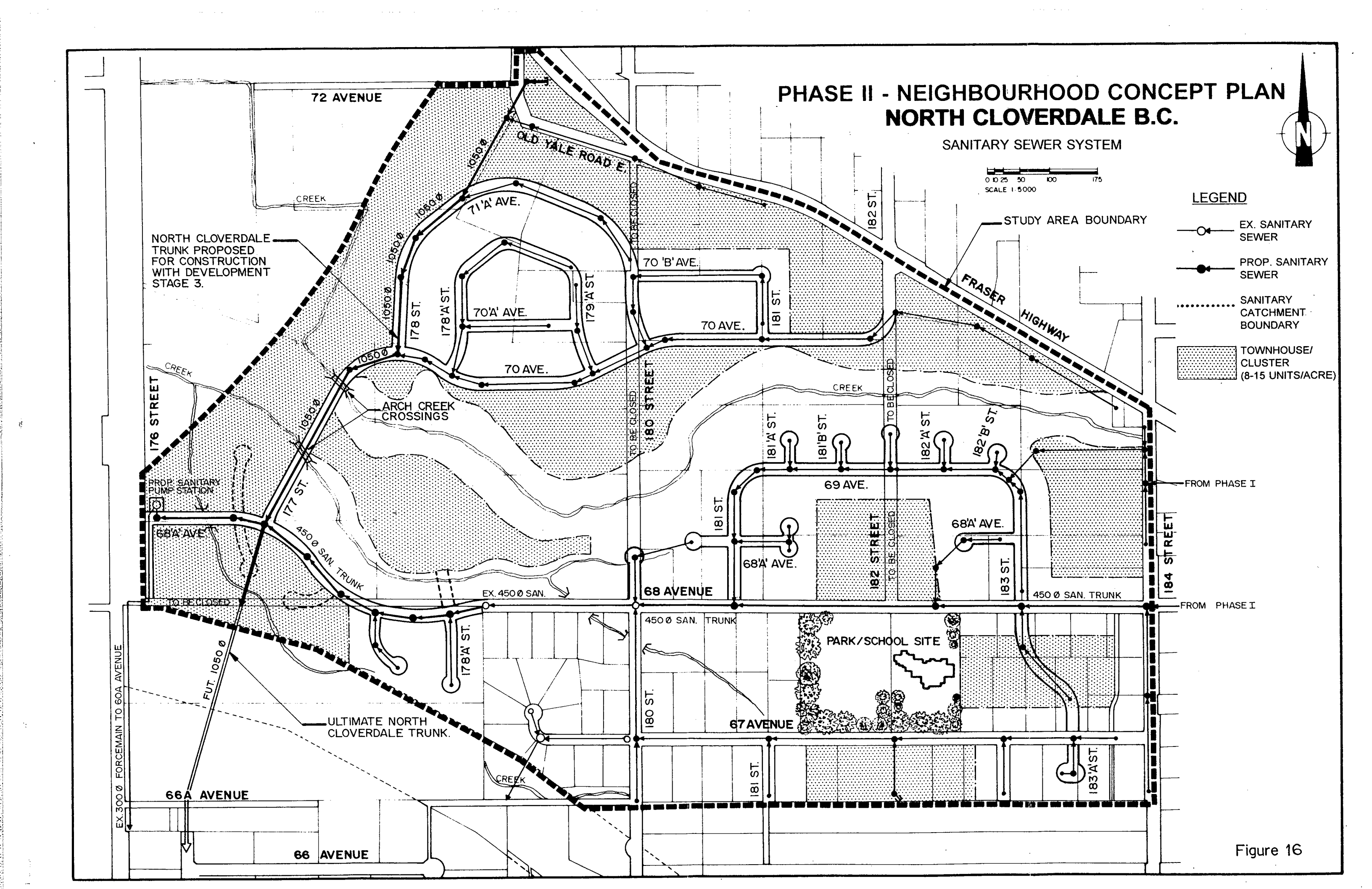

North Cloverdale Phase II – Trunk Sewer
Preliminary Concept
Elevation (m)
Distance (m)
176A St & 60 Ave
176A St & 64 Ave
176A St & 68A Ave
Fraser Hwy & 72 Ave
Siphon Section
Ground Elevation
Proposed Invert

Figure 15

PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE B.C.

