Stantec

City of Grande Prairie
84 Street Functional Planning Study

Functional Planning Report

December 13, 2012

Executive Summary

The City of Grande Prairie retained Stantec Consulting Ltd. (Stantec) to complete a Functional Planning Study for 84 Street from 68 Avenue to 132 Avenue, which has a total length of approximately 6.4 kilometres. 84 Street is an important component of the City's long term arterial road network. Ultimately, it will function as the primary northbound/southbound traffic corridor on the east side of the City and provide direct connections to 116 Avenue and 132 Avenue to complete the arterial road network "grid". This Study sets forth a basis for future detailed design and construction staging to the ultimate build-out of the roadway that is projected to occur beyond the 90,000 population horizon. The objectives of this Study included, but were not limited to assessing and modeling existing and future traffic volumes, completing geometric roadway assessments, reviewing existing and future land use plans, determining future deep and franchise utility considerations, determining future right-of-way and land acquisition requirements, presenting and gathering feedback from relevant stakeholders and the general public, and preparing order of magnitude opinions of probable costs.

The existing 84 Street roadway is a 9.5 metre wide paved rural roadway extending from 68 Avenue to 100 Avenue. No roadway exists between 100 Avenue and 132 Avenue. There is an existing Aquatera 300mm sanitary force main that runs along 84 Street and Aquatera water main crossings at the intersections at 68 Avenue and 100 Avenue. ATCO Electric, ATCO Gas, and TELUS all have utilities that run along the 84 Street corridor. The existing ATCO Electric 44kV overhead transmission line is considered too substantial to relocate or bury and as such, 84 Street will be required to be designed around ATCO Electric's right-of-way. Figures 2.1 through 2.8 illustrate the existing roadway conditions and utility alignments.

As part of this study the future land uses outlined in the Municipal Development Plan, Intermunicipal development Plan, Northeast Area Structure Plan, Southeast Area Structure Plan, and outline plans for future developments adjacent to 84 Street were reviewed and incorporated into the plans. The land adjacent to 84 Street is primarily designated for low density residential development, but there are also adjacent medium density residential and commercial parcels that are planned. Figures 3.1 and 3.2 illustrate the proposed future land use concept.

The design criteria for this project was based on the *City of Grande Prairie Standard Guidelines for Design and Development of Municipal Improvements* and supplemented with Transportation Association of Canada (TAC) standards. The 84 Street roadway will ultimately be an urban arterial divided roadway with a design speed of 80 km/h (posted speed limit of 70km/h). Roadway classifications, intersection spacing, traffic volumes, horizontal and vertical alignments, design vehicles, cross-section elements, and access management criteria were assessed and are described in detail in Section 4 of this report.

Traffic analyses were completed for the five arterial roadway intersections along 84 Street, including 68 Avenue, 84 Avenue, 100 Avenue, 116 Avenue, and 132 Avenue. The ultimate buildout of development along 84 Street will occur beyond the 90,000 population horizon utilized in the *City of Grande Prairie Transportation Master Plan.* In coordination with the City, Stantec generated traffic volumes for the intersection analyses based on land use assumptions and in conjunction with trip distributions based on the *Institute of Traffic Engineers' Trip Generation Manual.* Synchro 8 and Sim Traffic 8 software was used to assess the capacity and queuing of the intersections as well as the Volume to Capacity (V/C) ratio and Levels of Service (LOS). A V/C ratio of 0.90 or less and a LOS 'E' are considered acceptable for long-term horizons. The results of the traffic modeling were considered acceptable in general, but with some of the turning movements projected to be between 0.90 and 1.01 at the 132 Avenue and 100 Avenue intersections. The traffic modeling assumptions were generally conservative, but the analyses should be updated as required in the future to incorporate actual development trends and updates to the Transportation Master Plan.

A high level review of the long term water, sanitary sewer, and storm drainage systems was completed. In general, it is preferred that the major water and sanitary sewer lines run within adjacent developments rather than along arterial roadways to prevent major traffic disruptions that would be necessary in the events of future maintenance and/or repairs. Should water and sanitary lines be required within the 84 Street corridor, they would ideally be constructed within the future ultimate northbound lanes. The storm sewer should be constructed in the future ultimate southbound lanes due to phasing and urbanization considerations.

The 84 Street corridor lays within three drainage basins and will ultimately be constructed adjacent to five stormwater management facilities (SWMF's). The storm sewer along 84 Street will primarily accommodate runoff generated within the road corridor only and will discharge into the SWMF's within the adjacent developments. Storm sewer crossings will be required to accommodate the SWMF outlets in accordance with the requirements of the major drainage system. A large storm sewer will be required along 84 Street to connect the future West Carriage Lane SWMF to the future SWMF in NE19 71-5-6.

Functional Planning drawings were prepared to illustrate the short and long term roadway configurations of 84 Street. The drawings package includes cross-sections, horizontal and vertical geometrics, detailed intersection geometrics for the five arterial roadway intersections, and a conceptual phasing strategy.

The first phase of the 84 Street project will be the construction of the new 84 Street roadway connecting 100 Avenue to 132 Avenue. In the short term, the connection will be a two lane undivided roadway, but ultimately, first phase will become incorporated into the future northbound lanes when 84 Street is upgraded to a divided roadway. Given that the ultimate buildout of 84 Street will occur beyond the horizons in the Transportation Master Plan, the detailed phasing of 84 Street should be reassessed and refined in future updates to the Transportation Master Plan and other reports.

The ultimate 84 Street roadway will require approximately 17.8 Hectares of land acquisition to accommodate the right-of-way requirements. Details of the land acquisition requirements for each land parcel are summarized in the Land Acquisition drawings summarized in a table in Section 8 of this report.

ParklandGEO, Stantec's geotechnical subconsultant for this project, completed a Desktop Geotechnical Investigation that provides high level recommendations in regards to the anticipated soils and groundwater conditions and typical construction considerations. The investigation was based on available information including, but not limited to, historical geotechnical data, aerial photography, water well records, and an on-site assessment. A detailed geotechnical drilling program should be completed prior to or as part of the detailed design of future 84 Street upgrades.

As part of this project, two public open houses were facilitated to present the functional plans to stakeholders and members of the public. Both open houses were arranged in two stages – the first stage for internal stakeholders only, including City Departments and utility companies, and the second stage for both internal and external stakeholders. Comment forms and attendance lists were utilized to formally document all comments and feedback received as part of the consultation process.

Order of magnitude opinions of probable costs were developed for the interim rural road connection from 100 Avenue to 132 Avenue as well as the ultimate urban divided roadway upgrades. The opinions of probable costs were based on current industry construction pricing and estimated quantities for the configurations shown in the Functional Planning Drawings and as detailed in Appendix E. The associated costs include a 30% allowance for contingency and professional services. The initial connection from 100 Avenue to 132 Avenue is approximately $5.7M. The long term future urbanization and dividing of 84 Street from 68 Avenue to 100 Avenue is approximately $26.6M. The costs should be updated in the future, as required, to incorporate phasing considerations and pricing trends.

Table of Contents

LIST OF FIGURES

LIST OF TABLES

1.0 Introduction

The City of Grande Prairie retained the services of Stantec Consulting Ltd to complete a functional design review of 84 Street from 68 Avenue to 132 Avenue. This design review will set forth a basis for future detailed design and construction staging of 84 Street. The first two lanes, extending from 100 Avenue to 132 Avenue, are included in the City's 5 Year Capital Plan and the remaining upgrades will be completed in the future when traffic volumes warrant the roadway improvements.

The purpose of this review is to develop a plan that addresses the short term issues of the roadway while taking into consideration that 84 Street will ultimately function as the major north/south arterial roadway corridor on the east side of Grande Prairie.

1.1 BACKGROUND

Over the last decade, The City of Grande Prairie has experienced rapid population growth due to the strong economic conditions encountered throughout Alberta. The City's population is projected to continue to grow at an aggressive pace for the next several decades. Land development and upgrades to the City's existing infrastructure will be required to accommodate the future population.

Much of the City's future residential development expansion is projected to take place on the east side of the City along the 84 Street corridor. As described in Section 3, there are numerous outline plans already in place for future land development adjacent to 84 Street and beyond. Currently, those plans do not take into full consideration the ultimate four-lane build-out of the roadway.

1.2 PROJECT AREA

This preliminary design includes the entire length of 84 Street extending from 68 Avenue to 132 Avenue. Figure 1.1, included at the end of this section, illustrates the project area, which is highlighted by the orange line.

1.3 RELEVANT STUDIES COMPLETED PREVIOUSLY

In order to familiarize ourselves with the project, Stantec has reviewed the following:

- Existing legal and right of way plans;
- Engineering record drawings of existing infrastructure;

- City of Grande Prairie Construction Specifications (Stantec, 2011);
- City of Grande Prairie Design Guidelines (Stantec, 2011);
- City of Grande Prairie Transportation Master Plan (ISL Engineering, July 2011);
- City of Grande Prairie Storm Drainage Master Plan (Associated, October 2004);
- City of Grande Prairie North East Drainage Basin Study (Focus Corporation, August 2011);
- Intermunicipal Development Plan, City of Grande Prairie and County of Grande Praire No. 1 (Bylaws C-1043 & 2896, June 14, 2010);
- Northeast Area Structure Plan, Bylaw C-1087 (Focus Corporation, Jan. 26, 2009);
- Southeast Area Structure Plan, Bylaw C-1060 (Armin A. Preiksaitis & Associates, 2007);
- City of Grande Prairie Growth Study (Lovatt Planning Consultants Inc., January 2008);
- 68 Avenue Functional Planning Study (ISL Engineering, May 2000);
- Signature Falls Outline Plan (ISL Engineering, December 2005);
- West Carriage Lane Outline Plan (Focus Corporation, January 26, 2009);
- Brookfield Outline Plan (Focus Corporation, 2012);
- Copperwood Outline Plan (ISL Engineering and Beairsto Lehners Ketchum, May 2007);
- Crystal Landing Outline Plan (Focus Corporation)
- 2008 – 2013 Transit Master Plan (iTRANS Transportation Planning & Engineering Consulting, March 2009);
- Kingsgate Outline Plan (ISL Engineering, August 11, 2008);
- Woodgrove Estates Outline Plan (Focus Corporation);
- Aquatera - City of Grande Prairie Wastewater Collection System Master Plan (ISL Engineering, January 2005);
- Aquatera - City of Grande Prairie Water Distribution System Master Plan (ISL Engineering, January 2005);
- Aquatera - Areas SE of City of Grande Prairie Servicing Study (ISL Engineering, September 2004);
- Land title certificates.

1.4 OTHER RELEVANT STUDIES IN PROGRESS

Other studies that are relevant to the 84 Street project but were not yet complete or made available at the time of the project include:

- 100 Avenue Functional Study (ISL Engineering); and
- 132 Avenue Functional Study (Focus Engineering).

1.5 STUDY OBJECTIVES

The 84 Street Functional Planning Study involves analysis of the following components included as part of this report:

- Review site conditions, record drawings of shallow and deep utility locations, right of way boundaries, and other available reference information.
- Review of existing and future land use plans to ensure that the plans tie together appropriately and provide recommendations for how the 84 Street roadway and utilities will ultimately be accommodated.
- Review deep and shallow utility service plans and identify existing and potential conflicts. Utilities include, but are not limited to, power, gas, telephone, water, sanitary, and storm. ATCO Electric is considered the most critical utility stakeholder in regards to the planning.
- Conduct supplementary geotechnical investigations as required to assess subsurface conditions along the proposed alignment and provide geotechnical recommendations regarding site preparation, widening construction, and pavement structure.
- Complete a geometric assessment that reviews and evaluates traffic count data on 84 Street, intersection design and geometry, transitions, turning lanes, design vehicles, etc.
- Review all practical roadway alignments and cross-section alternatives.
- Provide extensive trail/pedestrian connectivity along 84 Street.
- Assess and model traffic volumes.
- Review stormwater drainage to assess and quantify the stormwater catchment area and options available for conveying runoff.
- Conduct supplementary surveys as required.
- Liaise with authorities and identify all necessary permits and approvals which will be required for all aspects of the work. The approving bodies may include, but are not limited to various city departments, Alberta Transportation (AT), and Alberta Environment.

