

TOWN OF CHESTERMERE

BYLAW 2003-604/1

PROVINCE OF ALBERTA

**BEING THE SOUTH EAST CHESTERMERE AREA STRUCTURE
PLAN**

WHEREAS

pursuant to the provisions of the *Municipal Government Act*, Chapter 26, Revised Statutes of Alberta 2000, and amendments thereto, the Council of the Town of Chestermere in the Province of Alberta (hereinafter called the Council) may adopt an Area Structure Plan, which provides a framework for subsequent subdivision and development of an area of land within its Municipal boundaries.

WHEREAS

the Council did direct the preparation of an Area Structure Plan for all of Sec.2, Rge.28, Twp.24, W4M and the northerly 66 feet of that portion of the N.W. ¼ which lies to the east of the subdivision on Plan 29310 to the N. of parcel "A" on Plan 3713FJ and the N.W. of the canal right of way on Plan IRR 62.

WHEREAS

an Area Structure Plan has been prepared under the direction of Council.

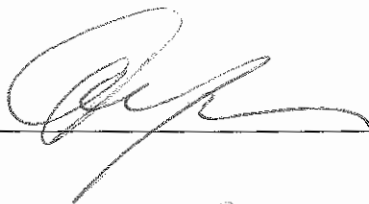
NOW THEREFORE the Council hereby enacts as follows:

1. This Bylaw may be cited as the "South East Chestermere Area Structure Plan".
2. The South East Chestermere Area Structure Plan being Schedule "A" attached hereto and forming part of this Bylaw.
3. This Bylaw comes into full force and effect on the date of third and final reading.

FIRST READING PASSED THIS 17th DAY OF MAY, 2004.

SECOND READING PASSED THIS 6th DAY OF SEPTEMBER, 2005.

THIRD READING PASSED THIS 6th DAY OF SEPTEMBER, 2005.



MAYOR



ACTING CHIEF ADMINISTRATIVE OFFICER

SOUTH EAST CHESTERMERE AREA STRUCTURE PLAN

**Town of Chestermere
Chestermere, Alberta
September 2005**

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Town of Chesternere
Planning & Development

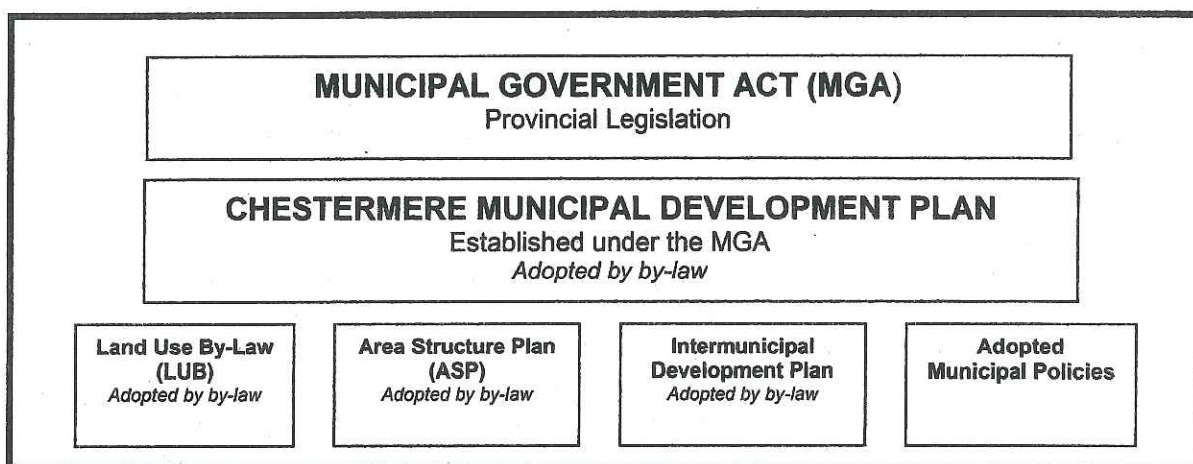
SOUTH EAST CHESTERMERE AREA STRUCTURE PLAN

INTRODUCTION

GENERAL PROCESS AND DOCUMENT HIERARCHY

The following synopsis provides an overview of general planning documents and processes common to many municipalities. The S.E. Chestermere Area Structure Plan, if approved, would come into effect through By-law 2003-604/1.

The following table outlines the general structure and hierarchy of planning documents.



A Municipal Development Plan (MDP) sets out general development policies for an entire municipality. The Town of Chestermere's Municipal Development Plan (MDP) 'identifies important issues for the Town and sets out policies to direct growth, development and redevelopment... over the long term.' The MDP is general in nature and pertains to the municipality as a whole.

An Area Structure Plan (ASP) takes direction from the Municipal Development Plan, and outlines general development guidelines and policies for a specific area within a municipality. The East Chestermere Area Structure Plan deals with lands as outlined in Figure 2 (Plan Area). The intent of the ASP is to provide general policy direction and guidelines for the indicated Plan Area as set out in the Municipal Government Act.

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Section 633 of the Municipal Government Act, as amended, states that the purpose of an Area Structure Plan is to provide a framework for subsequent subdivision and development of an area of land in a municipality. Specifically, it states that

An area structure plan must describe

1. *the sequence of development proposed for the area,*
2. *the land uses proposed for the area, either generally or with respect to specific parts of the area,*
3. *the density of population proposed for the area either generally or with respect to specific parts of the area, and*
4. *the general location of major transportation routes and public utilities*

The planning and development of a new community follows the general hierarchy and process outlined below, although each municipality will follow its' own established process.

Approval of an Area Structure Plan:

Adopted by Council through by-law, the ASP establishes general guidelines for future applications for land use and subdivision. The process of approval of an Area Structure Plan includes three readings of the by-law. Council will generally give first reading in order to initiate the process (allowing the plan to be circulated, reviewed and discussed). A public hearing is then held in accordance with the Municipal Government Act. Council may give second reading with requested amendments and conditions; and third and final reading of the by-law is given in approval of the plan. The approval of an area structure plan does not automatically change the existing land use of the area subject to the plan. A separate application (see below) is required for re-zoning.

Approval of Land Use:

Adopted by Council through by-law, usually in response to an application made by a landowner to change the land use on a parcel of land. The land use applied for should correspond to a specific category set out in the Land Use By-law or through a Direct Control By-law (by-law established for a piece of land that does not fit into a category in the Land Use Bylaw with its own specific set of circumstances and allowances). A similar process to the approval of an Area Structure Plan is followed (a public hearing and three readings are required to approve the by-law). Council

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will generally follow the guidelines set out in the Area Structure Plan in assessing whether or not a particular application for land use is feasible for a particular area.

Approval of Subdivision:

Reviewed by the designated approving authority in place for the municipality, a subdivision application will go through a process which examines specific development items such as lot sizes, site servicing, fencing, specific locations and sizes of roads, utility rights of ways, and other issues the municipality deems as relevant. The conditions of approval for subdivision are included within the Development Agreement, a contract between the developer and municipality that establishes specific requirements of the development.

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SETTING

The Town of Chestermere is a rapidly expanding municipality with approximately 8,300 residents as of 2005. Its growth rate over the past several years provides a strong indicator of its attraction as a residential district. With a population increase of 72% since the year 2000 and building permits increasing by 112% in the same time period, new communities have contributed to the identity of the Town as a desirable place to live.

In anticipation of continued growth, Council has adopted the South East Chestermere Area Structure Plan as a guide to facilitate future development in a logical, planned, and economical manner.

This Area Structure Plan is adopted in accordance with the provisions of the Municipal Government Act and the objectives of the Chestermere Municipal Development Plan. It provides guidelines in establishing future land uses for residential and open spaces, as well as a framework for the provision of transportation and servicing related to the development of such uses within the subject lands.

HISTORY

The Town annexed the lands contained within the South East Chestermere Area Structure Plan in 1996, in anticipation of continued urban growth. Berrien & Associates made an application for an Area Structure Plan in the fall of 1997 for the north 65 acre piece only. During the course of the application, the lands changed ownership and new owners inherited the existing application and ASP. The application lapsed in the fall of 2000, and it was understood that Council wished to see an Area Structure Plan brought forward with the cooperation of all landowners within the Study Area. Subsequently, it took some time to ensure that all landowners were ready or able to proceed, and a new application for an Area Structure Plan was made in the fall of 2003.

Although the 1997 application lapsed, meetings were held with Town staff, consultants and Council prior to as well as after the expiry date of the by-law. Information and guidance obtained from those meetings, as well as input from open houses, and meetings with a residents' ad hoc committee, were used to guide the creation of the current South East Chestermere Area Structure Plan.

SOUTH EAST CHESTERMERE AREA STRUCTURE PLAN

1.0 OBJECTIVES

1.1 PLAN OBJECTIVES

The South East Chestermere Area Structure Plan establishes policies for growth management of the Plan Area in accordance with the following objectives:

- 1.1.1 To provide a framework for development within the Plan Area that allows for growth to occur in a sustainable and comprehensive manner while recognizing the character and uses within the existing community;
- 1.1.2 To outline land use patterns, transportation networks, open spaces and public utility systems that addresses the needs of current and future development within the Plan Area;
- 1.1.3 To propose guidelines for population densities within the Plan area, and provide a phasing plan to allow development to occur in stages;
- 1.1.4 To establish a framework to review and evaluate the feasibility and appropriateness of any redesignation, subdivision and/or development proposal within the Plan Area.

1.2 PLAN AREA – LOCATION AND OWNERSHIP

The subject lands for the South East Chestermere Area Structure Plan (ASP) are located in the southeast part of the Town of Chestermere (Figure 1). The Plan Area contains approximately 101.6 hectares± (251.08 acres±) and is illustrated in Figure 2.

Ownership of the Plan Area is divided amongst several landowners; a detailed description is included in Appendix 4.

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2.0 BACKGROUND

2.1 PHYSICAL FEATURES

2.1.1 Natural Environment

General natural features and topography are illustrated in Figure 3 and summarized below.

The lands are generally flat with a gentle slope down towards the southeast. The majority of the area is pastureland. Soil and groundwater conditions have determined the site to be suitable for development. A slight depression exists on the east boundary towards the north end of the site adjacent to Lake Ere Estates.

The lands on the south end of the ASP area is currently planted in nursery stock and operates as a tree farm. A small man-made pond exists on the property, as indicated in Figure 3. The lands are suitable for residential development.

2.1.2. Built Environment

Existing and Adjacent Development

The Plan Area is adjacent to areas comprised mainly of residential and agricultural districts. Land uses to the north, to the north-east, and to the west of the Plan Area are predominantly residential with a greater mix of agricultural lands bordering along the south-east in the M.D. of Rocky View.

Three existing residences are scattered throughout the Plan Area and a tree farm operation exists at the southernmost 40 acres of the Plan Area. General locations of the residences and the tree farm are outlined in Figure 4.

Existing surrounding land use districts are depicted in Figure 5.

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2.2 EXISTING UTILITY INFRASTRUCTURE

2.2.1 Sanitary Sewer

Sanitary services to the Town of Chestermere are received from the City of Calgary. Existing sanitary mains are shown in Figure 6.

One 200 mm sanitary sewer exists in East Lakeview Road along the northern boundary of the Plan Area. This system is approximately 5.0 metres deep. It flows by gravity to existing mains in East Chestermere Drive and ultimately to Lift Station # 3.

The Town's sanitary trunk system consists of 200 mm. and 250 mm. gravity mains installed at grades ranging from 0.25% to 1.0%, plus lift stations where required. The Town's Lift Station Report has identified those lift stations which may require upgrading and the point at which the upgrades may be required, depending on development levels.

2.2.2 Storm Drainage

The Plan Area is identified as Catchment Area #3 in the Town's Master Drainage Plan. The natural drainage is from North to South and from West to East, with low areas in the East third of the property. No significant drainage course exists.

2.2.3 Water Distribution

Water service is available at East Lakeview Drive to the north, Sandpiper Lane to the south and East Chestermere Drive and West Chestermere Drive to the west. Any servicing to the Plan Area will require extensions to these mains.

The water distribution system for the Town of Chestermere is supplied from the City of Calgary. The Town's system at present will require upgrading to accommodate future development. Off-site levies and development charges for tying into the Town's system will be set to recover the required upgrades.

Existing water services are shown in Figure 7.

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3.0 POLICIES

3.1 LAND USE

The policies in this section refer to general land uses within the Plan Area. The land uses depicted within this Plan are meant to serve as guidelines for future development. Therefore, the land uses set out are listed generically as 'residential' or 'commercial' rather than referring to specific land uses as listed under the Land-Use Bylaw. Multi-family housing is identified at the ASP stage in conformance with the Town of Chestermere's Municipal Development Plan.

The approval of this ASP will not change existing land uses. Landowners within the Plan Area must apply for re-designation through a separate process in order to change their land use. The re-designation process will include a public hearing and three readings from Council to pass a by-law allowing for a land use change.

Subdivision of lands occurs as a separate process from land use. This process ensures, among other things, that the subdivision meets specific criteria, such as lot sizes, areas and widths, as listed in the Land Use By-law.

- 3.1.1 The predominant land use within the Plan Area shall be residential in the form of both single family detached and multi-unit housing with a small commercial component placed centrally within the Plan Area. Figure 8 establishes general guidelines for appropriate future land use patterns within the Plan area.
- 3.1.2 An amendment to the Town of Chestermere's Municipal Development Plan removing the current proposed industrial designation is required to bring it into alignment with this Area Structure Plan.
- 3.1.3 A Direct Control Land Use District will be established in the Land Use Bylaw to accommodate a minimum lot width of 22.86 metres (75') on lots fronting East Lakeview Road as indicated in Figure 8. Provisions for this district will include specific requirements of side-attached garages and shared driveways.
- 3.1.4 A Direct Control Land Use District will be established in the Land Use Bylaw to accommodate larger estate style lots in the range of

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18.28 metres (60') to 22.86 metres (75') lots backing onto the existing Lake Ere Estates development as indicated in Figure 8.

- Redesignation
- 3.1.5 When reviewing applications for redesignation, Council shall consider the proposal in accordance with land uses outlined in Figure 8 and applicable provisions of this Plan.
- 3.1.6 Notwithstanding the provisions of 3.1.1 and 3.1.5, certain lands within the Plan Area may differ from the identified land use due to on-site conditions or serviceability issues.
- 3.1.7 Where an application for redesignation proposes a land use not contemplated by this Plan or in the opinion of the Municipality is not in conformity with this Plan, the Municipality may:
- (i) Require an amendment to the proposal to bring it into conformity to this Plan;
 - (ii) Refuse the proposal, or
 - (iii) Amend this plan.
- 3.1.8 Pursuant to policy 3.1.6, when considering the appropriateness of a plan amendment, the Municipality may require the proponent to submit, in support of the amendment, an Outline Plan and/or other studies deemed appropriate by the Municipality.
- Subdivision
- 3.1.9 When considering applications for subdivision approval, the Municipality should evaluate tentative plans for subdivision in terms of the following considerations:
- (i) Conformity to the principles in this Plan, which may necessitate an amendment to this Plan.
 - (ii) The serviceability of the proposed subdivision.
 - (iii) The design of the proposed road system having regard for Town municipal engineering standards and integration with the existing road network.
- 3.1.10 Traffic counts may be required as a condition of subdivision approval to prove that the environmental design guidelines of East

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Lakeview Road and East Chestermere Drive will not be exceeded by the particular phase under review for approval.

- Multi-unit
- 3.1.11 In accordance with the Town of Chestermere MDP, multi-unit residential land uses are considered appropriate within the Plan Area subject to the provisions of this Plan.
- 3.1.12 Figure 8 identifies areas within the Plan Area generally considered appropriate for multi-unit residential land uses.
- 3.1.13 All multi-unit development within the Plan Area must be accommodated within a Direct Control District to be added to the Land Use Bylaw. Specific requirements will include direct street access for each unit. Pictorial examples of various townhouse styles have been included in Appendix 5 to serve as general guidelines to development.
- 3.1.14 Applications for redesignation and /or subdivision that propose residential multi-unit land uses should be considered pursuant to Figure 8 and attendant plan policies.
- 3.1.15 Notwithstanding policy 3.1.12, where the Municipality considers specific lands within the Plan Area that have not been identified for multi-unit residential land uses, to be appropriate for subdivision to accommodate multi-unit residential uses, an amendment to this Plan shall be undertaken.
- 3.1.16 When considering applications for multi-unit subdivision approval, the Municipality should evaluate tentative plans for subdivision in terms of the following considerations:
- (iv) Conformity to this Plan, which may necessitate an amendment to this Plan;
 - (v) The serviceability of the proposed subdivision;
 - (vi) Efficient placement of the multi-family site with regards to traffic volumes as they affect the capacity of the existing roadways, traffic flow and pedestrian safety;

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- (vii) Provision of adequate parking to current Town of Chestermere standards.

- Commercial
- 3.1.17 In accordance with the Town of Chestermere MDP, provision has been made for a 3 acre± commercial component to be included in the Plan Area, located adjacent to the multi-unit housing as shown in Figure 8.
 - 3.1.18 Depending on local and market demand, the commercial component may accommodate mixed uses, such as local commercial and/or residential uses. Council will consider the details of such uses when land use is applied for on this site.
 - 3.1.19 The design and scale of development on the commercial site must implement a level of architectural detail and landscaping that complements the character of the surrounding community.
- Special Recreational District
- 3.1.20 The proposed Special Recreational site as shown in Figure 8 will be used for active recreational activities (e.g. soccer fields) and pastureland. This area is expected to provide amenity value to the community.
 - 3.1.21 The exact size and location of the Special Recreational site will be finalised at time of land use and subdivision application.
 - 3.1.22 The Special Recreational site will provide a pedestrian links within its boundary, extending towards the MSR parcel to the North and the storm water ponds to the East. The location and alignment of the link will be determined during the outline plan process.

3.2 PHASING

The order of anticipated future development is outlined generally in this Plan. Specific information relating to phasing outlines, lot sizes, number of lots per phase, etc., are dealt with in increasing detail through the re-designation, outline plan and subdivision processes.

- 3.2.1 A phasing sequence has been established in Figure 9 to facilitate development according to servicing availability and requirements. Development of lands within the Plan Area and the associated

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proposals for re-designation and subdivision is expected to proceed in accordance within this sequence of priority.

Development on the 40 acre piece currently operating as a tree farm is expected to occur as the final phase in the overall Plan Area.

- 3.2.2 Notwithstanding the provisions contained in 3.2.1, Council will consider applications for land use and subdivision that differ from the identified sequence of phasing due to on-site conditions, serviceability issues, or other conditions deemed reasonable by Council.
- 3.2.3 The Special Recreational District portion included in Figure 9 as part of the initial phasing assumes development of that piece for recreational purposes only. Any future development of that piece for residential or other purposes is not anticipated and does not form part of this Plan.

3.3 DENSITY

- 3.3.1 Single detached family dwellings shall be the predominant form of housing in the Plan Area; however, a variety of housing shall be encouraged.
- 3.3.2 Overall density shall be in the range of 9 units per hectare (4 units per acre).
- 3.3.3 Specific areas may be approved for higher or lower density provided the overall density guidelines are maintained.
- 3.3.4 Higher densities in the range of 44.47 units per hectare (18 units per acre) will be allowed for multi-unit housing.
- 3.3.5 Density variations to accommodate semi-detached bungalow housing on cul-de-sacs will be considered at the discretion of Council.

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3.4 GENERAL DEVELOPMENT GUIDELINES

The guidelines in this section relate to overall intent in general terms. Specific architectural guidelines and their application to the development will be examined in further detail through the land use and subdivision processes.

- 3.4.1 Proposed structures should be sensitive to the scale and proportions of adjacent development in order to achieve compatibility in terms of size and overall massing.
- 3.4.2 Dwelling units should be grouped according to similar characteristics in terms of size and scale.

3.5 MUNICIPAL RESERVE (MR) / SCHOOL RESERVE (MSR)

The Town of Chestermere, through their MDP, is a strong proponent of parks and open space. The Town will ensure that the maximum reserve of 10% is dedicated in this development. The parcel sizes, outline and dedication of these lands will be dealt with in increasing detail through the land use and subdivision processes.

Municipal
Reserve (MR)

- 3.5.1 In order to provide for the recreational needs of the public, the dedication of park space (MR) shall be encouraged and cash in lieu of reserve lands for park space shall be discouraged. General locations for open spaces are indicated in Figure 10.
- 3.5.2 Individual land owners within the Plan Area must either provide their proportionate share of the required (10%) municipal reserve or reach an agreement with adjacent property owners to consolidate reserves.
- 3.5.3 Provision of MR at the north end of the Plan Area should be complimentary and not duplicative to the amenities located in the reserve parcel known as Triangle Park at the intersection of East Lakeview Rise and East Chestermere Drive.
- 3.5.4 Pedestrian access in the form of sidewalks or pathways should be provided to link municipal reserve parcels to any municipal school reserve parcels.

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- 3.5.5 Access points to the pathway located behind the proposed Direct Control district fronting East Lakeview Road shall be provided. Suitable locations for access will be determined at the outline plan stage.
- 3.5.6 Any pathway design or alignment along the north side of the canal should be carried out in consultation with the Western Irrigation District.
- 3.5.7 A north/south pathway must be provided between Township Road 241 and East Merganser Drive.
- 3.5.8 Tot lots shall be provided at a ratio of one lot per 20 hectares (50 acres) of development within the Plan Area as per the Town of Chestermere requirements.
- 3.5.9 When considering proposals for redesignation and/or subdivision, the Municipality should encourage the provision of reserve lands in a planned and well-designed manner that places an amenity value on the dedicated lands.
- 3.5.10 Municipal Reserve will be credited to the freeboard areas only of the storm ponds within the Plan Area. The freeboard area is defined as the area that is above the 1:100 year storm event storage requirement. (The weir in the control structure controls the water level so that this freeboard area is maintained.)
- 3.5.11 Pursuant to the Chestermere Municipal Development Plan, a 4.8 hectare (12 acre) school site shall be provided in the general vicinity indicated within Figure 10. The final alignment of the parcel will be set at time of subdivision approval.
- 3.5.12 Any municipal school reserve site must have direct access from a collector standard road.

Municipal
School Reserve
(MSR)

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3.6 TRANSPORTATION

The South East Chestermere ASP area covers approximately 251 acres, and when fully developed, is expected to accommodate anywhere from 980 to 1010 single detached and multi-family residential units. This new community is designed with the input of qualified traffic consultants to ensure that upgrades and additions to the existing road network occurs in a timely manner, allowing for the traffic generated by this new development to be properly distributed within the permitted road capacities.

Urban Systems Ltd. was contracted to prepare a traffic study to properly assess, prepare for, and manage the associated traffic impact that this new community would have on the existing infrastructure. Some crucial points that were required of this study were to:

- Assess the impact of the new residential units on the existing road network;
- Identify points at which upgrades to the existing infrastructure would be required to ensure that additional traffic volumes would be properly accommodated; and
- Establish a program to monitor traffic growth to ensure that the capacities of existing roads are not exceeded, and that the projections made in this traffic study in terms of densities, traffic distribution and movements match actual development as it occurs.

The completed study encompasses all these points and provides a workable proposal to ensure that development of the Plan Area proceeds in a responsible and controlled manner that limits the rate of growth in relation to traffic capacities.

A summary of the primary findings and recommendations from the Urban Systems study follows below. The detailed report, including the supporting and background data can be found in Appendix 1 of this Area Structure Plan.

One of the objectives was to establish a schedule that would ensure that the necessary road improvements would occur prior to any development of residential units that would exceed existing road capacities.

The existing road network was assessed for current volumes, existing capacities and expected future traffic loads. Additional traffic volumes that were anticipated for approved developments in the area were added to the background traffic volumes, and included in the existing capacities. Although some of these

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developments have not been completed, the traffic volumes at full build-out have been used in establishing the background (existing) traffic for this Plan Area. Updated traffic counts were taken in March of 2005 and incorporated into the study.

Development thresholds were determined based on the evaluation of the existing volumes against the capacities of the existing infrastructure. It was determined that the existing infrastructure can accommodate up to 525 dwelling units before additional infrastructure or upgrades are required. The limiting factor for development prior to upgrades is the vehicle per day (VPD) indicated by the Environmental Design Guidelines (EDG) of East Lakeview Road and East Chestermere Drive (independent of that section north of the fire hall and south of Highway 1A).

The Town of Chestermere also commissioned an independent transportation study with similar terms of reference, examining impacts specifically related to the South East Chestermere ASP Area. The findings of this study correlate closely with the findings by Urban Systems.

The following policies shall apply to the roadway system for the area:

- 3.6.1 In accordance with the Municipal Government Act, Figure 11 outlines the proposed general locations of major transportation routes within and adjacent to the Plan Area. Minor residential routes outlined in Figure 11 are conceptual only and subject to change without requiring an amendment to this Plan. Final alignment of these residential routes will be approved at time of subdivision.
- 3.6.2 Proposed transportation upgrades will occur in accordance with the Transportation Study prepared in conjunction with this plan. (Appendix 1).
- 3.6.3 A two lane internal collector standard road is required through the Plan Area as indicated in Figure 12 to assume primary traffic flows generated by new development according to the following provisions:
 - (i) Development of the collector road may be completed in stages, each stage corresponding with those portions of the

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road within or adjacent to their related phases as indicated in Figure 13;

- (ii) Completion of the collector road linking the north boundary (Twp. Rd. 241 and East Lakeview Road) to 148th Street must occur such that the Environmental Design Guidelines of East Lakeview Road and East Chestermere Drive (independent of that section north of the fire hall and south of Highway 1A) are not exceeded;
- (iii) Traffic counts may be required at each subdivision phase to determine the existing and residual traffic capacity, to be used by Town Council to establish an appropriate schedule for completion of the collector road.

3.6.4 A paved access south of the Plan Area should be in place to accommodate southbound vehicular traffic generated by new development within the Plan Area prior to the Environmental Design Guidelines of East Lakeview Road and East Chestermere Drive (independent of that section north of the fire hall and south of Highway 1A) being exceeded.

3.6.5 A concept for the intersection design required at the north end of the Plan Area is provided in Figure 13. Construction of this intersection must occur with the initial phase of development.

3.6.6 Safety measures for the school site will be developed in further detail at outline plan / re-designation and subdivision stages. General measures of precautions may include:

- (i) Designated drop off locations for parents;
- (ii) Designated drop off locations for school buses;
- (iii) Curb extension at the intersection with the commercial site;
- (iv) Pedestrian crossing signage at the commercial site intersection;
- (v) Sidewalks on both sides of the street along the municipal reserve site fronting onto the collector road.

3.6.7 Accessibility to any school sites in the Plan Area shall be to the satisfaction of the Town of Chestermere and in consultation with the appropriate School Division.

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- 3.6.8 The Plan Area must include a road right-of-way connection to the M.D. of Rocky View.
- 3.6.9 The provision of a Construction Traffic Mitigation Plan will be a condition of approval for every subdivision application made within the Plan Area.
- 3.6.10 The local road network shall be developed to minimize long term maintenance costs.

3.7 SERVICING

This section outlines policies relating to the general location and provision of utilities. Detailed engineering relating to specific servicing issues are submitted and examined in increasing detail at the land use and subdivision processes.

- 3.7.1 All development within the Plan Area shall be fully serviced through municipal water, storm, and sanitary sewer systems.
- 3.7.2 All utilities are to be designed and installed in accordance with accepted engineering practices, and shall be satisfactory to Council and/or its designated approving authorities.
- 3.7.3 Cost sharing agreements amongst the individual property owners within the Plan Area must be in place for site servicing and roadway construction prior to the approval of any subdivision application.
- 3.7.4 Off-site levies or acreage assessments to recover the costs of providing major public utilities will be imposed by the Town in respect to land that is to be developed or subdivided, and which has not been previously subject to an off-site levy. These levies shall be assessed on a gross developable acreage basis, pursuant to the relevant sections of the Municipal Government Act.
- 3.7.5 Storm water servicing will be provided in accordance with the Storm Water Management Study (Appendix 3) prepared in conjunction with this plan. A general outline of storm ponds is shown in Figure 16.

SOUTH EAST CHESTERMERE AREA STRUCTURE PLAN

- 3.7.6 Storm water discharge rates and all storm water discharge into the canal shall be to the satisfaction of the Town of Chestermere and the Western Irrigation District and shall be compliant with all current agreements.
- 3.7.7 Storm water collection systems should be designed as either an underground piped system or an overland flow discharge system into the drainage canal.
- (i) Short-term storm water management by evaporation ponds will be considered as an interim solution between phases.
- 3.7.8 The provision of view corridors from the collector road into open space provided by storm water features will be addressed during the outline plan process.
- 3.7.9 Sanitary servicing will be provided in accordance with the Engineering Servicing Report (Appendix 2) prepared in conjunction with this plan. A general layout is shown in Figure 14.
- 3.7.10 Water distribution will be provided in accordance with the Engineering Servicing Report (Appendix 2) prepared in conjunction with this plan. A general layout for the distribution system is shown in Figure 15.
- 3.7.11 Shallow utilities will be provided through the extension of existing facilities offsite.
- 3.7.12 Phase I Environmental Site Assessment, Historical Resources Impact Assessment, and applicable Geotechnical Reports must be completed as a condition of approval for any subdivision application within the Plan Area.

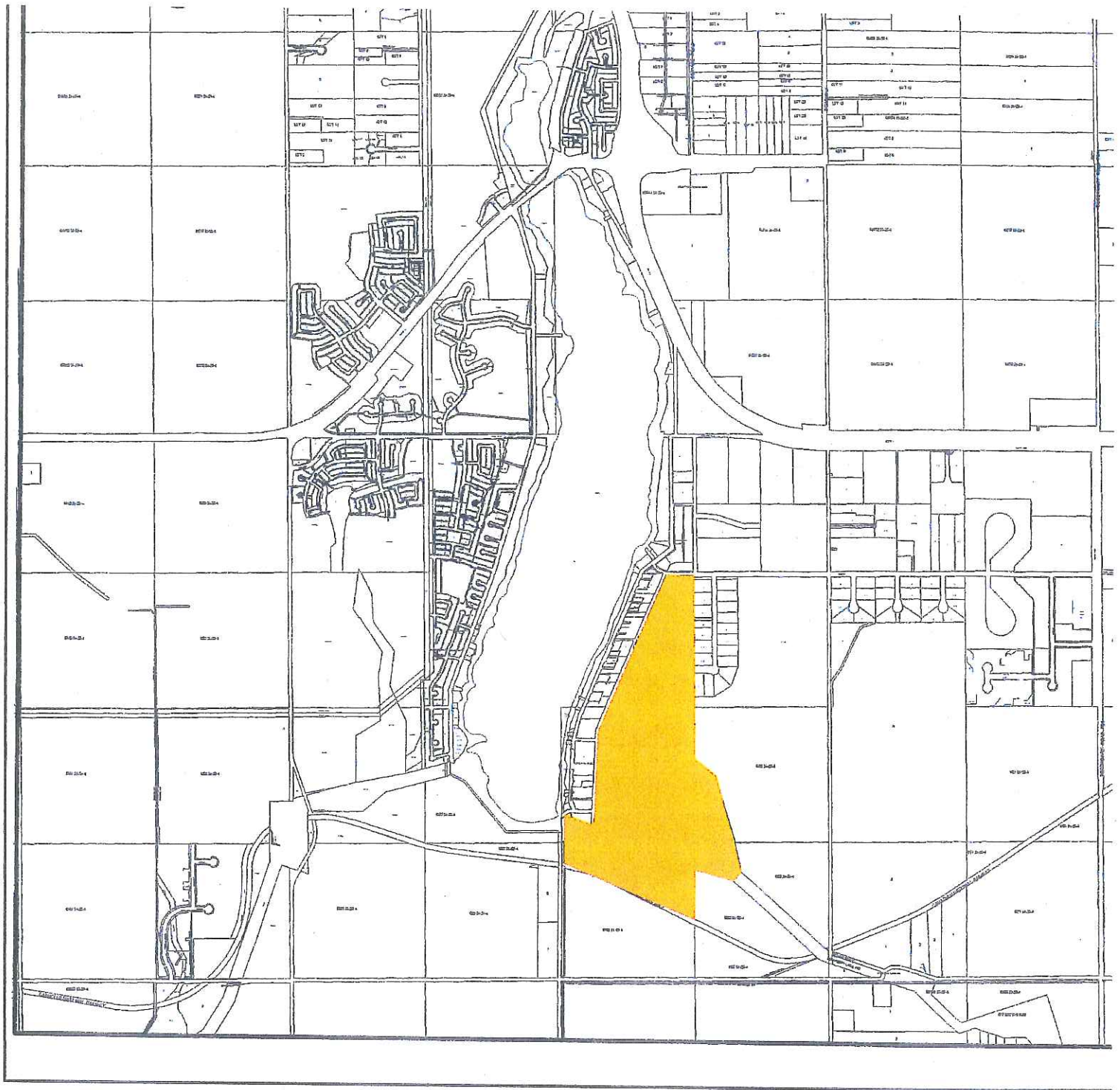
SOUTH EAST CHESTERMERE AREA STRUCTURE PLAN

CONCLUSION

The Southeast Chestermere Area Structure Plan (ASP) provides a reference for Council in planning for future development in this area.

The Plan allows for the growth of residential communities that are compatible with the existing residential use in the area, while providing additional open space, linear parks, a pedestrian network and a school site to the Town of Chestermere. All housing within the community will be controlled by architectural guidelines to create a sense of identity within the new communities as well as maintain aesthetic value to the area as a whole.

Concurrent or subsequent applications for land use and subdivision should be assessed with consideration to the policies contained within this Plan.



Subject Lands

SOUTHEAST CHESTERMERE
 AREA STRUCTURE PLAN
 Town of Chestermere

**Note: Conceptual Drawing; not to scale*

FIGURE 1
LOCATION PLAN

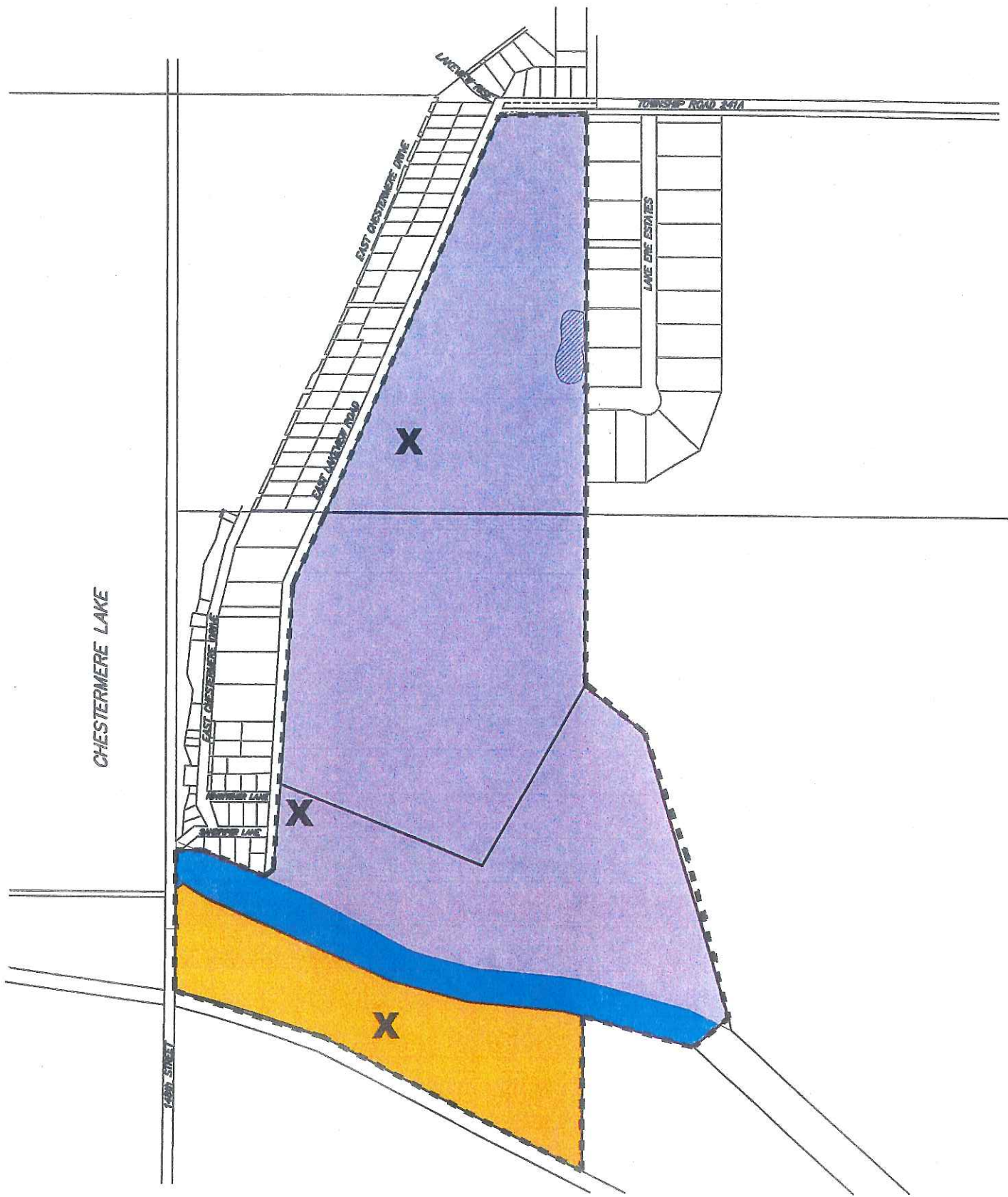


Subject Lands

SOUTHEAST CHESTERMERE
 AREA STRUCTURE PLAN
 Town of Chestermere

FIGURE 2
PLAN AREA

**Note: Conceptual Drawing; not to scale*



CHESTERMERE LAKE

TOWNSHIP ROAD 241A

LAKE ERIE ESTATES

EAST CHESTERMERE DRIVE
EAST WILKINSON ROAD

EAST CHESTERMERE DRIVE

PROVINCIAL LAKE
SANDWICH LAKE

LABRIE STREET

- X** Existing Residence
- Pasture
- Small Depression
- Nursery Stock / Tree Farm