SANITARY SEWER SYSTEM

SCALE 1:5000



LEGEND

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

Figure 16

PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE B.C.

EXISTING SITE DRAINAGE & CATCHMENTS

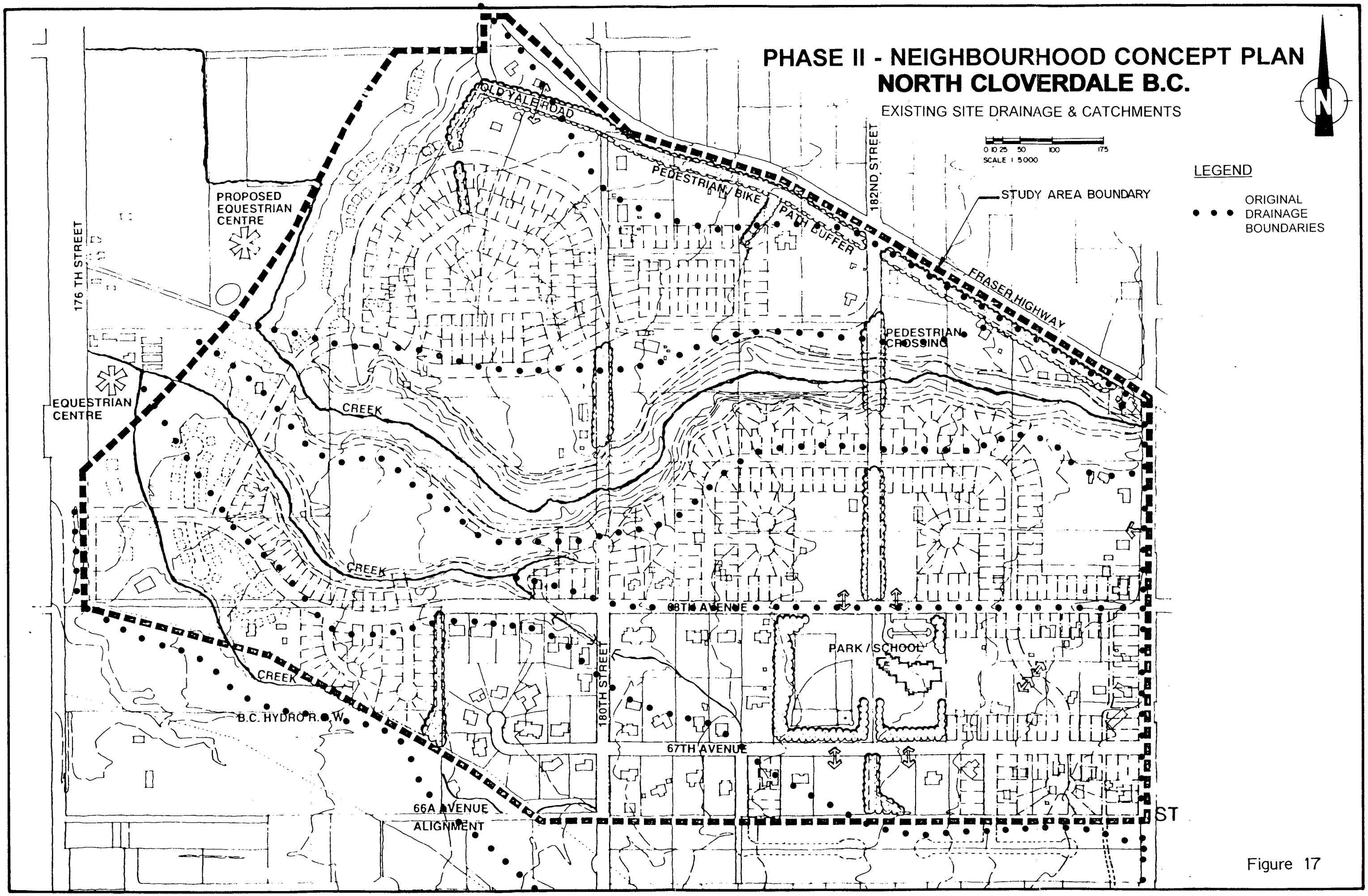


Figure 17

PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE, B.C.