- Determine future right-of-way and land acquisition requirements.
- Consult with and identify the concerns of internal (Public Works) and external (i.e. landowners, business owners) stakeholders.

This report will provide a detailed evaluation and recommendation for these items listed above. The works undertaken in the preparation of this report are not limited to the previous list of items.

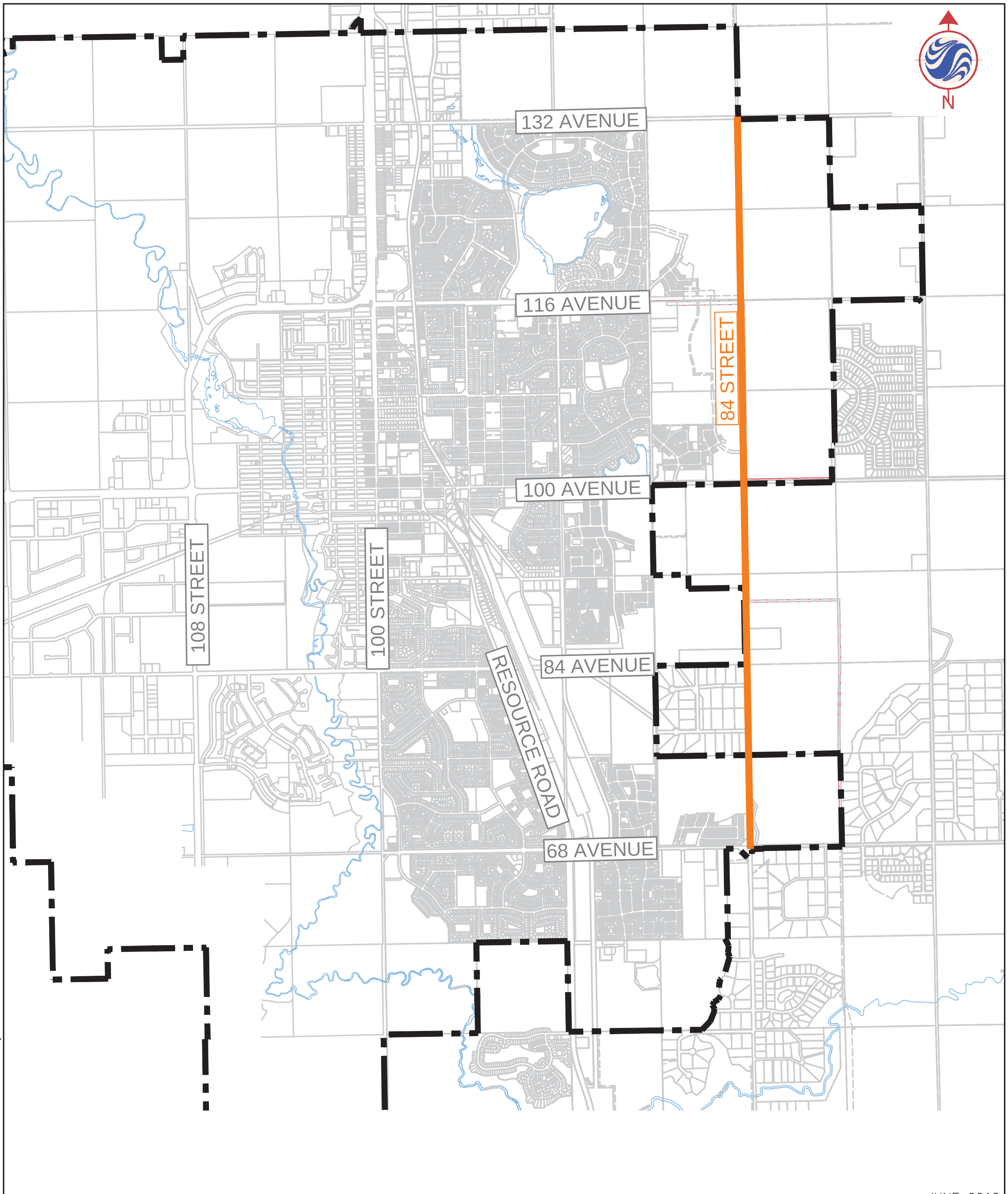

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Figure No.

1.1

Title

PROJECT LOCATION

2.0 Existing Conditions

This section describes, in detail, a review of the existing conditions, including a review of all as-built data, outline plans, legal drawings, existing survey information, utility servicing information, aerial photography, base maps, and utility plan information. The existing conditions are shows in Figures 2.1 through 2.8.

The following items have been included in the preparation of the existing conditions and have been discussed below:

- Existing Roadway Conditions;
- Existing Utilities;
- Existing Accesses; and
- Other constraints.

2.1 EXISTING ROADWAY CONDITIONS

The existing 84 Street roadway extends from south of 68 Avenue to the 100 Avenue intersection. No roadway exists within the 84 Street right-of-way between 100 Avenue and 132 Avenue.

The existing roadway between 68 Avenue and 100 Avenue is an approximately 9.5 metre wide two lane rural road with a posted speed limit of 80km/h. The centreline of the road is currently elevated approximately 0.5 to 1.5 metres higher than the adjacent lands.

The past construction of 84 Street was completed in such a manner that ensured appropriate, non-organic material was used for the subgrade and fill material. Detailed geotechnical investigation, including boreholes, should be completed at the time of detailed design to determine the specific geotechnical conditions and the impact that they could have on future gradelines of the ultimate upgraded roadway.

The right-of-way width of 84 Street varies throughout the project limits and is summarized in Table 2.1 below.

TABLE 2.1 – EXISTING RIGHT-OF-WAY WIDTHS

Section of 84 Street Roadway	Right-of-Way Width (m)
Station 0+000 (68 Avenue) to 2+665:	30.18
Station 2+665 to 3+465 (100 Avenue):	25.15
Station 3+495 (100 Avenue) to 6+705 (132 Avenue)	20.12

2.2 EXISTING UTILITIES

There are numerous City owned and privately owned utilities along or within the vicinity of the 84 Street corridor, including water mains, sanitary mains, ATCO Electric, ATCO Gas, TELUS, and East Link Cable.

2.2.1 Water Mains

There are no existing water mains that run along the 84 Street corridor. However, there are three locations along 84 Street where water trunks cross 84 Street:

- 68 Avenue – A 300mm diameter water main runs along the north side of 68 Avenue from the west and splits at the northwest corner of the 84 Street intersection to service rural residential developments to the east and south. The east/west crossing is a 300mm diameter main and the north/south crossing is a 250mm diameter main.

- 100 Avenue – A 250mm diameter water main runs along the south side of 100 Avenue up to the west side of the intersection, where it crosses 100 Avenue to the north and then 84 Street to the east. This water main provides the south loop connection to the existing Carriage Lane subdivision located 800 metres east of 84 Street.

- Station 4+820 – A 300mm diameter water main crosses 84 Street to provide the north loop connection to the existing Carriage Lane subdivision located 800 metres east of 84 Street.

2.2.2 Sanitary Mains

There is an existing 300mm diameter sanitary force main that runs along the east side of the 84 Street right-of-way from 100 Avenue to 68 Avenue to service the existing Carriage Lane subdivision. At the 84 Street / 68 Avenue intersection, the force main flows westward. Force mains from the south and east, with diameters of 150mm and 200m respectively, also tie into the 300mm force main at the northeast corner of the 68 Avenue intersection.

2.2.3 ATCO Electric

An overhead 44 kV ATCO Electric transmission runs along the east side of 84 Street from 116 Avenue to Station 2+420, where the line continues to run eastward away from 84 Street. The overhead transmission line crosses 84 Street twice on the south side of the future 116 Avenue intersection to provide power to a power station.

Overhead 3-phase and single phase power lines run along 84 Street as follows:

- 84 Street / 68 Avenue intersection – 3-phase line crosses 84 Street at the 68 Avenue intersection (underground crossing);
- Station 0+000 (68 Avenue) to 1+430 (north rural subdivision intersection) – 3-phase line runs along the east side of 84 Street;
- Station 1+430 (north Eagle Estates intersection) to 1+890 - the 3-phase line continues to run along the east side of the roadway and crosses 84 Street at Station 1+890. A single phase line runs along the west side of the roadway from the north Eagle Estates intersection to the crossing at 1+890.
- Station 1+890 to 3+200 (100 Avenue) – the 3-phase line runs along the west side of the road right-of-way, with the exception of the portion that runs along the east property line within the private Meadowview Mobile Home park.
- Station 3+200 (100 Avenue) to Station 4+800 – the 3-phase line runs along the center of the road right-of-way from 100 Avenue to Station 4+800, where the line redirects westward.
- Station 6+400 (132 Avenue intersection) – there is a 3-phase line that runs east/west along the north side of 132 Avenue to 84 Street, where it crosses and runs northward from the intersection.

Figure 2.0 below is a typical example of ATCO Electric's overhead lines that run along 84 Street. The image is facing northward along the Meadow View Mobile Home Park.

Figure 2.0: Typical ATCO Electric Overhead Power Lines

2.2.4 ATCO Gas

ATCO Gas has numerous lines within the 84 Street vicinity from 68 Avenue to 100 Avenue as follows:

- Station 0+246 (68 Avenue) to Station 1+272 (south Eagle Estates intersection) – the gas line runs within an easement along the west property line. At the Eagle Estates intersection, the line runs westward to service the existing development.

- Station 1+676 (north Eagle Estates intersection) to 3+490 (100 Avenue) – the gas line runs within an easement along the west property line from the north Eagle Estates intersection to Station 1+630, where the gas line crosses the 84 Street roadway and continues to run northward along the east property line to 100 Avenue. There are service stubs at Station 1+700.

- Station 3+490 (100 Avenue intersection) – The gas line that runs along the east side of 84 Street crosses 100 Avenue, where it ties into a tee. There are two gas lines that run east of 84 Street along the north side of 100 Avenue and one line that runs west from 84 Street.

2.2.5 TELUS – Telephone and Fiber Optic

There is an existing buried TELUS line that runs along the west property line of 84 Street from 68 Avenue to 100 Avenue. This line provides a connection between 68 Avenue and 100 Avenue and also provides a connection to the Eagle Estates subdivision.

At the 68 Avenue intersection, there is a buried line that runs east/west along the south side of 68 Avenue. The line crosses 68 Avenue on the west side of the intersection.

There are two buried TELUS lines that run east/west along the north and south sides of 100 Avenue. Both lines cross the 84 Street right-of-way. The TELUS line crosses 100 Avenue on the west side of the intersection.

2.3 EXISTING ACCESSES

There are numerous accesses along 84 Street from 68 Avenue to 100 Avenue that are described in the table below. All approaches were paved to the property line.

TABLE 2.2 EXISTING ACCESSES

Station	Side of Road	Description
0+790.000	West	Agricultural / field approach
0+790.000	East	Agricultural / field approach
1+020.000	West	Rural residential subdivision intersection (Eagle Estates)
1+140.000	East	Agricultural / acreage access
1+420.000	West	Rural residential subdivision intersection (Eagle Estates)
1+700.000	West	Agricultural / acreage access
1+800.000	East	Agricultural / field approach
1+850.000	East	Agricultural / acreage access
2+150.000	East	Agricultural / field approach
2+160.000	West	Agricultural / field approach
2+390.000	West	Agricultural / acreage access

Station	Side of Road	Description
2+480.000	West	Agricultural / field approach
2+500.000	East	Agricultural / acreage access
3+000	East	Agricultural / field approach

2.4 OTHER CONSTRAINTS

2.4.1 Meadow View Mobile Home Park

There is an existing mobile home park located on the southwest corner of the 84 Street / 100 Avenue intersection. The mobile home park is approximately 4.6 Hectares in size. There are approximately 18 units that back directly against the east property line.