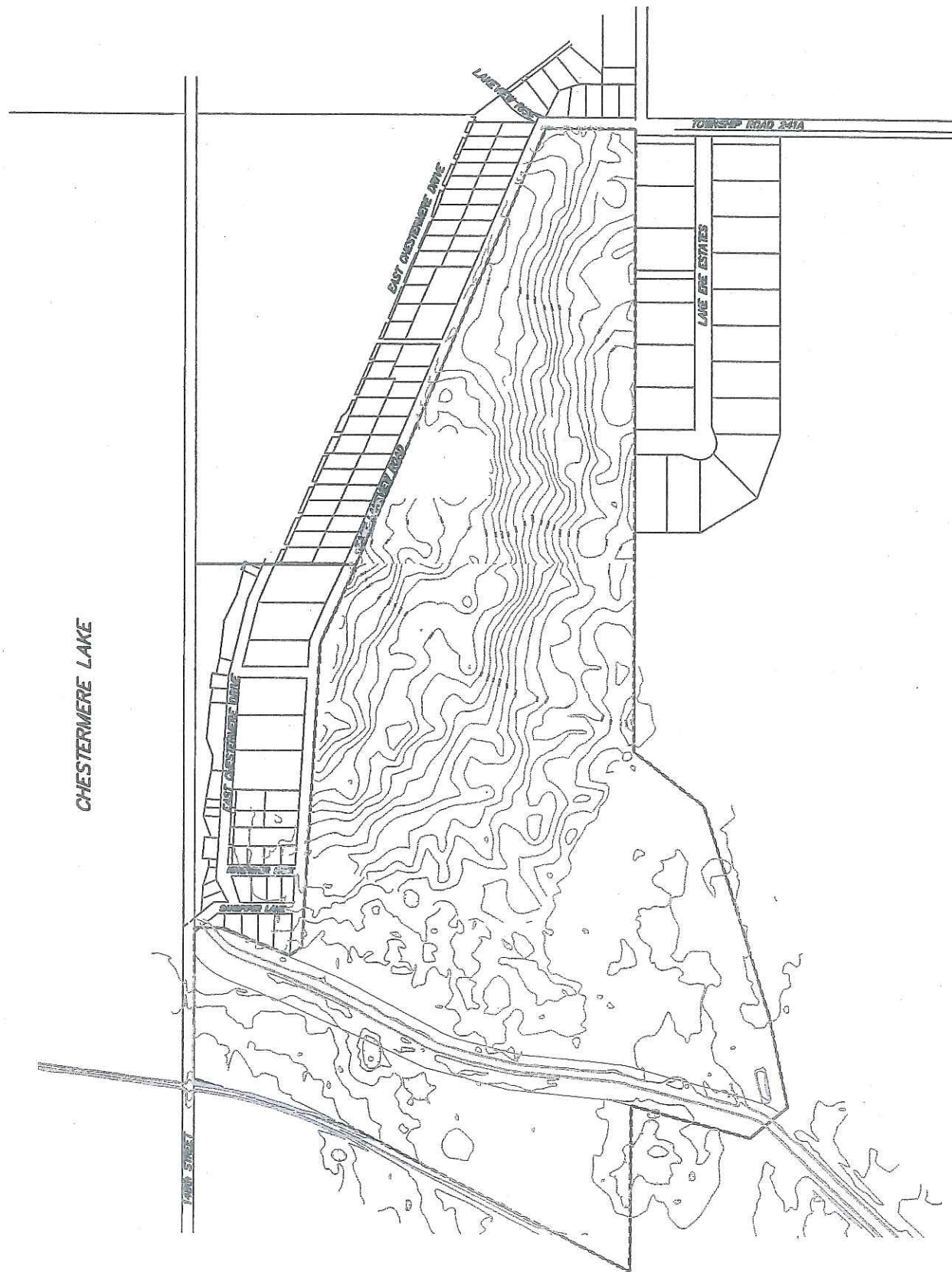
- - - - Plan Boundary
- Canal

SOUTHEAST CHESTERMERE
AREA STRUCTURE PLAN
Town of Chestermere



**Note: Conceptual Drawing; not to scale*

FIGURE 3
EXISTING CONDITIONS

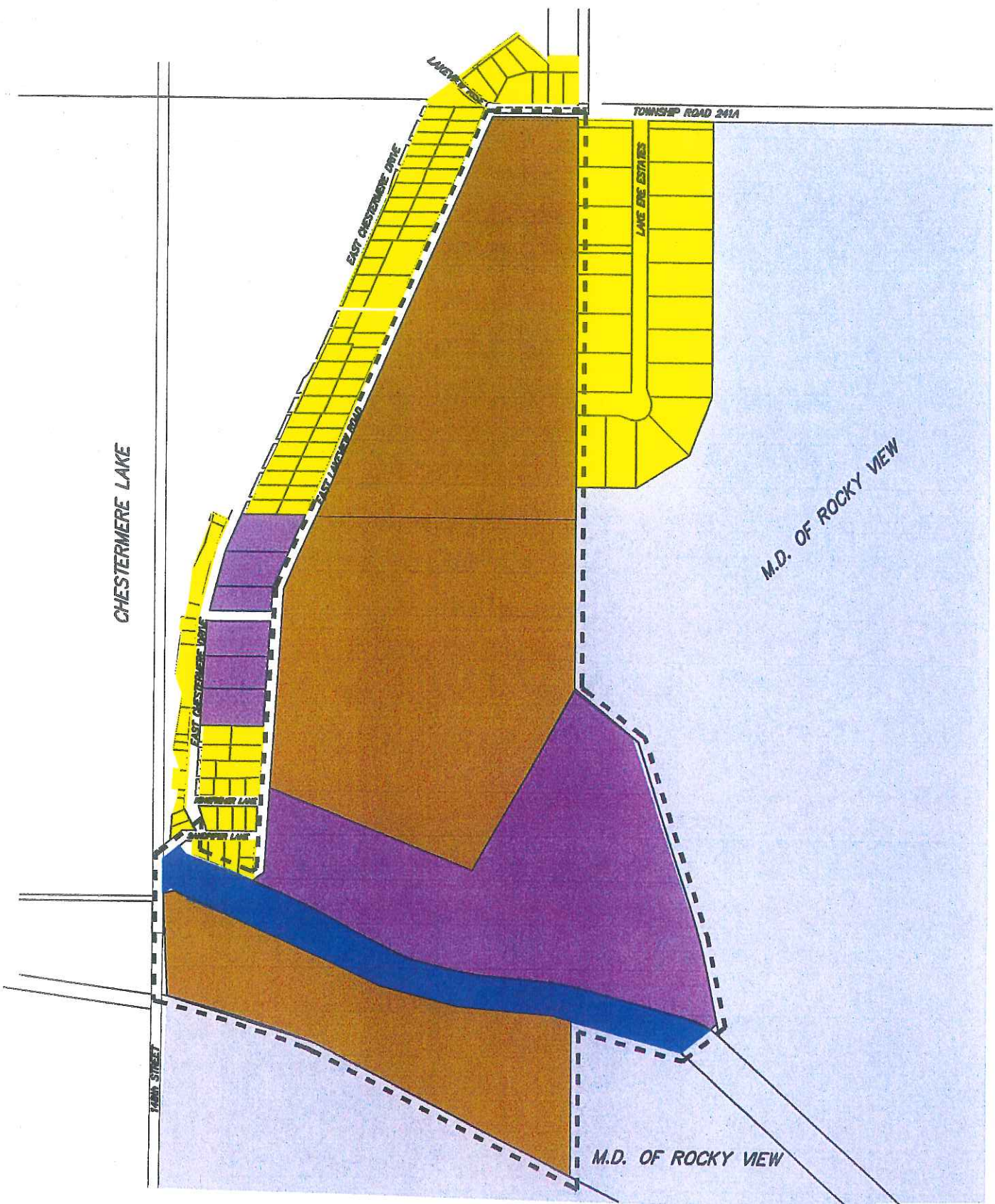


 CONTOURS
 PLAN BOUNDARY

SOUTHEAST CHESTERMERE
 AREA STRUCTURE PLAN
 Town of Chestermere

**Note: Conceptual Drawing; not to scale*

FIGURE 4
EXISTING TOPOGRAPHY



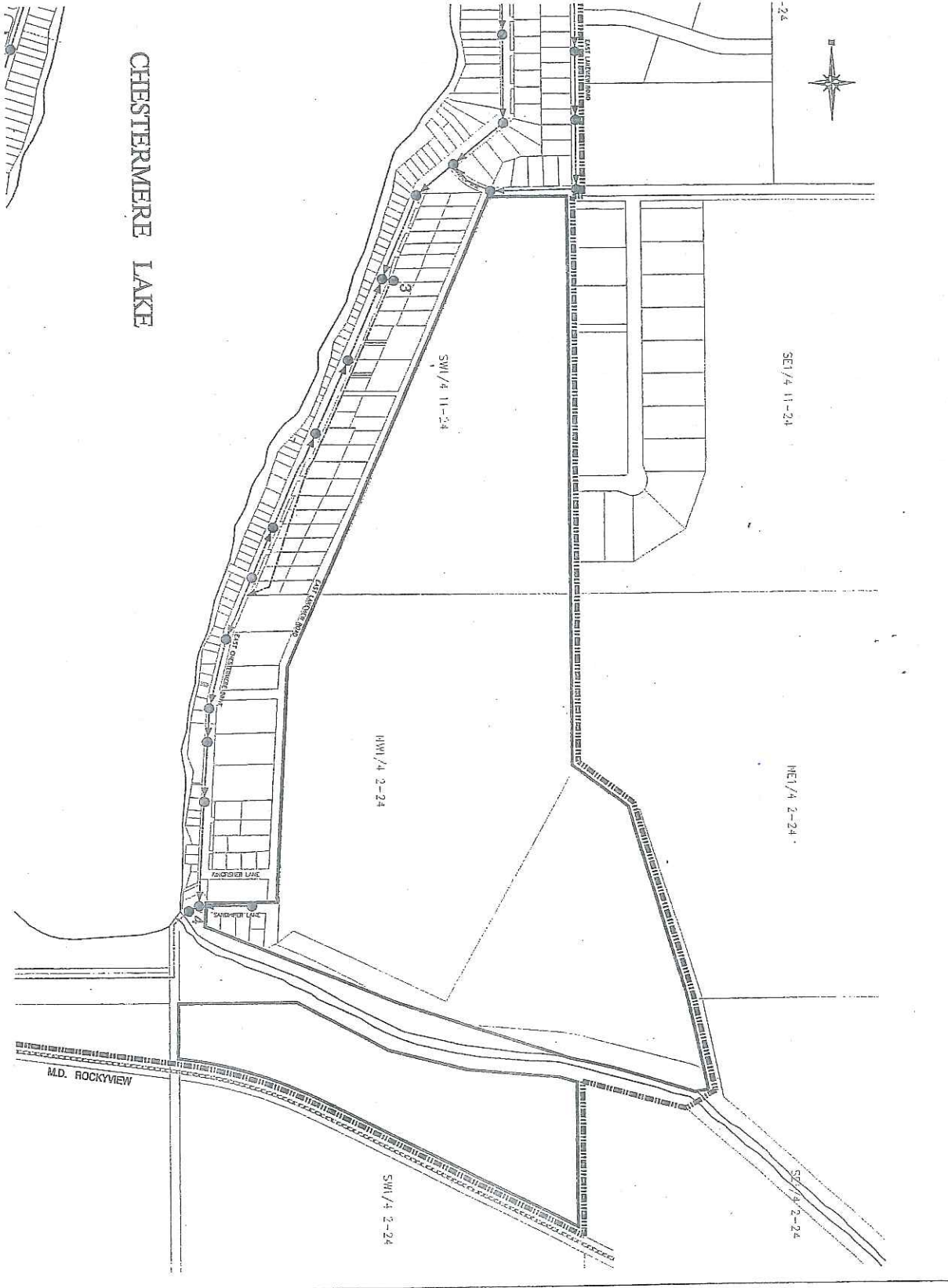
- Residential
- Special Recreational
- Urban Reserve
- Ranch & Farm

Existing Canal

**SOUTHEAST CHESTERMERE
AREA STRUCTURE PLAN**
Town of Chestermere

**Note: Conceptual Drawing; not to scale*

**FIGURE 5
EXISTING GENERAL LAND USE**



CHESTERMERE LAKE

M.D. ROCKYVIEW

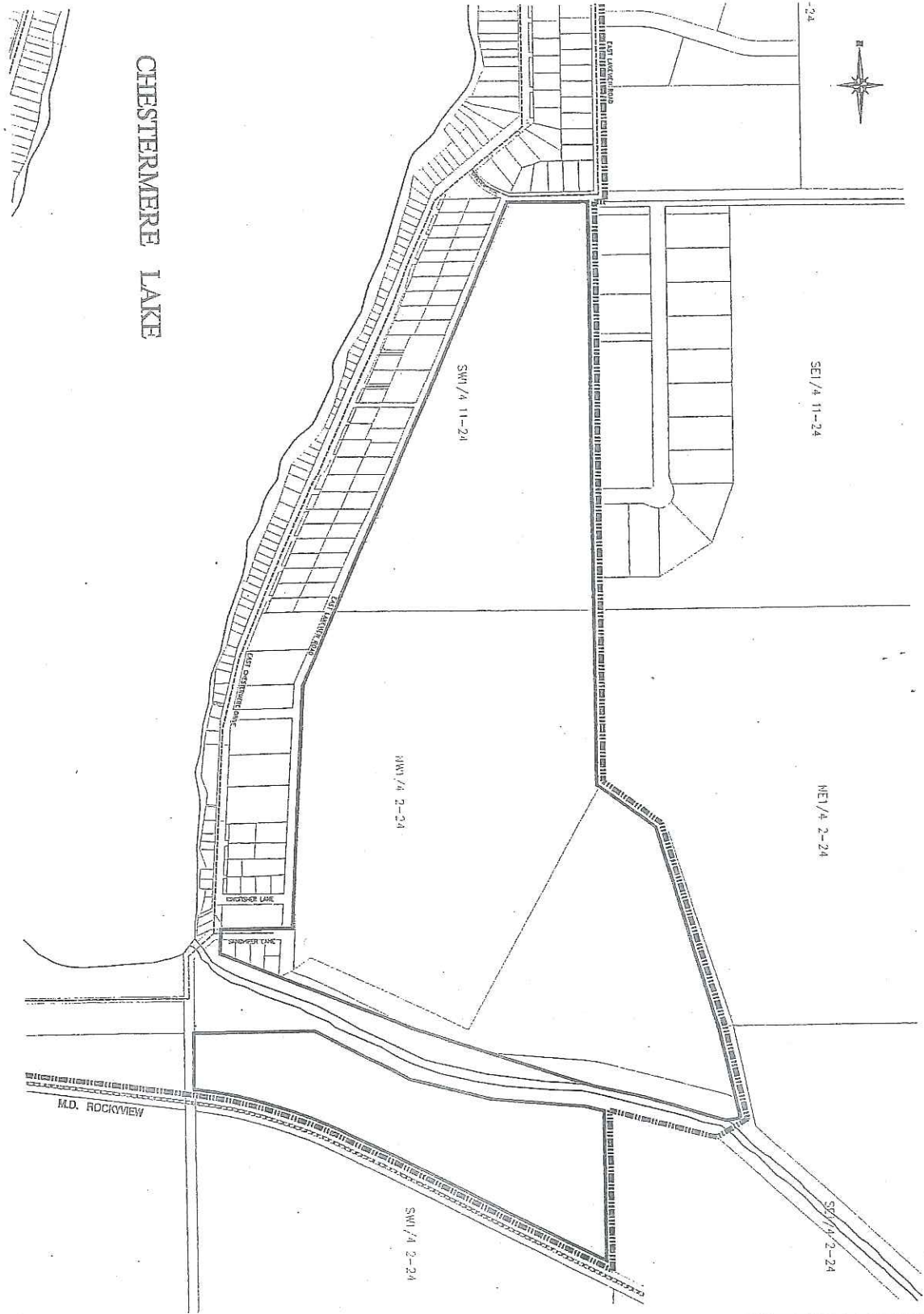
SOUTHEAST CHESTERMERE
 AREA STRUCTURE PLAN
 Town of Chestermere

- LEGEND:**
- TOWN BOUNDARY
 - STUDY AREA
 - EXISTING SANITARY
 - EXISTING FORCE MAIN
 - SEWAGE LIFT STATION NUMBER



*Note: Conceptual Drawing;
 not to scale

FIGURE 6
EX. SANITARY SEWER SYSTEM



CHESTERMERE LAKE

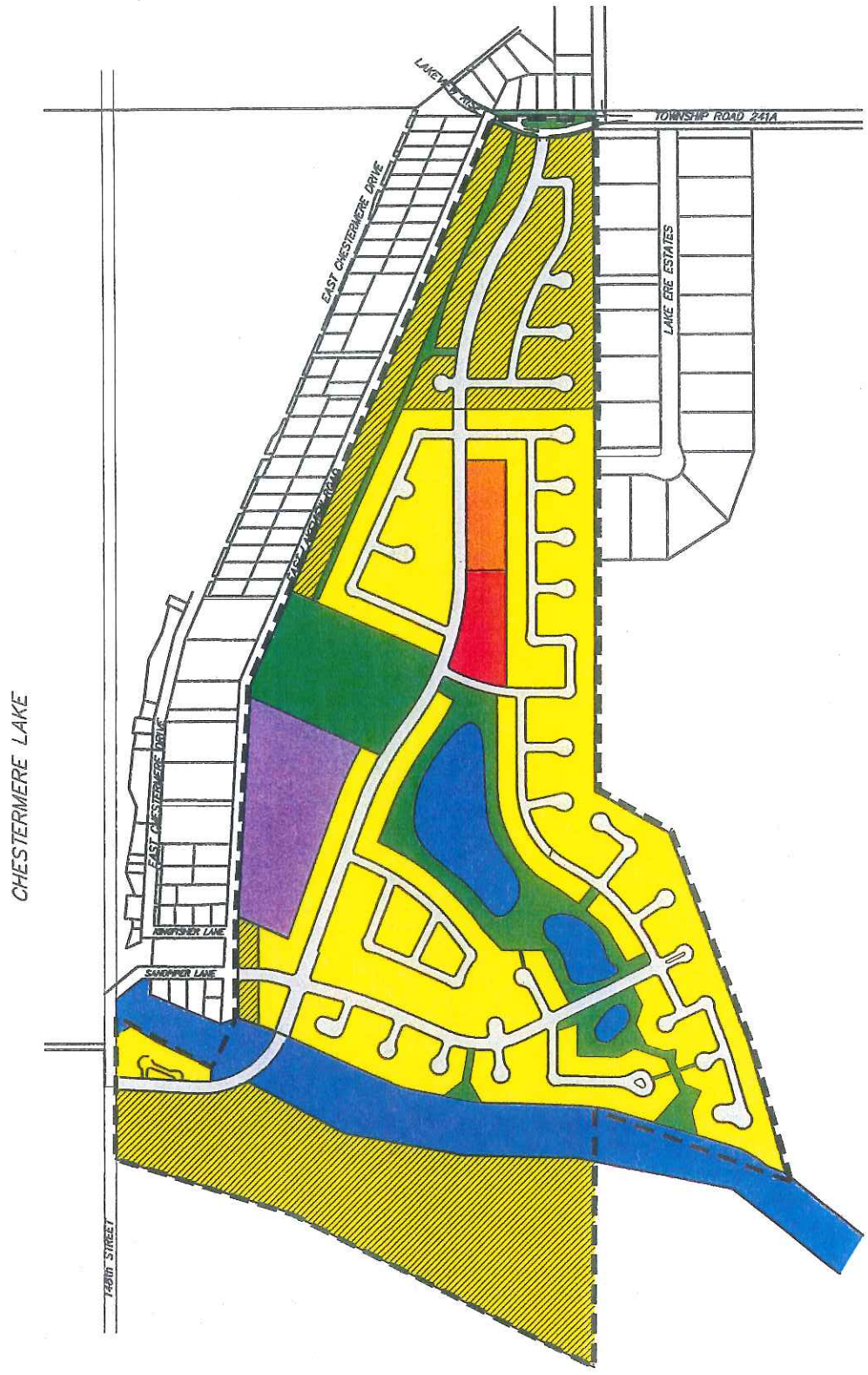











LEGEND:
 TOWN BOUNDARY [dashed line]
 STUDY AREA [double line]
 EXISTING WATERMANS [solid line]

**SOUTHEAST CHESTERMERE
 AREA STRUCTURE PLAN**
 Town of Chestermere

*Note: Conceptual Drawing;
 not to scale

**FIGURE 7
 EX. WATER SYSTEM**



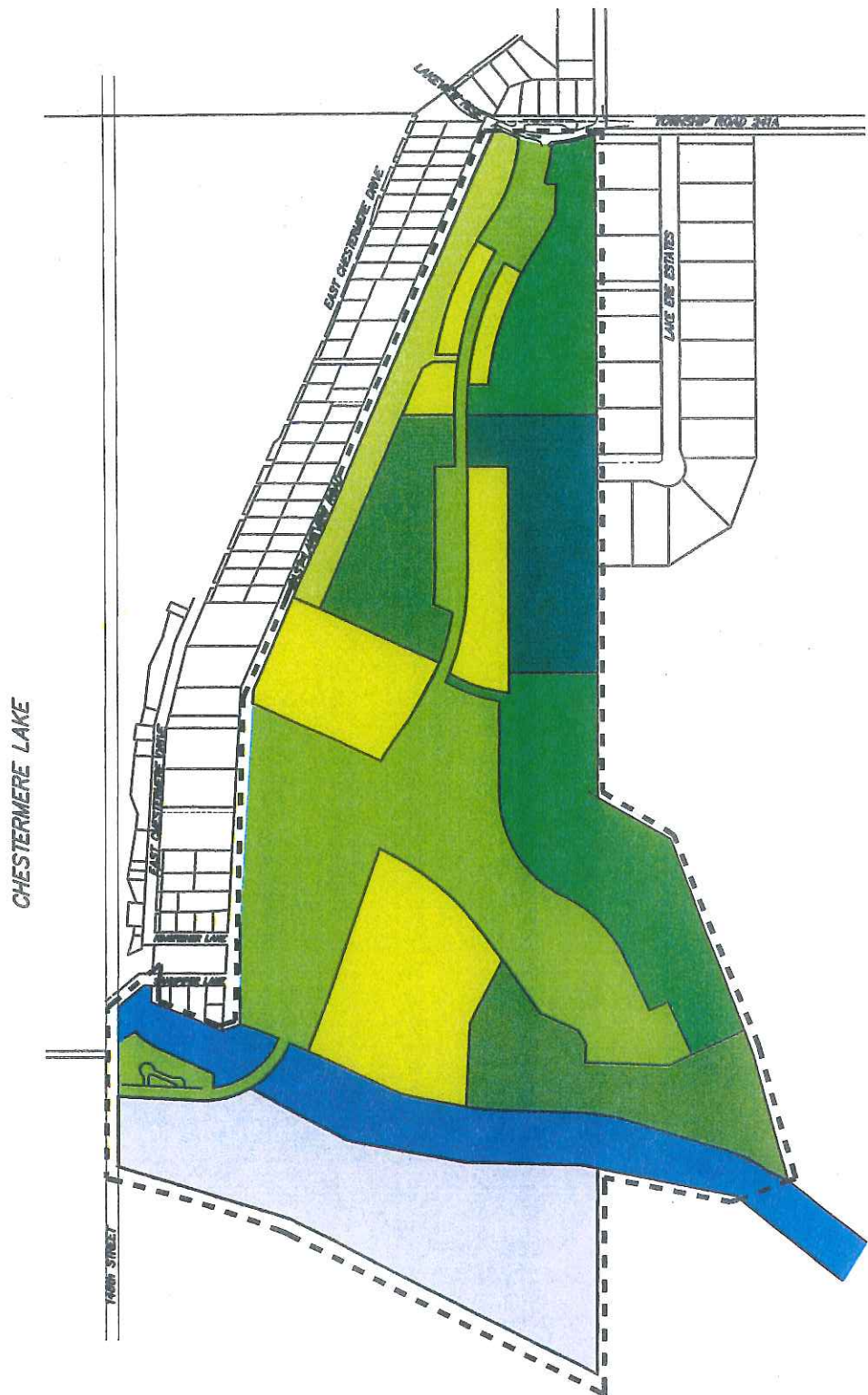
- | | | | |
|---|----------------------|---|------------------------|
|  | Residential |  | Multi Unit Residential |
|  | Estate Residential |  | Commercial |
|  | Roads |  | Open Spaces |
|  | Special Recreational |  | Canal / Ponds |
| | |  | Plan Area |

**SOUTHEAST CHESTERMERE
AREA STRUCTURE PLAN**









Town of Chestermere
September 2005

**FIGURE 8
PROPOSED LAND USE**

**Note: Conceptual Drawing; not to scale and Subject to Change Without Notice*



**Note: Conceptual Drawing; not to scale*

	PHASE 1		PHASE 5	<p>SOUTHEAST CHESTERMERE AREA STRUCTURE PLAN</p> <p>Town of Chestermere September 2005</p> <p>FIGURE 9</p> <p>PROPOSED PHASING SEQUENCE</p>
	PHASE 2		PHASE 6	
	PHASE 3		PHASE 7	
	PHASE 4		EXISTING CANAL	

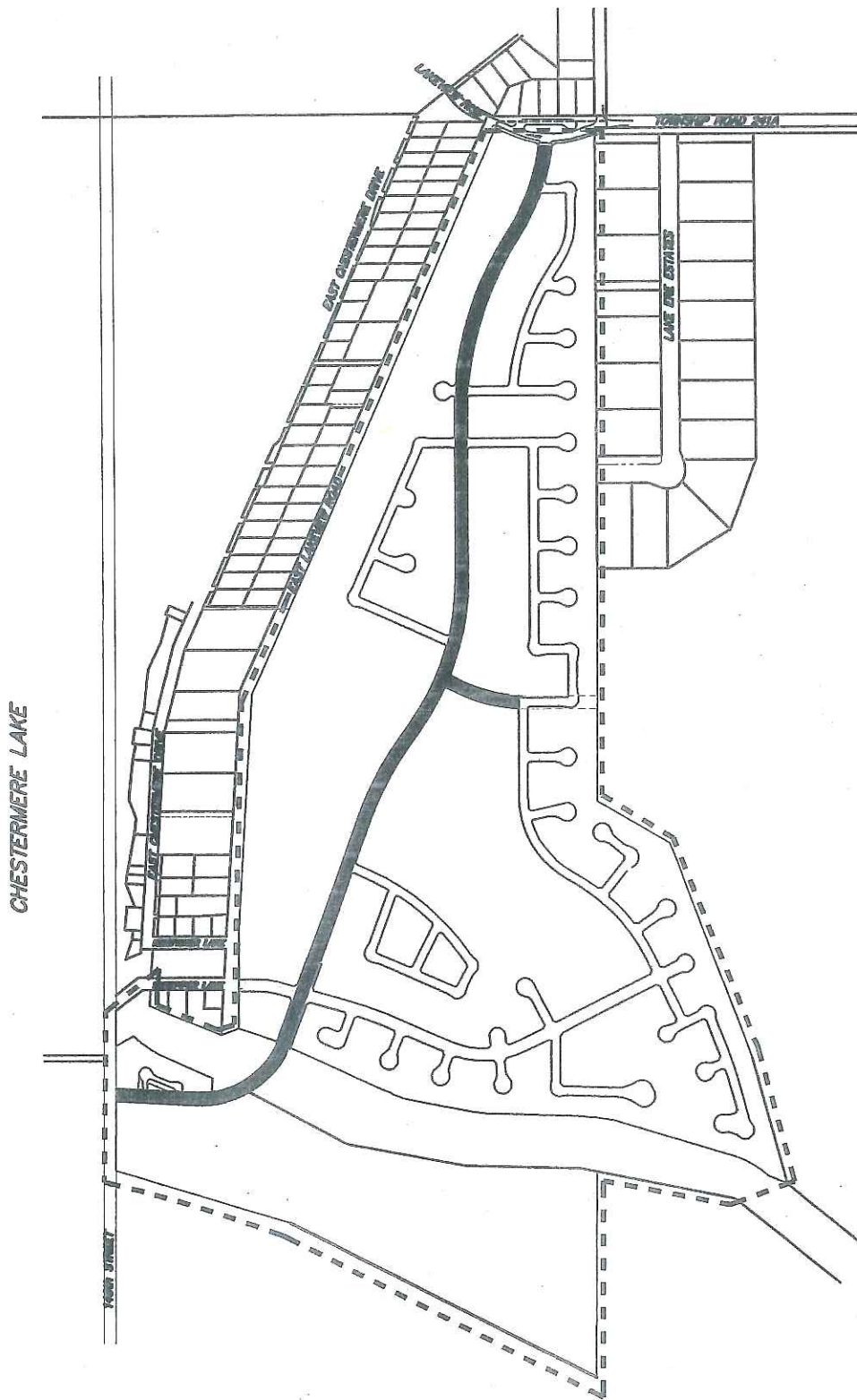


- OPEN SPACE
- FUTURE SCHOOL SITE
- Regional Pathway

**SOUTHEAST CHESTERMERE
 AREA STRUCTURE PLAN**
 Town of Chestermere
 September 2005

**FIGURE 10
 PROPOSED OPEN SPACES**

**Note: Conceptual Drawing; not to scale*



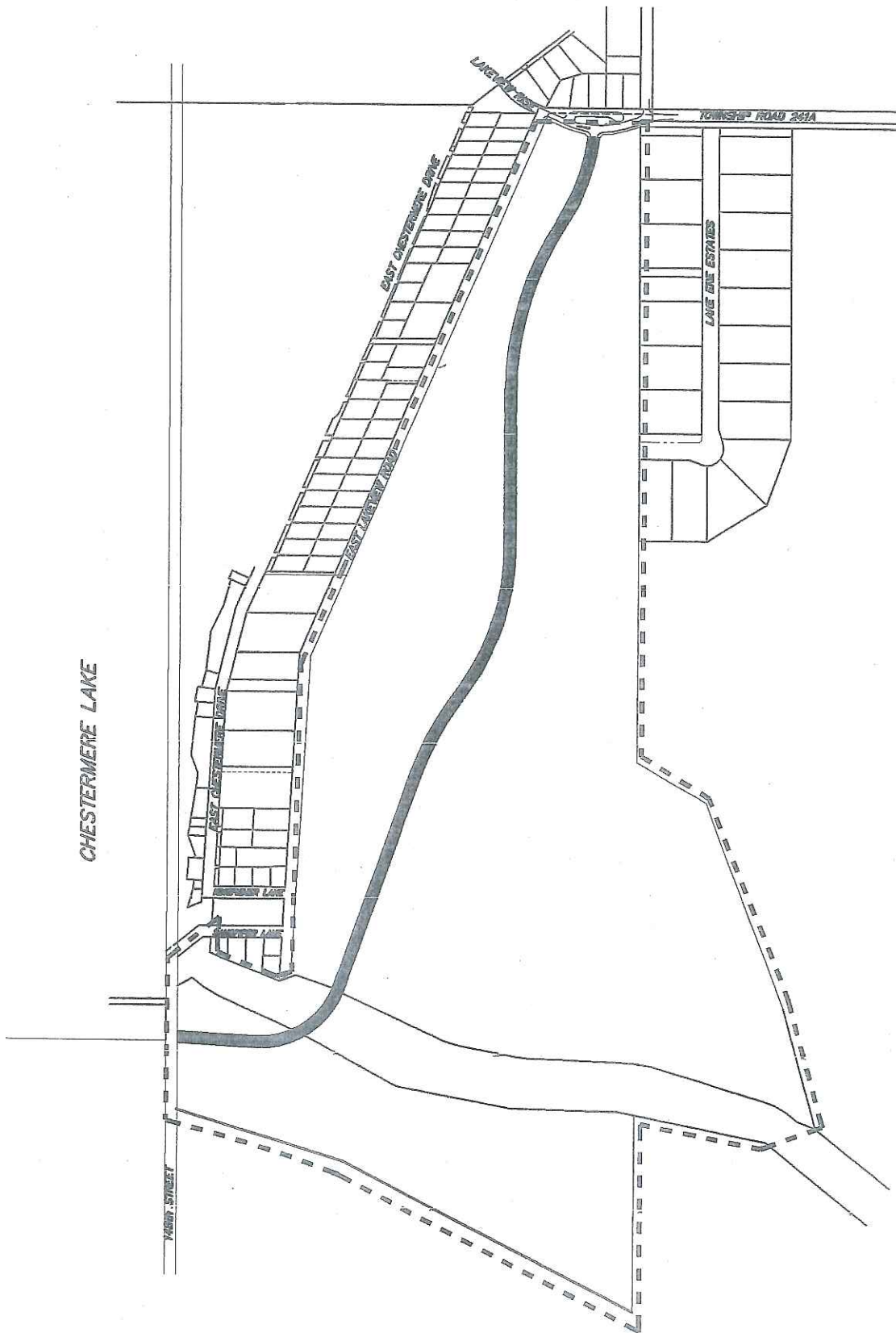
- Collector
- Residential
- Right of Way for future extension of collector road

SOUTHEAST CHESTERMERE
AREA STRUCTURE PLAN

Town of Chestermere
September 2005

FIGURE 11
PROPOSED ROAD NETWORK

**Note: Conceptual Drawing; not to scale*



■ Proposed Collector

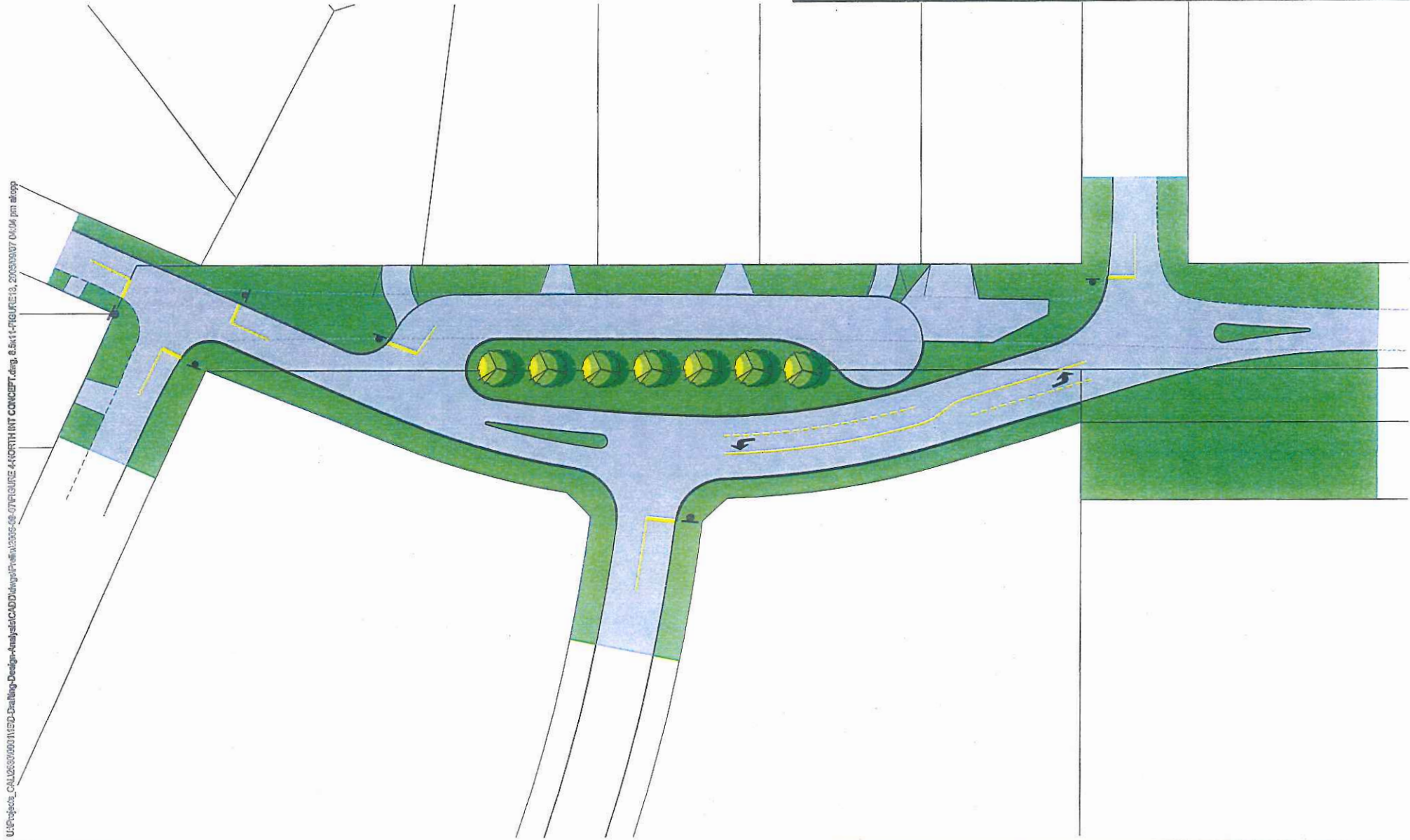
SOUTHEAST CHESTERMERE
 AREA STRUCTURE PLAN
 Town of Chestermere

FIGURE 12
PROPOSED COLLECTOR

**Note: Conceptual Drawing; not to scale*

S.E. CHESTERMERE ASP

U:\Projects_CAL\263000011\ED-Drafting-Design-Analysis\CADD\dwg\Plan\2630-08-07\FIGURE 4-NORTH INT CONCEPT.dwg, 8.5x11-FIGURE 13, 2005/08/07 04:04 pm atp



URBANSYSTEMS.
 100 - 2886 SUNRIDGE WAY N.E.
 CALGARY, AB, CANADA
 T1Y 7H9
 Tel. 403.291.1193
 Fax. 403.291.1374
 www.urban-systems.com

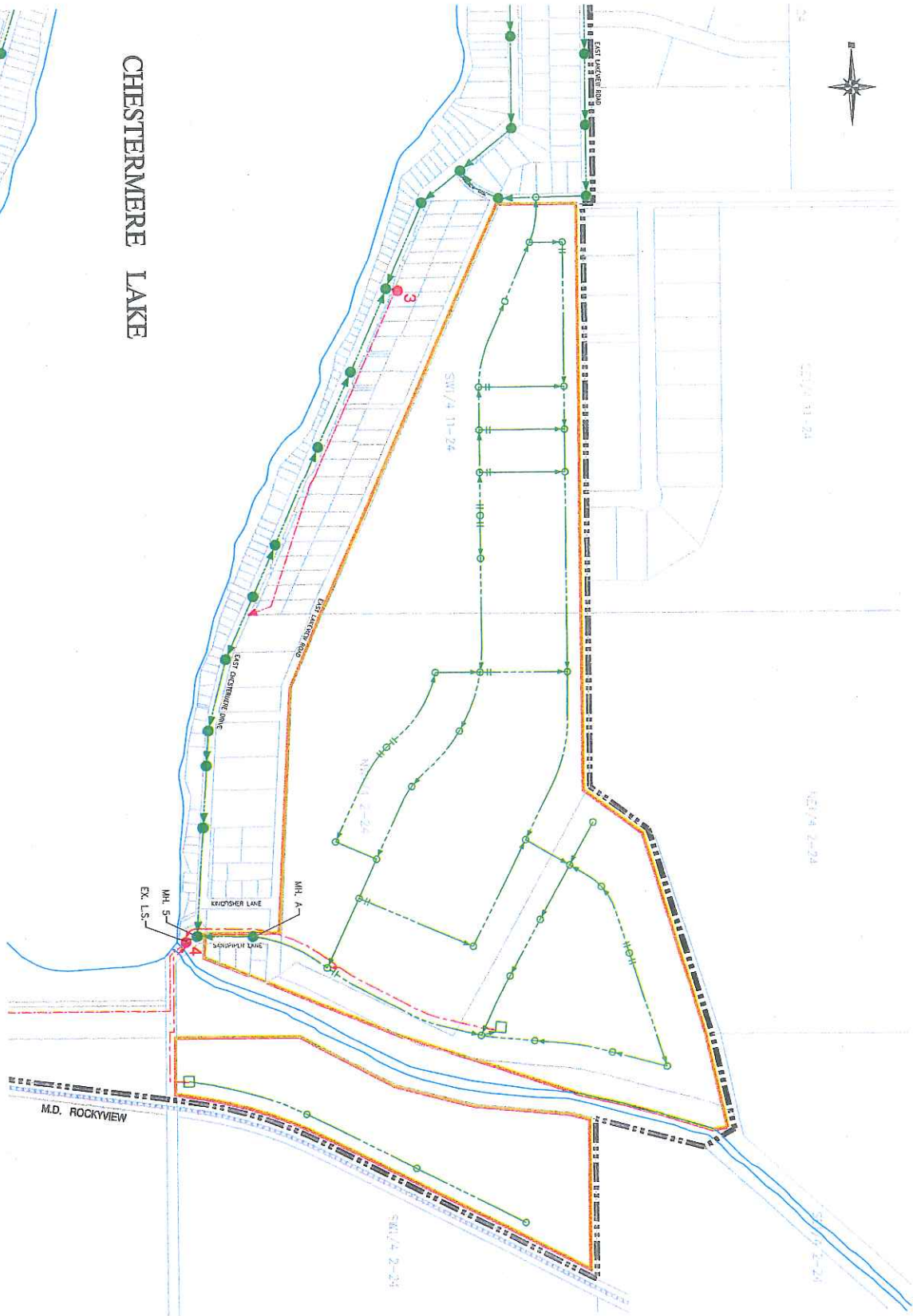
- LEGEND**
- Edge of Existing Roadway
 - Edge of Proposed Roadway
 - Right of Way
 - ⬇ Existing Stop Sign
 - ⬇ Proposed Stop Sign



Client/Project		
CHESTERMERE LAKE DEVELOPMENT CORP.		
Scale	Date	Figure No.
1:1000		13
File No. 2630.0001.15		Title

NORTH INTERSECTION CONCEPT

CHESTERMERE LAKE



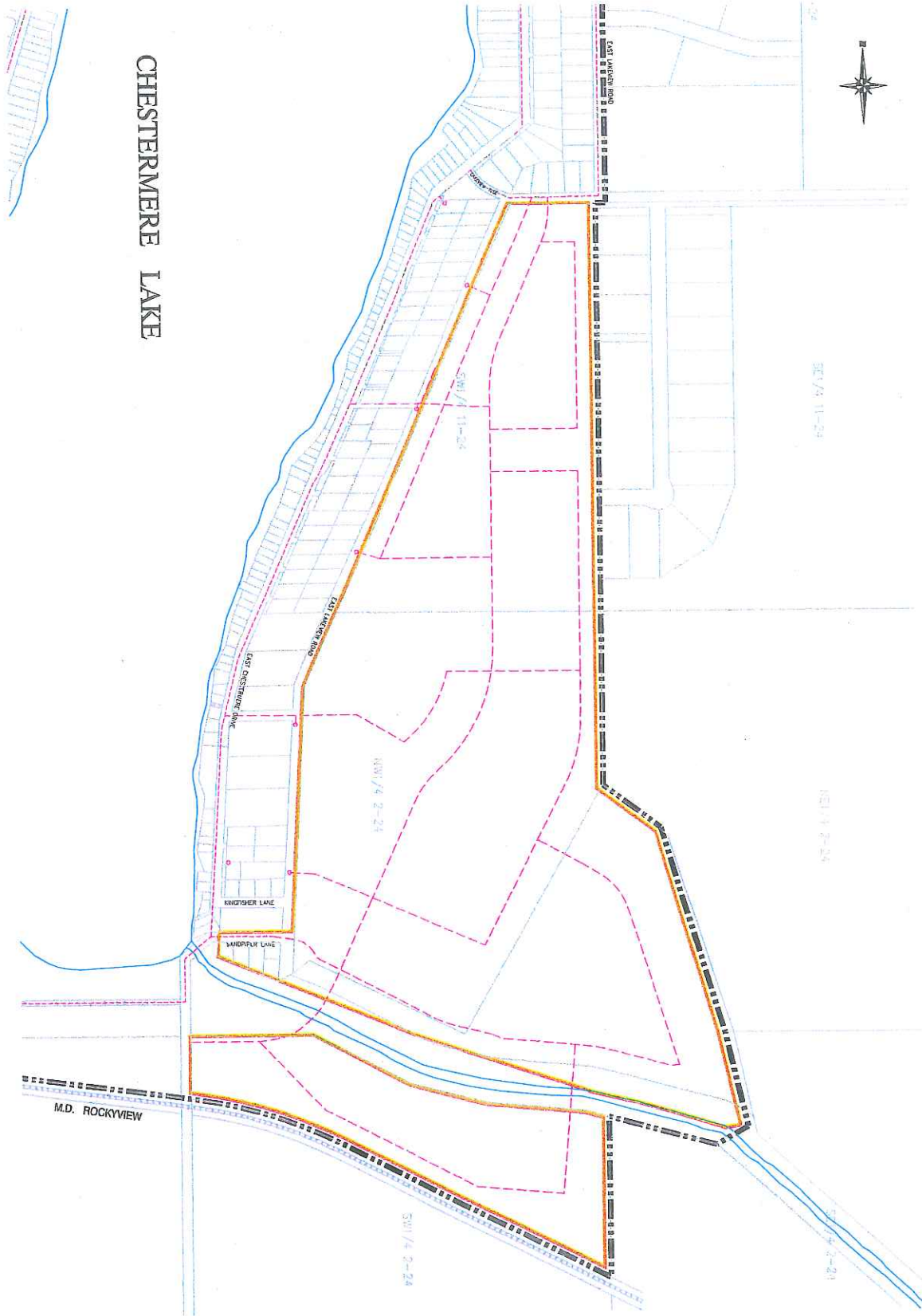
- LEGEND:**
- TOWN BOUNDARY
 - STUDY AREA
 - EXISTING SANITARY
 - EXISTING FORCEMAIN
 - SEWAGE LIFT STATION NUMBER
 - PROPOSED SANITARY
 - PROPOSED FORCEMAIN
 - PROPOSED LIFT STATION

**SOUTHEAST CHESTERMERE
AREA STRUCTURE PLAN**
Town of Chestermere



*Note: Conceptual Drawing;
not to scale

**FIGURE 14
FUT. SANITARY SEWER SYSTEM**



CHESTERMERE LAKE



LEGEND:

- TOWN BOUNDARY
- STUDY AREA
- EXISTING WATERMANS
- PROPOSED WATERMANS

**SOUTHEAST CHESTERMERE
AREA STRUCTURE PLAN**
Town of Chestermere



*Note: Conceptual Drawing;
not to scale

**FIGURE 15
FUT. WATER SYSTEM**

Appendix 1

Transportation Review

South East Cheshire
Area Structure Plan



September 7, 2005

File: 2630.0001.15

GLB Planning Ltd.
113-2060 Pegasus Way NE
CALGARY AB T2Z 3K6

Attention: Grace Lui

RE: SOUTHEAST CHESTERMERE ASP - TRANSPORTATION REVIEW UPDATE

This transportation planning review letter is in support of the Southeast Chestermere Area Structure Plan (ASP). The purpose of this review is to identify the impact of the development traffic on the existing and future road networks, and this letter documents the following findings from the review.