EXTERNAL & INTERNAL CATCHMENTS AND
LOWLAND DRAINAGE IMPROVEMENTS

SCALE 1:10000

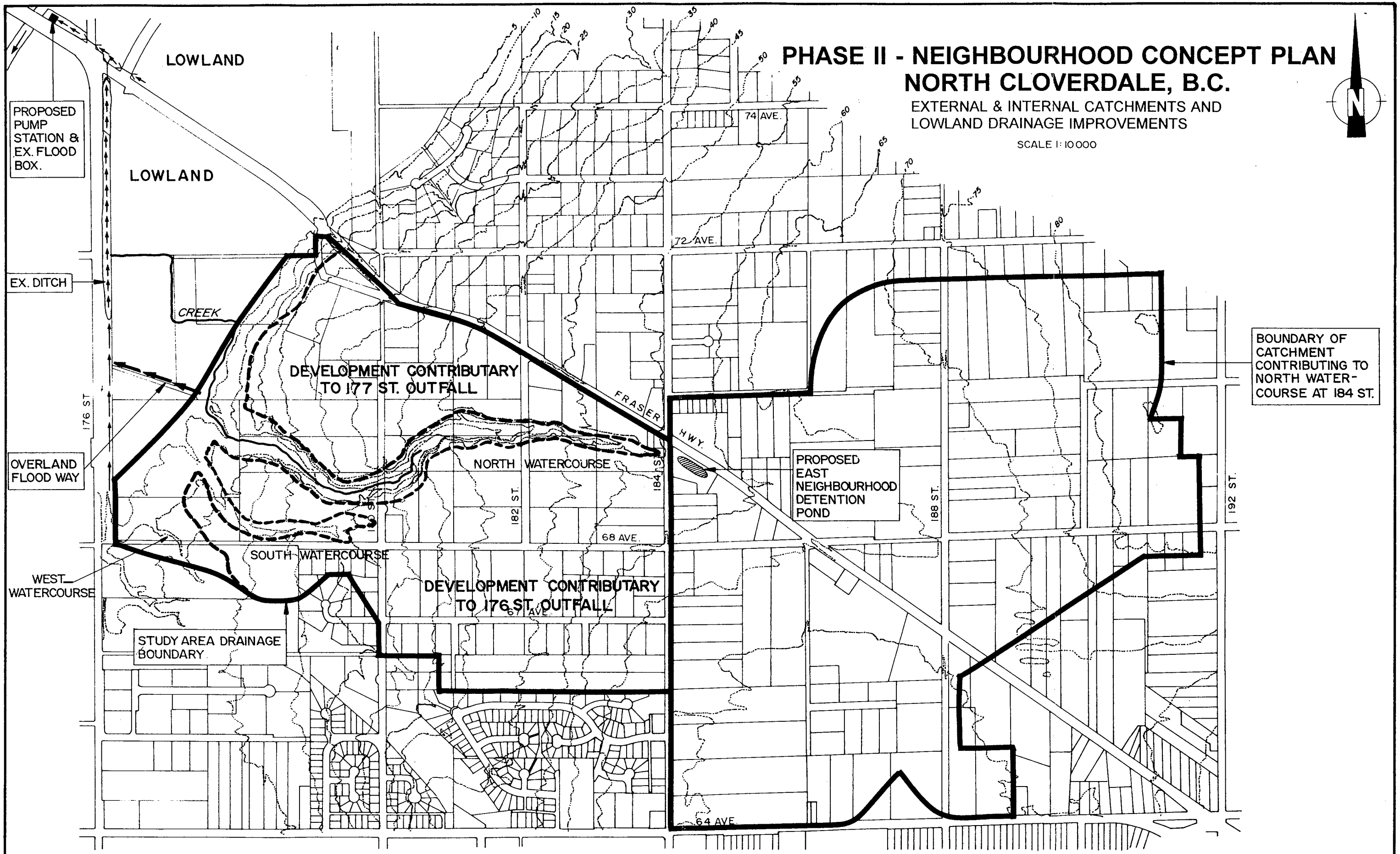
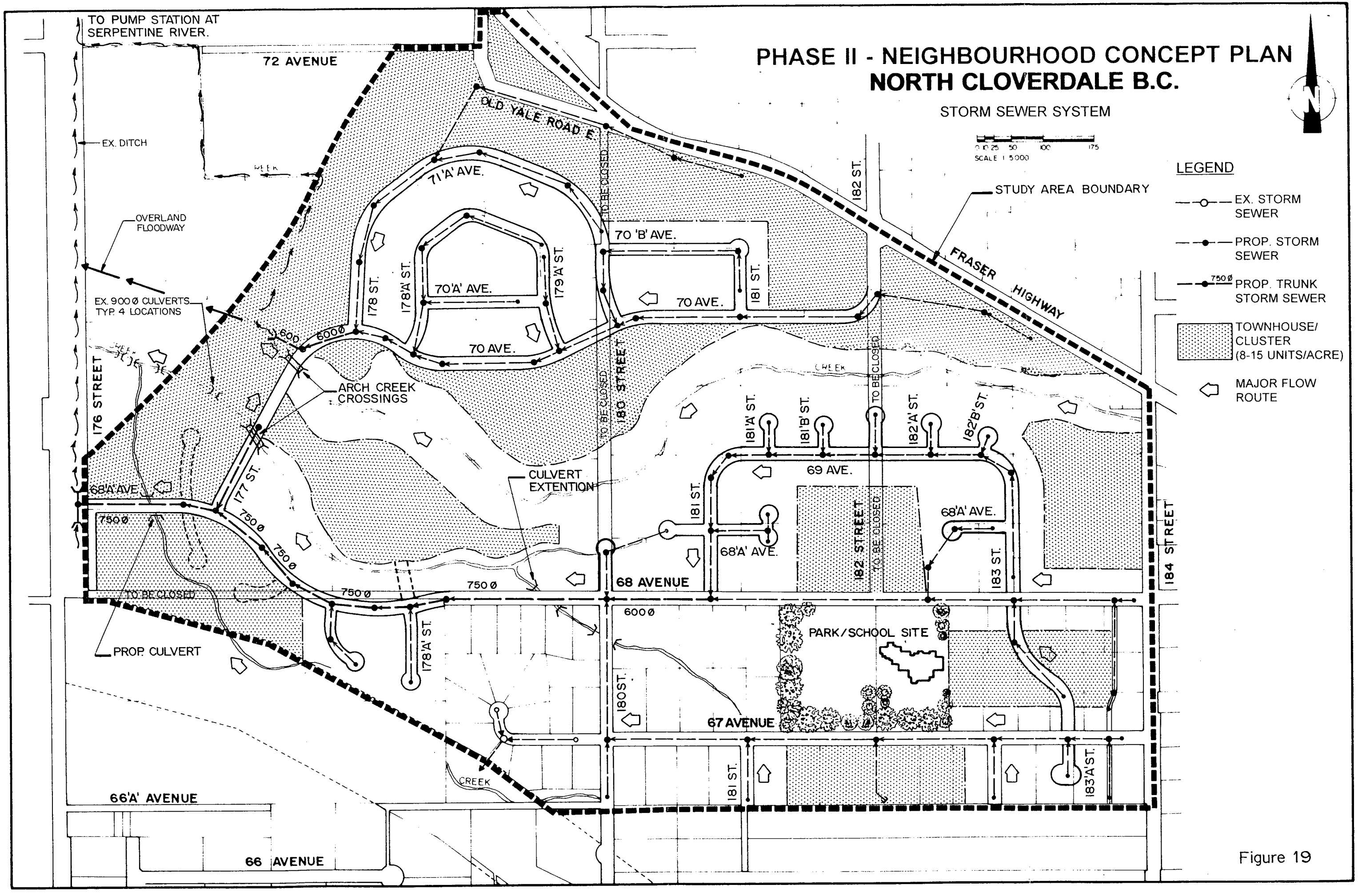