2.4.2 Existing Agricultural Pond

There is an existing agricultural pond within and adjacent to the west of the 84 Street right-of-way approximately 100m north of the 100 Avenue intersection. The pond is notably deep and will require a considerable amount of suitable fill material to accommodate the ultimate build-out of the 84 Street roadway.

2.4.3 Existing Wetlands and Vegetation

There are existing wetlands located within and adjacent to the 84 Street right-of-way in three quarter sections: NE31 71-5-6 (Kingsgate Landing), NE30 71-5-6 (Woodgrove Estates), and NW32 71-5-6. Ultimately, 84 Street will be required to be constructed through the wetlands. A Phase I Environmental Site Assessment (ESA) should be completed for each of the wetlands at the time of detailed design to confirm any necessary requirements as per the Water Act and the Environmental Protection and Enhancement Act.

There is an existing City-owned peat moss farm located within and adjacent to the west of the 84 Street right-of-way in the Woodgrove Estates lands. The peat moss was on average 0.57 metres deep (maximum 1.4 metres deep) and mined and is still in operation. Suitable fill will be required to replace the peat moss that was removed in order to accommodate the construction of the road.

There are small patches of vegetation that run adjacent to 84 Street throughout the extents of the projects. In order to accommodate the construction of the ultimate roadway, vegetation will be required to be removed.

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	EDGE OF ASPHALT	P	EXISTING U/G POWER LINE		WATER VALVE
	DITCH OR SWALE	CATV	EXISTING CABLE TV		CATCHBASIN MANHOLE
SS	EXISTING SANITARY SEWER	T	EXISTING TELEPHONE LINE		CATCHBASIN
ST	EXISTING STORM SEWER	PP	EXISTING POWER POLE		STORM MANHOLE
W	EXISTING WATER MAIN		EXISTING STREET LIGHTS		SANITARY MANHOLE
FM	EXISTING FORCE MAIN				SIGN POST
G	EXISTING ATCO GAS LINE				

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Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
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Figure No.
2.1

Title
EXISTING CONDITIONS

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	EDGE OF ASPHALT	P	EXISTING U/G POWER LINE		WATER VALVE
	DITCH OR SWALE	CATV	EXISTING CABLE TV		CATCHBASIN MANHOLE
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FM	EXISTING FORCE MAIN				SIGN POST
G	EXISTING ATCO GAS LINE				

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Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
2.2

Title
EXISTING CONDITIONS

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EDGE OF ASPHALT	P — EXISTING U/G POWER LINE
DITCH OR SWALE	CATV — EXISTING CABLE TV
SS — EXISTING SANITARY SEWER	T — EXISTING TELEPHONE LINE
ST — EXISTING STORM SEWER	PP — EXISTING POWER POLE
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FM — EXISTING FORCE MAIN	
G — EXISTING ATCO GAS LINE	

FIRE HYDRANT
WATER VALVE
CATCHBASIN MANHOLE
CATCHBASIN
STORM MANHOLE
SANITARY MANHOLE
SIGN POST

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CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
2.3

Title
EXISTING CONDITIONS

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	EDGE OF ASPHALT	P	EXISTING U/G POWER LINE		WATER VALVE
	DITCH OR SWALE	CATV	EXISTING CABLE TV		CATCHBASIN MANHOLE
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W	EXISTING WATER MAIN		EXISTING STREET LIGHTS		SANITARY MANHOLE
FM	EXISTING FORCE MAIN				SIGN POST
G	EXISTING ATCO GAS LINE				

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CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.

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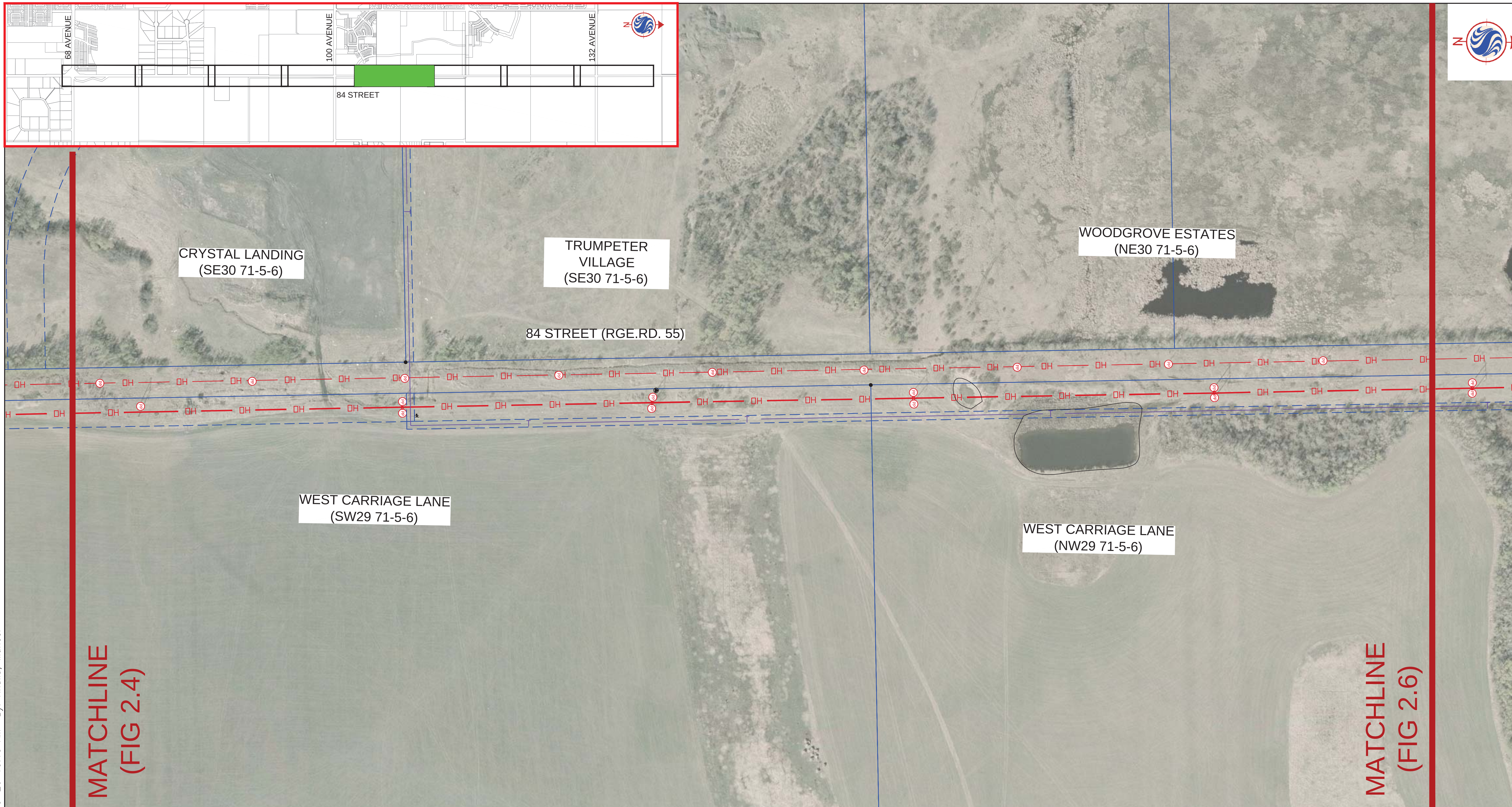
EXISTING CONDITIONS



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	EDGE OF ASPHALT	P	EXISTING U/G POWER LINE		WATER VALVE
	DITCH OR SWALE	CATV	EXISTING CABLE TV		CATCHBASIN MANHOLE
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W	EXISTING WATER MAIN		EXISTING STREET LIGHTS		SANITARY MANHOLE
FM	EXISTING FORCE MAIN				SIGN POST
G	EXISTING ATCO GAS LINE				

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Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
2.5

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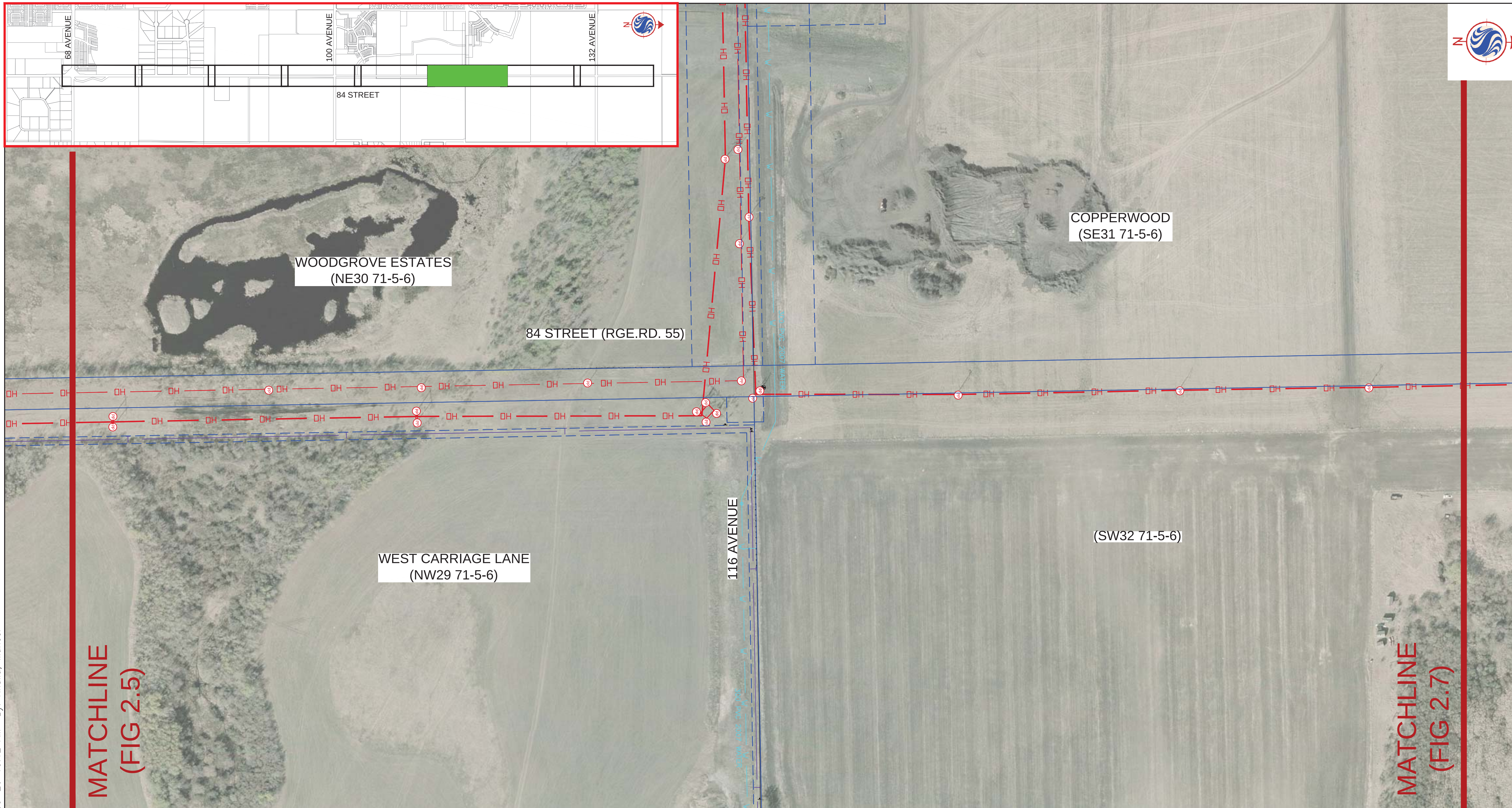
EXISTING CONDITIONS