Executive Summary

- During the initial phase of development, the entire length of the internal collector road will be constructed and half of the width paved between Township Road 241A in the north and the WID canal in the south. In addition, the new canal crossing will be constructed and the collector road extended to Range Road 282. A southern paved route between Lake Chestermere and Glenmore Trail will also be completed through the MD of Rocky View utilizing Range Road 282, Township Road 240 and Range Road 283.
- This infrastructure is not required to support the initial stages of development in the Plan Area. Analysis indicates that between 150 dwelling units and 525 dwelling units can be developed in the Plan Area before the proposed level of infrastructure is required.
- Background traffic volumes include updated existing traffic counts obtained March 15th 2005, development traffic from the approved Shannon Lands, and development traffic from the 12 acre infill site south of the Shannon Lands. Traffic signals are warranted at both the Highway 1A/East Chestermere Drive intersection and at the Highway 1/Range Road 281 intersection to accommodate these existing background traffic volumes.
- Installation of traffic signals at the East Chestermere Drive/Highway 1A intersection is recommended with the background development of the Shannon Lands and the 12 acre infill (approximately 128 single family residential dwelling units).
- Installation of traffic signals at the Highway 1/Range Road 281 intersection is not warranted with the background development of the Shannon Lands and the 12 acre infill (approximately 128 single



family residential dwelling units) under the Alberta Transportation Traffic Signal Warrant Analysis. However, installation of traffic signals is recommended to resolve any intersection safety concerns.

- Based on anticipated daily traffic volumes at Full Build-out of the ASP area with the improved road network, the south end of the internal collector should be built to a primary collector standard from the intersection with Range Road 282 to the first intersection north of the canal.

Introduction

The approximately 252 acres of development area are located in southeast Chestermere, south of Township Road 241A, east of East Lakeview Drive, and north of the CN Rail. The land north of the canal is all planned for development within the 1 to 10 year time frame. The portion of the Plan Area south of the canal is currently a tree farm and is slated to begin development after full build-out of all lands north of the canal. The estimated existing daily traffic volume along East Lakeview Road and East Chestermere Drive shown in Figure 1 are based on count information obtained on March 15, 2005. The remaining existing daily traffic volumes were factored from data within the Southeast Chestermere Transportation Planning Study by Morasch Transportation Ltd., March 28, 2000.

Road Network

Existing Road Capacities

Table 1 summarizes the updated existing daily traffic volume, obtained on March 15th 2005, at key reference points through the study area and identifies the allowable daily traffic volume based on the existing roadway classification. Refer to Figure 2 showing the locations of these reference points in the study area.

Table 1
Existing Roadway Volumes and Classification

Roadway (Reference Point)	Road Class	Allowable Daily Volume (vpd)	Existing Daily Volume (vpd)
East Chestermere Drive (At the park)	Rural Collector	< 6,500	1,850
East Lakeview Road (South of 241A)	Rural Residential	< 1,500	460
East Lakeview Road (North of 241A)	Rural Collector	< 6,500	330
Twp. Road 241A (East of Lake Ere Estates Road)	Rural Collector	< 6,500	880
Range Road 281 (164 th Street SE) (North of Merganser Drive E)	Rural Collector	< 6,500	950

Note: vpd = vehicles per day



Highway 1 and Range Road 281

In discussion with Alberta Infrastructure and Transportation (AIT), the status of the Highway 1/Range Road 281 (164th Street SE) access is uncertain at this time. Closure of the access will be dependent on several factors including the safety of the access, the construction of a future interchange to the east at Highway 791, and the extent of annexation between the Town of Chestermere, the MD of Rocky View, and the City of Calgary. The closure of the Highway 1 access is expected to occur in conjunction with the construction of an interchange at Highway 1 and Highway 791 in approximately 15 years.

Internal Collector Road and North Intersection Design

Capacities exist within the current road infrastructure to accommodate 150-525 dwelling units prior to any upgrades being required. However, the developer has offered to construct both the internal collector, as well as provide a paved south link from the Plan Area through to Glenmore Trail prior to receiving occupancy permits for non-showhome dwelling units. Specifically, the proposal includes:

1. The construction of the entire length of the internal collector with half of the width paved from Township Road 241A across the WID canal to Range Road 282.
2. Provision of a paved southern link to be completed along Range Road 282, Township Road 240 and Range Road 283 as shown in Figure 3.

The development of the Plan Area is scheduled to proceed following the construction of the proposed internal collector road and will begin at the south end of the Plan Area. The proposed concept for the northern intersection connecting the internal collector to Township Road 241A is shown in Figure 4. The concept shows a T-intersection that allows Plan Area traffic a choice of routes. Traffic can either turn left to head toward East Chestermere Drive or turn right to head toward East Lakeview Road or Range Road 281. Little to no Plan Area traffic is anticipated to use East Chestermere Drive south of East Merganser Drive.

Background Development Traffic Volume

Based on direction received from the Town, growth in background traffic volumes includes the approved Shannon Lands, and a potential 12 acre infill area lot situated just south of the Shannon Lands. The Shannon Lands consist of 96 residential dwelling units with an assumed density of approximately 5.2 units per acre. The 12 acre infill is also anticipated to build-out at approximately 5.2 units per acre (upa) for a total of approximately 62 residential dwelling units.



The trips generated by the full build-out of the Shannon Lands and the 12 acre infill sites were included in the background traffic assumed as part of this study. The trips generated by these developments are summarized in Table 2.

Table 2
 Background Development Trip Generation

Development	Size	Trip Generation Rate			Traffic Volumes Generated		
		Inbound	Outbound	Total	Inbound	Outbound	Total
AM PEAK HOUR							
Shannon Lands	96 DU	0.19 vph/DU	0.56 vph/DU	0.75 vph/DU	18 vph	54 vph	72 vph
12 acre Infill	62 DU	0.19 vph/DU	0.56 vph/DU	0.75 vph/DU	12 vph	35 vph	47 vph
TOTAL	158 DU				30 vph	89 vph	119 vph
PM PEAK HOUR							
Shannon Lands	96 DU	0.65 vph/DU	0.35 vph/DU	1.00 vph/DU	62 vph	34 vph	96 vph
12 acre Infill	62 DU	0.65 vph/DU	0.35 vph/DU	1.00 vph/DU	40 vph	22 vph	62 vph
TOTAL	158 DU				103 vph	55 vph	158 vph
DAILY							
Shannon Lands	96 DU	5.00 vpd/DU	5.00 vpd/DU	10.00 vpd/DU	480 vpd	480 vpd	960 vpd
12 acre Infill	62 DU	5.00 vpd/DU	5.00 vpd/DU	10.00 vpd/DU	310 vpd	310 vpd	620 vpd
TOTAL	158 DU				790 vpd	790 vpd	1580 vpd

Note: DU = dwelling unit(s); vph = vehicles per hour; vpd = vehicles per day

The distribution of this additional background traffic from the Shannon Lands and the infill area are as follows:

- 75% travels north via East Lakeview Road/East Chestermere Drive to Highway 1A;
- 10% travels east via Highway 1/Range Road 281;
- 10% travels south of the canal to Range Road 282; and
- 5% travels east via Township Road 241A.

The volumes generated by these newly developing areas were added to the existing volumes to create the existing background volumes, as shown in Figure 5.

Southeast Chestermere Development Traffic Volume

The land uses proposed for the 252 acre development area are as outlined in Table 3.



Table 3
 Proposed Southeast Chestermere Development

Land Use	Proposed Development Level	Density
Single Family Residential	920 DU	3.7 upa
Multi-Family Residential	55 DU	18 upa
Junior High/Middle School	500 students	-
Commercial	35,300 ft ² (3.53 acres)	-

Note: DU = dwelling unit(s); upa = units per acre

Development is projected to proceed from south to north along the proposed internal collector road.

Full Build-out of Development

Full Build-out of the entire Plan Area will consist of approximately 975 residential dwelling units, a junior high/middle school, and a small commercial site. This includes the long-term residential lands south of the canal. Table 4 details the trips generated at Full Build-out of development using the City of Calgary peak hours and daily trip generation rates for single family residential. Trip generation information unique to Chestermere was collected to determine the travel characteristics of Chestermere residents. The data suggests that for Chestermere, a trip rate of 7.2 trips per day is more appropriate than 10 trips per day. However, 10 trips per day was used to ensure that this study was conservative in nature. The Institute of Transportation Engineers (ITE) Trip Generation Manual was used to determine the trip generation rates for commercial land use and for the junior high/middle school.

The City of Calgary trip generation rates for a typical multi-family residential unit are approximately 70% of the single family residential rates. These rates are typically used for higher density multi-family development. The types of multi-family development currently proposed for Southeast Chestermere are townhome-style. A more conservative estimate of approximately 90% of the single-family residential trip generation rate is used for this study.



Table 4
Full Build-out of Southeast Chestermere Development Trip Generation

Development	Size	Trip Generation Rate			Traffic Volumes Generated		
		Inbound	Outbound	Total	Inbound	Outbound	Total
AM PEAK HOUR							
Single Family Residential	920 DU	0.19 vph/DU	0.56 vph/DU	0.75 vph/DU	173 vph	517 vph	690 vph
Multi Family Residential	55 DU	0.17 vph/DU	0.51 vph/DU	0.68 vph/DU	9 vph	28 vph	37 vph
Junior High / Middle School	500 Students	0.26 vph/student	0.20 vph/student	0.46 vph/student	131 vph	99 vph	230 vph
Commercial	35,300 ft ²	3.27 vph/1,000 ft ²	2.09 vph/1,000 ft ²	5.36 vph/1,000 ft ²	115 vph	74 vph	189 vph
TOTAL	975 DU				428 vph	718 vph	1,146 vph
PM PEAK HOUR							
Single Family Residential	920 DU	0.65 vph/DU	0.35 vph/DU	1.00 vph/DU	598 vph	322 vph	920 vph
Multi Family Residential	55 DU	0.59 vph/DU	0.31 vph/DU	0.90 vph/DU	32 vph	17 vph	49 vph
Junior High / Middle School	500 Students	0.12 vph/student	0.06 vph/student	0.18 vph/student	58 vph	32 vph	90 vph
Commercial	35,300 ft ²	8.35 vph/1,000 ft ²	9.04 vph/1,000 ft ²	17.39 vph/1,000 ft ²	295 vph	319 vph	614 vph
TOTAL	975 DU				983 vph	690 vph	1,673 vph
DAILY							
Single Family Residential	920 DU	5.00 vpd/DU	5.00 vpd/DU	10.00 vpd/DU	4,600 vpd	4,600 vpd	9,200 vpd
Multi Family Residential	55 DU	4.50 vpd/DU	4.50 vpd/DU	9.00 vpd/DU	247 vpd	248 vpd	495 vpd
Junior High / Middle School	500 Students	0.73 vpd/student	0.73 vpd/student	1.45 vpd/student	363 vpd	362 vpd	725 vpd
Commercial	35,300 ft ²	68.50 vpd/1,000 ft ²	68.50 vpd/1,000 ft ²	137.00 vpd/1,000 ft ²	2,418 vpd	2,418 vpd	4,836 vpd
TOTAL	975 DU				7,628 vpd	7,628 vpd	15,256 vpd

Note: DU = dwelling unit(s); vph = vehicles per hour; vpd = vehicles per day

The vehicle trips generated in Table 4 represent the total traffic generated by each land use. Approximately 35% of the trips generated by the Junior High/Middle School are estimated to be internal to the Plan Area, and approximately 50% of the trips generated by the commercial site are anticipated to be pass-by trips; or trips already on the road network. All residentially generated traffic is assumed to be external to the Plan Area. The number of external trips on a daily basis is, therefore, 12,600.

Distribution of Southeast Chestermere Development Traffic

The distribution of the development traffic is based on data from time trials completed in June 2003 and May 2004 by Urban Systems.



Once the internal collector is complete, some of the existing background traffic will shift to the internal collector road rather than use East Lakeview Road. The resulting future background traffic volumes are shown in Figure 6.

The anticipated Plan Area development traffic distribution is expected to favour travel along the internal collector. Traffic activity along East Chestermere Drive and East Lakeview Road west of the internal collector is expected to remain low as a result. The traffic distribution and resultant traffic volumes at full development are shown in Figures 7 and 8, respectively.

Capacity of the Area Road Network

The road capacities at various reference points on the area road network were determined after Full Build-out of the Plan Area. The daily traffic volume generated by the development was added to the existing daily background traffic volumes at the various reference points, and compared to the allowable daily volume (ADV). The daily traffic volumes are compared to the existing roadway ADV in Table 5.

Table 5
 Daily Traffic Volumes

Roadway (Reference Point)	Road Class	Allowable DV (vpd)	Existing DV (vpd)	Full Build-out DV (vpd)
East Chestermere Drive (At the park)	Rural Collector	< 6,500	1,850	4,300
East Lakeview Road (south of 241A))	Rural Residential	< 1,500	460	1,100
East Lakeview Road (north of 241A)	Rural Collector	< 6,500	330	2,750
Twp. Road 241A (East of Range Road 281)	Rural Collector	< 6,500	880	2,050
Range Road 281 (164 th Street SE) (North of Merganser Drive E)	Rural Collector	< 6,500	950	4,800
Internal Collector (North End)	Primary Collector	< 12,500	n/a	5,900
Internal Collector (South End)	Primary Collector	< 12,500	n/a	6,050

Note: DV = Daily Volume; vpd = vehicles per day

According to the City of Calgary road standard, the Environmental Design Guideline (EDG) of a primary collector road is approximately 12,500 vehicles per day, the EDG of a collector road is approximately 6,500 vehicles per day, and the EDG of a residential road is approximately 1,500 vehicles per day. As shown in Table 5, the daily traffic volumes at Full Build-out are lower than the allowable daily traffic volumes for each road segment. These thresholds have been established subjectively by the City. As a



means of mitigating future concerns regarding volumes and noise, the City successfully implemented the EDG system to ensure the correct land use pattern adjacent to higher volume roadways.

In approximately 15 years, the connection of Range Road 281 to Highway 1 may be closed and replaced with an interchange at Highway 791 to the east. The closure of this connection will again alter the traffic distribution. The anticipated distribution and daily volumes are shown in Figures 9 and 10, respectively, for Full Build-out of the Plan Area. Traffic volumes indicate that the south end of the internal collector should be built to a primary collector standard from the intersection with Range Road 282 to the first intersection north of the canal to support the anticipated daily traffic volumes at Full Build-out of the Plan Area. The capacity on the improved road network will not exceed the allowable daily traffic volume at each key reference point.

Phasing of Development

The development of the Plan Area lands will be completed in phases over a 5 to 10 year period. The infrastructure to support each phase of development could also be provided annually. For instance, the developers are proposing to build the internal collector road before the homes, but some development could occur before the internal collector road is required. Without the internal collector road, the network could accommodate between 150 dwelling units and 525 dwelling units before the internal collector and south connection are necessary. The following assumptions were made:

1. Phase 1: Begins with approximately 50 units per development cell for a total of 150 dwelling units. The two southern cells would access East Lakeview Road south of Township Road 241A. The northern cell would access Township Road 241A. The limiting piece of the road network for Phase 1 is East Lakeview Road south of Township Road 241A where only 1,000 additional daily trips can be accommodated which equates to 100 DU.
2. Phase 2: The development could continue in the Plan Area as long as additional access was not granted to the critical section of East Lakeview Road south of Township Road 241A. Development would then have to occur from the north along the internal collector road. If we assume that 2/3 of the traffic generated by the Plan Area uses East Lakeview Road and East Chestermere Drive north of Township Road 241A to travel to Highway 1A, then this link can accommodate another 3,500 daily trips near the park. The other 1/3 of the development traffic would use Range Road 281 to access Highway 1. This is equivalent to a total of 525 dwelling units or an additional 375 dwelling units in Phase 2.



These are the thresholds for development of the Plan Area:

- 100 units could develop with sole access to East Lakeview Road south of Township Road 241A.
- Another 425 units could develop from north to south before the volumes on East Chestermere Drive near the park reached another threshold.
- Therefore, at the end of Phase 2, a total of 525 dwelling units would be developed and the internal collector road would be constructed from the canal crossing to Township Road 241A.
- For the development of more dwelling units beyond the Phase 2 total of 525 dwelling units, the connection across the canal to Range Road 282 is required along with a paved connection to Highway 560 (Glenmore Trail).

From this discussion, it is clear that development in the Plan Area could occur without requiring new major road infrastructure. In fact, over 50% of the proposed homes in the Plan Area could be constructed before the canal crossing and paved connection are required to the south to draw traffic away from East Chestermere Drive.

The fact that the developers are proposing to complete the internal collector road connection, the canal crossing and the paved southern route to Highway 560 means that there are no transportation constraints for the Plan Area. In addition, by constructing this infrastructure in the early stages, the developers are helping to establish travel patterns that draw people away from East Chestermere Drive, so that existing roads within the Town will not reach volume thresholds during or after build-out of the Plan Area.

The final threshold that needs to be discussed is when will the final half of the internal collector need to be paved. The north end of the internal collector road can accommodate 6,500 vpd, while the south end can accommodate 12,500 vpd. If only half the width is paved, then it is reasonable to assume that this narrow road can accommodate slightly less than 50% of the allowable daily volume. Therefore, the north end is the constraint. It is recommended that the internal collector road be completed with full pavement when the volume reaches 3,000 vpd. This is equivalent to 300 dwelling units contributing traffic to this roadway.

Analysis of Study Intersections

The Town of Chestermere requested Urban Systems Ltd to assess the potential impact of development traffic on the operation of the following key intersections:

- Highway 1A/East Chestermere Drive (north-south stop controlled);



- Highway 1/Range Road 281 (north-south stop controlled);
- Lakeview Rise/East Lakeview Road/Township Road 241A (3 way stop controlled); and
- Internal Collector/Township Road 241A (northbound stop controlled).

The performance of the intersections was analyzed for the existing plus background traffic condition and Full Build-out of the Plan Area during the morning and afternoon peak hour. Synchro v.6 software was used to analyze the operation of the study intersection. Synchro uses the methods of the 2000 Highway Capacity Manual (*Transportation Research Board, 2000*) for the analysis of signalized and unsignalized intersections.

Traffic signal warrants were also completed at the highway intersections for each scenario. Alberta Transportation has a method for determining if traffic signals are warranted at an existing unsignalized intersection. The procedure is based on the Traffic Signal Warrant from the Manual of Uniform Traffic Control Devices for Canada. The method takes into account average annual daily traffic (AADT), pedestrian volumes and collisions. The procedure yields a priority point total or score. If the score is close to or exceeds 100 points, traffic signals are considered, and installation is recommended if the intersection operates with a poor level of service. Other general guidelines also indicate that if the operation of the intersection is poor prior to reaching 100 points (i.e. warrant points total approximately 90 points), installation of traffic signals may still be recommended.

Note that reportable collisions are not included in this analysis; as such, the following results may underscore the overall priority point total. As a result, unwarranted intersections may still require installation of traffic signals after an independent review of collision data for the area. Also, the Highway 1 and Range Road 281 intersection is not analyzed at full build-out since it is assumed this interchange will be closed by this time. Furthermore, the future north access intersection at the existing background stage is not analyzed since it is not expected to experience any traffic activity until the internal collector is fully built. The results of the analyses are summarized in Table 6.



Table 6
 Performance Summary for Study Intersections

Horizon	Period	Comments*
Highway 1A & East Chestermere Drive (north-south stop controlled)		
Existing plus Background	AM	All movements will have fair operating conditions. AT Traffic Signal Warrant Point = 88 pts. Traffic signals warranted.
	PM	North and southbound approach will have poor operating conditions. AT Traffic Signal Warrant Point = 88 pts. Traffic signals warranted.
Full Build-out Development	AM	Traffic signals in place. All movement will have good operational conditions.
	PM	Traffic signals in place. All movement will have good operational conditions.
Highway 1 & Range Road 281 (north-south stop controlled)		
Existing plus Background	AM	All movements will have fair operating conditions or better. AT Traffic Signal Warrant Point = 70 pts. Traffic signals not warranted.
	PM	All movements will have fair operating conditions or better. AT Traffic Signal Warrant Point = 70 pts. Traffic signals not warranted.
Full Build-out Development	AM	North and southbound approaches will have fair to poor operating conditions. AT Traffic Signal Warrant Point = 119. Traffic signals warranted.
	PM	North and southbound approaches will have fair to poor operating conditions. AT Traffic Signal Warrant Point = 119. Traffic signals warranted.
Lakeview Rise/East Lakeview Road/Township Road 241A (3-way stop controlled)		
Existing plus Background	AM	All movements will have good operational conditions.
	PM	All movements will have good operational conditions.
Full Build-out Development	AM	All movements will have good operational conditions.
	PM	All movements will have good operational conditions.
Future north access/Township Road 241A (NB stop controlled)		
Existing plus Background	AM	Intersection does not exist.
	PM	Intersection does not exist.
Full Build-out Development	AM	All movements will have good operational conditions.
	PM	All movements will have good operational conditions.

Note: AT = Alberta Transportation.

The results shown in Table 6 indicate the following:

- The Alberta Transportation Traffic Signal warrant points for the Highway 1A/East Chestermere Drive intersection totalled 88; lower than the 100 points required for traffic signals to be considered. During the afternoon peak hour, the north and southbound approaches will have poor operating conditions for the existing plus background development traffic condition. The installation of traffic signals is recommended.

The addition of traffic signals at Highway 1A and East Chestermere Drive will improve the operation of the intersection. Validation for traffic signals along the provincial highway will be required prior to its installation. Analysis of the intersection at Full Build-out of Southeast Chestermere indicates no additional improvements beyond the traffic signals will be required.



- The Highway 1/Range Road 281 intersection will continue to operate at a fair level of service for the existing plus background development condition. Traffic signals are not warranted at this intersection for the existing background conditions and for development in the Plan Area. The intersection will operate at fair levels if it is unsignalized and will operate well if it is signalized. However, it is recommended that this intersection be monitored annually by Alberta Transportation to review intersection operation and safety concerns.

The installation of traffic signals may resolve many of the intersection safety but a thorough review by Alberta Transportation may be required prior to the installation of traffic signals at this location. No additional improvements are recommended at this intersection. The intersection is assumed to be closed after the Plan Area is fully developed and an interchange is constructed at Highway 1 and Highway 791.

School Site Safety Measures

The District School Board's assessment and preliminary siting plan situates the junior high/middle school in the middle of the Plan Area backing onto East Lakeview Road, and fronting the internal north-south collector. The school site is located on the east side of the reserve piece with a multi-family site and a commercial development across the street. It is recommended that access for the school site be restricted to the internal collector road. This will ensure a minimal increase in traffic volumes on East Lakeview Road as a result of the school.

Some additional measures to alleviate concerns regarding pedestrian safety include the following:

- Designated drop off locations for parents. For example, restrict parking in front of the school site, and limit to a drop off/pick up zone during school hours. Depending on school travel patterns, an additional drop off/pick up zone may be considered on the east side of the collector road.
- Designated drop off locations for school buses. The design of the school site should include a drive in/drop off location for buses on the school site.
- Curb extension at the intersection with the commercial site on the northeast corner. Curb extension will reduce the crossing distance for pedestrians, as well as increase their presence with drivers. Curb extensions also serve to calm traffic as the road width is narrowed. The curb extension would also assist students crossing the collector if their parents drop them off on the east side of the street.



- Pedestrian crossing signage at the commercial site intersection. Adequate signage will raise awareness of possible pedestrian presence.
- Sidewalks along both sides of the street. Sidewalks should be coordinated with the regional pathway system that will run through the community.

These are some general measures of precautions that should be considered for implementation when designing the school site. Additional measures may be considered with a more detailed layout of the surrounding area.

Should you have any comments or questions regarding the information provided in this letter, please contact the undersigned at (403) 291-1193.

Yours truly,

URBAN SYSTEMS LTD.

Robert B. Gibbard, P.Eng.
Senior Transportation Engineer
Principal

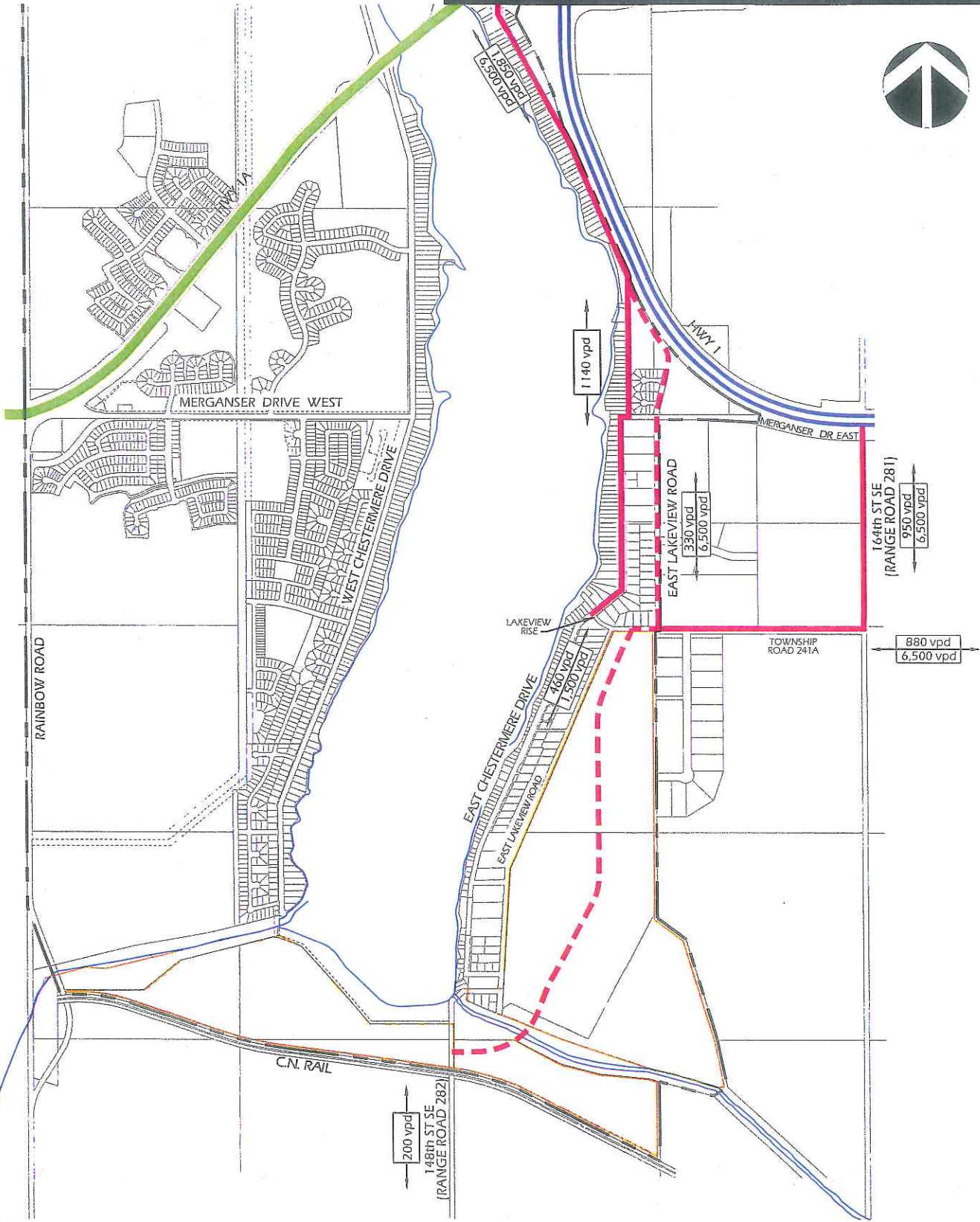
RG/jm
Enclosures

cc: Aiki Yeung, Chestermere Lake Development Corp.
Craig Johnston, New North Properties Ltd.

U:\Projects_CAL\2630\0001\15\C-Correspondence\2005-09-07-Let-GLB-TransReviewUpdate.doc



S.E. CHESTERMERE ASP



U:\Projects_Canada\2630000\urban-systems\design\working\Design\Drawings\2005-09-07\2005-09-07-001.dwg FIGURE 1 - EXISTING AND PROPOSED ROAD NETWORK - 2005-09-07 08:56

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LEGEND

- DAILY TRAFFIC VOLUME (IN VEHICLES PER DAY)**
- DIVIDED HIGHWAY**
- UNDIVIDED HIGHWAY**
- COLLECTOR ROAD**
- FUTURE COLLECTOR ROAD**
- TOWN BOUNDARY**
- DAILY TRAFFIC VOLUME (IN VEHICLES PER DAY)**
ALLOWABLE DAILY VOLUME (IN VEHICLES PER DAY)

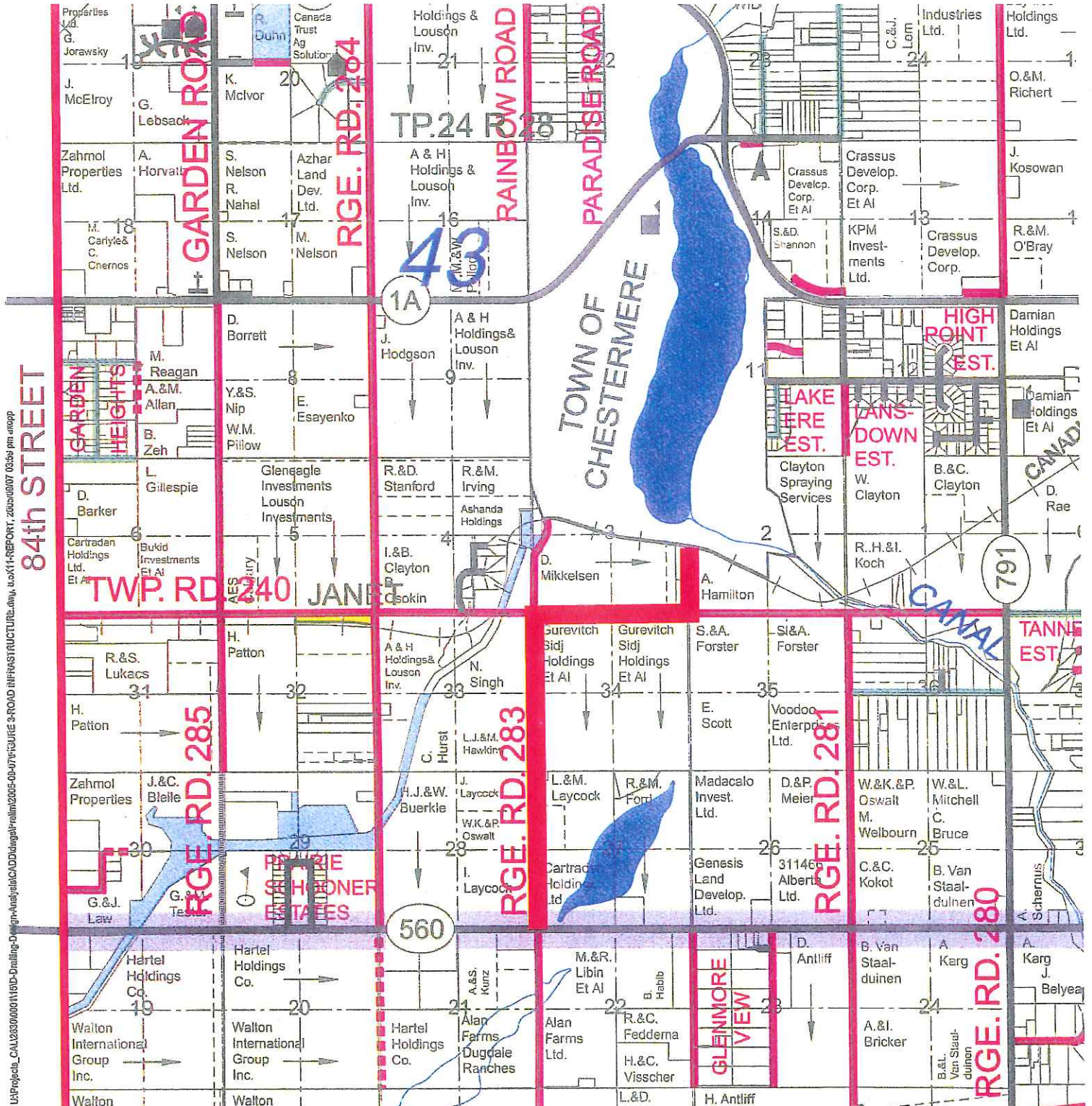
Client/Project

CHESTERMERE LAKE DEVELOPMENT CORP.

Scale	Date	Figure No.
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File No. - 2630.000 1.15		Title

EXISTING DAILY TRAFFIC VOLUMES

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LEGEND

Future Paved Route

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Scale	Date	Exhibit No.
N.T.S.	2005/09/07	3
File No. - 2630.0001.15		Title

U:\Projects_CAD\2630000011610-Drilling-Design-Analyse\CADD\dwg\c:\allin\2005-09-07\FIGURE 4-NORTH INT CONCEPT.dwg, 8.8x11-FIGURE4, 2005/09/07 04:59 pm drapp



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LEGEND

- Edge of Existing Roadway
- Edge of Proposed Roadway
- Right of Way
- ⊥ Existing Stop Sign
- ⊞ Proposed Stop Sign



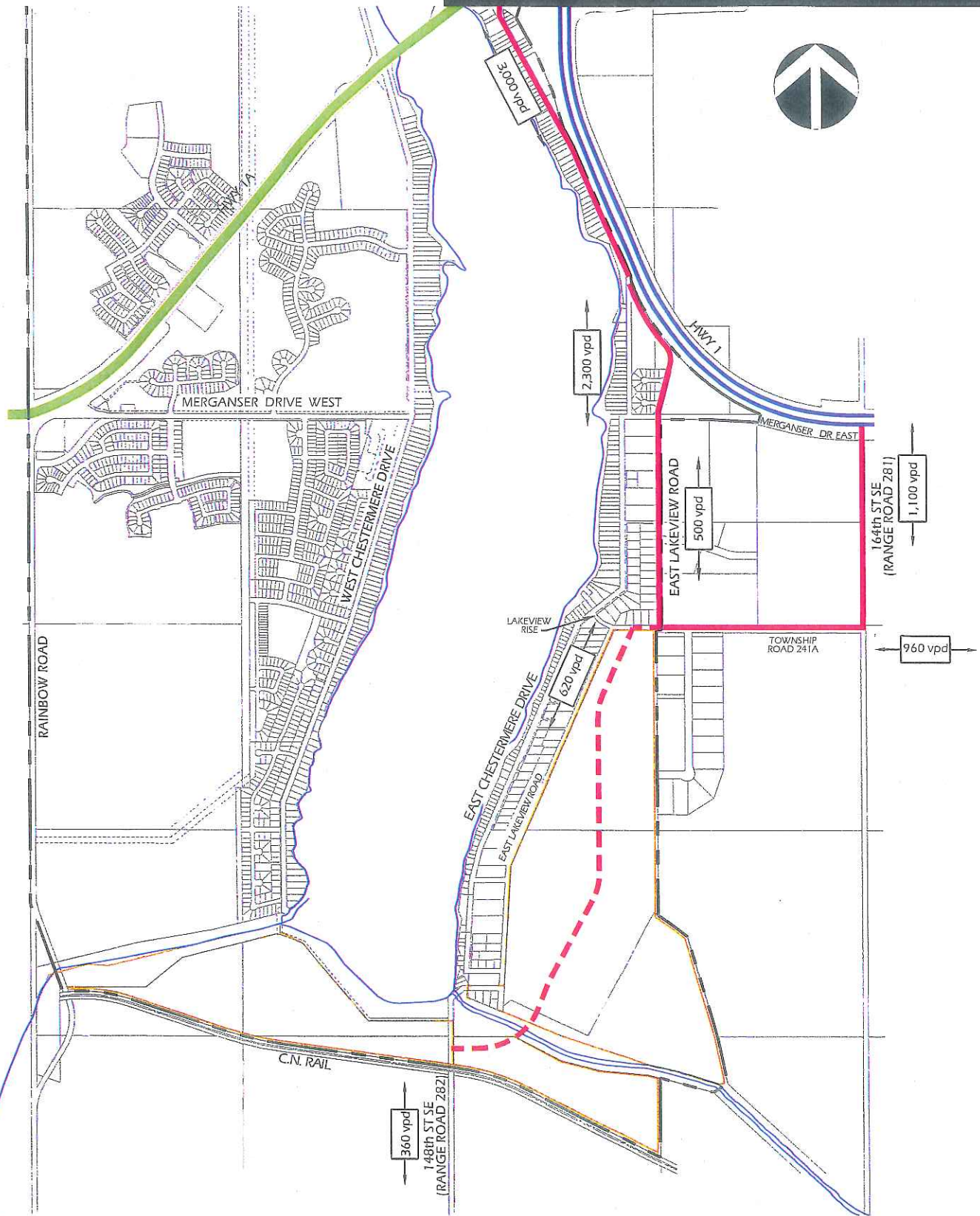
Client/Project

CHESTERMERE LAKE
 DEVELOPMENT CORP.

Scale	Date	Figure No.
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File No. 2630.0001.15		Title

NORTH INTERSECTION CONCEPT

S.E. CHESTERMERE ASP



UNProjects_C:\AL\330\0001161D-Drafting-Design-Analyse\CA\DD\dwg\TP\m2015-08-07\Figure 5-EX. BKGD. DEV. DAILY TRAFFIC VOLUMES.dwg, FIGURE 5, 2005/09/07 04:05 pm alopp

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LEGEND

- | | | | |
|--|-----------------------|--|--|
| | COLLECTOR ROAD | | DIVIDED HIGHWAY |
| | FUTURE COLLECTOR ROAD | | UNDIVIDED HIGHWAY |
| | TOWN BOUNDARY | | DAILY TRAFFIC VOLUME (IN VEHICLES PER DAY) |

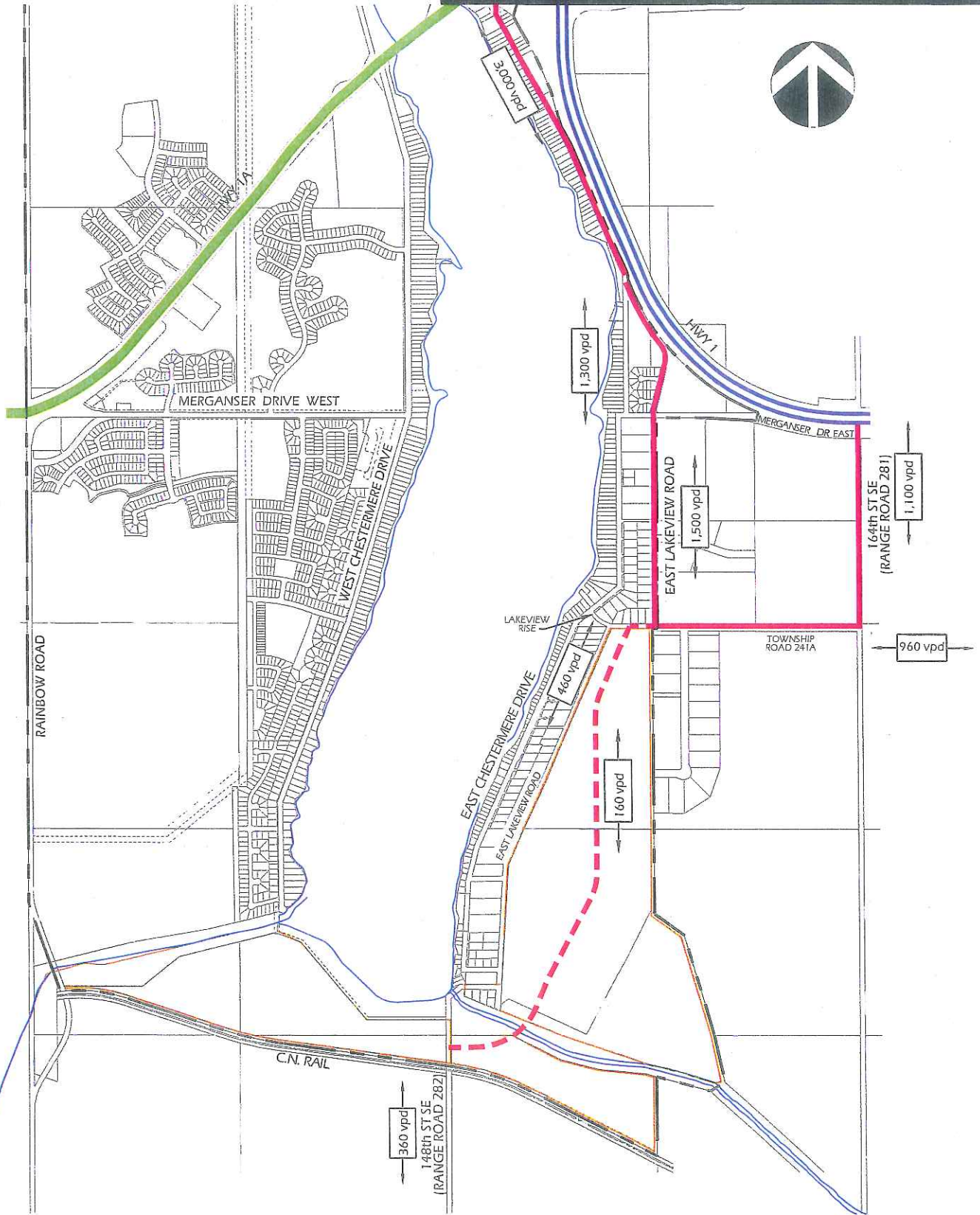
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CHESTERMERE LAKE DEVELOPMENT CORP.