Figure 18

PHASE II - NEIGHBOURHOOD CONCEPT PLAN
NORTH CLOVERDALE B.C.

STORM SEWER SYSTEM

SCALE 1:5000



LEGEND

- STUDY AREA BOUNDARY
- EX. STORM SEWER
- PROP. STORM SEWER
- 750Ø PROP. TRUNK STORM SEWER
- TOWNHOUSE/ CLUSTER (8-15 UNITS/ACRE)
- MAJOR FLOW ROUTE

Figure 19

a) North Watercourse, weir at approx. 150m downstream of 184 Street.

b) North watercourse, bed material lost exposing till.

Plate 1

a) North Watercourse, bank undercut.

b) North watercourse. Lawn basin erosion approx. 100m upstream of 180 Street.

Plate 2

a) North Watercourse, no erosion downstream of 180 Street.

b) South watercourse, no erosion.

8. N.C.P. PREPARATION COSTS AND AMENITIES

The North Cloverdale Neighbourhood Concept Plan - West Neighbourhood will place additional pressure on amenities, protective and social services in the City. It was established in the East Neighbourhood that the costs of the Planning and Preliminary Engineering Studies to prepare the N.C.P. and contributions to fund the provision of amenities be dealt with on an equitable basis and be collected on a per unit basis.

The items requiring funding have been established in the adopted Local Area Plan, a City of Surrey Amenity Study, the N.C.P. Land Use approval and through discussions and review with City Staff. To allow development to proceed the owners and developers within the N.C.P. boundary are prepared to front-end their contribution towards these costs, based on the following formulae. These financial contributions would be payable upon individual rezoning, subdivision, or building permit approvals in accordance with Surrey policies.

8.1 Planning and Preliminary Engineering

Planning and Preliminary Engineering Studies to prepare the Neighbourhood Concept Plan for the West Neighbourhood have been paid for by Progressive Construction Ltd.

Progressive Construction Ltd. engaged the following consultants to prepare the Neighbourhood Concept Plan for the West Neighbourhood:

Planning Consultant	Davidson Yuen Simpson Architects
Engineering Consultant	Coastland Engineering & Surveying Ltd.
Environmental Consutlant	ECL Envirowest Consultants Ltd.
Drainage Consultant	Robert Bland, P.Eng.
Traffic Consultant	Ward Consulting Group

The projected population for the West Neighbourhood is approximately 4,402 which is based on a total of 1,338 units being created, ie. 3.29 average persons per unit.

The costs to complete both the (Stage I/Stage II) reports and plans from November 1992 to their completion in May 1996 was $245,336.

8. N.C.P. PREPARATION COSTS AND AMENITIES

As the main proponent of this N.C.P., Progressive Construction Ltd. has agreed to underwrite 50% of the costs of preparing the plan. The remaining 50% will be paid for by developers/owners in the N.C.P. Study Area who will contribute their proportionate share at the time of rezoning approvals.

Under the terms of this agreement, Progressive Construction Ltd. will underwrite a total of **50%** of the costs for planning and Preliminary Engineering. Their rezoning application currently on file with the Planning Department is, therefore, exempt from any preparation costs, as they are included in this initial 50%. For properties included in Progressive's applcation refer to the map on page 95. Every other unit within the N.C.P. Study Area, excluding those proposed by Progressive Construction Ltd. will pay a contribution based on a 1 in 992 share (1338 total units - 346 Progressive units) of the remaining 50% of the total N.C.P. Planning and Preliminary Engineering Costs of $245,336 per the table below.

Payments will be collected by the City as noted herein and the repayment to Progressive Construction Ltd., to a maximumof $122,668 will be on a twice yearly (every 6 months) basis.

N.C.P. PREPARATION COSTS

PLANNING & PRELIMINARY ENG. COSTS PAID BY PROGRESSIVE CONSTRUCTION TO MAY 31, 1996	COSTS UNDERWRITTEN BY PROGRESSIVE CONSTRUCTION (50%)	CONTRIBUTION REQUIRED BY REMAINING 992 UNITS IN STUDY AREA (50%)	PER UNIT CONTRIBUTION
$ 245,336	$ 122,668	$ 122,668	$ 123.66

8.2 Parkland Development

The City presently owns a 6.78 acre site designated as parkland on 68th Avenue. School District 36 (Surrey) owns a 4.46 acre site adjacent to the parkland which provides an adequate combined site (11.24 acres) for the development of a combined school and park site.

The Local Area Plan and the Neighbourhood Concept Plan have identified the need to fund landscaping and development costs of the Neighbourhood Park in combination with the athletic needs of the Elementary School. It is proposed that

the school and park site provide a combined soccer pitch and softball diamond along with general landscaping of the site.

As was established in the East Neighbourhood, there is an uncertainty of the need for a Neighbourhood House. It is therefore proposed that the funds associated with the construction of a Neighbourhood House be redirected to landscaping and additional parkland development within the Neighbourhood Park.

It should also be noted that the watermains proposed for this neighbourhood are of sufficient size to provide the recommended fire protection for a private day care centre to be located in most areas within the N.C.P.