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FM — EXISTING FORCE MAIN		SIGN POST	
G — EXISTING ATCO GAS LINE			

0 25 75 125m

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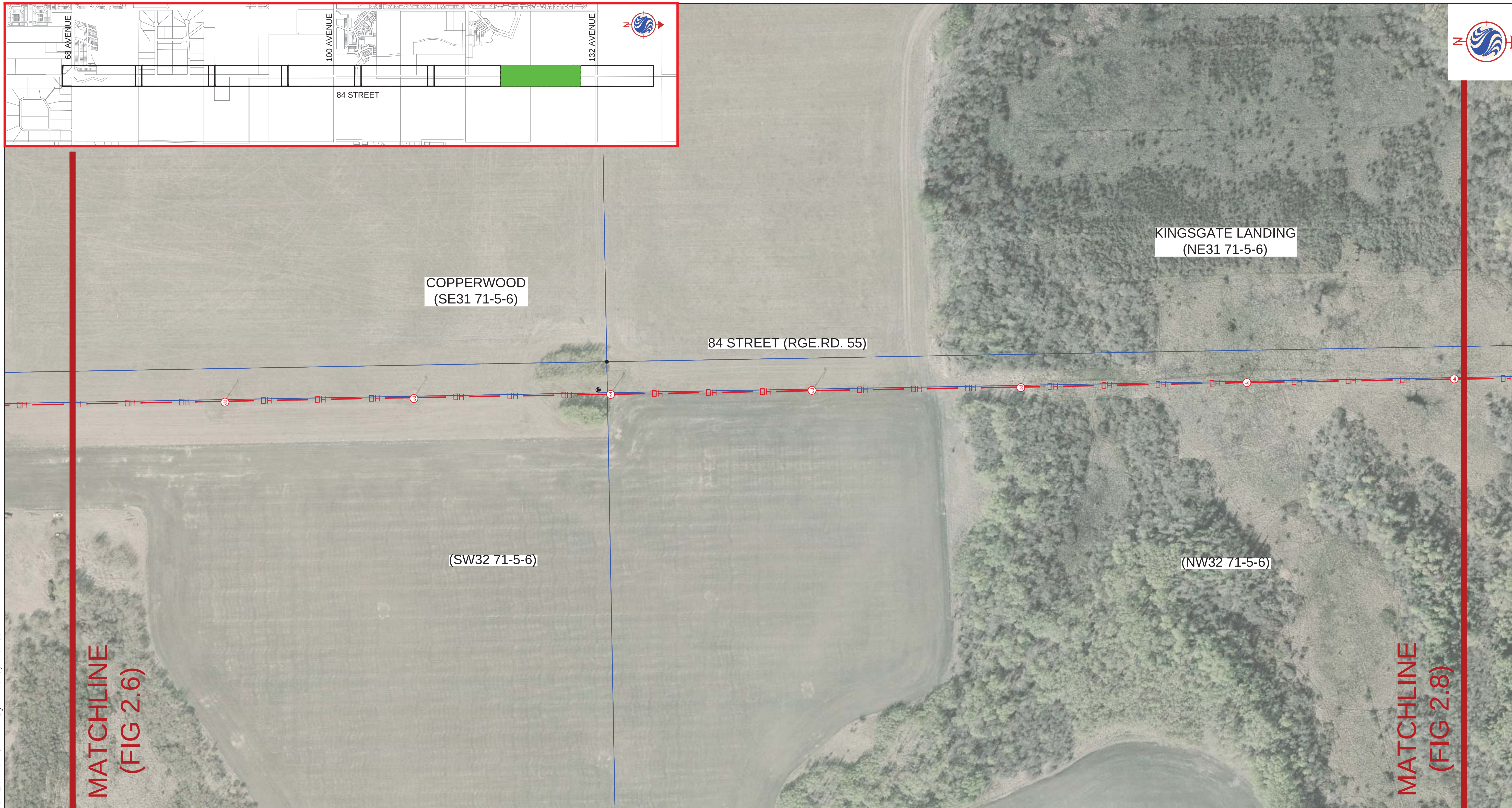
Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
2.6

Title
EXISTING CONDITIONS



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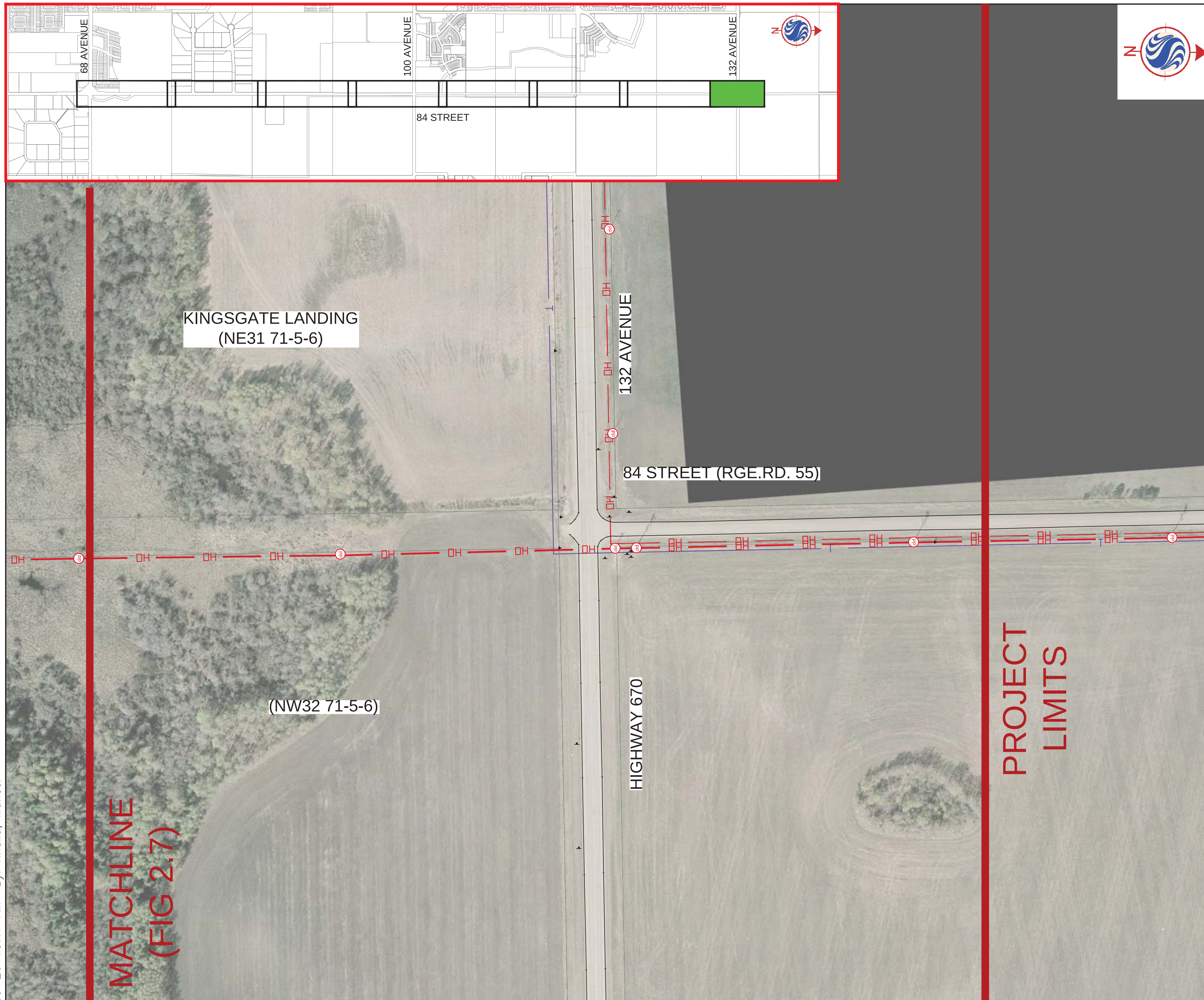
	EXISTING PROPERTY LINE	OH	EXISTING O/H POWER LINE		FIRE HYDRANT
	EDGE OF ASPHALT	P	EXISTING U/G POWER LINE		WATER VALVE
	DITCH OR SWALE	CATV	EXISTING CABLE TV		CATCHBASIN MANHOLE
SS	EXISTING SANITARY SEWER	T	EXISTING TELEPHONE LINE		CATCHBASIN
ST	EXISTING STORM SEWER	PP	EXISTING POWER POLE		STORM MANHOLE
W	EXISTING WATER MAIN		EXISTING STREET LIGHTS		SANITARY MANHOLE
FM	EXISTING FORCE MAIN				SIGN POST
G	EXISTING ATCO GAS LINE				

0 25 75 125m

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
2.7

Title
EXISTING CONDITIONS



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	EXISTING PROPERTY LINE	OH	EXISTING O/H POWER LINE		FIRE HYDRANT
	EDGE OF ASPHALT	P	EXISTING U/G POWER LINE		WATER VALVE
	DITCH OR SWALE	CATV	EXISTING CABLE TV		CATCHBASIN MANHOLE
SS	EXISTING SANITARY SEWER	T	EXISTING TELEPHONE LINE		CATCHBASIN
ST	EXISTING STORM SEWER	PP	EXISTING POWER POLE		STORM MANHOLE
W	EXISTING WATER MAIN		EXISTING STREET LIGHTS		SANITARY MANHOLE
FM	EXISTING FORCE MAIN				SIGN POST
G	EXISTING ATCO GAS LINE				

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Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
2.8