Scale	Date	Figure No.
N.T.S.	2005/09/07	5
File No. - 2630.0001.15		Title

EXISTING BACKGROUND DEVELOPMENT DAILY TRAFFIC VOLUMES

S.E. CHESTERMERE ASP



L:\Projects_CAD\20050607\1160-Drafting-Design-Analyse\CAD\Drawings\Prelim\2005-06-07\FIGURE 6-FUTURE BKGD-DEV. TRAFFIC VOLUMES.dwg, FIGURE 6, 2005/06/07 09:00 pm elopp

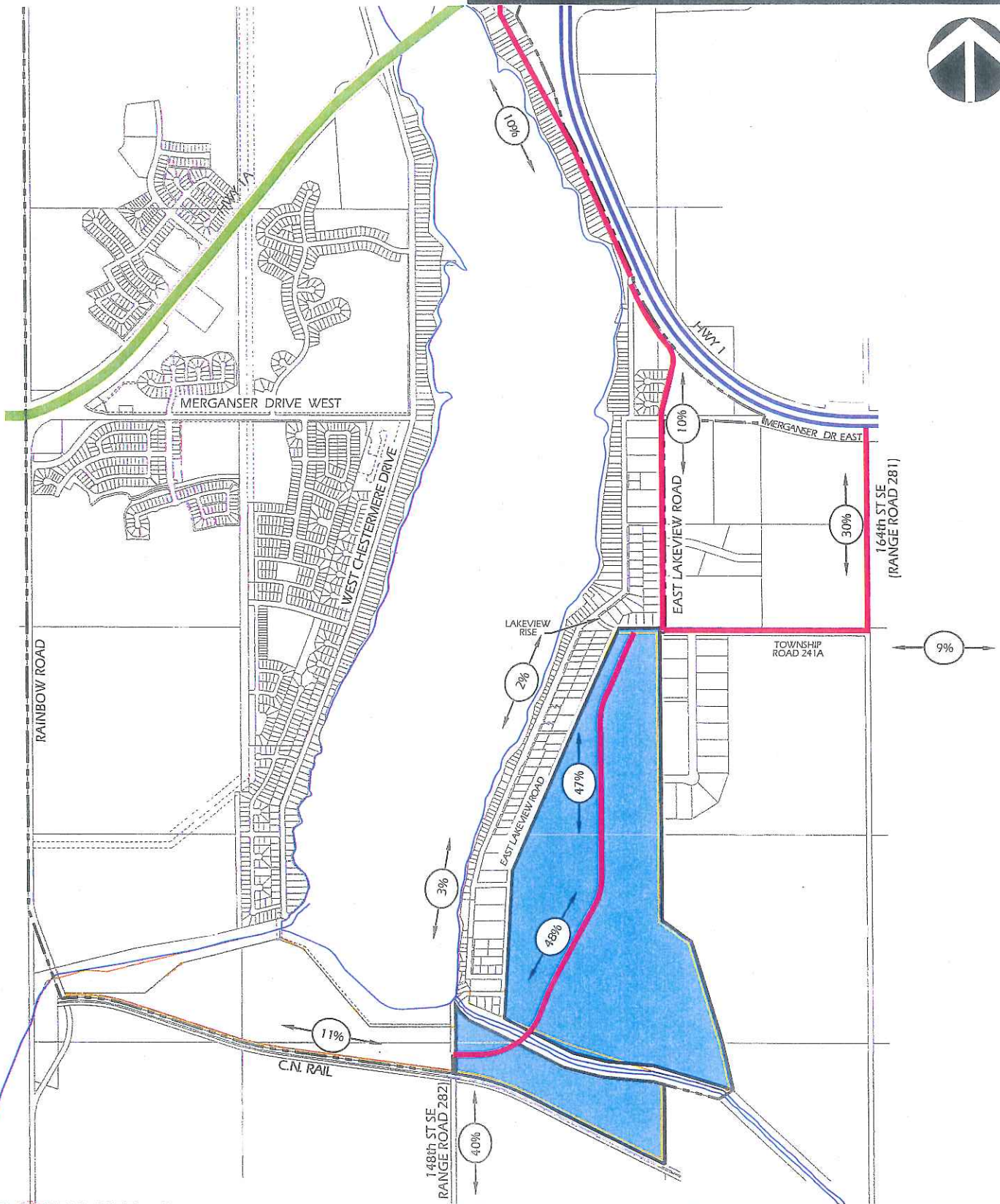
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LEGEND

- COLLECTOR ROAD
- - - FUTURE COLLECTOR ROAD
- TOWN BOUNDARY
- DIVIDED HIGHWAY
- UNDIVIDED HIGHWAY
- DAILY TRAFFIC VOLUME (IN VEHICLES PER DAY)

Client/Project		
CHESTERMERE LAKE DEVELOPMENT CORP.		
Scale	Date	Figure No.
N.T.S.	2005/06/07	6
File No. - 2630.0001.15		Title
FUTURE BACKGROUND DEVELOPMENT DAILY TRAFFIC VOLUMES		

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U:\Projects_CAD\263000011810-Drafting-Design-Analyses\CAD\Drawings\2005-09-07\Figure 7-Traffic Distribution.dwg, FIGURE 7, 2005/09/07 04:00 pm ekopp

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LEGEND

- | | | | |
|--|-----------------------|--|---------------------------------|
| | COLLECTOR ROAD | | UNDIVIDED HIGHWAY |
| | FUTURE COLLECTOR ROAD | | APPROXIMATE AREA OF DEVELOPMENT |
| | TOWN BOUNDARY | | DEVELOPMENT DISTRIBUTION |
| | DIVIDED HIGHWAY | | |

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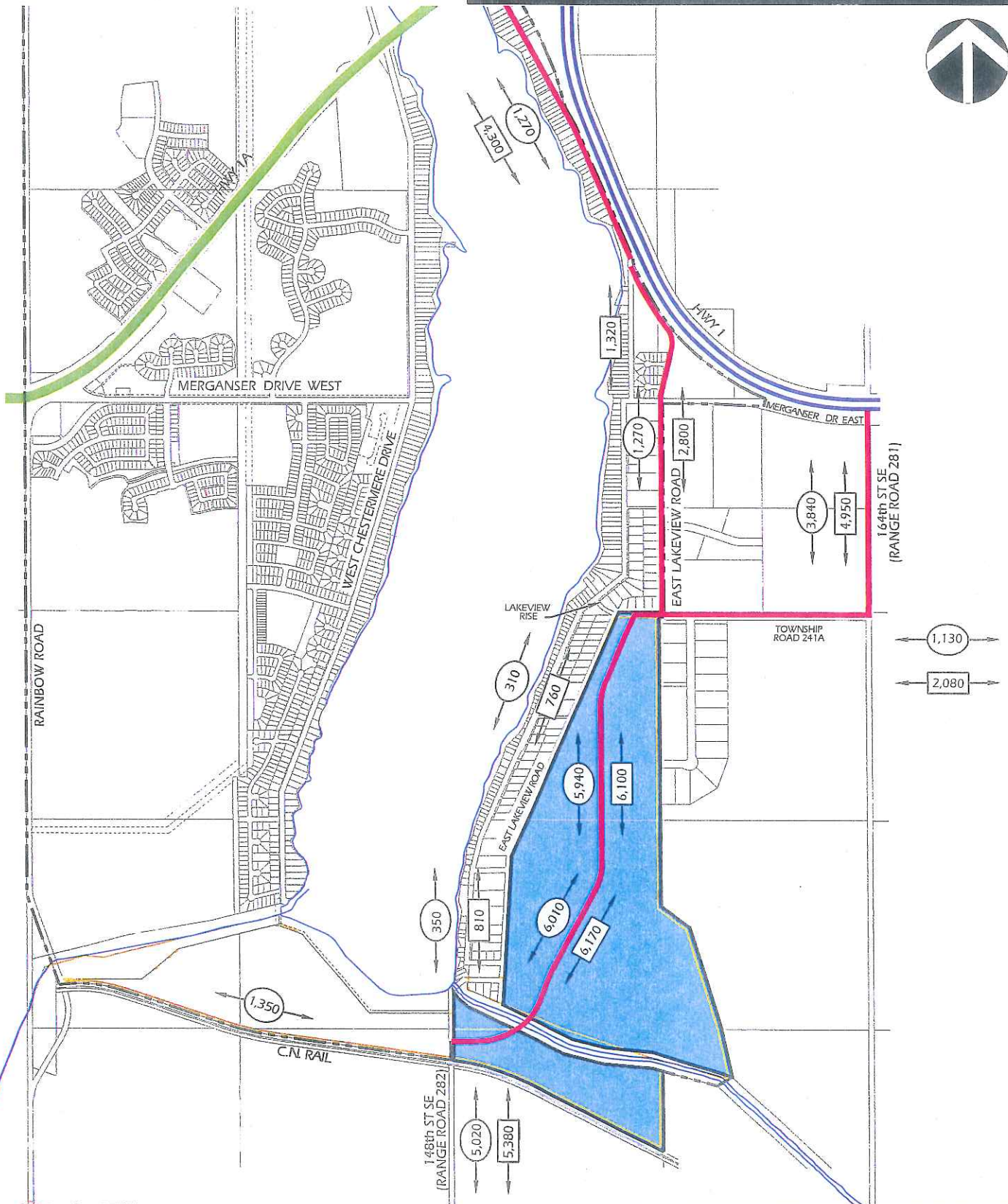
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FULL BUILDOUT
 HIGHWAY 1 INTERSECTION OPEN
 DEVELOPMENT TRAFFIC DISTRIBUTION

S.E. CHESTERMERE ASP



U:\Projects_CAL\03030000\1150-Drafting-Design-Analy\dst\CAD\DWG\Pre\120106-05-07\FIGURE 8-DAILY TRAFFIC VOLUMES.dwg - FIGURE 8, 20050807 04:00 pm atcnp



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LEGEND

- COLLECTOR ROAD
- - - FUTURE COLLECTOR ROAD
- TOWN BOUNDARY
- DIVIDED HIGHWAY
- UNDIVIDED HIGHWAY
- APPROXIMATE AREA OF DEVELOPMENT
- DEVELOPMENT VOLUMES
- COMBINED VOLUMES

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CHESTERMERE LAKE DEVELOPMENT CORP.

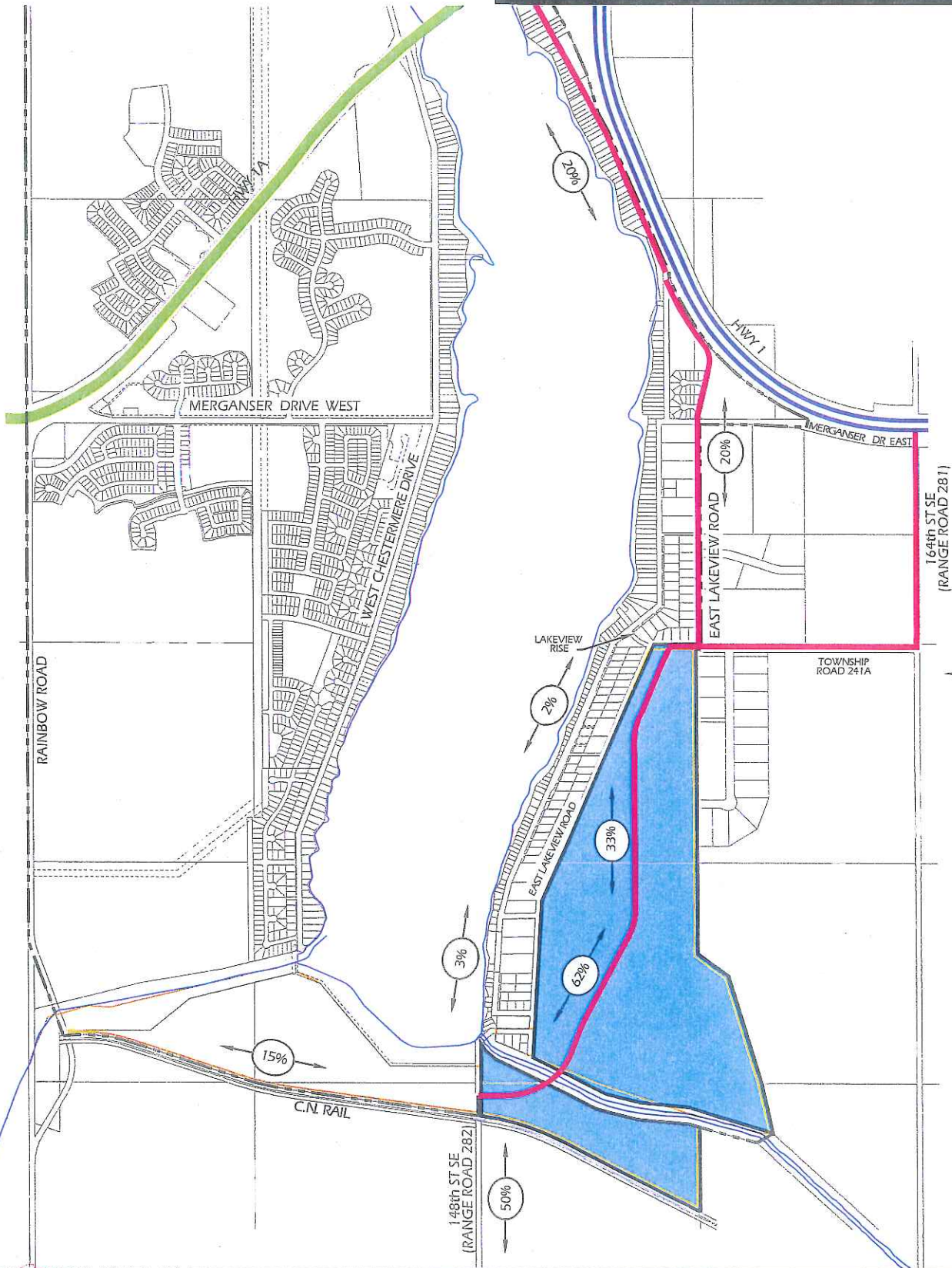
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File No. - 2630.0001.15		Title

FULL BUILDOUT HIGHWAY 1 INTERSECTION OPEN DAILY TRAFFIC VOLUMES

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LN\Projects_CAL\2630000116\16\16-Drafting-Design-Analyse\CA\01\dwg\T\palm2005-08-07\FIGURE 9-TRAFFIC DISTRIBUTION.dwg, FIGURE 9, 2005/09/07 04:10 pm alamp



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LEGEND

- COLLECTOR ROAD
- - - FUTURE COLLECTOR ROAD
- TOWN BOUNDARY
- DIVIDED HIGHWAY
- UNDIVIDED HIGHWAY
- APPROXIMATE AREA OF DEVELOPMENT
- DEVELOPMENT DISTRIBUTION

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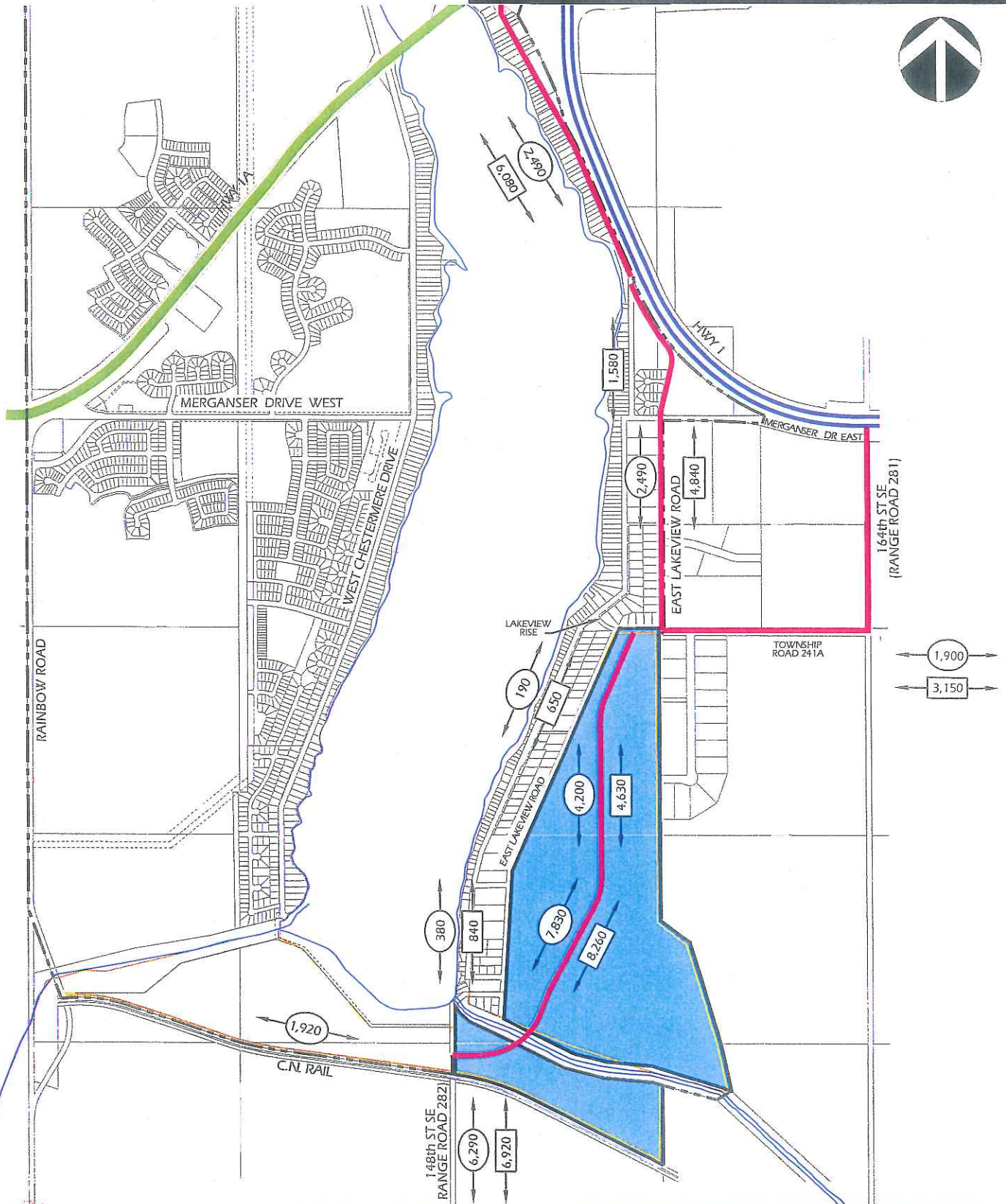
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N.T.S.	2005/09/07	9
File No. - 2630.0001.15		Title

FULL BUILDOUT
 HIGHWAY 1 INTERSECTION CLOSED
 DEVELOPMENT TRAFFIC DISTRIBUTION

S.E. CHESTERMERE ASP



U:\Projects_CAL\263000011616D-Design-Analysis\CADD\Drawings\Print\2005-09-07\FIGURE 10-DAILY TRAFFIC VOLUMES.dwg, FIGURE 10, 2006/09/07 04:11 pm aloop



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LEGEND

- COLLECTOR ROAD
- - - FUTURE COLLECTOR ROAD
- TOWN BOUNDARY
- DIVIDED HIGHWAY
- UNDIVIDED HIGHWAY
- APPROXIMATE AREA OF DEVELOPMENT
- DEVELOPMENT VOLUMES
- COMBINED VOLUMES

Client/Project

CHESTERMERE LAKE
 DEVELOPMENT CORP.

Scale	Date	Figure No.
N.T.S.	2005/09/07	10
File No. - 2630.0001.15		Title

FULL BUILDOUT
 HIGHWAY 1 INTERSECTION CLOSED
 DAILY TRAFFIC VOLUMES

Appendix 2

Engineering Servicing Report

South East Chestermere
Area Structure Plan

**ENGINEERING SERVICING REPORT
SOUTHEAST CHESTERMERE
AREA STRUCTURE PLAN
MARCH 2004 FILE 03-015**

**PREPARED FOR:
GLB PLANNING LTD.**

**SUBMITTED BY:
JUBILEE ENGINEERING CONSULTANTS LTD.
4, 911-32ND AVE. N. E.
CALGARY, ALBERTA T2E 6X6
PHONE 276-1001**

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Figure 4	Existing Town of Chestermere Water Distribution System
Figure 5	Existing Town of Chestermere and Surrounding Area Road Network
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1.0 INTRODUCTION

1.1 General

Jubilee Engineering Consultants Ltd. have been engaged by GLB Planning Ltd. to prepare a preliminary Engineering Servicing Report as a supporting document for the Southeast Chestermere Area Structure Plan, shown on **Figure 1**. The report addresses primarily the water distribution, sanitary sewer, and stormwater servicing requirements for the study area.

The report will analyze the interim and future sanitary sewer requirements and recommend gravity and force main sizes and the location of the lift station(s). The water distribution will be developed as a water main looped system for reliability and will provide for domestic and fire flow requirements. The storm water system will address the requirement of stormwater retention facilities and the recommended outfall locations and storm mains. The road network will be classified to ensure that they are within their environmental capacities.

1.2 Study Area and Land Ownership

Figure 2 shows the extent of the area to be addressed in the engineering servicing study. The study area is split into two sections by the WID Secondary Canal, the area north and south respectively of the WID Secondary Canal. The area north of the WID Secondary Canal is bounded by East Lakeview Road to the west and north, the Town boundary to the east, and the WID Secondary Canal to the south. These areas include the following landowners, Silvercreek Developments, Chestermere Park Estates and the Western Irrigation District/New North Projects Ltd.

The area south of the WID Secondary Canal is bounded by the Town boundary to the east, CN Railway to the south, WID Secondary Canal to the north, and canal access road to the west. This area is owned by Mr. Phil Paxton.

1.3 Study Objective

The objective of the study is to develop a preliminary servicing plan to facilitate the development of the lands outlined on **Figure 2**. These areas will be analyzed to determine the feasibility of servicing the site with the existing infrastructure and to provide details of any constraints to the development. The specific activities of the study were as follows:

1. Site visit to familiarize with the ASP area and review location of existing services.
2. Meeting with Angus Sutherland of Silvercreek Developments, Grace Lui of GLB Planning Ltd., and Craig Johnson of New North Projects Ltd.
3. Meeting with Norm Trapp and Ian Hunche of Southwell Trapp & Associates.
4. Analyze and determine the servicing requirements for the ASP lands.
5. Document the analysis in a report.

1.4 Background and Existing Servicing

The Town of Chestermere was developed as a summer village along the shores of Chestermere Lake. At present the Town has grown further to the west and north with a number of new developments including The Cove, Westmere, West Creek, Lakeview Landing, and The Beaches Area. The ASP lands are located at the southeast end of the Town and east of East Lakeview Road.

Figures 3 and 4 show the existing sewer and water service mains respectively. The Town of Chestermere receives water and sewer services from the City of Calgary. The Town is in the process of constructing a new sewer line to Calgary which will provide adequate capacity for future growth.

The existing water and sewer lines were initially constructed around the lake and provided the services to the properties along East Chestermere Lake Road and West Chestermere Lake Road. These services have since been extended to service the new developments to the north and west. The City of Calgary provides all the water supply needs for the Town of Chestermere.

The water from the City of Calgary is metered and fills up the Town reservoir located at the intersection of 128th Street and Merganser Road (See **Figure 4**). The pump station located at the reservoir provides the fire flow and the domestic requirement for the Town of Chestermere.

The existing road network servicing the Town is described in **Figure 5**. The regional road network facilities consists of Highway 1, Highway 1A, and Secondary Highway 560. East Lakeview Road and East Chestermere Drive facilitate the internal traffic movement and provide access to external roads. The M. D. of Rocky View road network provides the external connections. These consist of Range Road 281, Secondary Highway 91, Township Road 241A, 148th Street, and 50th Avenue East.

2.0 MUNICIPAL SERVICING PLAN

2.1 General

The north areas consists of Silvercreek Developments, Chestermere Estates Ltd. and the WID/New North Projects lands. The south areas are referred to as Chesser and Paxton lands. The Western Irrigation District Canal and Chestermere Lake dissects the ASP area into two distinct areas. Currently no municipal services exist on the south side and all ties will require crossing the WID Canal.

2.2 Site Topography

Figure 6 shows the existing contours from aerial plans which was provided by the study proponents.

The areas north of WID Canal have a rolling terrain from west to east. There is an existing depression at the east end of the Silvercreek area adjacent to Lake Ere Estates. The lowest lands are located in the WID/New North Projects Ltd. property.

The areas south of the WID Canal, consisting of the Chesser and Paxton lands, exhibit a rolling terrain from the west toward the east where the topography flattens out. There is a natural low at the Paxton/Chesser property line and another low at the south east corner of the Paxton property.

2.3 Water Supply System

The existing water distribution system along East and West Chestermere Lake Road will provide the water feed to service these ASP lands. Figure 7 shows the proposed water distribution layout for the ASP lands. The primary water main ties for areas north of the WID Canal are to East Lakeview Road to the north and Sandpiper Road to the south. Two additional ties are shown, one from the Silvercreek Development in the SW 11-24-28-4 and the second from the Chestermere Estates in the NW 2-24-28-4. These latter ties will be through direct connections to East Chestermere Drive water mains. The area south of WID Canal will have two water main ties to the north ASP land and will also be tied to West Chestermere Lake Road in future.

The water distribution main sizes providing the water main looping within the development will be 200mm and 250mm in diameter.

2.4 Sanitary Sewer

Figure 8 shows the proposed sanitary sewer layout. The layout supports the preliminary phasing boundaries that are being contemplated by the developers.

Areas north of the WID Canal and west of the proposed collector will be serviced by a gravity sewer system. Areas east of the collector and fronting on to the collector will also be able to tie into the gravity main. The gravity mains will tie to the existing mains

on Sandpiper Lane or East Lakeview Road. All other areas east of the collector will flow to the lift station located in the WID lands as shown in Fig. 8.

Areas south of the WID Canal will gravitate to a lift station located in the Paxton Lands and will be pumped directly to lift station 4 adjacent to East Chestermere Drive.

Existing lift station No. 4 will require upgrading to accommodate the additional flows from these new areas. From our meetings with the Town Engineers, we understand that the pumps and controls are the only items that would require replacement and that the existing forcemain and the downstream sanitary sewer facilities are generally adequately sized. The extent of the upgrading work will be confirmed at the detailed engineering stage. The force main may be connected to MHA (Figure 8) on Sandpiper Road. However the capacity of the existing line between MHA and MH51 limits the serviceability of the ASP lands to 62 hectares. The line from MH51 to lift station No. 4 will also need to be upgraded for this alternative.

Figure 8 also shows the ultimate sanitary sewer plan for the areas east of the lake including the ASP Land. The sewage flow from these areas will be redirected to the future lift station to be built in the Rainbow Falls area. Sewage from the Rainbow Falls lift station will be pumped to the main lift station No. 7 located adjacent to Highway 1A.

The Town has raised the concern of odors emanating from the lift stations. Odors are due to anaerobic decomposition of the organic material in the sewage. This happens in the lift station because there is not enough sewage flow entering the lift station to activate the pumps on a regular basis. Because of the lack of flow the sewage tends to settle in the dead zone compounding the odor problem.

The ASP lands would improve the odor problem as they would contribute additional flow to the lift station and as such trigger the pumps to operate on a regular basis. We would also recommend that the lift station upgrade include flush valves that agitate the dead zone of the lift station sump which will further improve the situation. A scrubber can also be installed to further alleviate the problem. These are detailed engineering issues and should be addressed at that time.

2.5 Storm Sewer

Jubilee Engineering Consultants Ltd. have prepared a Stormwater Management Study (Ref. 2) for the ASP lands providing various alternatives for the collection and disposal of the stormwater. Upon review of the report by the Town and the discussion between the Town and the WID the following comments were provided.

1. The stormwater release rate from the area to the Western Irrigation Canal shall be restricted to 2.5 l/s/ha.
2. Pumping stormwater from the pond shall be avoided

Figure 9 shows the recommended 3 pond alternative discussed in the stormwater management study (ref 2). Appendix A provides the computer runs based on the new release rate of 2.5 l/s/ha. The computer model also allows for a portion of the Lake Erie Estates draining into the ASP Lands. Figure 9 has been revised to reflect the Town comments. In order to avoid pumping stormwater from the ponds sump and pump for the weeping tile drain system will be used in the ASP lands where required. These specific areas requiring sump and pump will be determined at the detailed engineering stage.

All properties located within the ASP requiring weeping tile may be directly or indirectly connected to the storm sewer system. For properties designed with a direct gravity weeping tile connection to the storm sewer, the basement elevation shall be above the Hydraulic Grade Line as determined by the backwater curve analysis. Properties designed with sump and pump for the weeping tile system can have an indirect connection to the storm sewer system. In this case, the pump would discharge the weeping tile flow to the ground surface and flow overland to the catch basins on the road.

2.6 Road & Transportation Access

The Road & Transportation Access for the ASP lands are addressed in reports submitted separately to the Town of Chestermere.

3.0 CONCLUSIONS AND RECOMMENDATIONS

The Engineering Servicing Study for the Southeast Chestermere Area Structure Plan has addressed the water, sanitary, storm, and transportation requirements for the residential development of the ASP lands, and can be summarized as follows:

- Water service is available in the vicinity of the site at East Lakeview Drive to the north, Sandpiper Lane to the south and East Chestermere Drive and West Chestermere Drive to the west. Extensions from the ASP lands to these mains will be required for servicing purposes. Hydrants will be provided throughout the ASP lands and East Chestermere Lake Drive as per Town of Chestermere standards.
- Sanitary sewer servicing plan supports the proposed planning of the ASP lands. Most of initial plans will be serviced by gravity lines tying into the mains on Sandpiper Lane and East Lakeview Road. Sewage lift stations will ultimately be required for the ASP areas north and south of the WID Canal. The sewage will ultimately be delivered to existing lift station No. 4. As soon as the new lift station in the Rainbow Falls development is operational, the sewage flow from the ASP lands and the east Chestermere area will be redirected to this lift station.

- A storm sewer system will be developed using the 3 pond option using a pond release rate of 2.5 e/s/ha. the stormwater from the retention ponds will discharge by gravity to the WID Canal. Sump and pumps will be required for the weeping tile drain system.

BIBLIOGRAPHY

- Ref. 1 South/East Chestermere Transportation Planning Study, March 28, 2002 -
Morasch Transportation Consultants Ltd.
- Ref. 2 East Chestermere Lake Preliminary Stormwater Management Study,
August 2002 by Jubilee Engineering Consultants Ltd.
- Ref. 3 Municipal Development Plan for Town of Chestermere

APPENDIX A

2 Metric units

*# Project Name: [EAST CHESTERMERE LAKE] Project Number: [02-035]

* PAXTON/CHESSER

*# Date : 01-14-2004

*# Modeller : [HB]

*# Company : Jubilee Engineering Consultants Ltd

*# License # : 5170115

START TZERO=[0.0], METOUT=[2], NSTORM=[0], NRUN=[0]
 [% [] <--storm filename, one per line for NSTORM time

CHICAGO STORM IUNITS=[2], TD=[24](hrs), TPRAT=[0.3], CSDT=[15](min),
 ICASECS=[1],
 A=[663.1], B=[1.87], and C=[0.712],

*PRE-DEV.
 CALIB NASHYD ID=[1], NHYD=[" "], DT=[5]min, AREA=[48.59](ha),
 DWF=[0](cms), CN/C=[72], IA=[19.75](mm),
 N=[3], TP=[0.54]hrs,
 RAINFALL=[, , ,](mm/hr), END=-1

*CATCHMENT AREA
 *MINOR SYSTEM 70L/s/ha
 CALIB STANDHYD ID=[2], NHYD=[" "], DT=[5](min), AREA=[48.59](ha),
 XIMP=[0.5], TIMP=[0.5], DWF=[0](cms), LOSS=[2],
 SCS curve number CN=[72],
 Pervious surfaces: IAper=[3.4](mm), SLPP=[2](%),
 LGP=[50](m), MNP=[0.06], SCP=[0](min),
 Impervious surfaces: IAimp=[1.7](mm), SLPI=[2](%),
 LGI=[900](m), MNI=[0.015], SCI=[0](min),
 RAINFALL=[, , ,](mm/hr), END=-1

COMPUTE DUALHYD IDin=[2], CINLET=[3.401](cms), NINLET=[1],
 MAJID=[9], MajNHYD=[109],
 MINID=[3], MinNHYD=[103],
 TMJSTO=[2500](cu-m)

ROUTE RESERVOIR IDout=[4], NHYD=[104], IDin=[3],
 RDT=[5](min),
 TABLE of (OUTFLOW-STORAGE) values
 (cms) - (ha-m)
 [0.0 , 0.0]
 [0.030 , 0.6452]
 [0.060 , 1.2905]
 [0.122 , 2.6240]
 [-1 , -1] (max twenty pts)
 IDovf=[], NHYDovf=[]

FINISH

```

SSSSS W W M M H H Y Y M M 000 999 999 =====
S W W W MM MM H H Y Y MM MM O O 9 9 9 9
SSSSS W W W M M M H H H H Y Y M M M O O ## 9 9 9 9 Ver. 4.02
S W W M M H H Y M M O O 9999 9999 July 1999
SSSSS W W M M H H Y M M 000 9 9 9 9 =====
9 9 9 9 # 5170115
StormWater Management Hydrologic Model 999 999 =====

```

```

*****
***** SWMHYMO-99 Ver/4.02 *****
***** A single event and continuous hydrologic simulation model *****
***** based on the principles of HYMO and its successors *****
***** OTTHYMO-83 and OTTHYMO-89. *****
***** Distributed by: J.F. Sabourin and Associates Inc. *****
***** Ottawa, Ontario: (613) 727-5199 *****
***** Gatineau, Quebec: (819) 243-6858 *****
***** E-Mail: swmhymo@jfsa.com *****
*****

```

```

+++++ Licensed user: Jubilee Engineering Consultants Ltd +++++
+++++ Calgary SERIAL#:5170115 +++++
+++++

```

```

*****
***** +++++ PROGRAM ARRAY DIMENSIONS +++++ *****
***** Maximum value for ID numbers : 10 *****
***** Max. number of rainfall points: 15000 *****
***** Max. number of flow points : 15000 *****
*****

```

```

***** DETAILED OUTPUT *****
*****
* DATE: 2004-01-14 TIME: 15:27:53 RUN COUNTER: 000069 *
*****
* Input filename: C:\PROGRA~1\SWMHYMO\projects\02-035PC.IN *
* Output filename: C:\PROGRA~1\SWMHYMO\projects\02-035PC.out *
* Summary filename: C:\PROGRA~1\SWMHYMO\projects\02-035PC.sum *
* User comments: *
* 1: _____ *
* 2: _____ *
* 3: _____ *
*****

```

```

-----
001:0001-----
*#*****
*# Project Name: [EAST CHESTERMERE LAKE] Project Number: [02-035]
* PAXTON/CHESSER
*# Date : 01-14-2004
*# Modeller : [HB]
*# Company : Jubilee Engineering Consultants Ltd
*# License # : 5170115
*#*****

```

```

| START | Project dir.: C:\PROGRA~1\SWMHYMO\projects\
----- Rainfall dir.: C:\PROGRA~1\SWMHYMO\projects\

```

```

TZERO = .00 hrs on 0
METOUT= 2 (output = METRIC)
NRUN = 001

```

NSTORM= 0

001:0002

CHICAGO STORM
Ptotal= 89.67 mm

IDF curve parameters: A= 663.100
B= 1.870
C= .712

used in: INTENSITY = A / (t + B)^{AC}

Duration of storm = 24.00 hrs
Storm time step = 15.00 min
Time to peak ratio = .30

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	1.107	6.25	4.650	12.25	2.554	18.25	1.456
.50	1.136	6.50	5.831	12.50	2.467	18.50	1.433
.75	1.168	6.75	8.169	12.75	2.386	18.75	1.411
1.00	1.201	7.00	16.640	13.00	2.312	19.00	1.390
1.25	1.237	7.25	88.690	13.25	2.243	19.25	1.369
1.50	1.276	7.50	22.018	13.50	2.179	19.50	1.349
1.75	1.317	7.75	13.243	13.75	2.118	19.75	1.330
2.00	1.362	8.00	9.893	14.00	2.062	20.00	1.311
2.25	1.411	8.25	8.052	14.25	2.010	20.25	1.293
2.50	1.464	8.50	6.865	14.50	1.960	20.50	1.276
2.75	1.523	8.75	6.026	14.75	1.913	20.75	1.259
3.00	1.587	9.00	5.399	15.00	1.869	21.00	1.242
3.25	1.659	9.25	4.908	15.25	1.827	21.25	1.227
3.50	1.738	9.50	4.512	15.50	1.788	21.50	1.211
3.75	1.828	9.75	4.186	15.75	1.750	21.75	1.196
4.00	1.929	10.00	3.911	16.00	1.714	22.00	1.182
4.25	2.045	10.25	3.676	16.25	1.680	22.25	1.168
4.50	2.179	10.50	3.472	16.50	1.648	22.50	1.154
4.75	2.337	10.75	3.293	16.75	1.617	22.75	1.141
5.00	2.525	11.00	3.135	17.00	1.587	23.00	1.128
5.25	2.755	11.25	2.994	17.25	1.559	23.25	1.115
5.50	3.042	11.50	2.868	17.50	1.532	23.50	1.103
5.75	3.414	11.75	2.753	17.75	1.505	23.75	1.091
6.00	3.918	12.00	2.649	18.00	1.480	24.00	1.079

001:0003

*PRE-DEV.

CALIB NASHYD
01: DT= 5.00

Area (ha)= 48.59 Curve Number (CN)=72.00
Ia (mm)= 19.750 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= .540

Unit Hyd Qpeak (cms)= 3.437
PEAK FLOW (cms)= .910 (i)
TIME TO PEAK (hrs)= 7.917
RUNOFF VOLUME (mm)= 28.977
TOTAL RAINFALL (mm)= 89.666
RUNOFF COEFFICIENT = .323

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0004

*CATCHMENT AREA
*MINOR SYSTEM 70L/s/ha

CALIB STANDHYD
02: DT= 5.00

Area (ha)= 48.59 Dir. Conn.(%)= 50.00
Total Imp(%)= 50.00

02-035PC.out

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	24.30	24.30	
Dep. Storage (mm)=	1.70	3.40	
Average Slope (%)=	2.00	2.00	
Length (m)=	900.00	50.00	
Mannings n =	.015	.060	
Max. eff. Inten. (mm/hr)=	88.69	34.26	
over (min)=	10.00	15.00	
Storage Coeff. (min)=	8.87 (ii)	14.13 (ii)	
Unit Hyd. Tpeak (min)=	10.00	15.00	
Unit Hyd. peak (cms)=	.12	.08	
			TOTALS
PEAK FLOW (cms)=	4.66	1.44	5.827 (iii)
TIME TO PEAK (hrs)=	7.25	7.42	7.333
RUNOFF VOLUME (mm)=	87.97	40.22	64.091
TOTAL RAINFALL (mm)=	89.67	89.67	89.666
RUNOFF COEFFICIENT =	.98	.45	.715

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN* = 72.0 Ia = Dep. Storage (Above)

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0005-

COMPUTE DUALHYD	Average inlet capacities [CINLET] =	3.401 (cms)
TotalHyd 02:	Number of inlets in system [NINLET] =	1
	Total minor system capacity =	3.401 (cms)
	Total major system storage [TMJSTO] =	2500. (cu.m.)

	ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
TOTAL HYD.	02:	48.59	5.827	7.333	64.091	.000
MAJOR SYST	09:000109	.00	.000	.000	.000	.000
MINOR SYST	03:000103	48.59	3.401	7.167	64.876	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

Maximum MAJOR SYSTEM storage used = 2148. (cu.m.)