Based on an evaluation of costs obtained from two consultants, the City Parks & Recreation Department, and using comparables from the N.C.P. East Neighbourhood, it is proposed that $526,600 be budgeted for these amenities (see table following). This corresponds to a per unit cost of $393.57.

PARKLAND DEVELOPMENT

North Cloverdale	UNIT	Estimate
Park Acreage/Road Area	8.33 acres	$ 166,600
Soccer Pitch		125,000
Ball Diamond		200,000
Signage		5,000
Bike Rack	2	1,000
Benches and Tables	10	9,000
Playground		20,000
Sub-Total		$ 526,600

Note:

It is anticipated that the City will be creating a D.C.C. for Park Development in the near future. If the D.C.C. is established prior to the complete development of this neighbourhood, then any remaining undeveloped properties should NOT be responsible for the $393.57 per unit charge.

8.3 Library Books

According to the Surrey Public Library the standard for providing library material per capita in Surrey is 1.5 items per capita at a cost of $25.00 per item.

Based on the projected population at an average of 3.0 people per unit, this corresponds to a charge of $112.50 per unit.

8.4 Fire Protection

Fire Hall #15 serves the neighbourhood. This newly constructed hall is situated on the north side of 64th Avenue at 189 Street. The Fire Department indicated in the Local Area Plan that both the East and West Neighbourhoods could be adequately served by the existing services.

The Fire Chief has provided information on the Fire Department's Total Capital Budget and expenditures for previous years and for future projections. The Fire Chief has determined that each new N.C.P. area shall pay a flat fee of $216.00 per unit to handle the increased demand for this essential service.

The Fire Department had also indicated that they require an aerial device if buildings within the neighbourhood are going to exceed 30 feet in height. It is therefore recommended that any multiple family development with units that exceeds 10m in height pay an **additional** "apartment dwelling" charge of $128.00 per unit, as established by the Fire Department.

8.5 Police Protection

The Police Department (R.C.M.P.) has suggested that a capital cost be established for all property owners within the N.C.P. areas to fund the

construction of a neighbourhood substation. There is an existing "Community Police Station" located in downtown Cloverdale, which is within 2 miles of this neighbourhood. Although operating costs for policing are funded by the Federal, Provincial and City Governments through both income tax and property tax, the Police Department insists that a contribution of $49.00 per unit be included for future neighbourhood needs. Therefore, based upon 1338 contributing units, at a per unit contribution of $49.00, the total contribution for Police Protection from the Study Area is $65,562.

8.6 Pathway Development

There is a proposed path network throughout this neighbourhood as shown on Figure 8 of this report. All pathways in the Hydro R/W, along the ravine, and in dedicated areas associated with the cluster developments are proposed as limestone surfaces. The pathway along the Fraser Highway is a proposed asphalt surface.

The Buffer and Pathway along Fraser Highway is considered an Urban Feature and therefore the construction costs are the responsibility of Surrey and funded through D.C.C.'s.

Historically all proposed pathway construction within existing hydro corridors has been the responsibility of Surrey. Therefore, the construction costs are to be the responsibility of Surrey, since the lands will be dedicated as park.

The pathway construction within any cluster development except along the ravine are the responsibility of the individual project developers.

The construction of the Ravine Pathway along the north side of the ravine and the Pedestrian Creek Crossing on 182 Street benefit the whole neighbourhood as a park amenity and therefore construction funding is a neighbourhood responsibility. The costs to construct the limestone pathway and pedestrian crossing is approximately $195,000. This corresponds to a per unit cost of $145.74 per unit. This is based on 1300 metres of limestone path @ $35.00/metre and a precast concrete span (approximately 25 metres) placed by crane, 2-3 metres above the creek, with a standard width of 2.1 metres and approximately 45 metres of wood stairs and landings.

Note:

The above noted costs represent park development costs, as the ravines are to be dedicated to Surrey as parkland when individual projects proceed to development.

As identified earlier, it is anticipated that the City will be creating a D.C.C. for Park Development. If the D.C.C. is established prior to the complete development of this neighbourhood, then any remaining undeveloped properties should NOT be responsible for the $145.74 per unit charge.

Schedule of Amenities:

ITEM	BUDGET	PER UNIT CONTRIBUTION
Parkland Development	$ 526,600	$ 393.57
Library Books	$ 150,525	$ 112.50
Fire Protection	$ 289,008	$ 216.00*
Police Protection	$ 65,562	$ 49.00
Pathway Development	$ 195,000	$ 145.74
TOTAL AMENITY CONTRIBUTION	$1,226,695	$ 916.81

* Multiple family developments with units that exceed 10m in height will pay an **additional** charge of $128.00 per unit, as detailed in Section 8.4.