Title
EXISTING CONDITIONS

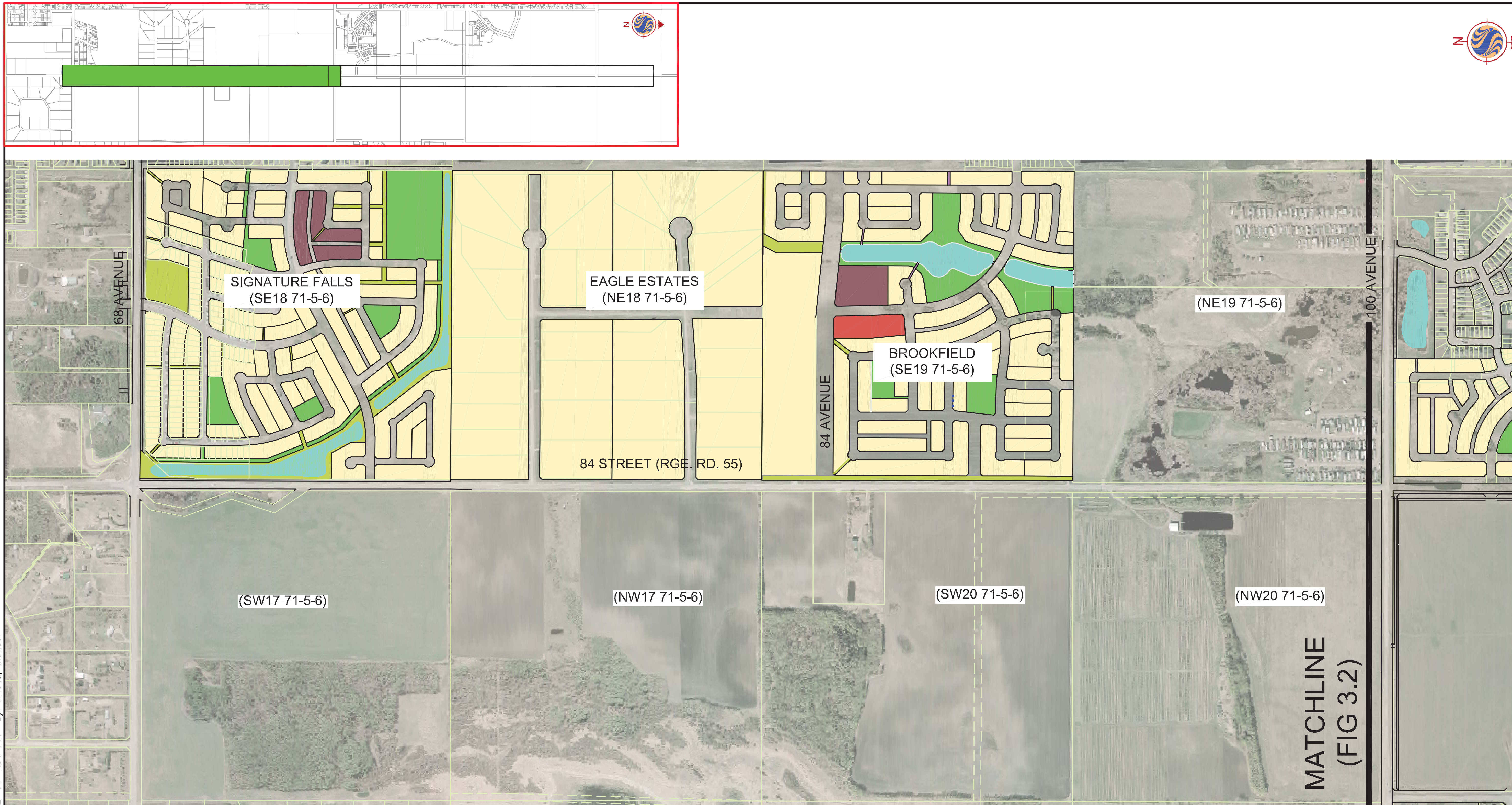
3.0 Future Land Use

In general, the Municipal Development Plan (MDP), Intermunicipal Development Plan (IDP), Northeast Area Structure Plan, and Southeast Area Structure Plan all primarily designate the future land use along the east and west sides of 84 Street from 68 Avenue to 132 Avenue for residential development. The IDP, however, contradicts the Northeast ASP and Kingsgate Landing Outline Plan by indicating that there is potential for commercial/industrial zoning along the south side of 132 Avenue east and west of 84 Street.

Figures 3.1 and 3.2 provide a compilation of the proposed land uses and development concepts adjacent to 84 Street. For the purpose of this study, where the there is a conflict between documents, the land uses incorporated into the figures are based on the most recent planning document. The quarter sections and relevant land planning documents included in the development of the figures within this report are summarized in the Table 3.1 below.

TABLE 3.1: RELEVANT LAND PLANNING DOCUMENTS

	Quarter Section	Subdivision	Land Planning Document
1	NE31 71-5-6	Kingsgate Landing	Kingsgate Outline Plan
2	NW32 71-5-6	N/A	Northeast ASP
3	SE31 71-5-6	Copperwood	Copperwood Outline Plan, Northeast ASP
4	SW32 71-5-6	None	Northeast ASP
5	NE30 71-5-6	Woodgrove	Northeast ASP
6	NW29 71-5-6	West Carriage Lane	West Carriage Lane Outline Plan, Northeast ASP
7a	SE30 71-5-6 (North portion)	Trumpeter Village	Northeast ASP
7b	SE30 71-5-6 (South portion)	Crystal Landing	Crystal Landing Outline Plan, Northeast ASP
8	SW29 71-5-6	West Carriage Lane	West Carriage Lane Outline Plan, Northeast ASP
9	NE19 71-5-6	None	None
10	NW20 71-5-6	Meadowview	Meadowview ASP
11	SE19 71-5-6	Brookfield	Brookfield Outline Plan, Meadowview ASP
12	SW20 71-5-6	None	None
13	NE18 71-5-6	Eagle Estates	Southeast ASP
14	NW17 71-5-6	None	None
15	SE18 71-5-6	Signature Falls	Signature Falls Outline Plan, Southeast ASP
16	SW17 71-5-6	None	None



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- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- COMMERCIAL
- POND / PARK AREA
- STORM MANAGEMENT FACILITY

NOTES:

OUTLINE PLANS ARE SHOWN FOR DEMONSTRATIVE AND FUNCTIONAL STUDY PURPOSES ONLY. FIGURE 3.1 AND 3.2 ARE NOT TO BE USED AS A FORMAL NEIGHBORHOOD PLANNING DOCUMENT.

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Client/Project

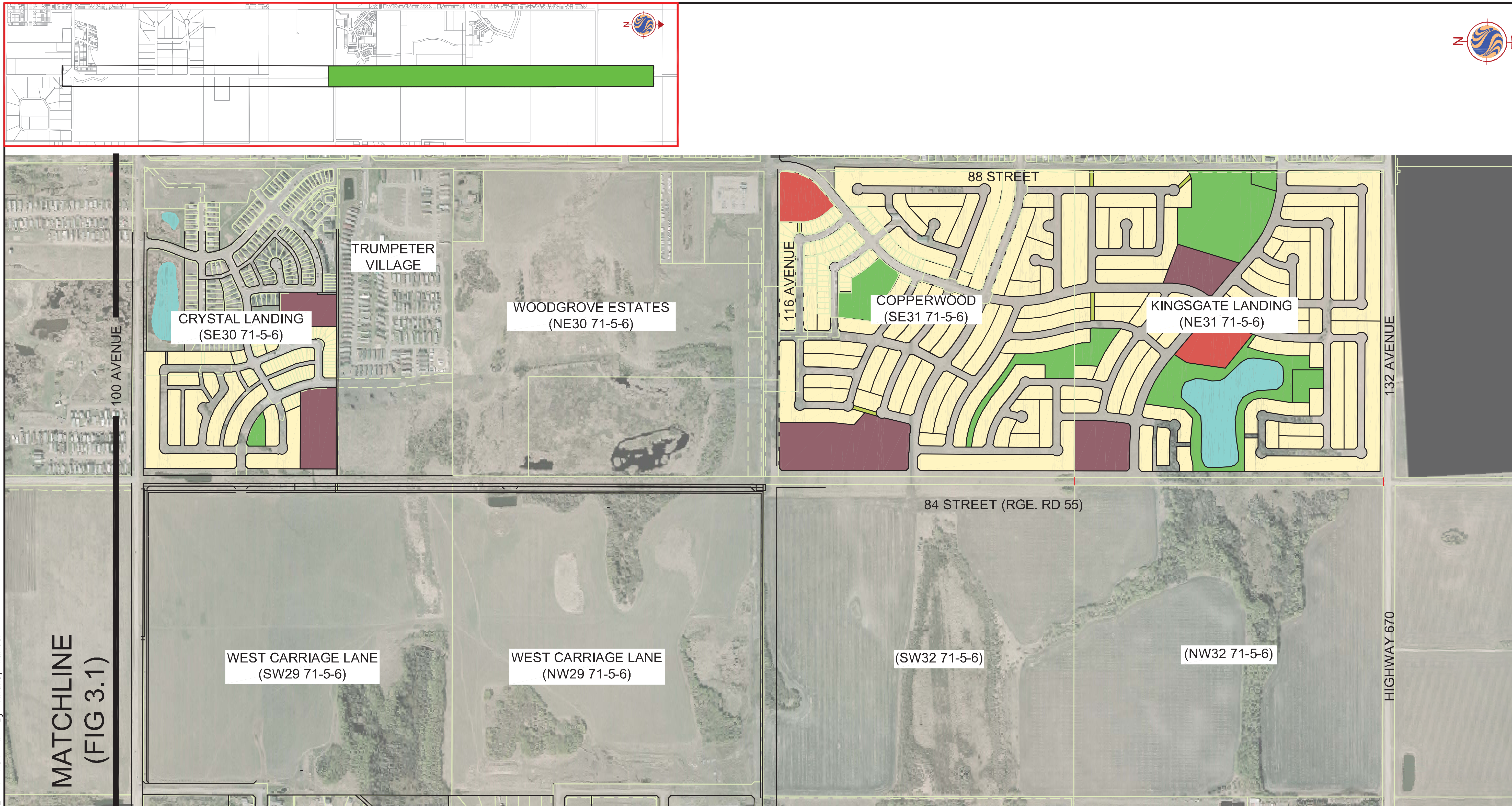
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.

3.1

Title

PROPOSED FUTURE
LAND USE CONCEPT



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Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
3.2

Title
PROPOSED FUTURE
LAND USE CONCEPT

4.0 Design Criteria

Determining the design criteria is a critical step in the design process. The design criteria for 84 Street is based on the City of Grande Prairie Standard Guidelines for Design and Development of Municipal Improvements and supplemented with Transportation Association of Canada (TAC) standards. Both the City's and TAC's design criteria provide recommendations for desirable design criteria elements where site conditions are favorable as well as maximum/minimum design criteria elements where unique circumstances, such as unique topography, make it impossible or impractical to implement desirable design criteria. Given that there are no significant constraints to this project, the design criteria will be based on desirable conditions.

The following design criteria are discussed:

- Road Classification;
- Traffic Volumes;
- Vertical Alignment;
- Cross-section Elements
- Intersection Spacing;
- Horizontal Alignment;
- Design Vehicles;
- Access Management

4.1 ROAD CLASSIFICATION

FIGURE 4.1 ROAD CLASSIFICATION

Based on the Transportation Master Plan and design classification guidelines described in TAC's Geometric Design Guide for Canadian Roads, 84 Street from 68 Avenue to 132 Avenue will ultimately be considered as a major urban arterial roadway with a design speed of 80 km/h (UAD80) with a posted speed limit of 70 km/h. In the interim, the rural road standard may be developed such that it can accommodate a design speed of 90 km/h (RAU90) with a posted speed limit of 80 km/h, which would accommodate speed limit consistency along the entire corridor before it is urbanized.

In general, the primary design consideration for major arterial roadways is traffic movement. Access to adjacent properties is rigidly controlled and typically only provided to major commercial developments or other unique circumstances in retrofit situation. Arterial roadways require more travel lanes and greater spacing between intersections and accesses than collector roadways. Further, arterial roadways are often divided where geometry permits while collectors are almost always undivided.

Figure 4.1 shows the roadway classification of 84 Street and its intersecting avenues. Ultimately, 84 Street will intersect with five arterial roadways within the project limits, including 68 Avenue, 84 Avenue, 100 Avenue, 116 Avenue, and 132 Avenue. Intersections with residential collector roadways will also be provided in accordance with TAC's recommended intersection requirements.

4.2 INTERSECTION SPACING AND SIGNALIZATION

The spacing of intersections along a road has a significant impact on the operation, level of service, and capacity of the roadway. On new arterial roadways, TAC recommends a minimum intersection spacing of 400 metres. In areas where there is intense existing development, 300 metre spacing is typically recommended to accommodate back-to-back left turn bays.

The desirable spacing between signalized intersections is dependent on the average running speed of the roadway and the desirable traffic signal cycle lengths. The average running speed for arterial roadways is typically 10km/h less than the design speed and as such, an average running speed of 70km/h is considered appropriate for 84 Street. For an average running speed of 70km/h and a desirable cycle length of 80 seconds, TAC recommends that the signalized intersections be spaced a minimum of 780 metres. Therefore, the intersections with the major arterial roadways (68 Avenue, 84 Avenue, 100 Avenue, 116 Avenue, and 132 Avenue) should ultimately be the only signalized intersections.

4.3 TRAFFIC VOLUMES

The traffic volumes used for the design are described in detail in Section 5 and are also found in Appendix B. Major arterial roadways are typically designed to accommodate 10,000 – 30,000 vehicles per day. For intersection capacity analysis, generally speaking, a V/C ratio of 0.85 and LOS 'D' are considered acceptable for short-term (10-years or less) planning horizons and a V/C ratio of 0.90 and LOS 'E' are considered acceptable for long-term planning horizons.