001:0006-

ROUTE RESERVOIR IN>03:(000103) OUT<04:(000104)	Requested routing time step = 5.0 min.
	===== OUTFLOW STORAGE TABLE =====
	OUTFLOW STORAGE OUTFLOW STORAGE
	(cms) (ha.m.) (cms) (ha.m.)
	.000 .0000E+00 .060 .1291E+01
	.030 .6452E+00 .122 .2624E+01

ROUTING RESULTS	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW >03: (000103)	48.59	3.401	7.167	64.876
OUTFLOW <04: (000104)	48.59	.116	24.083	64.875

PEAK FLOW REDUCTION [Qout/Qin] (%) = 3.416
 TIME SHIFT OF PEAK FLOW (min) = 1015.00
 MAXIMUM STORAGE USED (ha.m.) = .2499E+01

001:0007-

FINISH

WARNINGS / ERRORS / NOTES

Simulation ended on 2004-01-14 at 15:27:53

2 Metric units

*# Project Name: [EAST CHESTERMERE LAKE] Project Number: [02-035]

*# NEWNORTH PROJECTS

*# Date : 01-14-2004

*# Modeller : [HB]

*# Company : Jubilee Engineering Consultants Ltd

*# License # : 5170115

START TZERO=[0.0], METOUT=[2], NSTORM=[0], NRUN=[0]
 [% [] <--storm filename, one per line for NSTORM time

CHICAGO STORM IUNITS=[2], TD=[24](hrs), TPRAT=[0.3], CSDT=[15](min),
 ICASECS=[1],
 A=[663.1], B=[1.87], and C=[0.712],

*#-----|-----|
 *PRE-DEV.
 CALIB NASHYD ID=[1], NHYD=[" "], DT=[5]min, AREA=[26.17](ha),
 DWF=[0](cms), CN/C=[72], IA=[19.75](mm),
 N=[3], TP=[0.47]hrs,
 RAINFALL=[, , ,](mm/hr), END=-1

*#-----|-----|
 *CATCHMENT AREA
 *MINOR SYSTEM 70L/s/ha
 CALIB STANDHYD ID=[2], NHYD=[" "], DT=[5](min), AREA=[26.17](ha),
 XIMP=[0.5], TIMP=[0.5], DWF=[0](cms), LOSS=[2],
 SCS curve number CN=[72],
 Pervious surfaces: IAper=[3.4](mm), SLPP=[2](%),
 LGP=[50](m), MNP=[0.06], SCP=[0](min),
 Impervious surfaces: IAimp=[1.7](mm), SLPI=[2](%),
 LGI=[500](m), MNI=[0.015], SCI=[0](min),
 RAINFALL=[, , ,](mm/hr), END=-1

*#-----|-----|
 COMPUTE DUALHYD IDin=[2], CINLET=[1.832](cms), NINLET=[1],
 MAJID=[9], MajNHYD=[109],
 MINID=[3], MinNHYD=[103],
 TMJSTO=[2000](cu-m)

*#-----|-----|
 ROUTE RESERVOIR IDout=[4], NHYD=[104], IDin=[3],
 RDT=[5](min),
 TABLE of (OUTFLOW-STORAGE) values
 (cms) - (ha-m)
 [0.0 , 0.0]
 [0.016 , 0.3478]
 [0.032 , 0.6956]
 [0.065 , 1.4130]
 [-1 , -1] (max twenty pts)
 IDovf=[], NHYDovf=[]

*#-----|-----|
 *#-----|-----|
 FINISH

```

SSSSS W W M M H H Y Y M M 000 999 999 =====
S W W W MM MM H H Y Y MM MM O O 9 9 9 9
SSSSS W W W M M M H H H H Y M M M O O ## 9 9 9 9 Ver. 4.02
S W W M M H H Y M M O O 9999 9999 July 1999
SSSSS W W M M H H Y M M 000 9 9
9 9 9 9 # 5170115
999 999 =====

```

Stormwater Management Hydrologic Model

```

*****
***** SWMHYMO-99 Ver/4.02 *****
***** A single event and continuous hydrologic simulation model *****
***** based on the principles of HYMO and its successors *****
***** OTTHYMO-83 and OTTHYMO-89. *****
***** Distributed by: J.F. Sabourin and Associates Inc. *****
***** Ottawa, Ontario: (613) 727-5199 *****
***** Gatineau, Quebec: (819) 243-6858 *****
***** E-Mail: swmhymo@jfsa.Com *****
*****

```

```

+++++++ Licensed user: Jubilee Engineering Consultants Ltd ++++++
+++++++ Calgary SERIAL#:5170115 ++++++
+++++++

```

```

*****
***** ++++++ PROGRAM ARRAY DIMENSIONS ++++++ *****
***** Maximum value for ID numbers : 10 *****
***** Max. number of rainfall points: 15000 *****
***** Max. number of flow points : 15000 *****
*****

```

```

***** DETAILED OUTPUT *****
*****
* DATE: 2004-01-14 TIME: 15:27:42 RUN COUNTER: 000068 *
*****
* Input filename: C:\PROGRA~1\SWMHYMO\projects\02-035N.IN *
* Output filename: C:\PROGRA~1\SWMHYMO\projects\02-035N.out *
* Summary filename: C:\PROGRA~1\SWMHYMO\projects\02-035N.sum *
* User comments: *
* 1: _____ *
* 2: _____ *
* 3: _____ *
*****

```

```

-----
001:0001-----
*#*****
*# Project Name: [EAST CHESTERMERE LAKE] Project Number: [02-035]
*# NEWNORTH PROJECTS
*# Date : 01-14-2004
*# Modeller : [HB]
*# Company : Jubilee Engineering Consultants Ltd
*# License # : 5170115
*#*****

```

```

| START | Project dir.: C:\PROGRA~1\SWMHYMO\projects\
----- Rainfall dir.: C:\PROGRA~1\SWMHYMO\projects\

```

```

TZERO = .00 hrs on 0
METOUT= 2 (output = METRIC)
NRUN = 001

```

NSTORM= 0

001:0002

CHICAGO STORM
Ptotal= 89.67 mm

IDF curve parameters: A= 663.100
B= 1.870
C= .712

used in: INTENSITY = A / (t + B)^{AC}

Duration of storm = 24.00 hrs
Storm time step = 15.00 min
Time to peak ratio = .30

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	1.107	6.25	4.650	12.25	2.554	18.25	1.456
.50	1.136	6.50	5.831	12.50	2.467	18.50	1.433
.75	1.168	6.75	8.169	12.75	2.386	18.75	1.411
1.00	1.201	7.00	16.640	13.00	2.312	19.00	1.390
1.25	1.237	7.25	88.690	13.25	2.243	19.25	1.369
1.50	1.276	7.50	22.018	13.50	2.179	19.50	1.349
1.75	1.317	7.75	13.243	13.75	2.118	19.75	1.330
2.00	1.362	8.00	9.893	14.00	2.062	20.00	1.311
2.25	1.411	8.25	8.052	14.25	2.010	20.25	1.293
2.50	1.464	8.50	6.865	14.50	1.960	20.50	1.276
2.75	1.523	8.75	6.026	14.75	1.913	20.75	1.259
3.00	1.587	9.00	5.399	15.00	1.869	21.00	1.242
3.25	1.659	9.25	4.908	15.25	1.827	21.25	1.227
3.50	1.738	9.50	4.512	15.50	1.788	21.50	1.211
3.75	1.828	9.75	4.186	15.75	1.750	21.75	1.196
4.00	1.929	10.00	3.911	16.00	1.714	22.00	1.182
4.25	2.045	10.25	3.676	16.25	1.680	22.25	1.168
4.50	2.179	10.50	3.472	16.50	1.648	22.50	1.154
4.75	2.337	10.75	3.293	16.75	1.617	22.75	1.141
5.00	2.525	11.00	3.135	17.00	1.587	23.00	1.128
5.25	2.755	11.25	2.994	17.25	1.559	23.25	1.115
5.50	3.042	11.50	2.868	17.50	1.532	23.50	1.103
5.75	3.414	11.75	2.753	17.75	1.505	23.75	1.091
6.00	3.918	12.00	2.649	18.00	1.480	24.00	1.079

001:0003

*PRE-DEV.

CALIB NASHYD
01: DT= 5.00

Area (ha)= 26.17 Curve Number (CN)=72.00
Ia (mm)= 19.750 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= .470

Unit Hyd Qpeak (cms)= 2.127

PEAK FLOW (cms)= .532 (i)
TIME TO PEAK (hrs)= 7.833
RUNOFF VOLUME (mm)= 28.977
TOTAL RAINFALL (mm)= 89.666
RUNOFF COEFFICIENT = .323

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0004

*CATCHMENT AREA
*MINOR SYSTEM 70L/s/ha

CALIB STANDHYD
02: DT= 5.00

Area (ha)= 26.17
Total Imp(%)= 50.00 Dir. Conn.(%)= 50.00

02-035N.out

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	13.09	13.09	
Dep. Storage	(mm)=	1.70	3.40	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	500.00	50.00	
Mannings n	=	.015	.060	
Max.eff.Inten.(mm/hr)=		88.69	37.53	
over (min)		5.00	10.00	
Storage Coeff. (min)=		6.23 (ii)	11.30 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		.19	.10	
				TOTALS
PEAK FLOW	(cms)=	2.99	.90	3.829 (iii)
TIME TO PEAK	(hrs)=	7.25	7.33	7.250
RUNOFF VOLUME	(mm)=	87.97	40.22	64.091
TOTAL RAINFALL	(mm)=	89.67	89.67	89.666
RUNOFF COEFFICIENT	=	.98	.45	.715

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 72.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
 THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0005-----

COMPUTE DUALHYD	Average inlet capacities [CINLET] = 1.832 (cms)
TotalHyd 02:	Number of inlets in system [NINLET] = 1
	Total minor system capacity = 1.832 (cms)
	Total major system storage [TMJSTO] = 2000.(cu.m.)

	ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
TOTAL HYD.	02:	26.17	3.829	7.250	64.091	.000
MAJOR SYST	09:000109	.00	.000	.000	.000	.000
MINOR SYST	03:000103	26.17	1.832	7.083	65.440	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

Maximum MAJOR SYSTEM storage used = 1460.(cu.m.)

001:0006-----

ROUTE RESERVOIR	Requested routing time step = 5.0 min.												
IN>03:(000103)													
OUT<04:(000104)													
	===== OUTFLOW STORAGE TABLE =====												
	<table border="1" style="margin: auto; border-collapse: collapse;"> <thead> <tr> <th>OUTFLOW (cms)</th> <th>STORAGE (ha.m.)</th> <th>OUTFLOW (cms)</th> <th>STORAGE (ha.m.)</th> </tr> </thead> <tbody> <tr> <td>.000</td> <td>.0000E+00</td> <td>.032</td> <td>.6956E+00</td> </tr> <tr> <td>.016</td> <td>.3478E+00</td> <td>.065</td> <td>.1413E+01</td> </tr> </tbody> </table>	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)	.000	.0000E+00	.032	.6956E+00	.016	.3478E+00	.065	.1413E+01
OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)										
.000	.0000E+00	.032	.6956E+00										
.016	.3478E+00	.065	.1413E+01										

ROUTING RESULTS	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW >03: (000103)	26.17	1.832	7.083	65.440
OUTFLOW <04: (000104)	26.17	.063	24.000	65.439

PEAK FLOW REDUCTION [Qout/Qin] (%) = 3.417
 TIME SHIFT OF PEAK FLOW (min) = 1015.00
 MAXIMUM STORAGE USED (ha.m.) = .1361E+01

001:0007-----

FINISH

WARNINGS / ERRORS / NOTES

Simulation ended on 2004-01-14 at 15:27:42

=====

2 Metric units

```

*#*****
*# Project Name: [EAST CHESTERMERE LAKE]   Project Number: [02-035]
* SILVERCREEK/CHESTERMERE
*# Date       : 01-14-2004
*# Modeller   : [HB]
*# Company    : Jubilee Engineering Consultants Ltd
*# License #   : 5170115
*#*****
START          TZERO=[0.0], METOUT=[2], NSTORM=[0], NRUN=[0]
*%             [ ] <--storm filename, one per line for NSTORM time
*%-----|
CHICAGO STORM  IUNITS=[2], TD=[24](hrs), TPRAT=[0.3], CSDT=[15](min),
               ICASEcs=[1],
               A=[663.1], B=[1.87], and C=[0.712],
*%-----|
*PRE-DEV.
CALIB NASHYD   ID=[1], NHYD=["      "], DT=[5]min, AREA=[66.17](ha),
               DWF=[0](cms), CN/C=[72], IA=[19.75](mm),
               N=[3], TP=[1.20]hrs,
               RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----|
*CATCHMENT AREA
*MINOR SYSTEM 70L/s/ha
CALIB STANDHYD ID=[2], NHYD=["      "], DT=[5](min), AREA=[66.17](ha),
               XIMP=[0.5], TIMP=[0.5], DWF=[0](cms), LOSS=[2],
               SCS curve number CN=[72],
               Pervious surfaces: IAPER=[3.4](mm), SLPP=[2](%),
                                   LGP=[50](m), MNP=[0.06], SCP=[0](min),
               Impervious surfaces: IAIMP=[1.7](mm), SLPI=[2](%),
                                   LGI=[1400](m), MNI=[0.015], SCI=[0](min)
               RAINFALL=[ , , , , ](mm/hr), END=-1
*%-----|
*COMPUTE DUALHYD
COMPUTE DUALHYD IDin=[2], CINLET=[4.153](cms), NINLET=[1],
                MAJID=[9], MajNHYD=[109],
                MINID=[3], MinNHYD=[103],
                TMJSTO=[3500](cu-m)
*%-----|
*ROUTE RESERVOIR
ROUTE RESERVOIR IDout=[4], NHYD=[104], IDin=[3],
                RDT=[5](min),
                TABLE of ( OUTFLOW-STORAGE ) values
                    (cms) - (ha-m)
                    [ 0.0 , 0.0 ]
                    [ 0.035 , 0.7577 ]
                    [ 0.070 , 1.5154 ]
                    [ 0.148 , 3.2040 ]
                    [ -1 , -1 ] (max twenty pts)
                IDovf=[ ], NHYDovf=[ ]
*%-----|
*%-----|
FINISH

```

```

SSSSS W W M M H H Y Y M M OOO          999 999 =====
S      W W W MM MM H H Y Y MM MM O O      9 9 9 9
SSSSS W W W M M M H H H H Y M M M O O ## 9 9 9 9 Ver. 4.02
S      W W M M H H Y M M O O              9999 9999 July 1999
SSSSS W W M M H H Y M M OOO              9 9 9 9 # 5170115
StormWater Management HYdrologic Model    999 999 =====

```

```

*****
***** SWMHYMO-99 Ver/4.02 *****
***** A single event and continuous hydrologic simulation model *****
***** based on the principles of HYMO and its successors *****
***** OTTHYMO-83 and OTTHYMO-89. *****
*****
***** Distributed by: J.F. Sabourin and Associates Inc. *****
***** Ottawa, Ontario: (613) 727-5199 *****
***** Gatineau, Quebec: (819) 243-6858 *****
***** E-Mail: swmhymo@jfsa.Com *****
*****

```

```

+++++ Licensed user: Jubilee Engineering Consultants Ltd +++++
+++++ Calgary SERIAL#:5170115 +++++
+++++

```

```

*****
***** +++++ PROGRAM ARRAY DIMENSIONS +++++ *****
***** Maximum value for ID numbers : 10 *****
***** Max. number of rainfall points: 15000 *****
***** Max. number of flow points : 15000 *****
*****

```

```

***** D E T A I L E D O U T P U T *****
*****
* DATE: 2004-03-25 TIME: 14:36:01 RUN COUNTER: 000093 *
*****
* Input filename: C:\PROGRA~1\SWMHYMO\projects\02-035SC.IN *
* Output filename: C:\PROGRA~1\SWMHYMO\projects\02-035SC.out *
* Summary filename: C:\PROGRA~1\SWMHYMO\projects\02-035SC.sum *
* User comments: *
* 1: _____ *
* 2: _____ *
* 3: _____ *
*****

```

```

-----
001:0001-----
*#*****
*# Project Name: [EAST CHESTERMERE LAKE] Project Number: [02-035]
* SILVERCREEK/CHESTERMERE
*# Date : 01-14-2004
*# Modeller : [HB]
*# Company : Jubilee Engineering Consultants Ltd
*# License # : 5170115
*#*****

```

```

-----
| START | Project dir.: C:\PROGRA~1\SWMHYMO\projects\
----- Rainfall dir.: C:\PROGRA~1\SWMHYMO\projects\
TZERO = .00 hrs on 0

```

METOUT= 2 (output = METRIC)
NRUN = 001
NSTORM= 0

001:0002-----

| CHICAGO STORM |
| Ptotal= 89.67 mm |

IDF curve parameters: A= 663.100
B= 1.870
C= .712

used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 15.00 min
Time to peak ratio = .30

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.25	1.107	6.25	4.650	12.25	2.554	18.25	1.456
.50	1.136	6.50	5.831	12.50	2.467	18.50	1.433
.75	1.168	6.75	8.169	12.75	2.386	18.75	1.411
1.00	1.201	7.00	16.640	13.00	2.312	19.00	1.390
1.25	1.237	7.25	88.690	13.25	2.243	19.25	1.369
1.50	1.276	7.50	22.018	13.50	2.179	19.50	1.349
1.75	1.317	7.75	13.243	13.75	2.118	19.75	1.330
2.00	1.362	8.00	9.893	14.00	2.062	20.00	1.311
2.25	1.411	8.25	8.052	14.25	2.010	20.25	1.293
2.50	1.464	8.50	6.865	14.50	1.960	20.50	1.276
2.75	1.523	8.75	6.026	14.75	1.913	20.75	1.259
3.00	1.587	9.00	5.399	15.00	1.869	21.00	1.242
3.25	1.659	9.25	4.908	15.25	1.827	21.25	1.227
3.50	1.738	9.50	4.512	15.50	1.788	21.50	1.211
3.75	1.828	9.75	4.186	15.75	1.750	21.75	1.196
4.00	1.929	10.00	3.911	16.00	1.714	22.00	1.182
4.25	2.045	10.25	3.676	16.25	1.680	22.25	1.168
4.50	2.179	10.50	3.472	16.50	1.648	22.50	1.154
4.75	2.337	10.75	3.293	16.75	1.617	22.75	1.141
5.00	2.525	11.00	3.135	17.00	1.587	23.00	1.128
5.25	2.755	11.25	2.994	17.25	1.559	23.25	1.115
5.50	3.042	11.50	2.868	17.50	1.532	23.50	1.103
5.75	3.414	11.75	2.753	17.75	1.505	23.75	1.091
6.00	3.918	12.00	2.649	18.00	1.480	24.00	1.079

001:0003-----

*PRE-DEV.

| CALIB NASHYD |
| 01: DT= 5.00 |

Area (ha)= 66.17 Curve Number (CN)=72.00
Ia (mm)= 19.750 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 1.200

Unit Hyd Qpeak (cms)= 2.106
PEAK FLOW (cms)= .773 (i)
TIME TO PEAK (hrs)= 9.000
RUNOFF VOLUME (mm)= 28.977
TOTAL RAINFALL (mm)= 89.666
RUNOFF COEFFICIENT = .323

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0004-----

*CATCHMENT AREA
*MINOR SYSTEM 70L/s/ha

| CALIB STANDHYD | Area (ha)= 66.17
| 02: DT= 5.00 | Total Imp(%)= 50.00 Dir. Conn.(%)= 50.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	33.08	33.08
Dep. Storage	(mm)=	1.70	3.40
Average Slope	(%)=	2.00	2.00
Length	(m)=	1400.00	50.00
Mannings n	=	.015	.060

Max.eff.Inten.(mm/hr)=		88.69	34.26
over (min)		10.00	15.00
Storage Coeff. (min)=		11.56 (ii)	16.82 (ii)
Unit Hyd. Tpeak (min)=		10.00	15.00
Unit Hyd. peak (cms)=		.10	.07

				TOTALS
PEAK FLOW	(cms)=	5.70	1.82	7.375 (iii)
TIME TO PEAK	(hrs)=	7.25	7.42	7.333
RUNOFF VOLUME	(mm)=	87.97	40.22	64.091
TOTAL RAINFALL	(mm)=	89.67	89.67	89.666
RUNOFF COEFFICIENT	=	.98	.45	.715

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 72.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0005-----

COMPUTE DUALHYD		Average inlet capacities [CINLET] =	4.153 (cms)
TotalHyd 02:		Number of inlets in system [NINLET] =	1
		Total minor system capacity =	4.153 (cms)
		Total major system storage [TMJSTO] =	3500.(cu.m.)

	ID: NHYD	AREA	QPEAK	TPEAK	R.V.	DWF
		(ha)	(cms)	(hrs)	(mm)	(cms)
TOTAL HYD.	02:	66.17	7.375	7.333	64.091	.000
MAJOR SYST	09:000109	.00	.000	.000	.000	.000
MINOR SYST	03:000103	66.17	4.153	7.167	64.925	.000

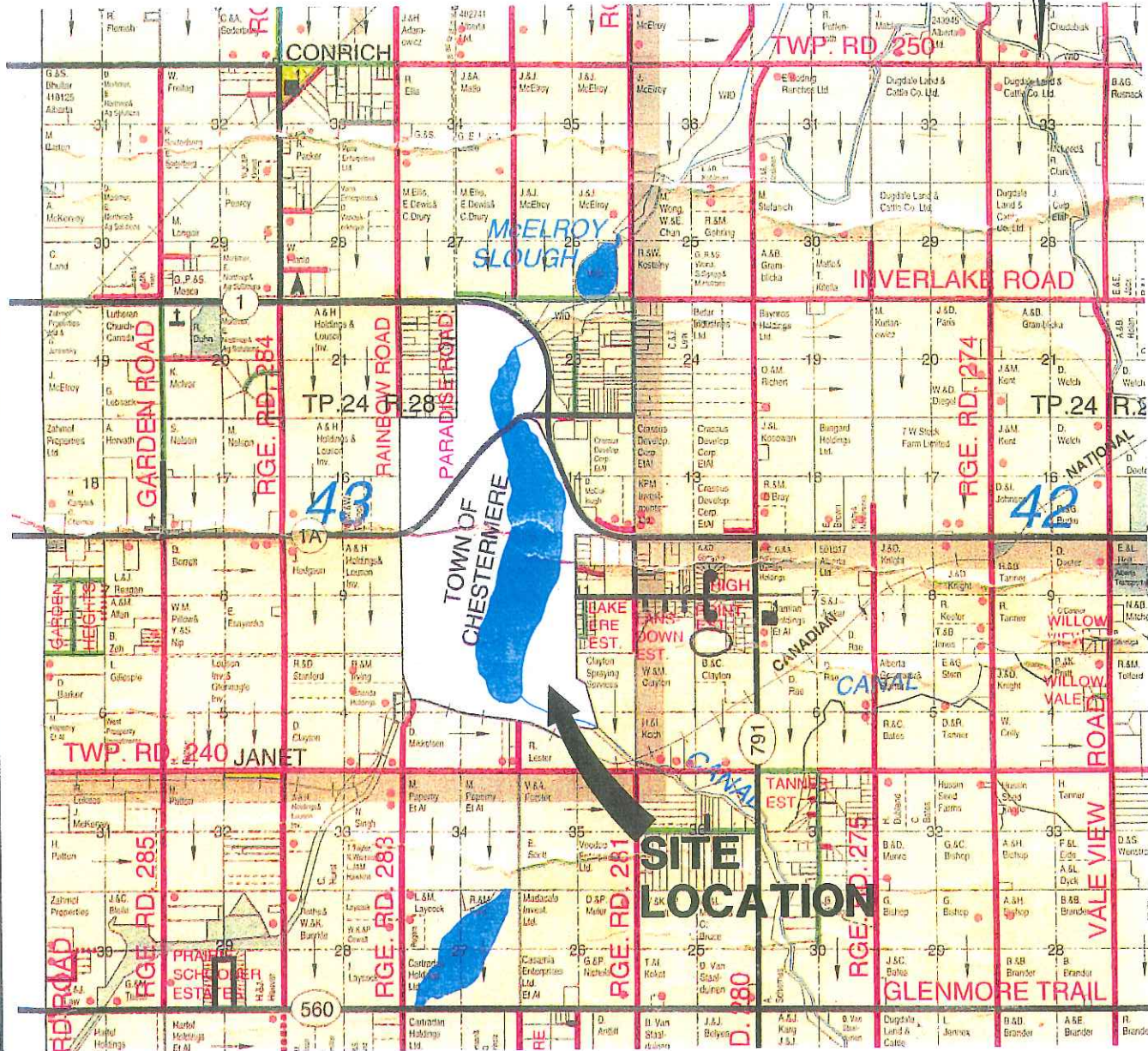
NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

Maximum MAJOR SYSTEM storage used = 3110.(cu.m.)

001:0006-----

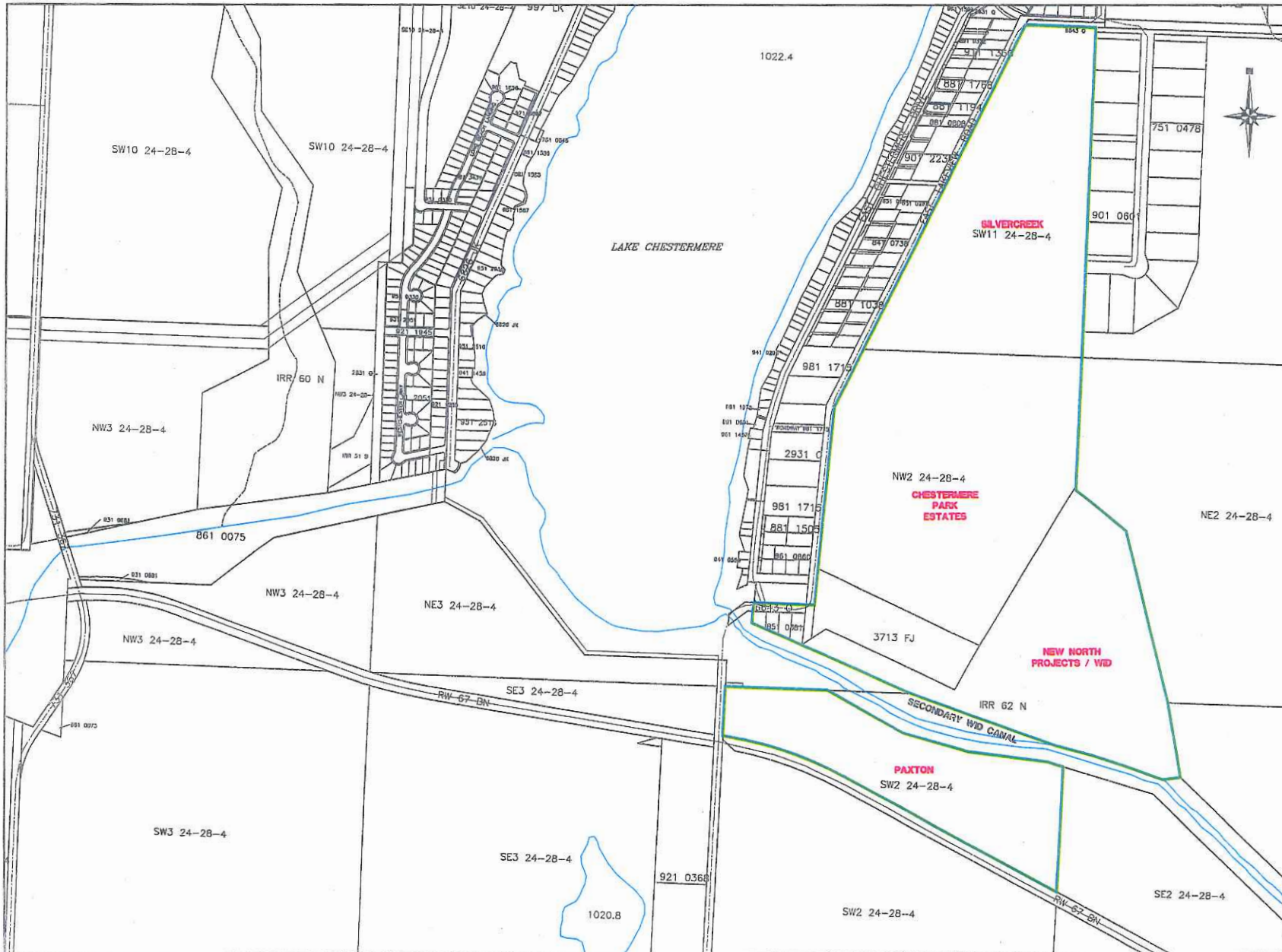
ROUTE RESERVOIR		Requested routing time step = 5.0 min.				
IN>03:(000103)						
OUT<04:(000104)						
		===== OUTFLOW STORAGE TABLE =====				
		OUTFLOW	STORAGE		OUTFLOW	STORAGE
		(cms)	(ha.m.)		(cms)	(ha.m.)
		.000	.0000E+00		.070	.1515E+01
		.035	.7577E+00		.148	.3204E+01

*** WARNING: STORAGE-Q values were extrapolated.
Increase curve or use overflow option.



**JUBILEE
ENGINEERING
CONSULTANTS LTD**

REV.	DATE	DESCRIPTION	APP'D	DRAWN RJB	TOWN OF CHESTERMERE	SHEET
				SCALE N.T.S.	EAST CHESTERMERE LAKE	FIG-1
				DATE FEB. 2003	PRELIM. SERVICING STUDY	FILE 03-015



NOTES

LEGEND

- STUDY AREA
- EXISTING CONTOURS

NO.	DATE	DESCRIPTION	BY
1			
2			
3			
4			

NO.	DATE	DESCRIPTION	BY
1			
2			
3			
4			

PERMIT

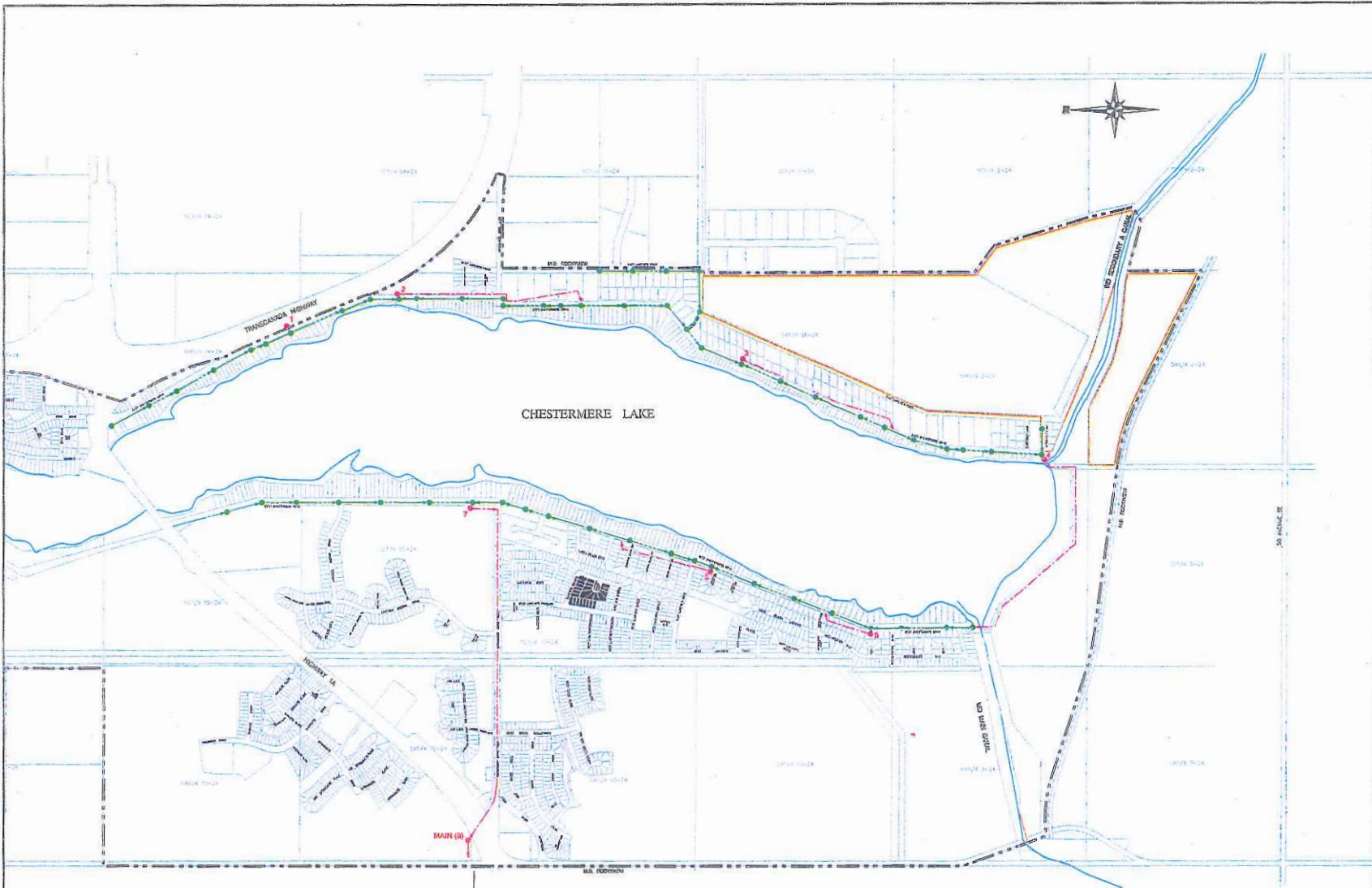
PERMIT TO PRACTICE
 JUBILEE ENGINEERING CONSULTANTS LTD.
 Signature: _____
 Date: _____
 PERMIT NUMBER: P 3550
 The Association of Professional Engineers, Geologists and Geophysicists of Alberta

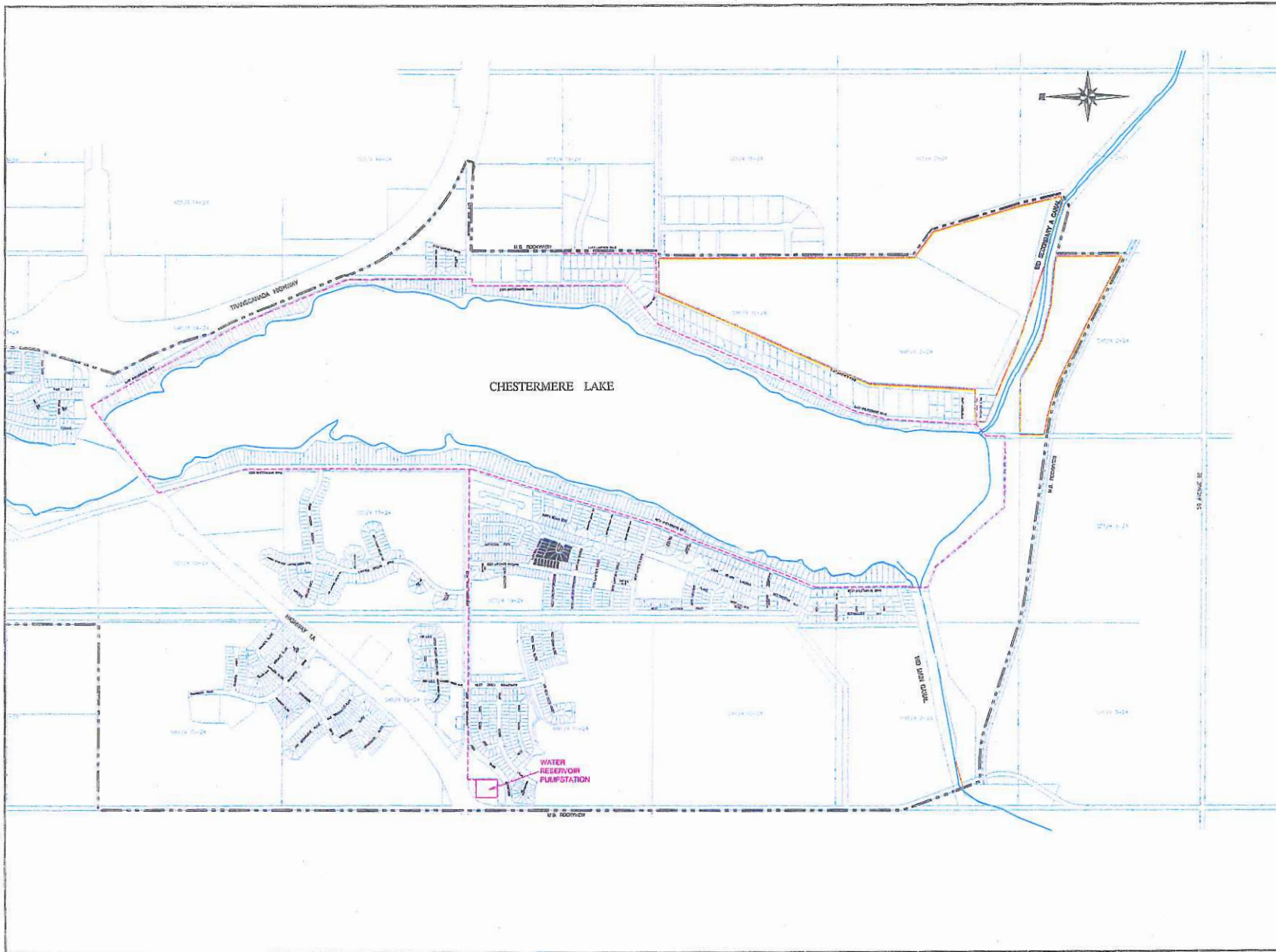
CLIENT

TOWN OF CHESTERMERE
 EAST CHESTERMERE LAKE
 PRELIMINARY SERVICING STUDY
 STUDY AREA & LAND OWNERSHIP

JUBILEE ENGINEERING CONSULTANTS LTD.
 111 30th Avenue SE, Calgary, Alberta T2C 1E5
 Phone: (403) 275-1001
 Fax: (403) 275-1001

DRAWN BY: S.R.
 CHECKED BY: J.L.M.
 DATE: FEB 2008
 SCALE: 1:4000
 JOB NUMBER: 03-019
 DRAWING NUMBER: FIG-2





NOTES

LEGEND

- TOWN BOUNDARY
- STUDY AREA
- EXISTING WATERMANS

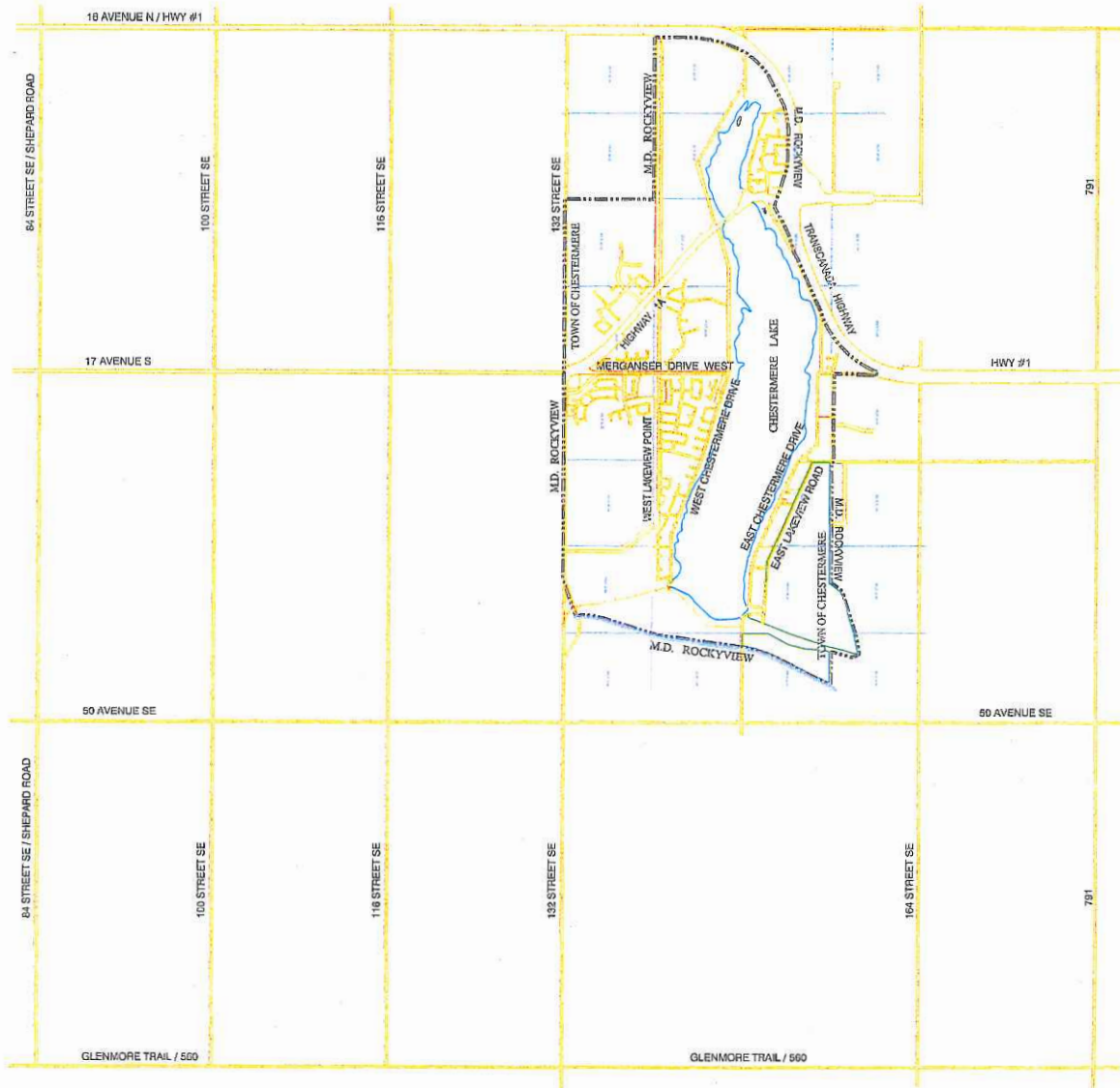
3			
4			
3			
2			
1			
REV.	DATE	DESCRIPTION	BY

4	AS-BUILT		
3	FOR TENDER		
2	FINAL APPROVAL		
1	PRELIMINARY APPROVAL		
JOB	DRAWING STATUS	DATE	APP.

DESIGNER	STAMP

TOWN OF CHESTERMERE
EAST CHESTERMERE LAKE
PRELIMINARY SERVICING STUDY
EX. WATER DISTRIBUTION SYSTEM

<p>JAMES ENGINEERING CONSULTANTS LTD. WATER, SEWERAGE & INDUSTRIAL DESIGNERS & RESIDENTIAL DEVELOPMENT PLANNERS & ENVIRONMENTAL SCIENTISTS</p> <p>111 Glenview Rd. Calgary, Alberta T2C 6B8 Phone: (403) 243-1991 Fax: (403) 243-1992</p>	DESIGN BY: S.B.
	DRAWN BY: J.B.
	CHECKED BY: H.B.
	DATE: FEB. 2003
SCALE: 1:12500	JOB NUMBER: 03-015
	DRAWING NUMBER: FIG-4



NOTES

LEGEND

TOWN BOUNDARY

STUDY AREA

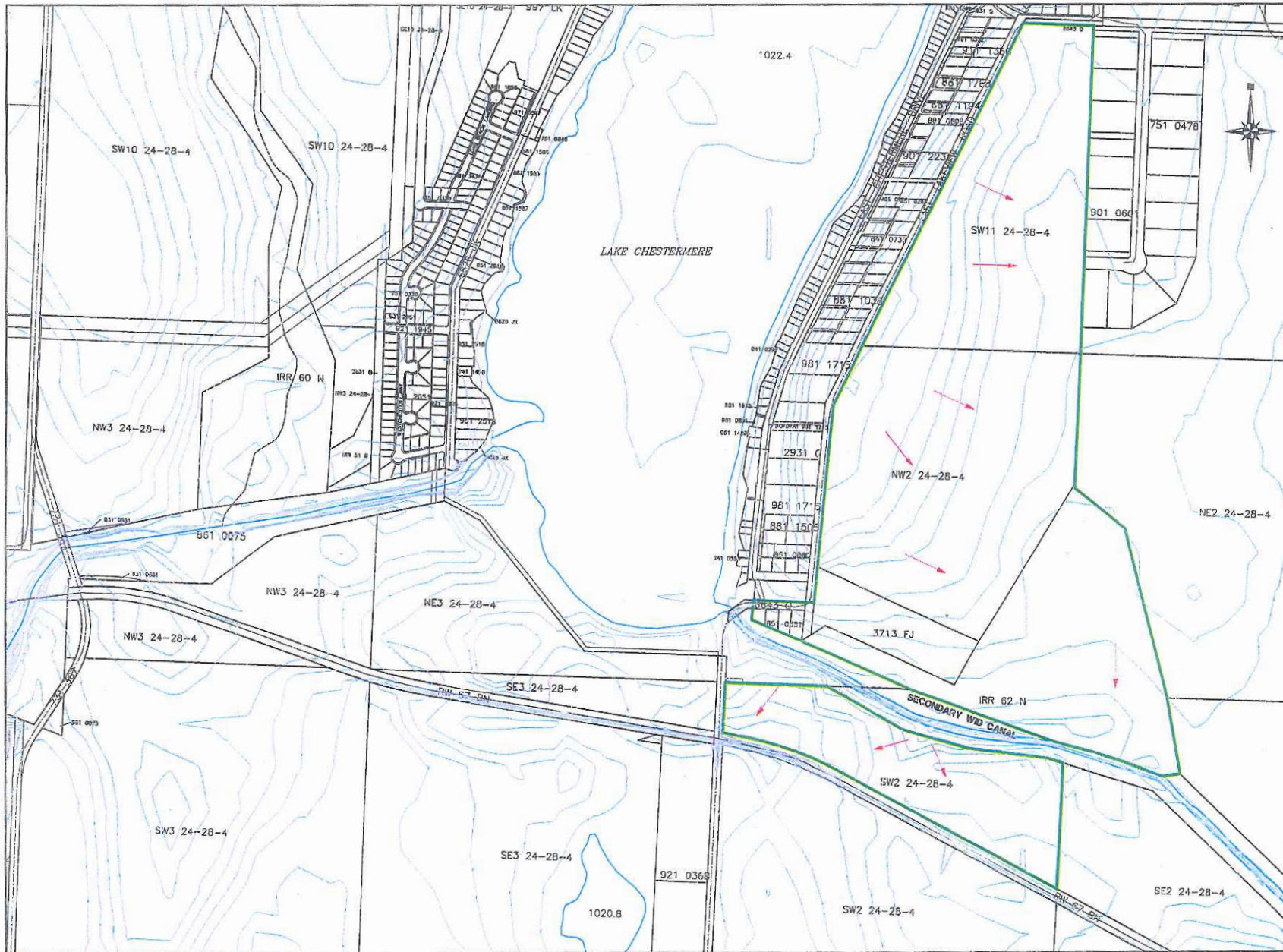
3			
4			
3			
2			
1			
Rev.	DATE	REVISION	BY
4		AS-BUILT	
3		FOR TENDER	
2		FINAL APPROVAL	
1		PRELIMINARY APPROVAL	
Rev.		DRAWING STATUS	DATE APP.