The foregoing cost estimates and revenue calculations are based on 1996 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 West Neighbourhood account for expenditure within the West Neighbourhood only.

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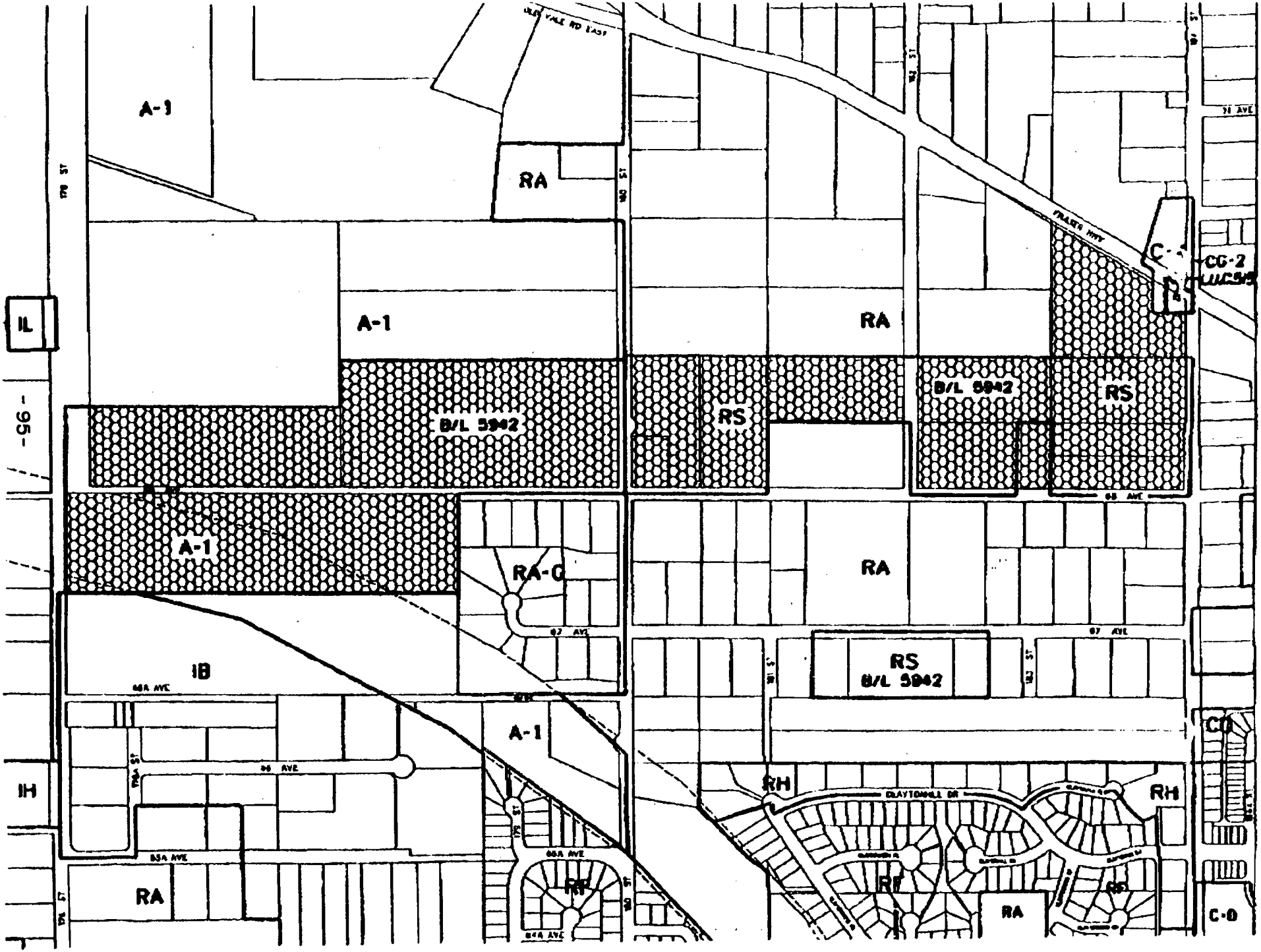
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