4.4 HORIZONTAL ALIGNMENT

The standard design elements of the horizontal alignment include horizontal curve radii, spirals, and rates of superelevation on curves. The horizontal alignment design criteria are directly related to each other as well as the design speed of the roadway, which as mentioned above, is 80km/h. Most of 84 Street from 68 Avenue to 132 Avenue will ultimately be a straight roadway, with the exception of the horizontal curves that will be required to shift the roadway west of the ATCO Electric transmission line.

For high speed urban roadways, TAC recommends using a rate of superelevation (e_{max}) of 0.04 to 0.08 m/m. The City of Grande Prairie Guidelines specify a maximum rate of 0.06 m/m and a desirable rate of 0.04m/m. As such, the rate of superelevation for the horizontal curves in this project will be 0.04m/m.

For a design speed of 80km/h and e_{max} of 0.04m/m, TAC recommends using a minimum radius of 280 metres. For the same design speed with no superelevation, TAC recommends using a minimum radius of 2,130 metres.

On urban roads with design speeds of at least 80 km/h and where superelevation is considered desirable, it is recommended that spirals be incorporated into the design of the curves. Spirals are defined as curves with constantly changing radii, providing a smooth transition for driver comfort between horizontal curves and tangents. Spirals are also used to comfortably transition the rate of superelevation between tangents and curves as well as between curves of different radii.

The length of a spiral is calculated by the formula:

$$L = A^2 / R$$

where L is the length of spiral in metres, A is the spiral parameter in metres, and R is the radius of the curve in metres. For a design speed of 80km/h and a rate of superelevation of 0.04m/m, the recommended spiral parameter is 135m.

4.5 VERTICAL ALIGNMENT

The vertical alignment design criteria generally consists of two components, vertical curves and maximum gradient. Both TAC and the City of Grande Prairie Design Guidelines provide recommendations for maximum and desirable maximum criteria. In determining the criteria, it is also important to consider other factors, such as traffic operations, drainage accommodation, costs, adjacent land use, etc.

For UAD80 roadways in non-mountainous conditions, TAC recommends a maximum gradient of 3% on grades with a length of more than 150 metres and 4% on grades with a length of less than 150 metres. The City of Grande Prairie Design Guidelines specify a maximum gradient of 6% and a desirable maximum gradient of 4%. For this project, the maximum design gradient will be 4% but in general, the natural topography of the road right-of-way does not exceed 2%.

The purpose of a vertical curve is to provide a smooth transition between grade changes. In urban settings, the vertical curve coefficient (K) is established based on the design speeds and therefore the stopping sight distance. TAC recommends a coefficient ranging from 24-36 on crest vertical curves and a coefficient ranging from 12-16 on sag vertical curves and where conditions make possible, the higher of the range is considered desirable. The City of Grande Prairie's Design Guidelines specify a coefficient of 36 on crest vertical curves and 16 on sag vertical curves. On crests and sags, it is recommended that the minimum coefficients be used to minimize stretches of curb and gutter with little grade.

4.6 DESIGN VEHICLES

Selection of design vehicles is important in establishing geometric design of roadways, particularly at intersections and unique business accesses. Turning paths made by the various types of traffic using the roadway must be taken into consideration in the design of cross-sections, intersections and major business accesses.

As described in the Transportation Master Plan, 84 Street will function as a truck route within the 10 Year Plan and will therefore be required to accommodate trucks in addition to passenger vehicles. All geometric design on this project will be completed to accommodate all of the common types of traffic outlined in TAC.

The design vehicle for this project is the WB-21 Tractor-Semi Trailer, which is shown in Figure 4.2 below. The WB-21 requires a larger turning path than the B-Train Double due to its longer wheel base.

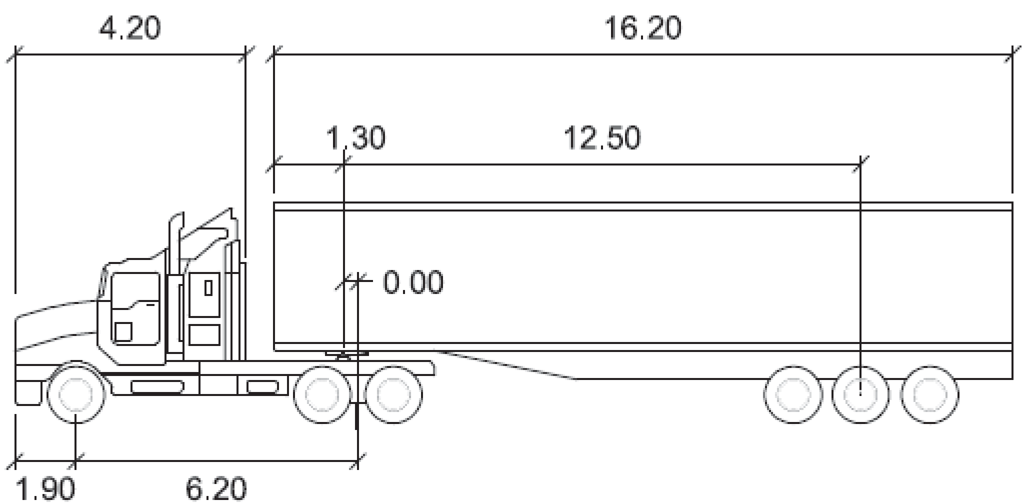


FIGURE 4.2 – WB-21 DESIGN VEHICLE

4.7 CROSS-SECTION ELEMENTS

When designing the cross-section, many elements are considered. These cross-sectional elements include the following items, which are discussed in detail below:

- Cross slope;

- Lane width;
- Median and Boulevards;
- Pedestrian and Bicyclists; and
- Turning Movements.

4.7.1 Cross Slope

The selection of a cross slope is generally related to drainage, driver behaviour and the type of surface structure. The cross slope for different types of surface structure can change based on the ability of the roadway to maintain its shape. Typically, gravel surfaces are constructed at a 3% cross slope because of the possibility of the granular materials being displaced and thus, obstructing drainage. Paved roadways typically hold their shape and therefore a lower cross slope of 2% is utilized. The City of Grande Prairie Design Guidelines requires the minimum cross slope to be 2.5%. Therefore, 84 Street will be designed with a 2.5% cross slope.

4.7.2 Lane Widths

Lane widths have a significant influence on capacity, safety and driver comfort. Although the minimum lane width according to TAC, is 3.5 metres, the standard width for through lanes on all divided roadways is 3.7 metres. This lane width was adopted to accommodate larger trucks and provide comfort to drivers of passenger vehicles. Left and right turn bays will be designed to a standard 3.5m width.

4.7.3 Medians and Boulevards

Medians are provided on multi-lane divided roadways to separate opposing flows of traffic, thus increasing safety. Medians also provide space for left turn lanes, snow storage, surface water collection, and refuge for pedestrians at crosswalks. The median width will vary from a minimum of 6.0 metres to accommodate single left turn lanes and 9.5 metres to accommodate dual left turn lanes.

Standard curb and gutters with 0.5 metre gutter widths will be utilized along the outer edges of the roadway and along the median to match the existing curb and gutter along 84 Street.

The boulevard serves as a safety separation as well as a location for underground utilities, snow storage, traffic signs and other control devices. Typically, it is preferred to locate obstructions away from the travelled lanes and it is desirable to provide a boulevard if the design speed exceeds 60 km/h. The minimum boulevard width recommended by TAC for arterial roadways is 1.5 metre and the desirable boulevard width is 3.0 metres. 84 Street has been designed with a 4.1 metre boulevard for potential accommodation of shallow utilities.

4.7.4 Pedestrians and Bicyclists

Throughout Grande Prairie, there is a growing demand for the development of trails for pedestrians and bicyclists as a healthier and more sustainable mode of transportation. The Transportation Master Plan conceptually prioritizes trail linkage to four main hubs around the City, including downtown, the Prairie Mall, Grande Prairie Regional College, and the Coca Cola Centre. As such, it is anticipated there will be east/west linkage requirements at each of the five arterial roadway intersections along 84 Street (68, 84, 100, 116, and 132 Avenue).

The cross-sections explained in the previous section all incorporate 3.0 metre wide paved trails on both sides of the roadway. A 3.0 metre wide pathway is considered by TAC and the Transportation Master Plan to be appropriate for high ranges of user groups in low volume situations.

4.8 STREET LIGHTING

Due to clearance requirements from the ATCO Electric Transmission line, the street lighting is proposed to run within the median along 84 Street. At the arterial roadway intersections, street lighting will be provided on bases shared with the traffic signal structures. Street lights in the median will be within TAC's recommended clear zone distance and as such, barricade protection should be provided adjacent to them. Special consideration, potentially street lights in the boulevard behind the walks, will be required to illuminate the left turn bay areas at the arterial roadway intersection.

At collector roadway intersections, street lighting will need to be provided on the external intersection quadrants. Special clearance considerations may be required for the lights on the east side of 84 Street that are in close proximity to the ATCO Electric Transmission line.

4.9 ACCESS MANAGEMENT

Access management is a practice used to create a practical balance between traffic mobility and business access needs and to ensure that an adequate level of safety will be provided when the traffic volumes increase in the future. Access management involves spacing and organization of accesses in a manner that optimizes safety conditions by reducing the number of driver conflict points, driver decision points, and unexpected events.

In general, the existing outline plans and ASP's within the 84 Street vicinity were developed with standard road classifications/hierarchies and intersection spacing criteria recommended by TAC. All proposed residential development access will be provided via a system of collector and local roads within the proposed developments. There is potential for some commercial development adjacent to 84 Street as outlined in the Northeast ASP.

For major arterial roadways, TAC recommends that access be either restricted or denied, particularly for new roadways that are not required to accommodate existing property accesses. TAC has an access classification system that includes categories ranging on a scale of 1 to 7, Access Level 1 being highly restricted and Access Level 7 having minimal restriction, limited to safety requirements only. 84 Street can be considered to be within either of or somewhere between the categories of Access Levels 3 and 4, which TAC defines as follows:

- Access Level 3 – right-turn access driveway only; and
- Access Level 4 – right and left-turn access in, right-turn access out.

For 84 Street, it is recommended that the access management be provided as Level 3 for the proposed future commercial sites. Left-in accesses to the proposed commercial sites would function as full intersections and would not meet the minimum standard intersection spacing of 400 metres. The primary accesses to the commercial sites should be provided via the collector roadways. Depending on the size and parameters of the commercial sites, secondary access could be provided directly on/off 84 Street as right-in/right-out only style accesses.

5.0 Traffic Analysis

5.1 INTRODUCTION

The City's existing Transportation Master Plan (ISL, August 2011) includes analysis of the roadway network up to the 90,000 population horizon. However, as shown on Exhibit 3.5 in the Transportation Master Plan, most of the parcels of land immediately adjacent to 84 Street are shown with minimal or no growth by the 90,000 population horizon.

In order to design 84 Street to be able to accommodate the ultimate development adjacent to and in the vicinity of the roadway beyond the 90,000 population horizon, assumptions were made regarding future land use, populations, and trip distribution for those parcels of land. The *Institute of Traffic Engineers' Trip Generation Manual, 8th Edition* was utilized in conjunction with the land use assumptions to generate the traffic volumes that were modeled for the purpose of this study. Stantec's letter dated March 1, 2012, included in Appendix B, outlines the population and trip assignment assumptions made for the 84 Street Functional Planning Study. It was also assumed for the purposes of this functional study, that 30% of the traffic generated by those parcels of land located east of 84 Street would be diverted to the future "Ring Road" which is currently in the conceptual stage and is anticipated to have a portion running parallel to and east of 84 Street.

Intersection capacity analysis was completed to compare the Level of Service (LOS) and the Volume to Capacity (V/C) Ratio for each of the turning movements at the five key intersections within the study area once subjected to the design volumes. For this purpose, the traffic modeling software packages of Synchro 8 and SimTraffic 8 were used for capacity and queuing analyses respectively. Those key intersections are:

- 84 Street and 132 Avenue;
- 84 Street and 116 Avenue;
- 84 Street and 100 Avenue;
- 84 Street and 84 Avenue; and
- 84 Street and 68 Avenue.