PERM	Stamp
------	-------

CLIENT
TOWN OF CHESTERMERE

TITLE
**EAST CHESTERMERE LAKE
PRELIMINARY SERVICING STUDY
EXISTING TOWN OF CHESTERMERE
& SURROUNDING AREA ROAD NETWORK**




<p>J. LEWIS ENGINEERING CONSULTANTS LTD.</p> <p>REGISTERED ENGINEERS & SURVEYORS & PROFESSIONAL ENGINEERS & ARCHITECTS</p> <p>811 2nd Avenue N.E. Calgary, Alberta T2C 0P8</p>	<p>DESIGN BY: J.L.S.</p> <p>DRAWN BY: J.L.S.</p> <p>CHECKED BY: H.S.P.</p> <p>DATE: FEB. 2003</p>
	<p>SCALE: 1:20,000</p> <p>JOB NUMBER: 03-013</p> <p>DRAWING NUMBER: FIG-5</p>



NOTES

1022.4
751 0478
901 0601
1020.8
921 0368

LEGEND

-  STUDY AREA
-  EXISTING DRAINAGE DIRECTION
-  EXISTING CONTOURS

NO.	DATE	DESCRIPTION	BY
3			
4			
2			
1			

4 25-2011
 3 FOR REVIEW
 2 FINAL APPROVAL
 1 PRELIMINARY APPROVAL
 DRG. DRG. STATUS: _____ DATE: _____

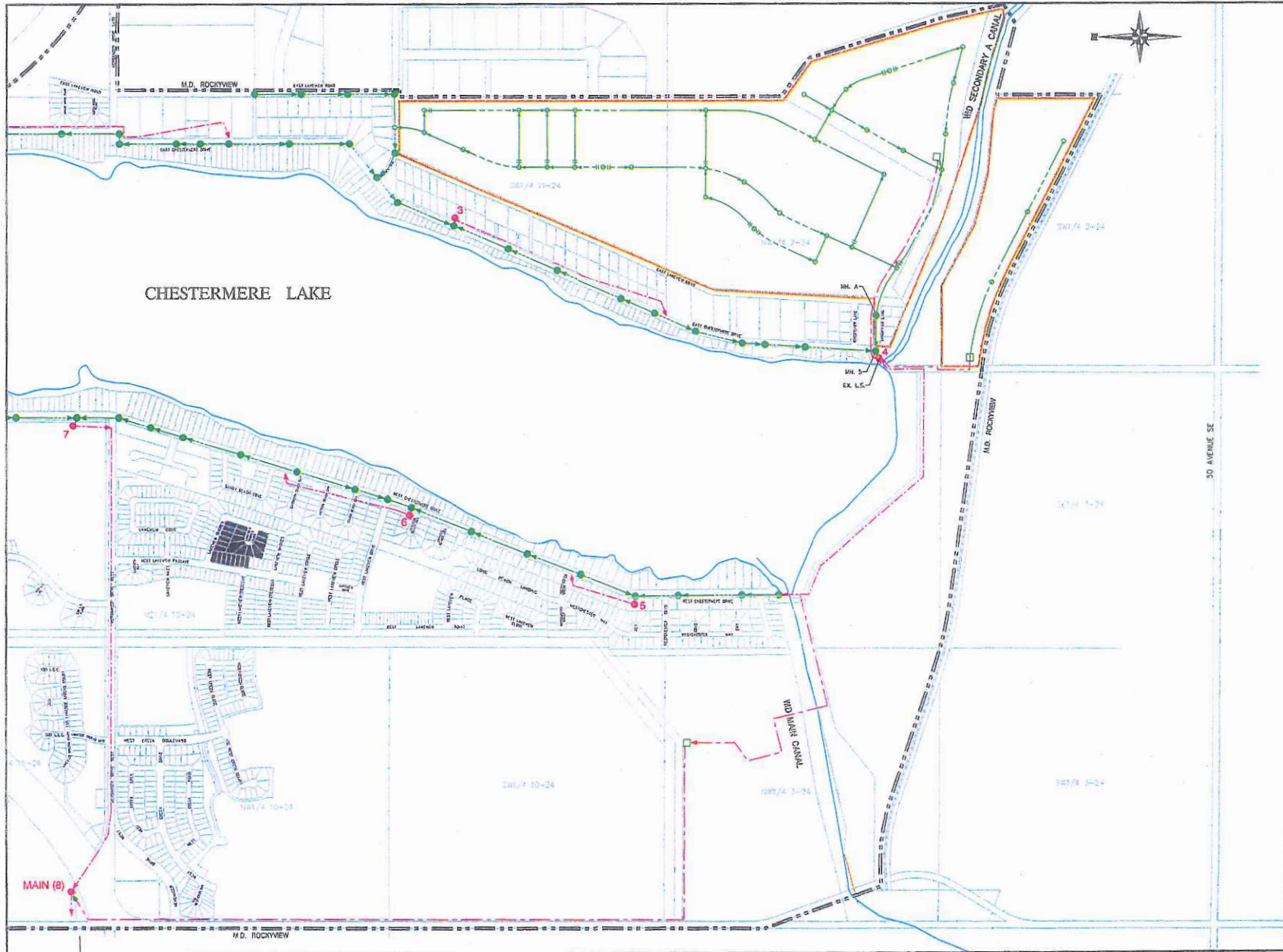
PERMIT TO PRACTICE
ABLES ENGINEERING CONSULTANTS LTD.
 Signature: _____
 Date: _____
 PERMIT NUMBER: P 3550
The Association of Professional Engineers, Geologists and Geophysicists of Alberta



CLIENT: **TOWN OF CHESTERMERE**
 TITLE: **EAST CHESTERMERE LAKE
 PRELIMINARY SERVICING STUDY
 EXISTING TOPOGRAPHY
 OF THE STUDY AREA**

ABLES ENGINEERING CONSULTANTS LTD.
MEMBER ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLGISTS AND GEOPHYSICISTS OF ALBERTA
 811 20th Avenue S.E. Calgary, Alberta T2C 2E2
 Phone: (403) 243-1991 Fax: (403) 243-1992

DESIGN BY: J.R.
 DRAWING BY: J.R.
 CHECKED BY: H.H.
 DATE: FEB 2003
 SCALE: 1:4000
 JOB NUMBER: 03-010
 DRAWING NUMBER: **FIG-6**



NOTES

LEGEND

- TOWN BOUNDARY
- STUDY AREA
- EXISTING SANITARY
- EXISTING FORCEMAIN
- SEWAGE LIFT STATION NUMBER
- PROPOSED SANITARY
- PROPOSED FORCEMAIN
- PROPOSED LIFT STATION

NO.	DATE	DESCRIPTION	BY

NO.	DATE	REVISIONS

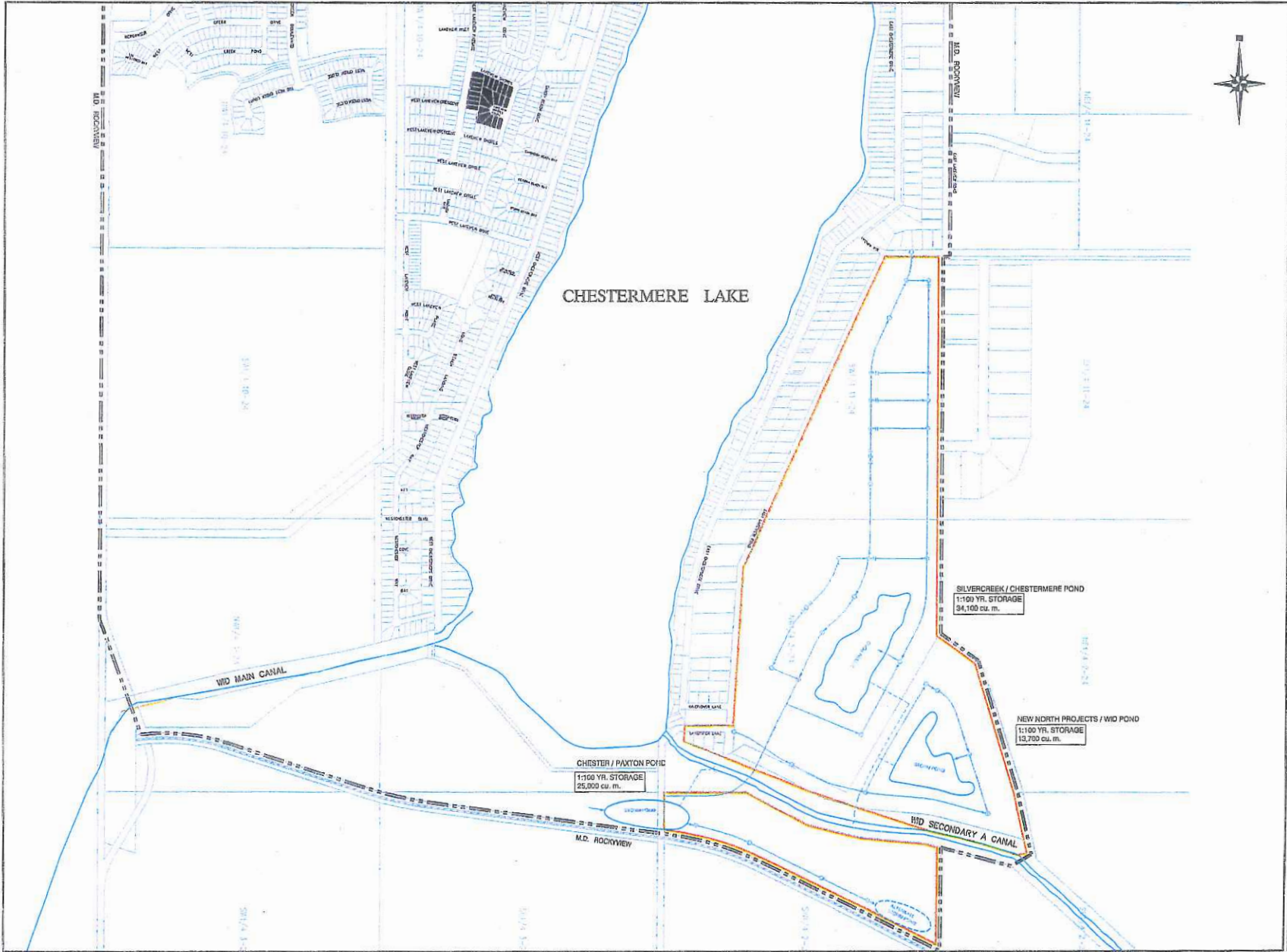
NO.	DATE	REVISIONS	DATE	APP.

FORM	SHAPE

CLIENT: TOWN OF CHESTERMERE

TITLE: EAST CHESTERMERE LAKE
PRELIMINARY SERVICING STUDY
PROPOSED SANITARY
SEWER SYSTEM

	DESIGN BY: S.B.
	DRAWN BY: T.S.
111 2ND AVENUE, S.E. SUITE 200 WASHINGTON, D.C. 20003	CHECKED BY: H.M.
	DATE: MAR. 2004
PHONE: (301) 971-1111 FAX: (301) 971-1112	SCALE: 1:5000
JOB NUMBER: 03-010 DRAWING NUMBER: FIG-8	JOB MANAGER:



NOTES

LEGEND

TOWN BOUNDARY ---

STUDY AREA ---

PROP. STORM SEWER ---

PROP. TREATED STORM SEWER ---

STORM POND ○

OUTFALL ---

NO.	DATE	DESCRIPTION	BY
1		PRELIMINARY APPROVAL	
2		FOR TENDER	
3		FOR TENDER	
4		FOR TENDER	

NO.	DATE	DESCRIPTION	BY
1		PRELIMINARY APPROVAL	
2		FOR TENDER	
3		FOR TENDER	
4		FOR TENDER	

TOWN OF CHESTERMERE

EAST CHESTERMERE LAKE

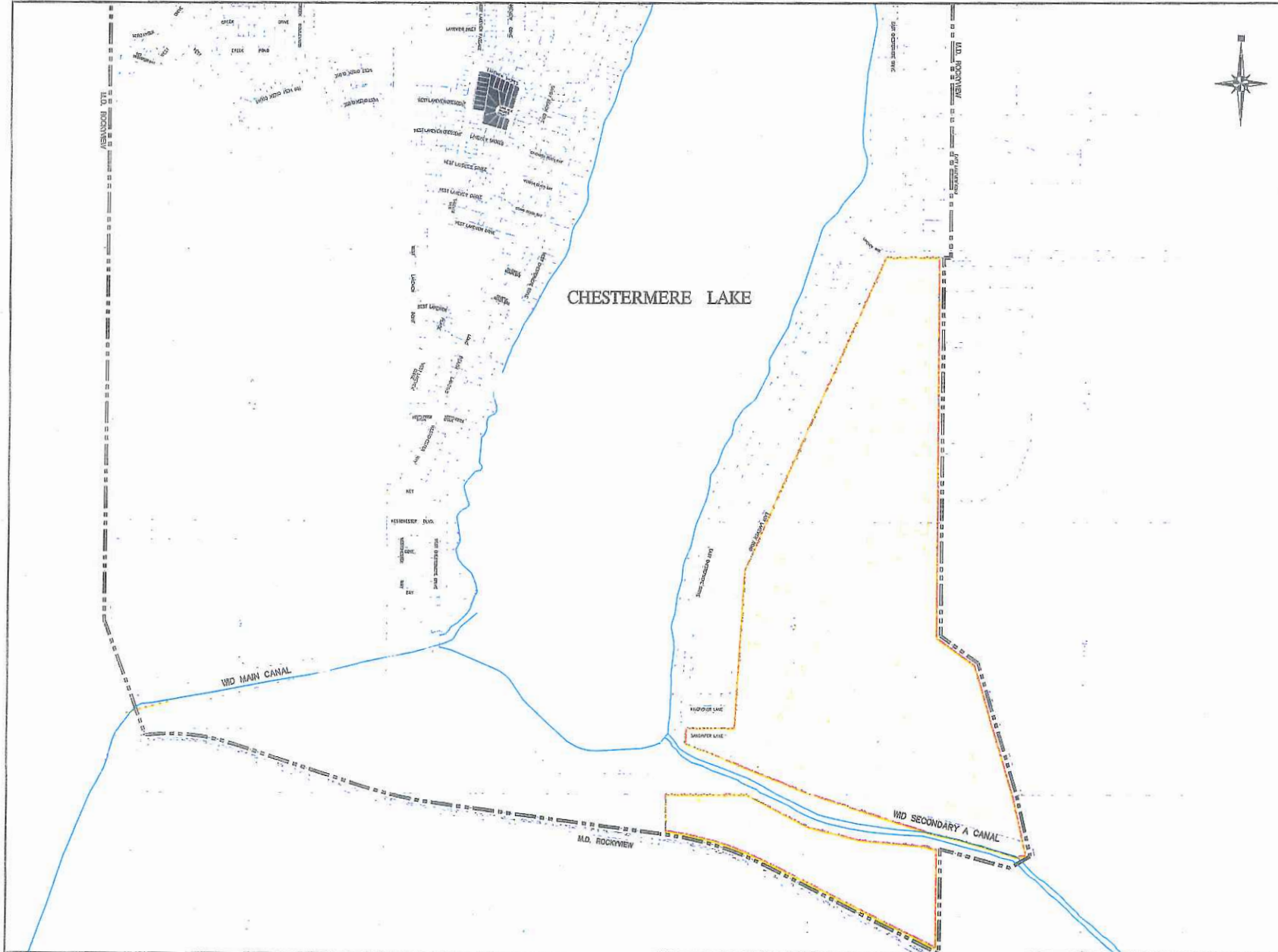
PRELIMINARY SERVICING STUDY

PROPOSED STORMWATER SYSTEM

JULIE ENGINEERING CONSULTANTS LTD.

MANITOBA ENGINEERING & SURVEYING PROFESSIONAL CORPORATION
 811 2nd Avenue, S.E. | Phone: (204) 333-1001 | Fax: (204) 333-1002

DESIGNED BY: S.L.
 CHECKED BY: H.S.
 DATE: MAR, 2001
 SCALE: 1:5000
 JOB NUMBER: 03-013
 DRAWING NUMBER: FIG-9



NOTES

LEGEND

TOWN BOUNDARY
 STUDY AREA
 PROP. ROAD WITH R.O.W. WIDTH

No.	DATE	DESCRIPTION / REVISIONS	BY

NO.	DATE	STATUS	DATE	LOGS

PERMIT	STAMP

CITY OF
TOWN OF CHESTERMERE
 TITLE
**EAST CHESTERMERE LAKE
 PRELIMINARY SERVICING STUDY
 ASP AREA ROAD NETWORK**

<p>J. L. HUBBARD ENGINEERING CONSULTANTS LTD.</p> <p>MANITOBA, ALBERTA & BRITISH COLUMBIA A PROFESSIONAL ENGINEERING FIRM IN REGISTRATION WITH THE ENGINEERING COUNCIL OF CANADA</p>	DESIGN BY: S.R. DRAWN BY: J.R. CHECKED BY: J.R. DATE: MAR 2004
	SCALE: 1:5000
	JOB NUMBER: 03-010
	DESIGNED BY: J.R.

FIG-10

Appendix 3

Stormwater Management Study

South East Chestermere
Area Structure Plan

**EAST CHESTERMERE LAKE
PRELIMINARY
STORMWATER MANAGEMENT STUDY
OCTOBER 30, 2003 FILE 02-035**

Prepared by

Jubilee Engineering Consultants Ltd.
#4, 911-32nd Ave. N. E.
Calgary, Alberta T2E 6X6
Contact: Mr. Shiraz Remtulla



**JUBILEE
ENGINEERING
CONSULTANTS LTD.**

CONSULTING ENGINEERS • SURVEYORS • PLANNERS

October 30, 2003

File 02-035

GLB Planning Ltd.
Unit 113, 2060 Pegasus Road NE
Calgary, Alberta T2E 8G8

Attention: Mrs. Grace Lui

Dear Madam:

**Subject: East Chestermere Lake
Preliminary Stormwater Management Study**

We are forwarding 2 copies of the Preliminary Stormwater Management Study for the above development to support the ASP application for the above lands.

As per our previous meeting with yourself and the Town, we understand that the Town is in discussion with the Western Irrigation District to set permissible rates of discharge into the Chestermere Lake and Canals A & B from new development in the Town of Chestermere.

The above report will have to be amended to reflect the new discharge rates when they are available.

If you have any questions, please do not hesitate to contact the writer.

Yours truly,

Shiraz Remtulla, P. Eng.

sr/cs

cc Craig Johnson
New North Projects Ltd.

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1.3	Study Objective	
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INTRODUCTION

1.1 General

Jubilee Engineering Consultants Ltd. has been requested by New North Projects Ltd. (Previously Urbco Inc.) to prepare a preliminary Stormwater Management Plan as a supporting document to the Area Structure Plan for the Southeast Chestermere area shown on Figure 1.

The Stormwater Management Plan outlines the drainage concept to manage the runoff generated from the study area. The plan presented in this report addresses the flow attenuation, the pre and post development flows, and quality control requirements of the stormwater storage treatment facilities, control of overland flows in the development area, and the offsite discharge to the Western Irrigation Canal.

1.2 Study Area and Land Ownership

Figure 2 shows the extent of the area to be addressed in the Stormwater Management Plan. The study area is split into 2 sections by the WID Secondary Canal, the area north and south respectively of the WID Secondary Canal. The area north of the WID Secondary Canal is bounded by East Chestermere Lakeview Road to the west and north, the Town boundary to the east, and the WID Secondary Canal to the south. These areas include the following landowners, Silvercreek Developments, Chestermere Park Estates and the Western Irrigation District/New North Projects Ltd.

The area south of the WID Secondary Canal is bounded by the Town boundary to the east, CN Railway to the south, and WID Main and Secondary Canal and the Chestermere Lake to the north and west. These areas encompass the following landowners, Mr. Phil Paxton and Mr. Greg Chesser.

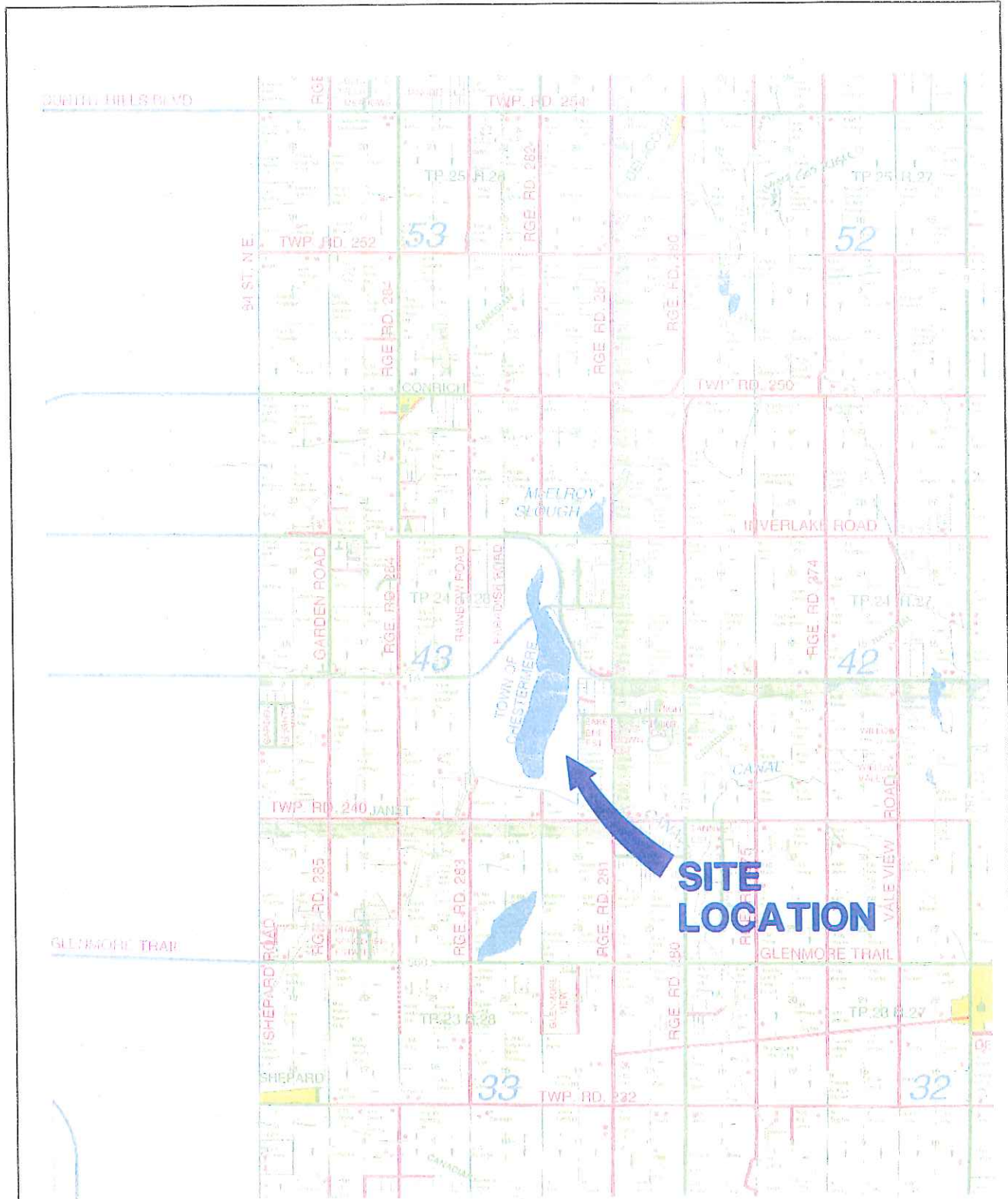
1.3 Study Objective

The objective of this study is to develop a preliminary Stormwater Management Plan for the study area using the Best Management Practices (BMP). Best Management Practices are defined as "state of art practices in engineering, planning or administration to control urban runoff pollutants".

Best Management Practices incorporate runoff attenuation and water quality improvement measures to achieve the desired results.

The Stormwater Management Plan will develop design criteria (at a pre-engineering level) for the surface runoff conveyance system components. These include the location and preliminary sizing of stormwater detention and storage facilities, and the offsite discharge of the storm water into the WID Secondary Canal.

The specific work activities of the study were as follows:



				DRAWN	RJB	NEW NORTH PROJECTS LTD.	SHEET	FIG-1
				SCALE	N.T.S.	PRELIM. STORM WATER	FILE	
				DATE	AUG 2002	MANAGEMENT STUDY	02-035	
REV.	DATE	DESCRIPTION	APP'D					

- Meet with Cam Hart of New North Projects Ltd., Grace Lui of GLB Planning, and Angus Sutherland of Silvercreek Developments.
- Discussion with Mr. Norm Trapp of Southwell Trapp and Associates.
- Discussion with Mr. Don Parker and Dale Telick of MPE Engineering Ltd. regarding the WID Canal.
- Collect available data including topographic mapping, soil data, and previous reports by others.
- Carry out study to determine drainage boundaries, downstream constraints, and drainage basin characteristics.
- Carry out computer simulations to determine runoff resulting from a 1:100 year return period storm event and its safe conveyance through the study area.
- Determine, on a pre-design engineering basis volume requirements, locations and layout of storm storage facilities.
- Document the analysis undertaken in a report.

2.0 BACKGROUND

Landowners of Southeast Chestermere are in the process of preparing the Southeast Chestermere Area Structure Plan (ASP). As a requirement of the ASP approval, a preliminary Stormwater Management Plan has to be submitted to the Town Council for approval in conjunction with the ASP. The provision of a Stormwater Management Plan identifies stormwater issues within a drainage catchment and addresses how the issue will be managed. The information contained in the Stormwater Management Plan is intended to form the basis for the landowners to develop a detailed Stormwater Management Plan when each landowner is closer to subdivision.

2.1 Previous Studies

The Town of Chestermere Master Drainage Plan prepared by Southwell Trapp and Associates (April, 1995) provides guidelines for developing the Stormwater Management Plan for new developments.

3.0 EXISTING DRAINAGE CONDITIONS

Figure 3 shows the existing contours for the various areas which was provided by the study proponent. The topography information is from the available aerial plans.

The Silvercreek area has a rolling terrain draining from west to east into an existing depression.

The Chestermere Park area has a similar topography to Silvercreek but drains from northwest to southeast into the WID/New North Projects Ltd. lands.

The New North Projects Ltd. lands do not exhibit any defined drainage pattern and contain a number of low lying areas. The lands are located at the downstream end of the study area north of the WID Secondary Canal.

The Paxton lands are relatively flat with lows distributed within the property.

The Chesser lands drain from west to east and to the low point located in the southeast corner of the property.

4.0 PROPOSED POST-DEVELOPMENT CONCEPT

4.1 General

As land is developed for urban use, a region is transformed from the natural state to an almost totally man-made state. Buildings and related infrastructure such as roads and recreational areas add large amounts of impervious areas to the watershed and considerably diminish the water storage and percolation capability. As the area covered by structures increases significantly, the amounts of vegetation, and natural surface available for infiltration will decrease dramatically. Consequently, urbanization will yield higher volumes of runoff and flow rates as compared to pre-development conditions.

To manage the increase in runoff from land development, a drainage system is required which typically includes the storm sewer pipe system (minor system), overland flow system (major system), and on-site storage facilities. Generally, the on-site storage facilities are a combination of parking lot storage, rooftop storage, and/or multi-purpose dry or wet detention ponds. The on-site storage facilities are designed to retain the (surface)runoff and to control the release rate from new developments in order to safeguard downstream developments. In addition to reduced flow rates to protect downstream drainage systems, on-site storage facilities reduce the costs of the downstream drainage facilities.

The division of drainage systems into minor and major system components is not precise; some components carry flow during both minor and major events. Usually, the minor system is approached as consisting of those drainage works that transport runoff from minor storm events quickly and efficiently from a catchment, providing convenient drainage. The establishment of capacity criteria for the minor system is largely a trade-off between cost and convenience in terms of level of service. For this study, the minor system is based on a unit area flow of 70 l/s/ha.

The major system consists of those drainage routes that transport flow during major storm events, with flow rates in excess of the capacity of the minor system. The dual drainage concept acknowledges that these systems do not act independently; in fact, during major storm events the storm sewer system may become surcharged when the interception at the catchbasins exceeds the capacity of the pipes. To prevent this from occurring, Inlet Control Devices (ICDs) are often installed in catchbasins at strategic locations. The present of these ICDs in turn have an impact on the amounts of flow that need to be accommodated by the major system. In the City of Calgary the level of service for the major (overland flow) system is the 1:100 year event. The performance of the major system must comply with criteria suggested by Alberta Environmental Protection (AENV) with respect to the permissible depth of ponding and depth and velocity of flow.

With the increasing concern about the quality of stormwater runoff, the implementation of so-called Best Management Practices (BMPs) has become essential to minimize potential impacts on receiving water bodies. BMPs are stormwater management methods that view the ultimate drainage system from an ecosystem approach and retain as much of the natural drainage characteristics as possible to minimize water quality degradation. In the past, the main focus of drainage design has been the response to severe storm events, however, with the advent of BMPs, adequate attention needs to be paid to more frequent small storms as they typically represent the largest contaminant load to the receiving

waters. The integration of BMPs into the planning and design of the drainage system is essential if an effective stormwater management plan is to happen.

4.2 Proposed Drainage Concept

The proposed drainage concepts for the study have been developed based on the site topography and using the Best Management Practices. The dual drainage concept consists of a minor system and a major system incorporating wet ponds will be implemented as a design basis for the study area.

The minor system shall be an underground pipe system designed to convey the unit area discharge of 70 l/s/ha to the detention facilities. The major system shall include all surface facilities used to convey the runoff overland to the detention pond, to accommodate storm runoff from storms up to 1:100 year event. Adequate water quality enhancement shall be provided to ensure a reduction of 80 percent of total suspended solids as established by Alberta Environment. A sediment and erosion control plan shall be prepared that provides mitigating measures to minimize sediment transport during the construction phase of the development.

Figures 4 and 5 depict the proposed Stormwater Management Plan for the study area. Figure 4 shows the layout with each of the landowners providing stormwater treatment/storage facilities on their properties except for Paxton/Chesser who will share a common stormwater/treatment facilities. Due to the constraints imposed by the existing topography, the WID/New North Projects Ltd. lands, and the Paxton/Chesser lands may require pumping facilities to discharge stormwater offsite, unless major earthwork to raise the site is undertaken. In the latter scenario, a system of sump and pump for the house weeping tile system would be utilized.

The Silvercreek, Chestermere Park Estates, and WID/New North Projects Ltd. lands will discharge to the WID Canal via a common trunk line. The Paxton and Chesser Lands will drain storm water directly to the WID Canal.

Figure 5 is a layout which shows a common pond for the Silvercreek/Chestermere Park Estates lands. This layout reduces the number of proposed ponds from 4 to 3, 2 north of the WID Canal and 1 to the south. There was consideration given to designing a single pond for areas north of the WID Canal located at the WID/New North Projects Ltd. lands. The analysis revealed that this option would only be practical using a pumping facility as the Hydraulic grade line requirement would require substantial fill at the WID/New North Projects Ltd. lands. The pumping facility would also be very large. (See Figure 6). As such, this option was considered uneconomical and will not be addressed.

5.0 STORMWATER MODELLING AND SIMULATION RESULTS

The stormwater modelling was performed using the single event SWMHYMO Model.

Table 1 shows the 1:100 year active storage volume and the allowable release rates that were obtained based on the 24 hour, 1:100 year design storm event with Chicago distribution. These results depict the scenario whereby each landowner has a dedicated stormwater management facility on their land.

Table 1
SWMHYMO Output Summary

Area No	Area (ha)	1:100 Year Computed Active Pond Storage Volumes (m ³)	Allowable Release Rate (l/s)
Silvercreek	26.66	5000	719
Chestermere Park Est.	32.67	6460	882
New North Projects	26.17	5000	828
Paxton/Chesser	48.59	9000	1404

Table 2 shows the minimum requirements to meet the quality standard of Alberta Environment (Reference 3). The minimum depth of the permanent pond shall be 2 m.

Table 2
Alberta Environment Detention Volume for Quality Control

Area No.	Area (ha)	Runoff Volume from 25mm Rainfall Permanent Pond (m ³)	Runoff Volume from 25mm Rainfall Active Pond (m ³)
Silvercreek	2666	6700	6700
Chestermere	3267	8200	8200
New North Projects	2617	6600	6600
Paxton/Chesser	4857	12200	12200

The active zone volume computed to meet the Alberta Environment (AENV) quality control criteria exceeds the volume required to control the outflow obtained by SWMHYMO (Table 1) to 1:100 year development rate.

A more refined and detailed analysis will be required at the detailed engineering design stage. This analysis should include continuous simulation modelling to verify the storage requirements and frequency of inundation as well as the level of water quality enhancement provided by the stormwater storage facilities.

Table 3 is the SWMHYMO output summary recalculated using the active storage pond storage as required by AENV quality control criteria. The new release rate for discharge to off-site is also shown in the table.

Table 3
SWMHYMO Output Summary
4 Pond Scenario

Area Identification	Area (ha)	1:100 Computed Active Pond Storage Volume m ³	Allowable Release rate l/s	On-Site Storage m ³	On-Site Storage m ³ /ha
Silvercreek	26.66	6700	417	1000	37.51
Chestermere Park Estate	32.67	8200	515	1226	37.50
New North Projects	26.17	6600	445	1035	39.50
Paxton/Chesser	48.59	12200	780	1460	30.05

Table 4 is the SWMHYMO output summary for a 3 pond scenario.

Table 4
SWMHYMO Output Summary
3 Pond Scenario

Area Identification	Area (ha)	1:100 Computed Active Pond Storage Volume m ³	Allowable Release rate l/s	On-Site Storage m ³	On-Site Storage m ³ /ha
Silvercreek/Chestermere Park Estates	59.33	14900	890	1336	22.52
New North Projects	26.17	6600	445	1035	39.50
Paxton/Chesser	48.59	12200	780	1460	30.05

Table 5 is the SWMHYMO output summary for a 2 pond scenario.

Table 5
SWMHYMO Output Summary
2 Pond Scenario

Area Identification	Area (ha)	1:100 Computed Active Pond Storage Volume m ³	Allowable Release rate l/s	On-Site Storage m ³	On-Site Storage m ³ /ha
Silvercreek/Chestermere Park Estates/ New North Projects	85.50	22000*	1165	1263	14.77
Paxton/Chesser	48.59	12200	780	1460	30.05

* Based on quantity (quality requires only 21,375)

The on-site storage volume requirement is a function of the capacity of the minor drainage system. This volume is calculated as a difference between the minor system capacity and the 1:100 year design storm. Based on 70 l/s/ha minor system capacity, the on-site storage will be as shown in the tables.

At the engineering stage, the minor system design capacity, the on-site storage requirement, the management of the 1:100 year flows using ICDs, and other details will be finalized.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The Preliminary Stormwater Management Plan is intended to provide a supporting document to the Southeast Area Structure Plan. The report will form the basis for the land owners to develop the design of the stormwater drainage facilities. The following are the conclusions and recommendations of the Preliminary Stormwater Management Plan.

- The Stormwater Management Plan is for Silvercreek, Chestermere Park Estates, New North Projects Ltd., Paxton and Chesser properties.
- The dual drainage system, using a combination of on-site storage and wet ponds, will be utilized for the development areas to control the flow and quality to a permissible level, and to provide a safe conveyance of overland flows.
- Under the 4 pond scenario the Silvercreek and the Chestermere Park Estates areas will drain by gravity to their respective detention facilities and will discharge again by gravity and under controlled flow to the off-site main. The New North Projects Ltd. property and Chessor/Paxton property will drain by gravity to a detention facility and discharge to the off-site main or WID Canal by gravity or pumping facility. The off-site main will discharge into the WID Secondary Canal at allowable rates.
- Under the 3 pond scenario the Silvercreek and Chestermere Park Estates will drain by gravity into a common detention facility located in the Chestermere Park Estates and then discharge by gravity and under controlled flow to the off-site main. The New North Projects Ltd. and Chesser and Paxton property stormwater management will be the same as the 4 pond scenario. This is the preferable option as it provides flexibility in the staging of the development and reduces the number of ponds to what is considered more practical
- Under the 2 pond option which utilizes a single pond to the north, it improves the hydraulic grade line for the upstream areas. However it increases the fill requirements substantially for the New North Projects Ltd./WID lands. Moreover, the land requirement for this pond will affect the proposed subdivision plans for New North Projects Ltd.
- All stormwater facilities shall be complete with properly sized forebay and inlet and outlet structures. The design, layout and configuration of these shall be in accordance with the Alberta Environment Guidelines.
- The 1:100 year storage volume requirement in the stormwater management facilities, the 1:100 year allowable rates, and the actual release rates for the on site storage for 3 pond and 4 pond scenarios are summarized in Table 7.
- Under all scenarios, easements will have to be arranged and secured between the different land owners in this area.

Table 7
Summary of 4, 3, and 2 Pond Scenarios

Area Identification	4 Pond Scenario					3 Pond Scenario					2 Pond Scenario				
	Storage Volume m ³		Allowable Release Rates l/s	Actual Release Rates l/s	On-site storage m ³ /ha	Storage Volume m ³		Allowable Release Rates l/s	Actual Release Rates	On-site storage m ³ /ha	Storage Volume m ³		Allowable Release Rates l/s	Actual Release Rates l/2	On-Site Storage m ³ /ha
	Permanent Pond m ³	Active Pond m ³				Perma- nent Pond m ³	Active Pond m ³				Perma- nent Pond m ³	Active Pond m ³			
Silvercreek	9550	6700	720	417	37.50	23890	14900	1010	890	22.50	37140	1165	22200	1165	14.80
Chestermere Park Estates	12100	8200	880	515	37.50										
New North Projects	9550	6600	830	445	39.50	9550	6600	830	445	39.50	19100	1400	12200	780	30.05
Paxton/Chesser	19100	12200	1400	780	30.05	19100	12200	1400	780	30.05	19100	1400	12200	780	30.05

Notes:

1. The above values shall be revised and finalized at the detailed Engineering phase of the project.
2. The permanent pond volumes are larger than those required by AENV because of the slope and the minimum 2m depth of water required in the pond.

7.0 REFERENCES

1. City of Calgary Wastewater and Drainage, Stormwater Management and Design Manual, December 2000.
2. 'SWMHYMO': Storm Water Management Hydrologic Model, User's Manual. J. F Sabourin & Associates, Ottawa, Canada, 1998.
3. Stormwater Management Guidelines for the Province of Alberta, January 1999.
4. Master Drainage Plan for Town of Chestermere – Southwell Trapp & Assoc. Ltd., April, 1995.