5.2 DESIGN CRITERIA

When evaluating the need for transportation infrastructure improvements, a benchmark acceptable level of congestion needs to be established. This maximum acceptable level of congestion varies from community to community and typically parallels the size of the community. For example, a level of congestion that motorists in Calgary or Edmonton are prepared to tolerate is usually not considered tolerable in Saskatoon. Likewise, what motorists are prepared to tolerate in Saskatoon on a regular basis may not be acceptable in smaller cities such as Grande Prairie.

Generally speaking, a V/C ratio of 0.85 and LOS ‘D’ are considered acceptable for short-term (10-years or less) planning horizons and a V/C ratio of 0.90 and LOS ‘E’ are considered acceptable for long-term planning horizons.

As the traffic volumes projected for the 84 Street Functional Planning Study are not expected to occur until beyond the 90,000 population horizon, which is currently the City’s long-term planning horizon, a V/C ratio of 0.90 and LOS ‘E’ or better have been used as the design criteria for this functional planning study.

5.3 DESIGN VOLUMES

The AM and PM peak design volumes were calculated based on the population assumptions outlined in the March 1, 2012, letter referred to above and are shown on Figure 5.1. Table 5.1, included in Appendix B, summarizes the trip generation calculations for each of the parcels of land within the study area. The AM and PM peak hour intersection analyses for the intersections are summarized in Table 5.2 included in Appendix B and are discussed in the following sections. The Syncho and SimTraffic reports for the completed analysis, are attached in Appendix B.

5.3.1 84 Street and 132 Avenue

Referring to the intersection capacity analyses summarized in Table 5.2 included in Appendix B, all movements operate at an acceptable V/C ratio and LOS in the AM and PM peak hours, with the exception of eastbound right-turn movement in the PM peak hour which operates at a LOS ‘C’ with a V/C ratio of 0.95.

The 95 percentile queue lengths for all dedicated turning lanes are lower than the proposed storage for both the AM and PM peak hours.

5.3.2 84 Street and 116 Avenue

Referring to the intersection capacity analysis summarized in Table 5.2 included in Appendix B, all movements operate at an acceptable V/C ratio and LOS in the AM and PM peak hours. The maximum V/C ratio of 0.82 with corresponding LOS ‘D’ is experienced by the southbound through movement in the PM peak hour.

The 95 percentile queue lengths for all dedicated turning lanes are lower than the proposed storage for both the AM and PM peak hours, with the exception of the southbound right-turn movement in the PM peak hour with a 95 percentile queue length of 122.3 m and a proposed storage bay length of 120 m.

5.3.3 84 Street and 100 Avenue

Referring to the intersection capacity analyses summarized in Table 5.2 2 included in Appendix B, all movements operate at an acceptable V/C ratio and LOS in the AM and PM peak hours, with the following exceptions in the PM peak hour only:

- Eastbound left-turn movement – V/C ratio of 0.93, LOS ‘E’;
- Northbound left-turn movement – V/C ratio of 0.94, LOS ‘E’;
- Northbound through movement – V/C ratio of 0.92, LOS ‘C’; and
- Southbound through movement – V/C ratio of 1.01, LOS ‘D’.

The 95 percentile queue lengths for all dedicated turning lanes are lower than the proposed storage for both the AM and PM peak hours, with one exception in the PM peak hour where the southbound right-turn traffic shows a lengthy 95 percentile queue length (254.0 m). This queue length is due to the anticipated queue length in the adjacent through lanes which then blocks access to the right-turn lane.

As development occurs along 84 Street, the intersection with 100 Avenue should be monitored so that signal timing plans can be updated accordingly and to determine if and when additional storage bay lengths are required for the various turning movements.

5.3.4 84 Street and 84 Avenue

Referring to the intersection capacity analyses summarized in Table 5.2 included in Appendix B, all movements operate at an acceptable V/C ratio and LOS in the AM and PM peak hours. The maximum V/C ratio of 0.81 with corresponding LOS ‘C’ is experienced by the southbound through movement in the PM peak hour.

The 95 percentile queue lengths for all dedicated turning lanes are lower than the proposed storage for both the AM and PM peak hours.

5.3.5 84 Street and 68 Avenue

Referring to the intersection capacity analyses summarized in Table 5.2 included in Appendix B, all movements operate at an acceptable V/C ratio and LOS in the AM and PM peak hours. The maximum V/C ratio of 0.83 with corresponding LOS 'C' is experienced by the eastbound left-turn movement in the PM peak hour.

The 95 percentile queue lengths for all dedicated turning lanes are lower than the proposed storage for both the AM and PM peak hours.

5.4 TRAFFIC ANALYSIS CONCLUSION

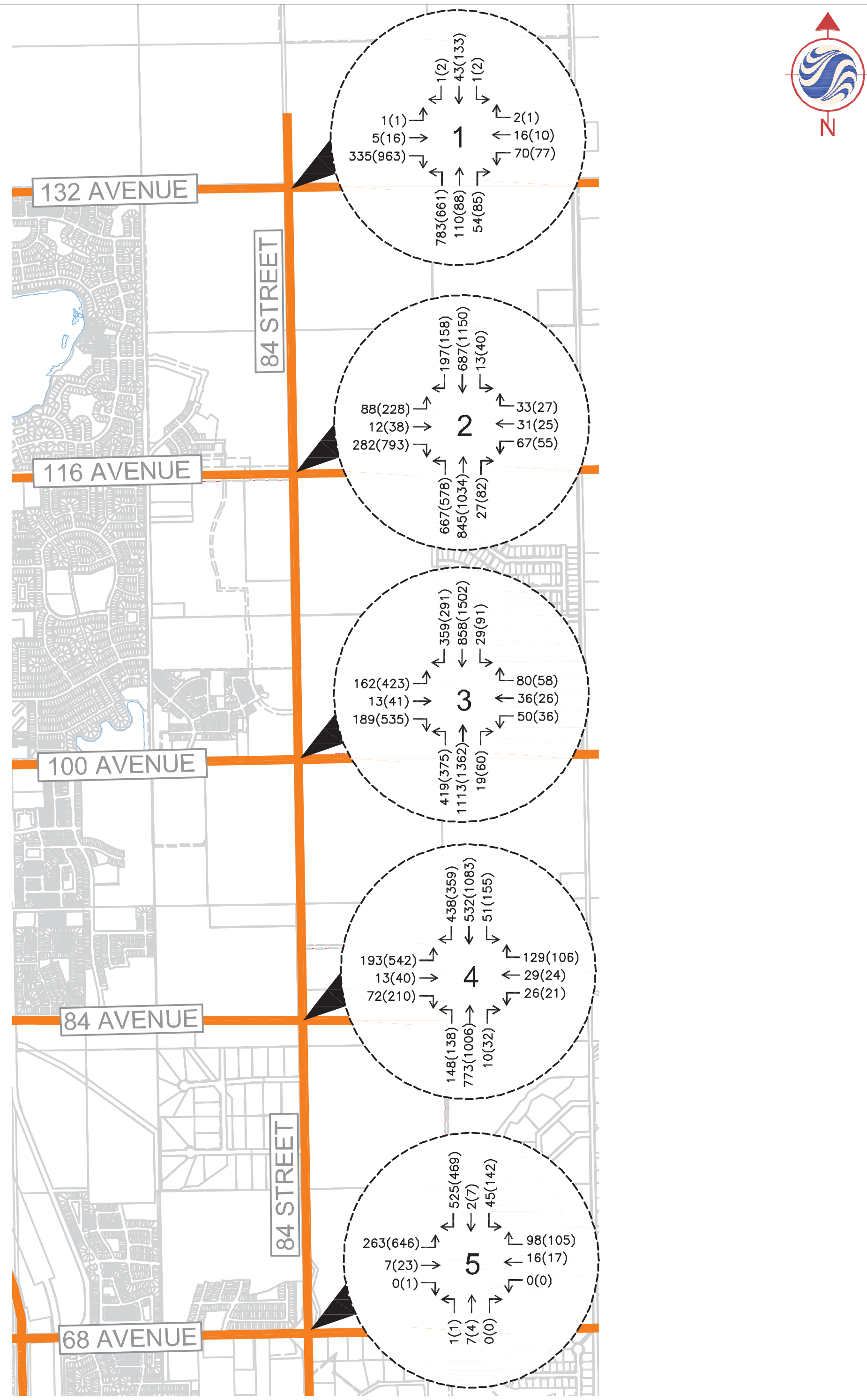
Based on the assumptions outlined in the March 1, 2012, letter and in the above report sections, the traffic modeling for the 84 Street Functional Planning Study generally has acceptable results for a long-term planning horizon, as is the case here. Four traffic movements experience V/C ratios that exceed the design criteria of 0.90 in the PM peak hour. However, based on the long-term nature of this study (exceeding the 90,000 population horizon) and based on the conservative nature of the trip generation results for those parcels of land that do not currently have an approved neighbourhood area structure plan, these results are still acceptable. As development occurs along 84 Street, individual traffic impact assessments typically required in conjunction with the municipal planning process will confirm or provide alternative assumptions to those made for this Functional Planning Study. Any significant differences in the requirements for the transportation network will be addressed as each parcel of land proceeds through the municipal development approval process.

Confirmation of required storage bay lengths for turn lanes should occur at the detail design stage for the intersection upgrades, including confirmation of the length of the free flow lanes for the eastbound right turn lane at 116 Avenue and both the eastbound and southbound right turn lanes at 100 Avenue. Depending on the spacing between the intersections and future development accesses, one option would be to extend the free flow lanes to the next access where it would become a dedicated right-turn movement.

Based on the analysis completed for the 84 Street Functional Planning Study, the following storage bay lengths are needed for the key intersections:

- 84 Street and 132 Avenue
    - Eastbound left – 50 m, eastbound right – 80 m;
    - Westbound left – 50 m, westbound right – 50 m;
    - Northbound left – 75 m (dual), northbound right – 50 m; and
    - Southbound left – 50 m, southbound right – 50 m.
- 84 Street and 116 Avenue

  - Eastbound left – 80 m, eastbound right – 50 m (free-flow);
  - Westbound left – 50 m, westbound right – 50 m;
  - Northbound left – 85 m (dual), northbound right – 50 m; and
  - Southbound left – 50 m, southbound right 120 m.
- 84 Street and 100 Avenue
  - Eastbound left – 100 m (dual); eastbound right – 50 m (free-flow);
  - Westbound left – 50 m, westbound right – 50 m;
  - Northbound left – 110 m (dual), northbound right – 50 m; and
  - Southbound left – 65 m, southbound right – 120 m (free-flow).
- 84 Street and 84 Avenue
  - Eastbound left – 90 m (dual), eastbound right – 60 m;
  - Westbound left – 50 m, westbound right – 50 m;
  - Northbound left – 60 m, northbound right – 50 m; and
  - Southbound left – 60 m, southbound right – 65 m.
- 84 Street and 68 Avenue
  - Eastbound left – 150 m, eastbound right – 50 m;
  - Westbound left – 50 m, westbound right – 50 m;
  - Northbound left – 50 m, northbound right – 50 m; and
  - Southbound left – 50 m, southbound right – 50 m.



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LEGEND

ARTERIAL ROADWAY

(0) ANALYZED INTERSECTION

XXX (YYY) AM PEAK (PM PEAK) TRAFFIC VOLUME

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CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.

5.1

Title

PROJECTED TRAFFIC VOLUMES

6.0 Utilities Planning Considerations

As discussed in Section 3.0 - Future Land Use Considerations, there will ultimately be sixteen quarter sections of residential and commercial land developed adjacent east and west of the 84 Street roadway between 68 Avenue and 132 Avenue. This section summarizes the long term utility servicing and storm drainage requirements for the future growth areas, as outlined in previous studies completed by the City of Grande Prairie and Aquatera.