APPENDIX A
SWMHYMO COMPUTER
INPUT/OUTPUT FILE

APPENDIX B
SWYMHYMO MODEL

4 POND SCENARIO

2 Metric units

```

*****
* Project Name: [CHESTERMERE]
* Silvercreek
* Project Number: [02-035]
* Date : 04-28-2002
*****

```

```

START TZERO=[0.0], METOUT=[2], NSTORM=[0], NRUN=[0]

```

```

*%-----|-----

```

```

* 1:100 Chicago Design Storm
CHICAGO STORM IUNITS=[2], TD=[24] (hrs), TPRAT=[0.3], CSDT=[15.0] (min),
ICASEcs=[1],
A=[663.1], B=[1.87], and C=[0.712],

```

```

*%-----|-----

```

* Pre-development flow calculations

```

*
DESIGN NASHYD ID=[1], NHYD=[101], DT=[5.0]min, AREA=[26.66] (ha),
DWF=[0] (cms), CN/C=[65], TP=[0.60]hrs,
RAINFALL=[ , , , ] (mm/hr), END=-1

```

```

*%-----|-----

```

* Catchment Area to Pond
* Discharges through Minor System @ 70 L/s/ha

```

*
CALIB STANDHYD ID=[2], NHYD=[102], DT=[5.0] (min), AREA=[26.66] (ha),
XIMP=[0.50], TIMP=[0.50], DWF=[0] (cms), LOSS=[2],
SCS curve number CN=[72],
Pervious surfaces: IAPER=[3.2] (mm), SLPP=[2.0] (%),
LGP=[50] (m), MNP=[0.25], SCP=[0] (min),
Impervious surfaces: IAIMP=[1.6] (mm), SLPI=[2.0] (%),
LGI=[700] (m), MNI=[0.015], SCI=[0] (min)
RAINFALL=[ , , , ] (mm/hr), END=-1

```

```

*%-----|-----

```

```

COMPUTE DUALHYD IDin=[2], CINLET=[1.866] (cms), NINLET=[1],
MAJID=[9], MajNHYD=["SPILL"],
MINID=[3], MinNHYD=[203],
TMJSTO=[1500] (cu-m)

```

```

*%-----|-----

```

```

ROUTE RESERVOIR IDout=[4], NHYD=[204], IDin=[3],
RDT=[5.0] (min),
TABLE of ( OUTFLOW-STORAGE ) values
(cms) - (ha-m)
[ 0.0 , 0.0 ]
[ 0.108 , 0.0587 ]
[ 0.241 , 0.3118 ]
[ 0.417 , 0.6700 ]
[ -1 , -1 ]
IDovf=[ ], NHYDovf=[ ]

```

```

*%-----|-----

```

```

SAVE HYD ID=[3], # OF PCYCLES=[-1], ICASEsh=[-1]
HYD_FILENAME=["HYDIN-S.DAT"]
HYD_COMMENT=["1:100 INFLOW TO POND"]

```

```

*%-----|-----

```

```

SAVE HYD ID=[4], # OF PCYCLES=[-1], ICASEsh=[-1]
HYD_FILENAME=["HYDOUT-S.DAT"]
HYD_COMMENT=["1:100 OUTFLOW FROM POND"]

```

```

*%-----|-----

```

FINISH

```

=====
SSSSS W W M M H H Y Y M M OOO          999 999 =====
S      W W W MM MM H H Y Y MM MM O O      9 9 9 9
SSSSS W W W M M M H H H H Y M M M O O ## 9 9 9 9 Ver. 4.02
S      W W M M M H H Y M M O O          9999 9999 July 1999
SSSSS W W M M H H Y M M OOO          9 9 =====
                                           9 9 9 9 # 5170115
StormWater Management HYdrologic Model          999 999 =====

```

```

*****
***** SWMHYMO-99 Ver/4.02 *****
***** A single event and continuous hydrologic simulation model *****
***** based on the principles of HYMO and its successors *****
***** OTHYMO-83 and OTHYMO-89. *****
***** Distributed by: J.F. Sabourin and Associates Inc. *****
***** Ottawa, Ontario: (613) 727-5199 *****
***** Gatineau, Quebec: (819) 243-6858 *****
***** E-Mail: swmhymo@jfsa.Com *****
*****

```

```

+++++++
+++++++ Licensed user: Jubilee Engineering Consultants Ltd. ++++++
+++++++ Calgary SERIAL#:5170115 ++++++
+++++++

```

```

*****
***** ++++++ PROGRAM ARRAY DIMENSIONS ++++++ *****
***** Maximum value for ID numbers : 10 *****
***** Max. number of rainfall points: 15000 *****
***** Max. number of flow points : 15000 *****
*****

```

```

***** D E T A I L E D O U T P U T *****
*****
* DATE: 2002-05-05 TIME: 18:09:18 RUN COUNTER: 000076 *
* Input filename: D:\JUBILEE\02-035\SWMHYM-1\SILVER.DAT *
* Output filename: D:\JUBILEE\02-035\SWMHYM-1\SILVER.out *
* Summary filename: D:\JUBILEE\02-035\SWMHYM-1\SILVER.sum *
* User comments: *
* 1: _____ *
* 2: _____ *
* 3: _____ *
*****

```

```

-----
001:0001-----
*****
* Project Name: [CHESTERMERE]
* Silvercreek
* Project Number: [02-035]
* Date : 04-28-2002
*****

```

```

-----
| START | Project dir.: D:\JUBILEE\02-035\SWMHYM-1\
----- Rainfall dir.: D:\JUBILEE\02-035\SWMHYM-1\
TZERO = .00 hrs on 0
METOUT= 2 (output = METRIC)
NRUN = 001
NSTORM= 0
-----

```

*
* 1:100 Chicago Design Storm

| CHICAGO STORM |
Ptotal= 89.67 mm

IDF curve parameters: A= 663.100
B= 1.870
C= .712

used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 15.00 min
Time to peak ratio = .30

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	1.107	6.25	4.650	12.25	2.554	18.25	1.456
.50	1.136	6.50	5.831	12.50	2.467	18.50	1.433
.75	1.168	6.75	8.169	12.75	2.386	18.75	1.411
1.00	1.201	7.00	16.640	13.00	2.312	19.00	1.390
1.25	1.237	7.25	88.690	13.25	2.243	19.25	1.369
1.50	1.276	7.50	22.018	13.50	2.179	19.50	1.349
1.75	1.317	7.75	13.243	13.75	2.118	19.75	1.330
2.00	1.362	8.00	9.893	14.00	2.062	20.00	1.311
2.25	1.411	8.25	8.052	14.25	2.010	20.25	1.293
2.50	1.464	8.50	6.865	14.50	1.960	20.50	1.276
2.75	1.523	8.75	6.026	14.75	1.913	20.75	1.259
3.00	1.587	9.00	5.399	15.00	1.869	21.00	1.242
3.25	1.659	9.25	4.908	15.25	1.827	21.25	1.227
3.50	1.738	9.50	4.512	15.50	1.788	21.50	1.211
3.75	1.828	9.75	4.186	15.75	1.750	21.75	1.196
4.00	1.929	10.00	3.911	16.00	1.714	22.00	1.182
4.25	2.045	10.25	3.676	16.25	1.680	22.25	1.168
4.50	2.179	10.50	3.472	16.50	1.648	22.50	1.154
4.75	2.337	10.75	3.293	16.75	1.617	22.75	1.141
5.00	2.525	11.00	3.135	17.00	1.587	23.00	1.128
5.25	2.755	11.25	2.994	17.25	1.559	23.25	1.115
5.50	3.042	11.50	2.868	17.50	1.532	23.50	1.103
5.75	3.414	11.75	2.753	17.75	1.505	23.75	1.091
6.00	3.918	12.00	2.649	18.00	1.480	24.00	1.079

001:0003-----

*
* Pre-development flow calculations
*

| DESIGN NASHYD | Area (ha)= 26.66 Curve Number (CN)=65.00
| 01:000101 DT= 5.00 | Ia (mm)= 1.500 # of Linear Res. (N)= 3.00

U.H. Tp(hrs)= .600

Unit Hyd Qpeak (cms)= 1.697

PEAK FLOW (cms)= .719 (i)
TIME TO PEAK (hrs)= 7.833
RUNOFF VOLUME (mm)= 34.558
TOTAL RAINFALL (mm)= 89.666
RUNOFF COEFFICIENT = .385

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0004-----

*
* Catchment Area to Pond
* Discharges through Minor System @ 70 L/s/ha
*

(d:\...SILVER.OUT)

```

-----
| CALIB STANDHYD | Area (ha)= 26.66
| 02:000102 DT= 5.00 | Total Imp(%)= 50.00 Dir. Conn.(%)= 50.00
-----

```

```

                IMPERVIOUS      PERVIOUS (i)
Surface Area    (ha)= 13.33      13.33
Dep. Storage    (mm)= 1.60       3.20
Average Slope   (%)= 2.00        2.00
Length          (m)= 700.00     50.00
Mannings n      = .015         .250

Max.eff.Inten. (mm/hr)= 88.69    28.54
                over (min) 10.00    20.00
Storage Coeff. (min)= 7.62 (ii) 20.95 (ii)
Unit Hyd. Tpeak (min)= 10.00     20.00
Unit Hyd. peak (cms)= .13        .05

                *TOTALS*
PEAK FLOW       (cms)= 2.69      .64      3.060 (iii)
TIME TO PEAK    (hrs)= 7.25      7.50     7.250
RUNOFF VOLUME   (mm)= 88.07     40.36    64.213
TOTAL RAINFALL  (mm)= 89.67     89.67    89.666
RUNOFF COEFFICIENT = .98        .45     .716

```

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 72.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0005

```

-----
| COMPUTE DUALHYD | Average inlet capacities [CINLET] = 1.866 (cms)
| TotalHyd 02:000102 | Number of inlets in system [NINLET] = 1
-----
                Total minor system capacity = 1.866 (cms)
                Total major system storage [TMJSTO] = 1500.(cu.m.)

```

	ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
TOTAL HYD.	02:000102	26.66	3.060	7.250	64.213	.000
MAJOR SYST	09:SPILL	.00	.000	.000	.000	.000
MINOR SYST	03:000203	26.66	1.866	7.167	64.425	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

Maximum MAJOR SYSTEM storage used = 1000.(cu.m.)

001:0006

```

-----
| ROUTE RESERVOIR | Requested routing time step = 5.0 min.
| IN>03:(000203) |
| OUT<04:(000204) |
-----

```

```

===== OUTFLOW STORAGE TABLE =====
OUTFLOW STORAGE | OUTFLOW STORAGE
(cms) (ha.m.) | (cms) (ha.m.)
.000 .0000E+00 | .241 .3118E+00
.108 .5870E-01 | .417 .6700E+00

```

ROUTING RESULTS	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW >03: (000203)	26.66	1.866	7.167	64.425
OUTFLOW <04: (000204)	26.66	.417	8.750	64.425

PEAK FLOW REDUCTION [Qout/Qin] (%) = 22.328

TIME SHIFT OF PEAK FLOW (min)= 95.00
MAXIMUM STORAGE USED (ha.m.)=.6694E+00

001:0007-----

| SAVE HYD | AREA (ha)= 26.660
| ID=03 (000203) | QPEAK (cms)= 1.866 (i)
| DT= 5.00 PCYC=-1 | TPEAK (hrs)= 7.167

VOLUME (mm)= 64.425

Filename: D:\JUBILEE\02-035\SWMHYM~1\HYDIN-S.DAT
Comments: 1:100 INFLOW TO POND

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0008-----

| SAVE HYD | AREA (ha)= 26.660
| ID=04 (000204) | QPEAK (cms)= .417 (i)
| DT= 5.00 PCYC=-1 | TPEAK (hrs)= 8.750

VOLUME (mm)= 64.425

Filename: D:\JUBILEE\02-035\SWMHYM~1\HYDOUT-S.DAT
Comments: 1:100 OUTFLOW FROM POND

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0009-----

FINISH

WARNINGS / ERRORS / NOTES

Simulation ended on 2002-05-05 at 18:09:20
=====

2 Metric units

* Project Name: [CHESTERMERE]
* Chestermere Park Estates
* Project Number: [02-035]
* Date : 04-28-2002

START TZERO=[0.0], METOUT=[2], NSTORM=[0], NRUN=[0]

*%-----|-----

* 1:100 Chicago Design Storm
CHICAGO STORM IUNITS=[2], TD=[24](hrs), TPRAT=[0.3], CSDT=[15.0](min),
ICASEcs=[1],
A=[663.1], B=[1.87], and C=[0.712],

*%-----|-----

* Pre-development flow calculations

DESIGN NASHYD ID=[1], NHYD=[101], DT=[5.0]min, AREA=[32.67](ha),
DWF=[0](cms), CN/C=[65], TP=[0.60]hrs,
RAINFALL=[, , ,](mm/hr), END=-1

*%-----|-----

* Catchment Area to Pond
* Discharges through Minor System @ 70 L/s/ha

CALIB STANDHYD ID=[2], NHYD=[102], DT=[5.0](min), AREA=[32.67](ha),
XIMP=[0.50], TIMP=[0.50], DWF=[0](cms), LOSS=[2],
SCS curve number CN=[72],
Pervious surfaces: IAper=[3.2](mm), SLPP=[2.0](%),
LGP=[50](m), MNP=[0.25], SCP=[0](min),
Impervious surfaces: IAimp=[1.6](mm), SLPI=[2.0](%),
LGI=[700](m), MNI=[0.015], SCI=[0](min)
RAINFALL=[, , ,](mm/hr), END=-1

*%-----|-----

COMPUTE DUALHYD IDin=[2], CINLET=[2.287](cms), NINLET=[1],
MAJID=[9], MajNHYD=["SPILL"],
MINID=[3], MinNHYD=[203],
TMJSTO=[1500](cu-m)

*%-----|-----

ROUTE RESERVOIR IDout=[4], NHYD=[204], IDin=[3],
RDT=[5.0](min),
TABLE of (OUTFLOW-STORAGE) values
(cms) - (ha-m)
[0.0 , 0.0]
[0.133 , 0.0728]
[0.297 , 0.3843]
[0.515 , 0.8200]
[-1 , -1]
IDovf=[], NHYDovf=[]

*%-----|-----

SAVE HYD ID=[3], # OF PCYCLES=[-1], ICASEsh=[-1]
HYD_FILENAME=["HYDIN-P.DAT"]
HYD_COMMENT=["1:100 INFLOW TO POND"]

*%-----|-----

SAVE HYD ID=[4], # OF PCYCLES=[-1], ICASEsh=[-1]
HYD_FILENAME=["HYDOUT-P.DAT"]
HYD_COMMENT=["1:100 OUTFLOW FROM POND"]

*%-----|-----

FINISH

```

=====
SSSSS W W M M H H Y Y M M OOO          999 999 =====
S      W W W M M M H H Y Y M M O O      9 9 9 9
SSSSS W W W M M M H H H H Y M M M O O ## 9 9 9 9 Ver. 4.02
      S W W M M H H Y M M O O          9999 9999 July 1999
SSSSS W W M M H H Y M M OOO          9 9 9 9 # 5170115
StormWater Management Hydrologic Model          999 999 =====

```

```

*****
***** SWMHYMO-99 Ver/4.02 *****
***** A single event and continuous hydrologic simulation model *****
***** based on the principles of HYMO and its successors *****
***** OTTHYMO-83 and OTTHYMO-89. *****
***** Distributed by: J.F. Sabourin and Associates Inc. *****
***** Ottawa, Ontario: (613) 727-5199 *****
***** Gatineau, Quebec: (819) 243-6858 *****
***** E-Mail: swmhymo@jfsa.Com *****
*****

```

```

+++++
+++++ Licensed user: Jubilee Engineering Consultants Ltd. +++++
+++++ Calgary SERIAL#:5170115 +++++
+++++

```

```

*****
***** +++++ PROGRAM ARRAY DIMENSIONS +++++ *****
***** Maximum value for ID numbers : 10 *****
***** Max. number of rainfall points: 15000 *****
***** Max. number of flow points : 15000 *****
*****

```

```

***** D E T A I L E D O U T P U T *****
*****
* DATE: 2002-05-05 TIME: 18:17:30 RUN COUNTER: 000080 *
*****
* Input filename: D:\JUBILEE\02-035\SWMHYM~1\CHESTER.DAT *
* Output filename: D:\JUBILEE\02-035\SWMHYM~1\CHESTER.out *
* Summary filename: D:\JUBILEE\02-035\SWMHYM~1\CHESTER.sum *
* User comments: *
* 1: _____ *
* 2: _____ *
* 3: _____ *
*****

```

```

-----
001:0001-----
*****
* Project Name: [CHESTERMERE]
* Chestermeré Park Estates
* Project Number: [02-035]
* Date : 04-28-2002
*****

```

```

-----
| START | Project dir.: D:\JUBILEE\02-035\SWMHYM~1\
----- Rainfall dir.: D:\JUBILEE\02-035\SWMHYM~1\
TZERO = .00 hrs on 0
METOUT= 2 (output = METRIC)
NRUN = 001
NSTORM= 0
-----

```

001:0002-----

(d:\...CHESTER.OUT)

*
* 1:100 Chicago Design Storm

| CHICAGO STORM |
Ptotal= 89.67 mm

IDF curve parameters: A= 663.100
B= 1.870
C= .712

used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 15.00 min
Time to peak ratio = .30

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.25	1.107	6.25	4.650	12.25	2.554	18.25	1.456
.50	1.136	6.50	5.831	12.50	2.467	18.50	1.433
.75	1.168	6.75	8.169	12.75	2.386	18.75	1.411
1.00	1.201	7.00	16.640	13.00	2.312	19.00	1.390
1.25	1.237	7.25	88.690	13.25	2.243	19.25	1.369
1.50	1.276	7.50	22.018	13.50	2.179	19.50	1.349
1.75	1.317	7.75	13.243	13.75	2.118	19.75	1.330
2.00	1.362	8.00	9.893	14.00	2.062	20.00	1.311
2.25	1.411	8.25	8.052	14.25	2.010	20.25	1.293
2.50	1.464	8.50	6.865	14.50	1.960	20.50	1.276
2.75	1.523	8.75	6.026	14.75	1.913	20.75	1.259
3.00	1.587	9.00	5.399	15.00	1.869	21.00	1.242
3.25	1.659	9.25	4.908	15.25	1.827	21.25	1.227
3.50	1.738	9.50	4.512	15.50	1.788	21.50	1.211
3.75	1.828	9.75	4.186	15.75	1.750	21.75	1.196
4.00	1.929	10.00	3.911	16.00	1.714	22.00	1.182
4.25	2.045	10.25	3.676	16.25	1.680	22.25	1.168
4.50	2.179	10.50	3.472	16.50	1.648	22.50	1.154
4.75	2.337	10.75	3.293	16.75	1.617	22.75	1.141
5.00	2.525	11.00	3.135	17.00	1.587	23.00	1.128
5.25	2.755	11.25	2.994	17.25	1.559	23.25	1.115
5.50	3.042	11.50	2.868	17.50	1.532	23.50	1.103
5.75	3.414	11.75	2.753	17.75	1.505	23.75	1.091
6.00	3.918	12.00	2.649	18.00	1.480	24.00	1.079

001:0003-----

*
* Pre-development flow calculations
*

| DESIGN NASHYD | Area (ha)= 32.67 Curve Number (CN)=65.00
| 01:000101 DT= 5.00 | Ia (mm)= 1.500 # of Linear Res. (N)= 3.00

U.H. Tp (hrs)= .600

Unit Hyd Qpeak (cms)= 2.080

PEAK FLOW (cms)= .882 (i)
TIME TO PEAK (hrs)= 7.833
RUNOFF VOLUME (mm)= 34.558
TOTAL RAINFALL (mm)= 89.666
RUNOFF COEFFICIENT = .385

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0004-----

*
* Catchment Area to Pond
* Discharges through Minor System @ 70 L/s/ha
*

```

-----
| CALIB STANDHYD | Area (ha)= 32.67
| 02:000102 DT= 5.00 | Total Imp(%)= 50.00 Dir. Conn.(%)= 50.00
-----

```

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	16.33	16.33	
Dep. Storage (mm)=	1.60	3.20	
Average Slope (%)=	2.00	2.00	
Length (m)=	700.00	50.00	
Mannings n =	.015	.250	
Max.eff.Inten.(mm/hr)=	88.69	28.54	
over (min)	10.00	20.00	
Storage Coeff. (min)=	7.62 (ii)	20.95 (ii)	
Unit Hyd. Tpeak (min)=	10.00	20.00	
Unit Hyd. peak (cms)=	.13	.05	
			TOTALS
PEAK FLOW (cms)=	3.30	.79	3.750 (iii)
TIME TO PEAK (hrs)=	7.25	7.50	7.250
RUNOFF VOLUME (mm)=	88.07	40.36	64.213
TOTAL RAINFALL (mm)=	89.67	89.67	89.666
RUNOFF COEFFICIENT =	.98	.45	.716

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 72.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0005-----

```

-----
| COMPUTE DUALHYD | Average inlet capacities [CINLET] = 2.287 (cms)
| TotalHyd 02:000102 | Number of inlets in system [NINLET] = 1
-----
| | Total minor system capacity = 2.287 (cms)
| | Total major system storage [TMJSTO] = 1500.(cu.m.)
-----

```

	ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
TOTAL HYD.	02:000102	32.67	3.750	7.250	64.213	.000
MAJOR SYST	09:SPILL	.00	.000	.000	.000	.000
MINOR SYST	03:000203	32.67	2.287	7.167	64.428	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

Maximum MAJOR SYSTEM storage used = 1226.(cu.m.)

001:0006-----

```

-----
| ROUTE RESERVOIR | Requested routing time step = 5.0 min.
| IN>03:(000203) |
| OUT<04:(000204) |
-----

```

```

===== OUTFLOW STORAGE TABLE =====
OUTFLOW STORAGE | OUTFLOW STORAGE
(cms) (ha.m.) | (cms) (ha.m.)
.000 .0000E+00 | .297 .3843E+00
.133 .7280E-01 | .515 .8200E+00

```

ROUTING RESULTS	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW >03: (000203)	32.67	2.287	7.167	64.428
OUTFLOW <04: (000204)	32.67	.514	8.667	64.428

PEAK FLOW REDUCTION [Qout/Qin](%)= 22.495

(d:\...CHESTER.OUT)

TIME SHIFT OF PEAK FLOW (min)= 90.00
MAXIMUM STORAGE USED (ha.m.)=.8190E+00

001:0007-----

| SAVE HYD | AREA (ha)= 32.670
| ID=03 (000203) | QPEAK (cms)= 2.287 (i)
| DT= 5.00 PCYC=-1 | TPEAK (hrs)= 7.167

VOLUME (mm)= 64.428

Filename: D:\JUBILEE\02-035\SWMHYM-1\HYDIN-P.DAT
Comments: 1:100 INFLOW TO POND

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0008-----

| SAVE HYD | AREA (ha)= 32.670
| ID=04 (000204) | QPEAK (cms)= .514 (i)
| DT= 5.00 PCYC=-1 | TPEAK (hrs)= 8.667

VOLUME (mm)= 64.428

Filename: D:\JUBILEE\02-035\SWMHYM-1\HYDOUT-P.DAT
Comments: 1:100 OUTFLOW FROM POND

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0009-----

FINISH

WARNINGS / ERRORS / NOTES

Simulation ended on 2002-05-05 at 18:17:32
=====

2 Metric units

* Project Name: [CHESTERMERE]

* Urbco

* Project Number: [02-035]

* Date : 03-24-2002

START TZERO=[0.0], METOUT=[2], NSTORM=[0], NRUN=[0]

*%-----|-----

*

* 1:100 Chicago Design Storm

CHICAGO STORM IUNITS=[2], TD=[24] (hrs), TPRAT=[0.3], CSDT=[15.0] (min),

ICASEcs=[1],

A=[663.1], B=[1.87], and C=[0.712],

*%-----|-----

*

* Pre-development flow calculations

*

DESIGN NASHYD ID=[1], NHYD=[101], DT=[5.0]min, AREA=[26.17] (ha),

DWF=[0] (cms), CN/C=[65], TP=[0.47]hrs,

RAINFALL=[, , ,] (mm/hr), END=-1

*%-----|-----

*

* Catchment Area to Pond

* Discharges through Minor System @ 70 L/s/ha

*

CALIB STANDHYD ID=[2], NHYD=[101], DT=[5.0] (min), AREA=[26.17] (ha),

XIMP=[0.50], TIMP=[0.50], DWF=[0] (cms), LOSS=[2],

SCS curve number CN=[72],

Pervious surfaces: IAper=[3.2] (mm), SLPP=[2.0] (%),

LGP=[50] (m), MNP=[0.25], SCP=[0] (min),

Impervious surfaces: IAimp=[1.6] (mm), SLPI=[2.0] (%),

LGI=[500] (m), MNI=[0.015], SCI=[0] (min)

RAINFALL=[, , ,] (mm/hr), END=-1

*%-----|-----

COMPUTE DUALHYD

IDin=[2], CINLET=[1.832] (cms), NINLET=[1],

MAJID=[9], MajNHYD=["SPILL"],

MINID=[3], MinNHYD=[203],

TMJSTO=[1500] (cu-m)

*%-----|-----

ROUTE RESERVOIR

IDout=[4], NHYD=[204], IDin=[3],

RDT=[5.0] (min),

TABLE of (OUTFLOW-STORAGE) values

(cms) - (ha-m)

[0.0 , 0.0]

[0.115 , 0.0578]

[0.257 , 0.3071]

[0.445 , 0.6600]

[-1 , -1]

IDovf=[], NHYDovf=[]

*%-----|-----

SAVE HYD

ID=[3], # OF PCYCLES=[-1], ICASEsh=[-1]

HYD_FILENAME=["HYDIN-U.DAT"]

HYD_COMMENT=["1:100 INFLOW TO POND"]

*%-----|-----

SAVE HYD

ID=[4], # OF PCYCLES=[-1], ICASEsh=[-1]

HYD_FILENAME=["HYDOUT-U.DAT"]

HYD_COMMENT=["1:100 OUTFLOW FROM POND"]

*%-----|-----

FINISH

```

SSSSS W W M M H H Y Y M M OOO          999 999 =====
S      W W W MM MM H H Y Y MM MM O O      9 9 9 9
SSSSS W W W M M M HHHH Y M M M O O ##    9 9 9 9 Ver. 4.02
S      W W M M H H Y M M O O              9999 9999 July 1999
SSSSS W W M M H H Y M M OOO              9 9 =====
                                           9 9 9 9 # 5170115
                                           999 999 =====

```

StormWater Management HYdrologic Model

```

*****
***** SWMHYMO-99 Ver/4.02 *****
***** A single event and continuous hydrologic simulation model *****
***** based on the principles of HYMO and its successors *****
***** OTTHYMO-83 and OTTHYMO-89. *****
***** Distributed by: J.F. Sabourin and Associates Inc. *****
***** Ottawa, Ontario: (613) 727-5199 *****
***** Gatineau, Quebec: (819) 243-6858 *****
***** E-Mail: swmhymo@jfsa.Com *****
*****

```

```

+++++++
+++++++ Licensed user: Jubilee Engineering Consultants Ltd. ++++++
+++++++ Calgary SERIAL#:5170115 ++++++
+++++++

```

```

*****
***** ++++++ PROGRAM ARRAY DIMENSIONS ++++++ *****
***** Maximum value for ID numbers : 10 *****
***** Max. number of rainfall points: 15000 *****
***** Max. number of flow points : 15000 *****
*****

```

```

***** D E T A I L E D O U T P U T *****
*****
* DATE: 2002-05-05 TIME: 18:18:05 RUN COUNTER: 000081 *
*****
* Input filename: D:\JUBILEE\02-035\SWMHYM~1\URBCO.DAT *
* Output filename: D:\JUBILEE\02-035\SWMHYM~1\URBCO.out *
* Summary filename: D:\JUBILEE\02-035\SWMHYM~1\URBCO.sum *
* User comments: *
* 1: _____ *
* 2: _____ *
* 3: _____ *
*****

```

```

-----
001:0001-----
*****
* Project Name: [CHESTERMERE]
* Urbco
* Project Number: [02-035]
* Date : 03-24-2002
*****

```

```

-----
| START | Project dir.: D:\JUBILEE\02-035\SWMHYM~1\
----- Rainfall dir.: D:\JUBILEE\02-035\SWMHYM~1\
TZERO = .00 hrs on 0
METOUT= 2 (output = METRIC)
NRUN = 001
NSTORM= 0
-----

```

001:0002-----

*

* 1:100 Chicago Design Storm

| CHICAGO STORM |
Ptotal= 89.67 mm

IDF curve parameters: A= 663.100
B= 1.870
C= .712

used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 15.00 min
Time to peak ratio = .30

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.25	1.107	6.25	4.650	12.25	2.554	18.25	1.456
.50	1.136	6.50	5.831	12.50	2.467	18.50	1.433
.75	1.168	6.75	8.169	12.75	2.386	18.75	1.411
1.00	1.201	7.00	16.640	13.00	2.312	19.00	1.390
1.25	1.237	7.25	88.690	13.25	2.243	19.25	1.369
1.50	1.276	7.50	22.018	13.50	2.179	19.50	1.349
1.75	1.317	7.75	13.243	13.75	2.118	19.75	1.330
2.00	1.362	8.00	9.893	14.00	2.062	20.00	1.311
2.25	1.411	8.25	8.052	14.25	2.010	20.25	1.293
2.50	1.464	8.50	6.865	14.50	1.960	20.50	1.276
2.75	1.523	8.75	6.026	14.75	1.913	20.75	1.259
3.00	1.587	9.00	5.399	15.00	1.869	21.00	1.242
3.25	1.659	9.25	4.908	15.25	1.827	21.25	1.227
3.50	1.738	9.50	4.512	15.50	1.788	21.50	1.211
3.75	1.828	9.75	4.186	15.75	1.750	21.75	1.196
4.00	1.929	10.00	3.911	16.00	1.714	22.00	1.182
4.25	2.045	10.25	3.676	16.25	1.680	22.25	1.168
4.50	2.179	10.50	3.472	16.50	1.648	22.50	1.154
4.75	2.337	10.75	3.293	16.75	1.617	22.75	1.141
5.00	2.525	11.00	3.135	17.00	1.587	23.00	1.128
5.25	2.755	11.25	2.994	17.25	1.559	23.25	1.115
5.50	3.042	11.50	2.868	17.50	1.532	23.50	1.103
5.75	3.414	11.75	2.753	17.75	1.505	23.75	1.091
6.00	3.918	12.00	2.649	18.00	1.480	24.00	1.079

001:0003-----

*

* Pre-development flow calculations

*

| DESIGN NASHYD |
01:000101 DT= 5.00

Area (ha)= 26.17 Curve Number (CN)=65.00
Ia (mm)= 1.500 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= .470

Unit Hyd Qpeak (cms)= 2.127

PEAK FLOW (cms)= .828 (i)
TIME TO PEAK (hrs)= 7.667
RUNOFF VOLUME (mm)= 34.558
TOTAL RAINFALL (mm)= 89.666
RUNOFF COEFFICIENT = .385

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0004-----

*

* Catchment Area to Pond

* Discharges through Minor System @ 70 L/s/ha

*

```

-----
| CALIB STANDHYD | Area (ha)= 26.17
| 02:000101 DT= 5.00 | Total Imp(%)= 50.00 Dir. Conn.(%)= 50.00
-----

```

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	13.09	13.09	
Dep. Storage	(mm)=	1.60	3.20	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	500.00	50.00	
Mannings n	=	.015	.250	
Max.eff.Inten.(mm/hr)=		88.69	28.54	
over (min)		5.00	20.00	
Storage Coeff. (min)=		6.23 (ii)	19.55 (ii)	
Unit Hyd. Tpeak (min)=		5.00	20.00	
Unit Hyd. peak (cms)=		.19	.06	
				TOTALS
PEAK FLOW (cms)=		2.99	.65	3.358 (iii)
TIME TO PEAK (hrs)=		7.25	7.50	7.250
RUNOFF VOLUME (mm)=		88.07	40.36	64.213
TOTAL RAINFALL (mm)=		89.67	89.67	89.666
RUNOFF COEFFICIENT =		.98	.45	.716

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 72.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0005

```

-----
| COMPUTE DUALHYD | Average inlet capacities [CINLET] = 1.832 (cms)
| TotalHyd 02:000101 | Number of inlets in system [NINLET] = 1
-----
| | Total minor system capacity = 1.832 (cms)
| | Total major system storage [TMJSTO] = 1500.(cu.m.)
-----

```

	ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
TOTAL HYD.	02:000101	26.17	3.358	7.250	64.213	.000
MAJOR SYST	09:SPILL	.00	.000	.000	.000	.000
MINOR SYST	03:000203	26.17	1.832	7.083	65.142	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

Maximum MAJOR SYSTEM storage used = 1035.(cu.m.)

001:0006

```

-----
| ROUTE RESERVOIR | Requested routing time step = 5.0 min.
| IN>03:(000203) |
| OUT<04:(000204) |
-----
| | ===== OUTFLOW STORAGE TABLE =====
| | OUTFLOW STORAGE | OUTFLOW STORAGE
| | (cms) (ha.m.) | (cms) (ha.m.)
| | .000 .0000E+00 | .257 .3071E+00
| | .115 .5780E-01 | .445 .6600E+00
-----

```

ROUTING RESULTS	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW >03: (000203)	26.17	1.832	7.083	65.142
OUTFLOW<04: (000204)	26.17	.443	8.500	65.142

PEAK FLOW REDUCTION [Qout/Qin] (%) = 24.183

TIME SHIFT OF PEAK FLOW (min)= 85.00
MAXIMUM STORAGE USED (ha.m.)=.6565E+00

001:0007-----

SAVE HYD	AREA	(ha)=	26.170
ID=03 (000203)	QPEAK	(cms)=	1.832 (i)
DT= 5.00 PCYC=-1	TPEAK	(hrs)=	7.083
-----	VOLUME	(mm)=	65.142

Filename: D:\JUBILEE\02-035\SWMHYM~1\HYDIN-U.DAT
Comments: 1:100 INFLOW TO POND

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0008-----

SAVE HYD	AREA	(ha)=	26.170
ID=04 (000204)	QPEAK	(cms)=	.443 (i)
DT= 5.00 PCYC=-1	TPEAK	(hrs)=	8.500
-----	VOLUME	(mm)=	65.142

Filename: D:\JUBILEE\02-035\SWMHYM~1\HYDOUT-U.DAT
Comments: 1:100 OUTFLOW FROM POND

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0009-----

FINISH

WARNINGS / ERRORS / NOTES

Simulation ended on 2002-05-05 at 18:18:06
=====

3 POND SCENARIO

2 Metric units

```
*****
* Project Name: [CHESTERMERE]
* Chesser/Paxton
* Project Number: [02-035]
* Date : 03-24-2002
*****
```

```
START TZERO=[0.0], METOUT=[2], NSTORM=[0], NRUN=[0]
*%-----|-----
```

```
*
* 1:100 Chicago Design Storm
CHICAGO STORM IUNITS=[2], TD=[24] (hrs), TPRAT=[0.3], CSDT=[15.0] (min),
ICASEcs=[1],
A=[663.1], B=[1.87], and C=[0.712],
*%-----|-----
```

```
*
* Pre-development flow calculations
*
DESIGN NASHYD ID=[1], NHYD=[101], DT=[5.0]min, AREA=[48.59] (ha),
DWF=[0] (cms), CN/C=[65], TP=[0.54]hrs,
RAINFALL=[ , , , ] (mm/hr), END=-1
*%-----|-----
```

```
*
* Catchment Area to Pond
* Discharges through Minor System @ 70 L/s/ha
*
```

```
CALIB STANDHYD ID=[2], NHYD=[101], DT=[5.0] (min), AREA=[48.59] (ha),
XIMP=[0.50], TIMP=[0.50], DWF=[0] (cms), LOSS=[2],
SCS curve number CN=[72],
Pervious surfaces: IAper=[3.2] (mm), SLPP=[2.0] (%),
LGP=[50] (m), MNP=[0.25], SCP=[0] (min),
Impervious surfaces: IAimp=[1.6] (mm), SLPI=[2.0] (%),
LGI=[900] (m), MNI=[0.015], SCI=[0] (min)
RAINFALL=[ , , , ] (mm/hr), END=-1
*%-----|-----
```

```
COMPUTE DUALHYD IDin=[2], CINLET=[3.401] (cms), NINLET=[1],
MAJID=[9], MajNHYD=["SPILL"],
MINID=[3], MinNHYD=[203],
TMJSTO=[1500] (cu-m)
*%-----|-----
```

```
ROUTE RESERVOIR IDout=[4], NHYD=[204], IDin=[3],
RDT=[5.0] (min),
TABLE of ( OUTFLOW-STORAGE ) values
(cms) - (ha-m)
[ 0.0 , 0.0 ]
[0.201 , 0.1107]
[0.450 , 0.5787]
[0.780 , 1.2200]
[ -1 , -1 ]
IDovf=[ ], NHYDovf=[ ]
*%-----|-----
```

```
SAVE HYD ID=[3], # OF PCYCLES=[-1], ICASEsh=[-1]
HYD_FILENAME=["HYDIN-C.DAT"]
HYD_COMMENT=["1:100 INFLOW TO POND"]
*%-----|-----
```

```
SAVE HYD ID=[4], # OF PCYCLES=[-1], ICASEsh=[-1]
HYD_FILENAME=["HYDOUT-C.DAT"]
HYD_COMMENT=["1:100 OUTFLOW FROM POND"]
*%-----|-----
```

```
FINISH
```

```

=====
SSSSS W W M M H H Y Y M M OOO          999 999 =====
S      W W W MM MM H H Y Y MM MM O O      9 9 9 9
SSSSS W W W M M M HHHH Y M M M O O ##    9 9 9 9 Ver. 4.02
S      W W M M H H Y M M O O              9999 9999 July 1999
SSSSS W W M M H H Y M M OOO              9 9
                                           9 9 9 9 # 5170115
StormWater Management Hydrologic Model    999 999 =====

```

```

*****
***** SWMHYMO-99 Ver/4.02 *****
***** A single event and continuous hydrologic simulation model *****
***** based on the principles of HYMO and its successors *****
***** OTTHYMO-83 and OTTHYMO-89. *****
***** Distributed by: J.F. Sabourin and Associates Inc. *****
***** Ottawa, Ontario: (613) 727-5199 *****
***** Gatineau, Quebec: (819) 243-6858 *****
***** E-Mail: swmhymo@jfsa.Com *****
*****

```

```

+++++
+++++ Licensed user: Jubilee Engineering Consultants Ltd. +++++
+++++ Calgary SERIAL#:5170115 +++++
+++++

```

```

*****
***** +++++ PROGRAM ARRAY DIMENSIONS +++++ *****
***** Maximum value for ID numbers : 10 *****
***** Max. number of rainfall points: 15000 *****
***** Max. number of flow points : 15000 *****
*****

```

```

***** D E T A I L E D O U T P U T *****
*****
* DATE: 2002-05-05 TIME: 18:31:59 RUN COUNTER: 000093 *
*****
* Input filename: D:\JUBILEE\02-035\SWMHYM~1\CHESSER.DAT *
* Output filename: D:\JUBILEE\02-035\SWMHYM~1\CHESSER.out *
* Summary filename: D:\JUBILEE\02-035\SWMHYM~1\CHESSER.sum *
* User comments: *
* 1: *
* 2: *
* 3: *
*****

```

```

-----
001:0001-----
*****
* Project Name: [CHESTERMERE]
* Chesser/Paxton
* Project Number: [02-035]
* Date : 03-24-2002
*****

```

```

| START | Project dir.: D:\JUBILEE\02-035\SWMHYM~1\
----- Rainfall dir.: D:\JUBILEE\02-035\SWMHYM~1\
TZERO = .00 hrs on 0
METOUT= 2 (output = METRIC)
NRUN = 001
NSTORM= 0

```

*
* 1:100 Chicago Design Storm

| CHICAGO STORM |
Ptotal= 89.67 mm

IDF curve parameters: A= 663.100
B= 1.870
C= .712
used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 15.00 min
Time to peak ratio = .30

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.25	1.107	6.25	4.650	12.25	2.554	18.25	1.456
.50	1.136	6.50	5.831	12.50	2.467	18.50	1.433
.75	1.168	6.75	8.169	12.75	2.386	18.75	1.411
1.00	1.201	7.00	16.640	13.00	2.312	19.00	1.390
1.25	1.237	7.25	88.690	13.25	2.243	19.25	1.369
1.50	1.276	7.50	22.018	13.50	2.179	19.50	1.349
1.75	1.317	7.75	13.243	13.75	2.118	19.75	1.330
2.00	1.362	8.00	9.893	14.00	2.062	20.00	1.311
2.25	1.411	8.25	8.052	14.25	2.010	20.25	1.293
2.50	1.464	8.50	6.865	14.50	1.960	20.50	1.276
2.75	1.523	8.75	6.026	14.75	1.913	20.75	1.259
3.00	1.587	9.00	5.399	15.00	1.869	21.00	1.242
3.25	1.659	9.25	4.908	15.25	1.827	21.25	1.227
3.50	1.738	9.50	4.512	15.50	1.788	21.50	1.211
3.75	1.828	9.75	4.186	15.75	1.750	21.75	1.196
4.00	1.929	10.00	3.911	16.00	1.714	22.00	1.182
4.25	2.045	10.25	3.676	16.25	1.680	22.25	1.168
4.50	2.179	10.50	3.472	16.50	1.648	22.50	1.154
4.75	2.337	10.75	3.293	16.75	1.617	22.75	1.141
5.00	2.525	11.00	3.135	17.00	1.587	23.00	1.128
5.25	2.755	11.25	2.994	17.25	1.559	23.25	1.115
5.50	3.042	11.50	2.868	17.50	1.532	23.50	1.103
5.75	3.414	11.75	2.753	17.75	1.505	23.75	1.091
6.00	3.918	12.00	2.649	18.00	1.480	24.00	1.079

001:0003-----

*
* Pre-development flow calculations
*

| DESIGN NASHYD | Area (ha)= 48.59 Curve Number (CN)=65.00
| 01:000101 DT= 5.00 | Ia (mm)= 1.500 # of Linear Res. (N)= 3.00

U.H. Tp (hrs)= .540

Unit Hyd Qpeak (cms)= 3.437

PEAK FLOW (cms)= 1.404 (i)
TIME TO PEAK (hrs)= 7.750
RUNOFF VOLUME (mm)= 34.558
TOTAL RAINFALL (mm)= 89.666
RUNOFF COEFFICIENT = .385

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0004-----

*
* Catchment Area to Pond
* Discharges through Minor System @ 70 L/s/ha
*

```

-----
| CALIB STANDHYD | Area (ha)= 48.59
| 02:000101 DT= 5.00 | Total Imp(%)= 50.00 Dir. Conn.(%)= 50.00
-----

```

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	24.30	24.30	
Dep. Storage (mm)=	1.60	3.20	
Average Slope (%)=	2.00	2.00	
Length (m)=	900.00	50.00	
Mannings n =	.015	.250	
Max.eff.Inten.(mm/hr)=	88.69	25.06	
over (min)	10.00	25.00	
Storage Coeff. (min)=	8.87 (ii)	22.90 (ii)	
Unit Hyd. Tpeak (min)=	10.00	25.00	
Unit Hyd. peak (cms)=	.12	.05	
			TOTALS
PEAK FLOW (cms)=	4.66	1.09	5.168 (iii)
TIME TO PEAK (hrs)=	7.25	7.58	7.250
RUNOFF VOLUME (mm)=	88.07	40.36	64.213
TOTAL RAINFALL (mm)=	89.67	89.67	89.666
RUNOFF COEFFICIENT =	.98	.45	.716

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 72.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0005-----

```

-----
| COMPUTE DUALHYD | Average inlet capacities [CINLET] = 3.401 (cms)
| TotalHyd 02:000101 | Number of inlets in system [NINLET] = 1
-----
|                   | Total minor system capacity = 3.401 (cms)
|                   | Total major system storage [TMJSTO] = 1500.(cu.m.)
-----

```

	ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
TOTAL HYD.	02:000101	48.59	5.168	7.250	64.213	.000
MAJOR SYST	09:SPILL	.00	.000	.000	.000	.000
MINOR SYST	03:000203	48.59	3.401	7.167	64.784	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

Maximum MAJOR SYSTEM storage used = 1460.(cu.m.)

001:0006-----

```

-----
| ROUTE RESERVOIR | Requested routing time step = 5.0 min.
| IN>03:(000203) |
| OUT<04:(000204) |
-----

```

```

===== OUTFLOW STORAGE TABLE =====
OUTFLOW STORAGE | OUTFLOW STORAGE
(cms) (ha.m.) | (cms) (ha.m.)
.000 .0000E+00 | .450 .5787E+00
.201 .1107E+00 | .780 .1220E+01

```

ROUTING RESULTS	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW >03: (000203)	48.59	3.401	7.167	64.784
OUTFLOW<04: (000204)	48.59	.779	8.750	64.784

PEAK FLOW REDUCTION [Qout/Qin] (%)= 22.913

TIME SHIFT OF PEAK FLOW (min)= 95.00
MAXIMUM STORAGE USED (ha.m.)=.1219E+01

001:0007-----

SAVE HYD		AREA	(ha)=	48.590
ID=03 (000203)		QPEAK	(cms)=	3.401 (i)
DT= 5.00 PCYC=-1		TPEAK	(hrs)=	7.167
-----		VOLUME	(mm)=	64.784

Filename: D:\JUBILEE\02-035\SWMHYM~1\HYDIN-C.DAT
Comments: 1:100 INFLOW TO POND

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0008-----

SAVE HYD		AREA	(ha)=	48.590
ID=04 (000204)		QPEAK	(cms)=	.779 (i)
DT= 5.00 PCYC=-1		TPEAK	(hrs)=	8.750
-----		VOLUME	(mm)=	64.784

Filename: D:\JUBILEE\02-035\SWMHYM~1\HYDOUT-C.DAT
Comments: 1:100 OUTFLOW FROM POND

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0009-----

FINISH

WARNINGS / ERRORS / NOTES

Simulation ended on 2002-05-05 at 18:32:01

2 Metric units

* Project Name: [CHESTERMERE]
* Silvercreek & Chestermere Park Estates
* Project Number: [02-035]
* Date : 08-11-2002

START TZERO=[0.0], METOUT=[2], NSTORM=[0], NRUN=[0]

*%-----|-----

*

* 1:100 Chicago Design Storm
CHICAGO STORM IUNITS=[2], TD=[24] (hrs), TPRAT=[0.3], CSDT=[15.0] (min),
ICASEcs=[1],
A=[663.1], B=[1.87], and C=[0.712],

*%-----|-----

*

* Pre-development flow calculations

*

DESIGN NASHYD ID=[1], NHYD=[101], DT=[5.0]min, AREA=[59.33] (ha),
DWF=[0] (cms), CN/C=[65], TP=[1.20]hrs,
RAINFALL=[, , ,] (mm/hr), END=-1

*%-----|-----

*

* Catchment Area to Pond
* Discharges through Minor System @ 70 L/s/ha

*

CALIB STANDHYD ID=[2], NHYD=[102], DT=[5.0] (min), AREA=[59.33] (ha),
XIMP=[0.50], TIMP=[0.50], DWF=[0] (cms), LOSS=[2],
SCS curve number CN=[72],
Pervious surfaces: IAper=[3.2] (mm), SLPP=[2.0] (%),
LGP=[50] (m), MNP=[0.25], SCP=[0] (min),
Impervious surfaces: IAimp=[1.6] (mm), SLPI=[2.0] (%),
LGI=[1400] (m), MNI=[0.015], SCI=[0] (min)
RAINFALL=[, , ,] (mm/hr), END=-1

*%-----|-----

COMPUTE DUALHYD IDin=[2], CINLET=[4.153] (cms), NINLET=[1],
MAJID=[9], MajNHYD=["SPILL"],
MINID=[3], MinNHYD=[203],
TMJSTO=[1500] (cu-m)

*%-----|-----

ROUTE RESERVOIR IDout=[4], NHYD=[204], IDin=[3],
RDT=[5.0] (min),

TABLE of (OUTFLOW-STORAGE) values

Table with 2 columns: (cms) and (ha-m). Rows: [0.0, 0.0], [0.281, 0.1365], [0.629, 0.7102], [0.890, 1.4900], [-1, -1]

IDovf=[], NHYDovf=[]

*%-----|-----

SAVE HYD ID=[3], # OF PCYCLES=[-1], ICASEsh=[-1]
HYD_FILENAME=["HYDIN-P.DAT"]
HYD_COMMENT=["1:100 INFLOW TO POND"]

*%-----|-----

SAVE HYD ID=[4], # OF PCYCLES=[-1], ICASEsh=[-1]
HYD_FILENAME=["HYDOUT-P.DAT"]
HYD_COMMENT=["1:100 OUTFLOW FROM POND"]

*%-----|-----

FINISH

*
* 1:100 Chicago Design Storm

| CHICAGO STORM |
Ptotal= 89.67 mm

IDF curve parameters: A= 663.100
B= 1.870
C= .712
used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 15.00 min
Time to peak ratio = .30

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.25	1.107	6.25	4.650	12.25	2.554	18.25	1.456
.50	1.136	6.50	5.831	12.50	2.467	18.50	1.433
.75	1.168	6.75	8.169	12.75	2.386	18.75	1.411
1.00	1.201	7.00	16.640	13.00	2.312	19.00	1.390
1.25	1.237	7.25	88.690	13.25	2.243	19.25	1.369
1.50	1.276	7.50	22.018	13.50	2.179	19.50	1.349
1.75	1.317	7.75	13.243	13.75	2.118	19.75	1.330
2.00	1.362	8.00	9.893	14.00	2.062	20.00	1.311
2.25	1.411	8.25	8.052	14.25	2.010	20.25	1.293
2.50	1.464	8.50	6.865	14.50	1.960	20.50	1.276
2.75	1.523	8.75	6.026	14.75	1.913	20.75	1.259
3.00	1.587	9.00	5.399	15.00	1.869	21.00	1.242
3.25	1.659	9.25	4.908	15.25	1.827	21.25	1.227
3.50	1.738	9.50	4.512	15.50	1.788	21.50	1.211
3.75	1.828	9.75	4.186	15.75	1.750	21.75	1.196
4.00	1.929	10.00	3.911	16.00	1.714	22.00	1.182
4.25	2.045	10.25	3.676	16.25	1.680	22.25	1.168
4.50	2.179	10.50	3.472	16.50	1.648	22.50	1.154
4.75	2.337	10.75	3.293	16.75	1.617	22.75	1.141
5.00	2.525	11.00	3.135	17.00	1.587	23.00	1.128
5.25	2.755	11.25	2.994	17.25	1.559	23.25	1.115
5.50	3.042	11.50	2.868	17.50	1.532	23.50	1.103
5.75	3.414	11.75	2.753	17.75	1.505	23.75	1.091
6.00	3.918	12.00	2.649	18.00	1.480	24.00	1.079

001:0003-----

*
* Pre-development flow calculations
*

| DESIGN NASHYD | Area (ha)= 59.33 Curve Number (CN)=65.00
| 01:000101 DT= 5.00 | Ia (mm)= 1.500 # of Linear Res.(N)= 3.00

U.H. Tp(hrs)= 1.200

Unit Hyd Qpeak (cms)= 1.888

PEAK FLOW (cms)= 1.010 (i)
TIME TO PEAK (hrs)= 8.667
RUNOFF VOLUME (mm)= 34.558
TOTAL RAINFALL (mm)= 89.666
RUNOFF COEFFICIENT = .385

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0004-----

*
* Catchment Area to Pond
* Discharges through Minor System @ 70 L/s/ha
*

```

-----
| CALIB STANDHYD      | Area      (ha)= 59.33
| 02:000102 DT= 5.00 | Total Imp(%)= 50.00 Dir. Conn.(%)= 50.00
-----

```

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	29.67	29.67	
Dep. Storage (mm)=	1.60	3.20	
Average Slope (%)=	2.00	2.00	
Length (m)=	1400.00	50.00	
Mannings n =	.015	.250	
Max.eff.Inten.(mm/hr)=	88.69	25.06	
over (min)	10.00	25.00	
Storage Coeff. (min)=	11.56 (ii)	25.59 (ii)	
Unit Hyd. Tpeak (min)=	10.00	25.00	
Unit Hyd. peak (cms)=	.10	.04	
			TOTALS
PEAK FLOW (cms)=	5.11	1.26	5.875 (iii)
TIME TO PEAK (hrs)=	7.25	7.58	7.333
RUNOFF VOLUME (mm)=	88.07	40.36	64.213
TOTAL RAINFALL (mm)=	89.67	89.67	89.666
RUNOFF COEFFICIENT =	.98	.45	.716

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 72.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0005-----

```

-----
| COMPUTE DUALHYD    | Average inlet capacities [CINLET] = 4.153 (cms)
| TotalHyd 02:000102 | Number of inlets in system [NINLET] = 1
-----
|                     | Total minor system capacity = 4.153 (cms)
|                     | Total major system storage [TMJSTO] = 1500.(cu.m.)
-----

```

	ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
TOTAL HYD.	02:000102	59.33	5.875	7.333	64.213	.000
MAJOR SYST	09:SPILL	.00	.000	.000	.000	.000
MINOR SYST	03:000203	59.33	4.153	7.167	65.080	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

Maximum MAJOR SYSTEM storage used = 1336.(cu.m.)

001:0006-----

```

-----
| ROUTE RESERVOIR   | Requested routing time step = 5.0 min.
| IN>03:(000203)    |
| OUT<04:(000204)   |
-----
|                     | ===== OUTFLOW STORAGE TABLE =====
|                     | OUTFLOW STORAGE | OUTFLOW STORAGE
|                     | (cms) (ha.m.) | (cms) (ha.m.)
|                     | .000 .0000E+00 | .629 .7102E+00
|                     | .281 .1365E+00 | .890 .1490E+01
-----

```

ROUTING RESULTS	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW >03: (000203)	59.33	4.153	7.167	65.080
OUTFLOW <04: (000204)	59.33	.890	8.917	65.080

PEAK FLOW REDUCTION [Qout/Qin] (%) = 21.422

TIME SHIFT OF PEAK FLOW (min)= 105.00
MAXIMUM STORAGE USED (ha.m.)=.1489E+01

001:0007-----

SAVE HYD	AREA	(ha)=	59.330
ID=03 (000203)	QPEAK	(cms)=	4.153 (i)
DT= 5.00 PCYC=-1	TPEAK	(hrs)=	7.167
	VOLUME	(mm)=	65.080

Filename: d:\JUBILEE\02-035\SWMHYM~1\QUALITY\HYDIN-P.DAT
Comments: 1:100 INFLOW TO POND

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0008-----

SAVE HYD	AREA	(ha)=	59.330
ID=04 (000204)	QPEAK	(cms)=	.890 (i)
DT= 5.00 PCYC=-1	TPEAK	(hrs)=	8.917
	VOLUME	(mm)=	65.080

Filename: d:\JUBILEE\02-035\SWMHYM~1\QUALITY\HYDOUT-P.DAT
Comments: 1:100 OUTFLOW FROM POND

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0009-----

FINISH

WARNINGS / ERRORS / NOTES

Simulation ended on 2002-08-11 at 20:28:44

2 POND SCENARIO

2 Metric units

* Project Name: [CHESTERMERE]
Silvercreek, Chestermere Park Estates & Urbco
* Project Number: [02-035]
* Date : 08-11-2002

START TZERO=[0.0], METOUT=[2], NSTORM=[0], NRUN=[0]

*%-----|-----

* 1:100 Chicago Design Storm
CHICAGO STORM IUNITS=[2], TD=[24] (hrs), TPRAT=[0.3], CSDT=[15.0] (min),
ICASEcs=[1],
A=[663.1], B=[1.87], and C=[0.712],

*%-----|-----

* Pre-development flow calculations

DESIGN NASHYD ID=[1], NHYD=[101], DT=[5.0]min, AREA=[85.50] (ha),
DWF=[0] (cms), CN/C=[65], TP=[1.67]hrs,
RAINFALL=[, , ,] (mm/hr), END=-1

*%-----|-----

* Catchment Area to Pond
* Discharges through Minor System @ 70 L/s/ha

CALIB STANDHYD ID=[2], NHYD=[101], DT=[5.0] (min), AREA=[85.50] (ha),
XIMP=[0.50], TIMP=[0.50], DWF=[0] (cms), LOSS=[2],
SCS curve number CN=[72],
Pervious surfaces: IAper=[3.2] (mm), SLPP=[2.0] (%),
LGP=[50] (m), MNP=[0.25], SCP=[0] (min),
Impervious surfaces: IAimp=[1.6] (mm), SLPI=[2.0] (%),
LGI=[1900] (m), MNI=[0.015], SCI=[0] (min)
RAINFALL=[, , ,] (mm/hr), END=-1

*%-----|-----

COMPUTE DUALHYD IDin=[2], CINLET=[5.985] (cms), NINLET=[1],
MAJID=[9], MajNHYD=["SPILL"],
MINID=[3], MinNHYD=[203],
TMJSTO=[1500] (cu-m)

*%-----|-----

ROUTE RESERVOIR IDout=[4], NHYD=[204], IDin=[3],
RDT=[5.0] (min),

TABLE of (OUTFLOW-STORAGE) values

Table with 2 columns: (cms) and (ha-m). Rows: [0.0 , 0.0], [0.368 , 0.2067], [0.824 , 1.0675], [1.165 , 2.2200], [-1 , -1]

IDovf=[], NHYDovf=[]

*%-----|-----

SAVE HYD ID=[3], # OF PCYCLES=[-1], ICASEsh=[-1]
HYD_FILENAME=["HYDIN-U.DAT"]
HYD_COMMENT=["1:100 INFLOW TO POND"]

*%-----|-----

SAVE HYD ID=[4], # OF PCYCLES=[-1], ICASEsh=[-1]
HYD_FILENAME=["HYDOUT-U.DAT"]
HYD_COMMENT=["1:100 OUTFLOW FROM POND"]

*%-----|-----

FINISH

```

SSSSS W W M M H H Y Y M M OOO          999 999 =====
S      W W W MM MM H H Y Y MM MM O O      9 9 9 9
SSSSS W W W M M M HHHH Y M M M O O ##    9 9 9 9 Ver. 4.02
      S W W M M H H Y M M O O          9999 9999 July 1999
SSSSS W W M M H H Y M M OOO          9 9 =====
                                           9 9 9 9 # 5170115
StormWater Management Hydrologic Model    999 999 =====

```

```

*****
***** SWMHYMO-99 Ver/4.02 *****
***** A single event and continuous hydrologic simulation model *****
***** based on the principles of HYMO and its successors *****
***** OTTHYMO-83 and OTTHYMO-89. *****
***** Distributed by: J.F. Sabourin and Associates Inc. *****
***** Ottawa, Ontario: (613) 727-5199 *****
***** Gatineau, Quebec: (819) 243-6858 *****
***** E-Mail: swmhymo@jfsa.Com *****
*****

```

```

+++++++
+++++++ Licensed user: Jubilee Engineering Consultants Ltd. ++++++
+++++++ Calgary SERIAL#:5170115 ++++++
+++++++

```

```

*****
***** ++++++ PROGRAM ARRAY DIMENSIONS ++++++ *****
***** Maximum value for ID numbers : 10 *****
***** Max. number of rainfall points: 15000 *****
***** Max. number of flow points : 15000 *****
*****

```

```

***** D E T A I L E D O U T P U T *****
*****
* DATE: 2002-08-11 TIME: 20:33:42 RUN COUNTER: 000140 *
*****
* Input filename: d:\JUBILEE\02-035\SWMHYM~3\QUANTITY\2PURBCO.DAT *
* Output filename: d:\JUBILEE\02-035\SWMHYM~3\QUANTITY\2PURBCO.out *
* Summary filename: d:\JUBILEE\02-035\SWMHYM~3\QUANTITY\2PURBCO.sum *
* User comments: *
* 1: _____ *
* 2: _____ *
* 3: _____ *
*****

```

```

-----
001:0001-----
*****
* Project Name: [CHESTERMERE]
* Silvercreek, Chestermere Park Estates & Urbco
* Project Number: [02-035]
* Date : 08-11-2002
*****

```

```

-----
| START | Project dir.: d:\JUBILEE\02-035\SWMHYM~3\QUANTITY\
----- Rainfall dir.: d:\JUBILEE\02-035\SWMHYM~3\QUANTITY\
TZERO = .00 hrs on 0
METOUT= 2 (output = METRIC)
NRUN = 001
NSTORM= 0
-----

```

001:0002-----

*
* 1:100 Chicago Design Storm

| CHICAGO STORM |
Ptotal= 89.67 mm

IDF curve parameters: A= 663.100
B= 1.870
C= .712

used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 15.00 min
Time to peak ratio = .30

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.25	1.107	6.25	4.650	12.25	2.554	18.25	1.456
.50	1.136	6.50	5.831	12.50	2.467	18.50	1.433
.75	1.168	6.75	8.169	12.75	2.386	18.75	1.411
1.00	1.201	7.00	16.640	13.00	2.312	19.00	1.390
1.25	1.237	7.25	88.690	13.25	2.243	19.25	1.369
1.50	1.276	7.50	22.018	13.50	2.179	19.50	1.349
1.75	1.317	7.75	13.243	13.75	2.118	19.75	1.330
2.00	1.362	8.00	9.893	14.00	2.062	20.00	1.311
2.25	1.411	8.25	8.052	14.25	2.010	20.25	1.293
2.50	1.464	8.50	6.865	14.50	1.960	20.50	1.276
2.75	1.523	8.75	6.026	14.75	1.913	20.75	1.259
3.00	1.587	9.00	5.399	15.00	1.869	21.00	1.242
3.25	1.659	9.25	4.908	15.25	1.827	21.25	1.227
3.50	1.738	9.50	4.512	15.50	1.788	21.50	1.211
3.75	1.828	9.75	4.186	15.75	1.750	21.75	1.196
4.00	1.929	10.00	3.911	16.00	1.714	22.00	1.182
4.25	2.045	10.25	3.676	16.25	1.680	22.25	1.168
4.50	2.179	10.50	3.472	16.50	1.648	22.50	1.154
4.75	2.337	10.75	3.293	16.75	1.617	22.75	1.141
5.00	2.525	11.00	3.135	17.00	1.587	23.00	1.128
5.25	2.755	11.25	2.994	17.25	1.559	23.25	1.115
5.50	3.042	11.50	2.868	17.50	1.532	23.50	1.103
5.75	3.414	11.75	2.753	17.75	1.505	23.75	1.091
6.00	3.918	12.00	2.649	18.00	1.480	24.00	1.079

001:0003-----

*
* Pre-development flow calculations
*

| DESIGN NASHYD |
01:000101 DT= 5.00

Area (ha)= 85.50 Curve Number (CN)=65.00
Ia (mm)= 1.500 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 1.670

Unit Hyd Qpeak (cms)= 1.955

PEAK FLOW (cms)= 1.165 (i)
TIME TO PEAK (hrs)= 9.333
RUNOFF VOLUME (mm)= 34.558
TOTAL RAINFALL (mm)= 89.666
RUNOFF COEFFICIENT = .385

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0004-----

*
* Catchment Area to Pond
* Discharges through Minor System @ 70 L/s/ha
*

```

-----
| CALIB STANDHYD | Area (ha)= 85.50
| 02:000101 DT= 5.00 | Total Imp(%)= 50.00 Dir. Conn.(%)= 50.00
-----

```

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	42.75	42.75	
Dep. Storage (mm)=	1.60	3.20	
Average Slope (%)=	2.00	2.00	
Length (m)=	1900.00	50.00	
Mannings n =	.015	.250	
Max. eff. Inten. (mm/hr)=	88.69	22.79	
over (min)	15.00	30.00	
Storage Coeff. (min)=	13.88 (ii)	28.46 (ii)	
Unit Hyd. Tpeak (min)=	15.00	30.00	
Unit Hyd. peak (cms)=	.08	.04	
			TOTALS
PEAK FLOW (cms)=	6.58	1.69	7.548 (iii)
TIME TO PEAK (hrs)=	7.33	7.67	7.417
RUNOFF VOLUME (mm)=	88.06	40.36	64.213
TOTAL RAINFALL (mm)=	89.67	89.67	89.666
RUNOFF COEFFICIENT =	.98	.45	.716

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 72.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0005-----

```

-----
| COMPUTE DUALHYD | Average inlet capacities [CINLET] = 5.985 (cms)
| TotalHyd 02:000101 | Number of inlets in system [NINLET] = 1
-----
| | Total minor system capacity = 5.985 (cms)
| | Total major system storage [TMJSTO] = 1500.(cu.m.)
-----

```

	ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
TOTAL HYD.	02:000101	85.50	7.548	7.417	64.213	.000
MAJOR SYST	09:SPILL	.00	.000	.000	.000	.000
MINOR SYST	03:000203	85.50	5.985	7.250	64.963	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

Maximum MAJOR SYSTEM storage used = 1263.(cu.m.)

001:0006-----

```

-----
| ROUTE RESERVOIR | Requested routing time step = 5.0 min.
| IN>03:(000203) |
| OUT<04:(000204) |
-----
| | ===== OUTFLOW STORAGE TABLE =====
| | OUTFLOW STORAGE | OUTFLOW STORAGE
| | (cms) (ha.m.) | (cms) (ha.m.)
| | .000 .0000E+00 | .824 .1067E+01
| | .368 .2067E+00 | 1.165 .2220E+01
-----

```

ROUTING RESULTS	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW >03: (000203)	85.50	5.985	7.250	64.963
OUTFLOW <04: (000204)	85.50	1.165	9.167	64.963

PEAK FLOW REDUCTION [Qout/Qin] (%) = 19.462

TIME SHIFT OF PEAK FLOW (min)= 115.00
MAXIMUM STORAGE USED (ha.m.)=.2220E+01

001:0007-----

| SAVE HYD | AREA (ha)= 85.500
| ID=03 (000203) | QPEAK (cms)= 5.985 (i)
| DT= 5.00 PCYC=-1 | TPEAK (hrs)= 7.250

VOLUME (mm)= 64.963

Filename: d:\JUBILEE\02-035\SWMHYM~3\QUANTITY\HYDIN-U.DAT
Comments: 1:100 INFLOW TO POND

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0008-----

| SAVE HYD | AREA (ha)= 85.500
| ID=04 (000204) | QPEAK (cms)= 1.165 (i)
| DT= 5.00 PCYC=-1 | TPEAK (hrs)= 9.167

VOLUME (mm)= 64.963

Filename: d:\JUBILEE\02-035\SWMHYM~3\QUANTITY\HYDOUT-U.DAT
Comments: 1:100 OUTFLOW FROM POND

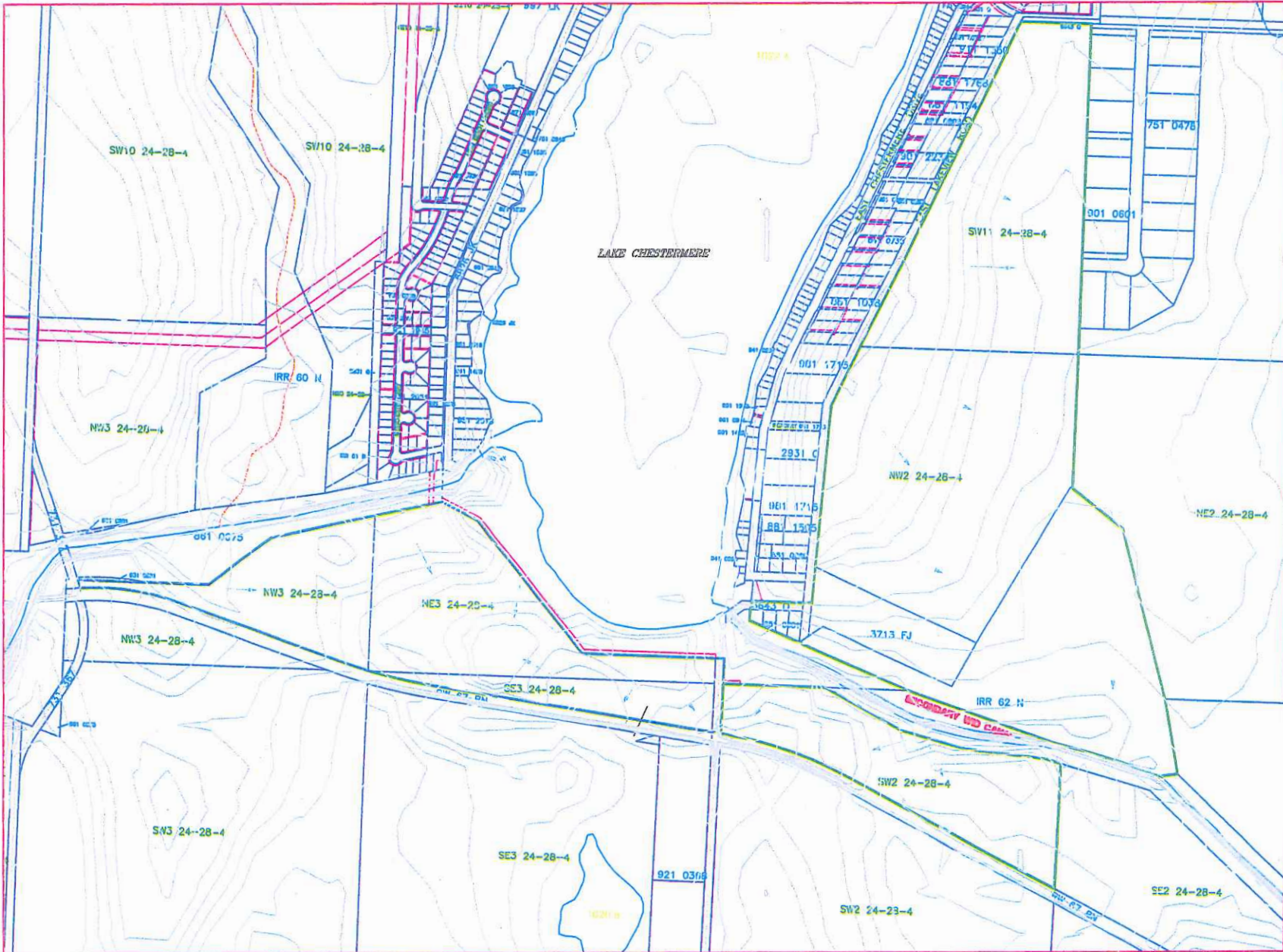
(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0009-----

FINISH

WARNINGS / ERRORS / NOTES




Simulation ended on 2002-08-11 at 20:33:44
=====



NOTES

Blank area for notes.

LEGEND

-  STUDY AREA
-  EXISTING DRAINAGE DIRECTION
-  EXISTING CONTOURS

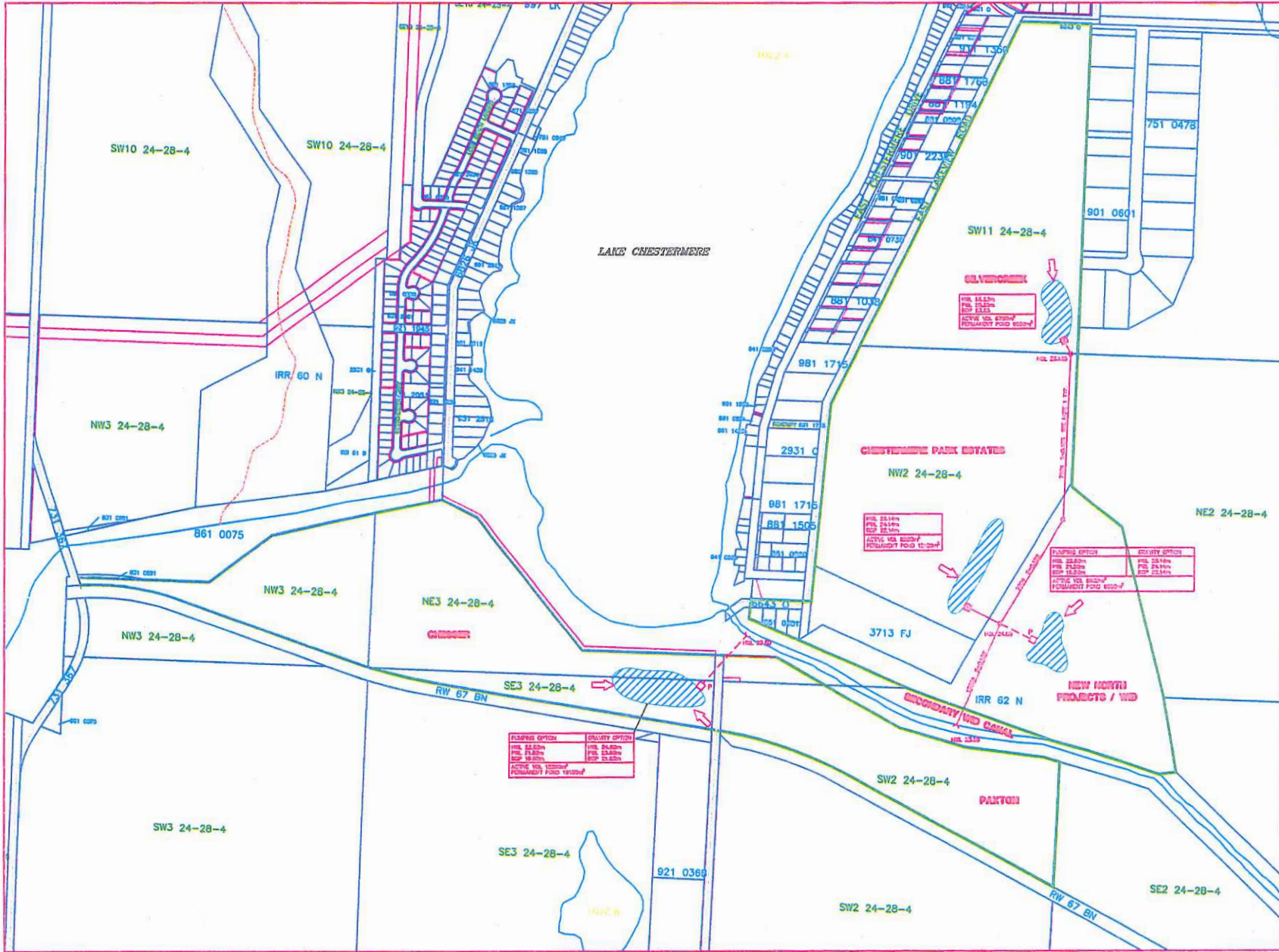
NO.	DATE	DESCRIPTION	BY
1		PRELIMINARY APPROVAL	
2		PERMITS	
3		FOR TENDERS	
4		AS-BUILT	

PERMIT TO PRACTICE
 CIVIL ENGINEERING CONSULTANTS LTD.
 Signature: _____
 Date: _____
 PERMIT NUMBER: P 2550
 The Association of Professional Engineers, Geologists and Geophysicists of Alberta



NEW NORTH PROJECTS LTD.
 PRELIMINARY STORE WATER
 MANAGEMENT STUDY
 EXISTING CONTOURS
 AND DRAINAGE


JAMES HENDERSON CONSULTANTS LTD.
 14000
 JOB NUMBER: 02-018
 DRAWING NUMBER: FIG-3



NOTES

1. No exception permitted to the treated storm water used.

LEGEND

- STUDY AREA
- WET POND
- STORM SYSTEM FLOW DIRECTION
- FORCE MAIN
- TRUNK MAIN
- OUTLET STRUCTURE WITH POSSIBLE PUMPED FACILITY
- OUTLET STRUCTURE

1.1			
1.2			
1.3			
1.4			
1.5			
1.6			
1.7			
1.8			
1.9			
1.10			
1.11			
1.12			
1.13			
1.14			
1.15			
1.16			
1.17			
1.18			
1.19			
1.20			

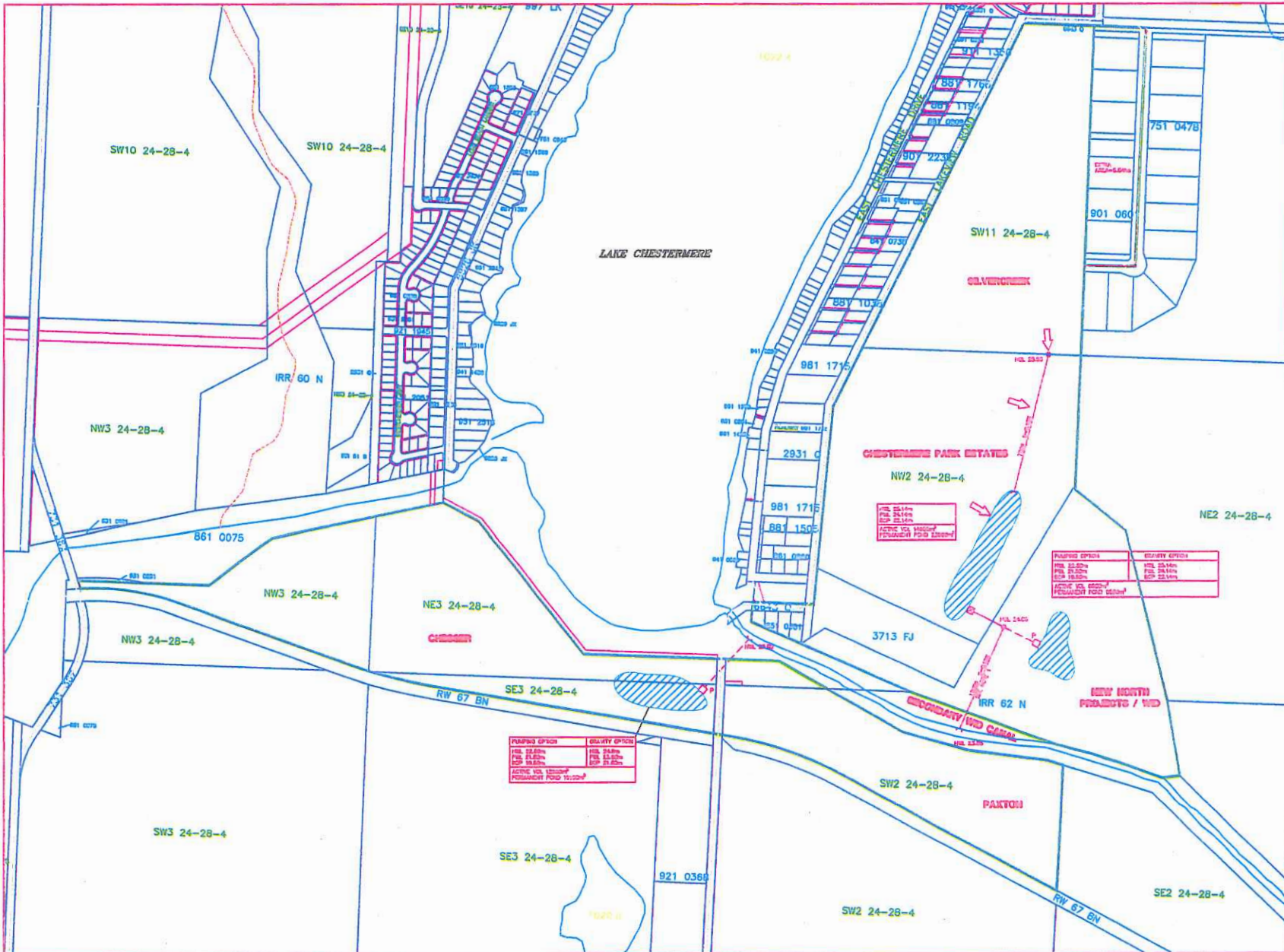
PROJECT

PERMIT TO PRACTICE
ALBERTA ENGINEERING CONTRACTORS INC.
 Signature: _____
PERMIT NUMBER: P-3320
 for the Province of Alberta, Canada and Dependencies of Alberta

CLIENT
NEW NORTH PROJECTS LTD.

DATE
NEW NORTH PROJECTS LTD.
EAST CHESTERMERE LAKE
PRELIMINARY STORM WATER
MANAGEMENT STUDY
4 POND SCENARIO

DESIGNED BY: JAC	DATE: 11/05/2010
CHECKED BY: JAC	DATE: 11/05/2010
DRAWN BY: JAC	DATE: 11/05/2010
SCALE: AS SHOWN	
JOB NUMBER: 10-010	
CD-010	
OPENED DRAWING: 11/05/2010	
FIG-4	



NOTES
1. No excavation permitted to the treated storm water tank.

LEGEND

- STUDY AREA
- WET POND
- MAIN SYSTEM FLOW DIRECTION
- FORCE MAIN
- TRUNK MAIN
- OUTLET STRUCTURE WITH POSSIBLE PUMPING FACILITY
- OUTLET STRUCTURE

1.1	DATE	DESCRIPTION	BY
1.2			
1.3			
1.4			
1.5			
1.6			
1.7			
1.8			
1.9			
1.10			

- 1.10 PRELIMINARY APPROVAL
- 1.11 CIVILIAN CIVILIAN
- 1.12 DATE APP.

PERMIT TO PRACTICE
AS A REGISTERED ENGINEER IN THE
PROFESSION OF CIVIL ENGINEERING
IN THE PROVINCE OF ONTARIO
REGISTERED PROFESSIONAL ENGINEER
No. 12345
PERMIT NUMBER: P-12345
The Association of Professional Engineers,
Geologists and Geophysicists of Ontario

CLIENT: NEW NORTH PROJECTS LTD.
PROJECT: EAST CHESTERMERE LAKE
PRELIMINARY STORM WATER
MANAGEMENT STUDY
3 POND SCENARIO

DESIGNED BY: S.H.C.
DRAWN BY: R.S.
CHECKED BY: J.L.L.
DATE: 10/20/20
SCALE: AS SHOWN
JOB NUMBER: 08-020
DRAWING NUMBER: FIG-5

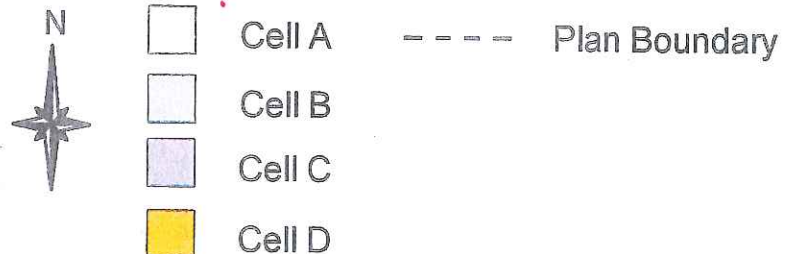
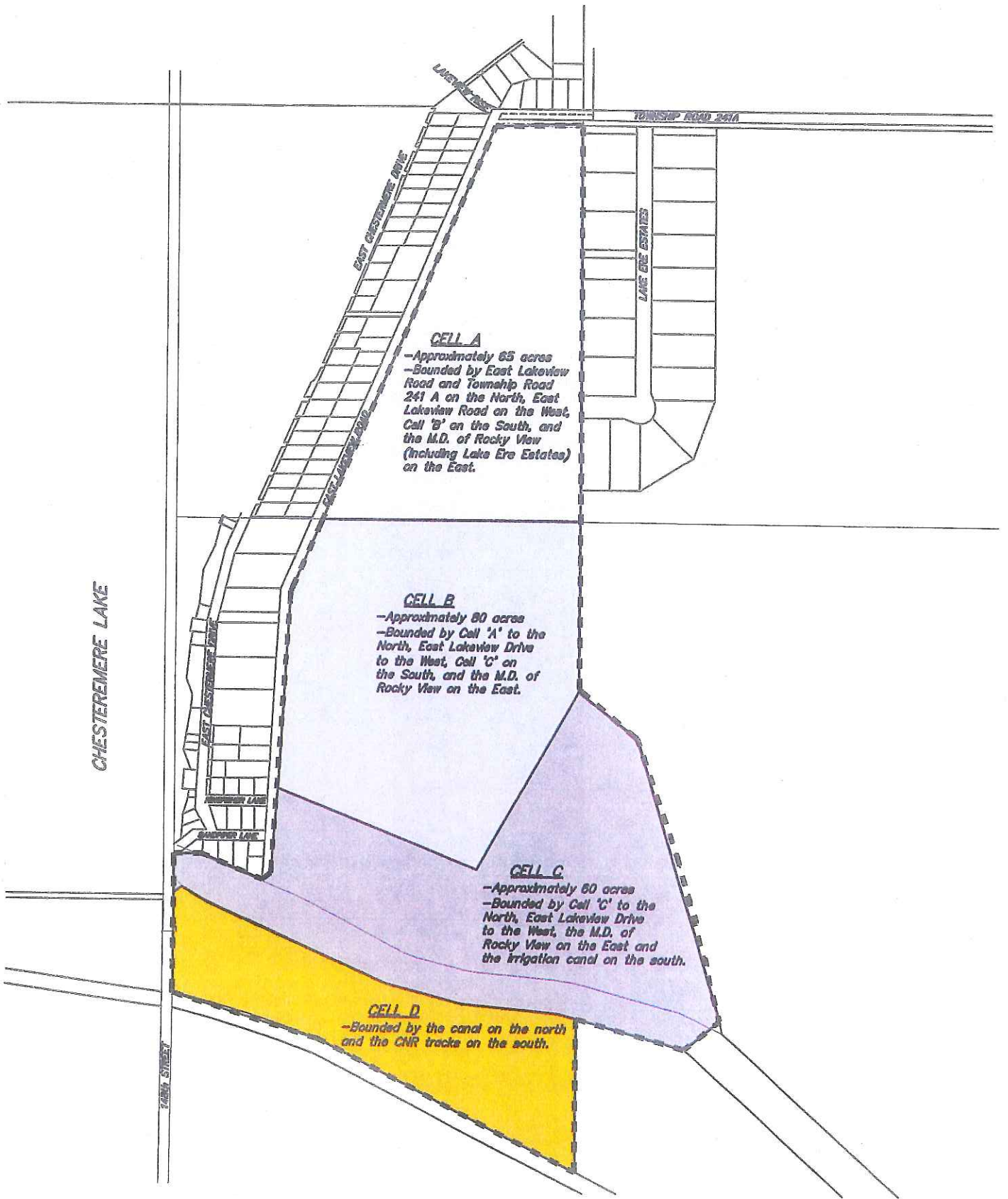
Appendix 4

Land Ownership

South East Chestermere
Area Structure Plan

LAND OWNERSHIP (MAY 2005)

Cell	Owner	Legal	Area (±)
A	Chestermere Lake Development Corp.	Ptn. SW ¼ 11-24-28 W4M	26.30 ha (64.98 ac.)
B	Chestermere Lake Development Corp.	Ptn. NW ¼ 2-24-28 W4M	33.17 ha. (81.98 ac.)
B	Chestermere Lake Development Corp.	Ptn. NW ¼ 2-24-28 W4M	0.809 ha. (2.00 ac.)
C	Western Irrigation District	Parcel A, Plan 3713 FJ	4.60 ha. (11.37 ac.)
C	Western Irrigation District	Plan IRR 62	21.34 ha (52.74 ac.)
D	BaBlake Ltd.	Ptn. SW ¼ 2-24-28 W4M	16.19 ha. (40 ac.)
TOTAL			102.41 ha. (253.07 ac.)



SOUTHEAST CHESTERMERE
 AREA STRUCTURE PLAN
 Town of Chestermere
 MAY 2005

*Note: Conceptual Drawing; not to scale

CELL BOUNDARIES

Appendix 5

Examples of possible multi-family development

South East Chestermere
Area Structure Plan
September 2005