Figures 6.1a and 6.1b illustrate a general overview of the major water and wastewater requirements for the area. Figures 6.2a and 6.2b illustrate the major storm drainage concept for the area. The figures also identify the key infrastructure that will be required to cross or run within the 84 Street right-of-way. Further details in regards to the locations, alignments, and sizing of the future utilities and infrastructure are included in the Functional Design drawings in Section 7.

No modeling or capacity analysis was completed for the water and sanitary mains as part of this project. The sizing and routes of the mains will be required to be determined in future separate studies by Aquatera.

6.1 WATER MAINS

6.1.1 68 Avenue to 100 Avenue

The quarter sections on the west side of 84 Street (Signature Falls, Eagle Estates, Brookfield, and NE19 71-5-6) are currently serviced and planned to be further serviced through existing water main connections to the developments to the west. These quarter sections will require no accommodation through 84 Street.

The quarter sections on the east side of 84 Street (SW17 71-5-6, NW17 71-5-6, SW20 71-5-6, and NW20 71-5-6) will require a future trunk in order to be serviced. The trunk will connect to mains along 100 Avenue and 68 Avenue. Depending on the phasing and timing of future development, as well as recommendations provided in future studies for the servicing of these quarter sections, the water trunk has two potential alternative alignments.

The first alternative is to construct the water trunk within the future development area. This would require thorough planning and coordination of all of the quarter sections in order to define an exact alignment and staging plan.

The second alternative is to construct it within the 84 Street roadway. Depending on phasing and cross-section considerations, it may be most practical to construct it under the future east lanes of the roadway, which will be approximately located in the existing roadway alignment. Stubs would be installed to each of the quarter sections at the collector roadway intersections.

6.1.2 100 Avenue to 132 Avenue

In general, all eight of the quarter sections from 100 Avenue to 132 Avenue will be serviced by connections to the existing mains to the west. No water mains are planned to be constructed along this portion of 84 Street. However, there will be a total of four crossings, which will take place at the collector roadway intersections.

6.2 SANITARY INFRASTRUCTURE

6.2.1 68 Avenue to 100 Avenue

Similarly to the water main servicing considerations described in Section 6.1.1, the quarter sections on the west side of 84 Street are currently serviced and planned to be further serviced by an existing trunk along 88 Street. The quarter sections to the east of 84 Street will require a new trunk to be constructed either along the 84 Street corridor or within the future development areas. The trunk would flow from north to south and connect to the system that runs along the Rge Rd. 55 right-of-way. The sanitary trunk will also be required to accommodate future flows from West Carriage Lane as described in Section 6.2.2.

Further study is required to assess the downstream system capacity and the exact alignment of the sanitary main.

6.2.2 100 Avenue to 132 Avenue

In general, the sanitary servicing will flow from north to south. The West Carriage Lane quarter sections (SW29 71-5-6 and NW29 71-5-6) will require a lift station that is planned to be located northeast of the 84 Street / 100 Avenue intersection. This lift station will transport the sanitary wastewater to the trunk that is planned to either run along the 84 Street corridor or within the future development area to the east, as described in Section 6.2.1.

The other six quarter sections along 84 Street (Crystal Landing, Woodgrove Estates, Copperwood, Kingsgate Landing, SW32 71-5-6, and NW32 71-5-6) are currently serviced and planned to be further serviced by the existing trunk that runs along 88 Street and through Crystal Landing and Woodgrove Estates.

At a minimum, sanitary trunks will be required to tie into or cross 84 Street at the two collector roadway intersections in these quarter sections. The NW32 71-5-6, and SW32 71-5-6 quarter sections are planned to tie into the Copper Wood sanitary mains. The Kingsgate Landing quarter section is planned to flow to the southeast into 84 Street. This can be accommodated by a trunk within 84 Street or within the NW32 71-5-6, and SW32 71-5-6 system.

Further study is required for sanitary servicing of the Kingsgate Landing, NW32 71-5-6, and SW32 71-5-6 quarter sections. The depths and grades of the existing and proposed mains should be further analyzed to determine whether or not a lift station is required due to topographic constraints. Further, a feasibility assessment is recommended to determine whether a trunk should be installed within 84 Street or entirely within the future development areas.

6.3 STORMWATER MANAGEMENT

The stormwater management component of this project has been broken down into two systems, the Major Storm System and the Minor Storm System, as discussed below. The minor storm system for this project is comprised of storm sewer, which is designed to provide a basic level of service in accommodating minor storms (1:5 year event or lesser). The major storm system is comprised of the roadway, ditches, and storm ponds that convey runoff for events that are greater than the capacity of the minor storm system.

Figures 6.2A and 6.2B below illustrate the major and minor stormwater management concepts. Details of the Minor Storm System, i.e. the storm sewer, are illustrated in the Functional Design Drawings in Section 7.

6.3.1 Major Storm System

Over the length extending from 68 Avenue to 132 Avenue, the 84 Street corridor is located within three major storm basins, including the Woody Creek Basin, the basin surrounding Wood Lake, and a basin in the northern portion of the project in the Kingsgate Landing area, as conceptualized in the Northeast Area Structure Plan. The approximate boundaries of each of the basins are illustrated in Figures 6.2A and 6.2B. Of the three basins, the Woody Creek Basin is the only basin that has historically been analyzed in detail.

From south to north, the major storm system considerations are summarized as follows:

- **Station 0+240 (68 Avenue) to 1+580** – The portion of 84 Street from 68 Avenue to the shared property line of Signature Falls and Eagle Estates lays within the Woody Creek Basin and drains from north to south. The roadway and storm sewers will be designed to tie in to the existing stormwater management facility located within Signature Falls.

- **Station 1+580 to 2+030 (84 Avenue)** – The portion of 84 Street from 1+580 to 84 Avenue is within the Wood Lake basin. The roadway and storm drainage within this basin will be designed such that the overland drainage and storm sewer drainage will be directed to Wood Lake through the future development areas. In general, the drainage direction is from west to east.

- **Station 2+030 (84 Avenue) to 2+665** – The portion of 84 Street from 84 Avenue to 2+665 will be split along a ridge that divides the Woody Creek Basin from the Wood Lake Basin. As such, the overland drainage and storm sewer systems will be designed such that 50% of the runoff is directed into the Woody Creek Basin through Brookfield and 50% will be directed into the Wood Lake Basin through future development in SW20 71-5-W6. In general, the drainage direction is from north to south.

- **Station 2+665 to 5+488** – The portion of 84 Street from 2+665 to 5+488 is within the Woody Creek Basin and generally drains from north to south. Numerous stormwater management facilities are planned to be constructed within future developments, including:

    - Brookfield;
    - NW20 71-5-W6;
    - West Carriage Lane;
    - Crystal Landing; and
    - Woodgrove.

  As demonstrated in Figures 6.2A and 6.2B, the stormwater management facilities will be connected via storm sewers and ditches throughout the future development areas. Along 84 Street, oversized storm sewer will be required at the following locations:

    - Station 2+900 to 3+500 (100 Avenue) – A storm sewer crossing will be required at 2+900 to connect the future stormwater management facility within NW20 71-5-6 to the future stormwater management facility in Brookfield. An oversized storm sewer will be required to extend along 84 Street from 2+900 to 3+500 to connect the future stormwater management facility within the south West Carriage Lane quarter section to the future stormwater management facility in Brookfield.

    - Station 4+445 – An oversized storm sewer crossing will be required to connect the future stormwater management facility within Woodgrove Estates to the stormwater management facility within West Carriage Lane.

- **Station 5+488 to 6+720 (132 Avenue)** – The portion of 84 Street from 5+488 to 132 Avenue lays within the northeast drainage basin. In general, the land drains from west to east. Stormwater management facilities are proposed to be constructed within Kingsgate Landing and within SW32 71-5-W6. An oversized storm sewer crossing will be required at Station 6+300.

6.3.2 Minor Storm System

The minor storm system (storm sewer), shall be designed to accommodate all runoff within the existing right-of-way. All runoff within future developments adjacent to 84 Street will be contained and managed within the development areas and thus, will not be accommodated for in the 84 Street storm sewer system.

As per the City of Grande Prairies Design Guidelines, the storm sewer along 84 Street was designed using the Rational Method, as follows:

$$Q = CiA / 360$$

Where: Q = the design peak flow rate in m^3/s
i = the intensity of rainfall in millimetres per hour corresponding to the time of concentration
A = the contributing area in hectares
C = the runoff coefficient

As developed by Atmospheric Environment Services of Environment Canada for the Grande Prairie Regional Airport, the Intensity-Duration-Frequency Curve (IDF Curves) for a 1:5 year storm is represented by the equation:

$i = 519.1\,(t + 6.08)^{-.0814}$, where t is the time of concentration for runoff, in minutes.

Using a time of concentration of t = 10 minutes, the design intensity of rainfall (i) shall be 54.1mm/hr at initial time of concentration.

The 84 Street corridor consists of both permeable and impermeable areas. As such, a weighted average of pervious and impervious area runoff coefficients was estimated according to the following equation:

$$C = \frac{C_p A_p + C_i A_i}{A_p + A_i}$$

where the subscripts “p” and “I” represent the pervious and impervious surfaces, respectively. As per the City’s Design Guidelines, the runoff coefficient is 0.20 for parks, lawn, and greenspace and 0.90 for paved streets. For the proposed 48.0m wide cross-section, the average runoff coefficient, using conservative engineering judgment is calculated as follows:

$$C = \frac{C_p A_p + C_i A_i}{A_p + A_i} = \frac{(0.20)(27.0m) + (0.90)(21.0m)}{21.0m + 27.0m} = 0.51$$

Detailed storm sewer design calculations are included in Appendix A.

6.4 SHALLOW AND OVERHEAD UTILITIES

In general, all shallow utility companies expressed interest in having space within the 84 Street right-of-way designated for their utilities. Alternatively, depending on timing and staging of future development to the east of 84 Street, there is potential to have all of the buried shallow utilities located within future development area.

With the street lights aligned in the median, there will be room for some buried shallow utilities within the boulevards. However, other furniture (cubicles, transformers, pedestals, etc.) should be kept outside of the boulevard to provide sufficient space from the edge of the roadway and therefore, the shallow utility furniture would have to be incorporated into the berm space. In addition, special consideration with shallow utility alignments will be required at all intersections in future detailed design stages.

6.4.1 ATCO Electric

The 44KV transmission line that runs along the east part of 84 Street from Station 2+420 to 5+100 would be cost-prohibitive to relocate. As such, the utility right-of-way will remain as-is and the 84 Street roadway will align to the west of the line.

There is an existing 3 Phase overhead line that runs within the existing 84 Street corridor from 68 Avenue to 116 Avenue. The portion of line from 100 Avenue to 116 Avenue runs within the centre of the road right-of-way. As part of the first stage of this project, which is the interim rural road connection from 100 Avenue to 132 Avenue described in Section 7.3, the overhead line will have to be relocated. As part of the second stage, which is full twinning and urbanization of 84 Street, the overhead line from 68 Avenue to 100 Avenue will have to be relocated and buried in the west boulevard.

Ultimately, the line will be buried within the west boulevard, possibly with future TELUS and Eastlink lines. For the interim configuration, it could remain overhead until future twinning, but it may be most economical over the long term to bury it is as part of the initial phase and not have to coordinate additional relocations/burials in the future.

6.4.2 ATCO Gas

The existing ATCO Gas lines from 68 Avenue to 100 Avenue will have to be relocated as part of the future twinning. The gas lines could be installed within the west boulevard space alongside the TELUS and ATCO Electric lines. Similarly, the ATCO Gas lines that run along the 100 Avenue roadway will also need to be relocated as part of future intersection upgrades.

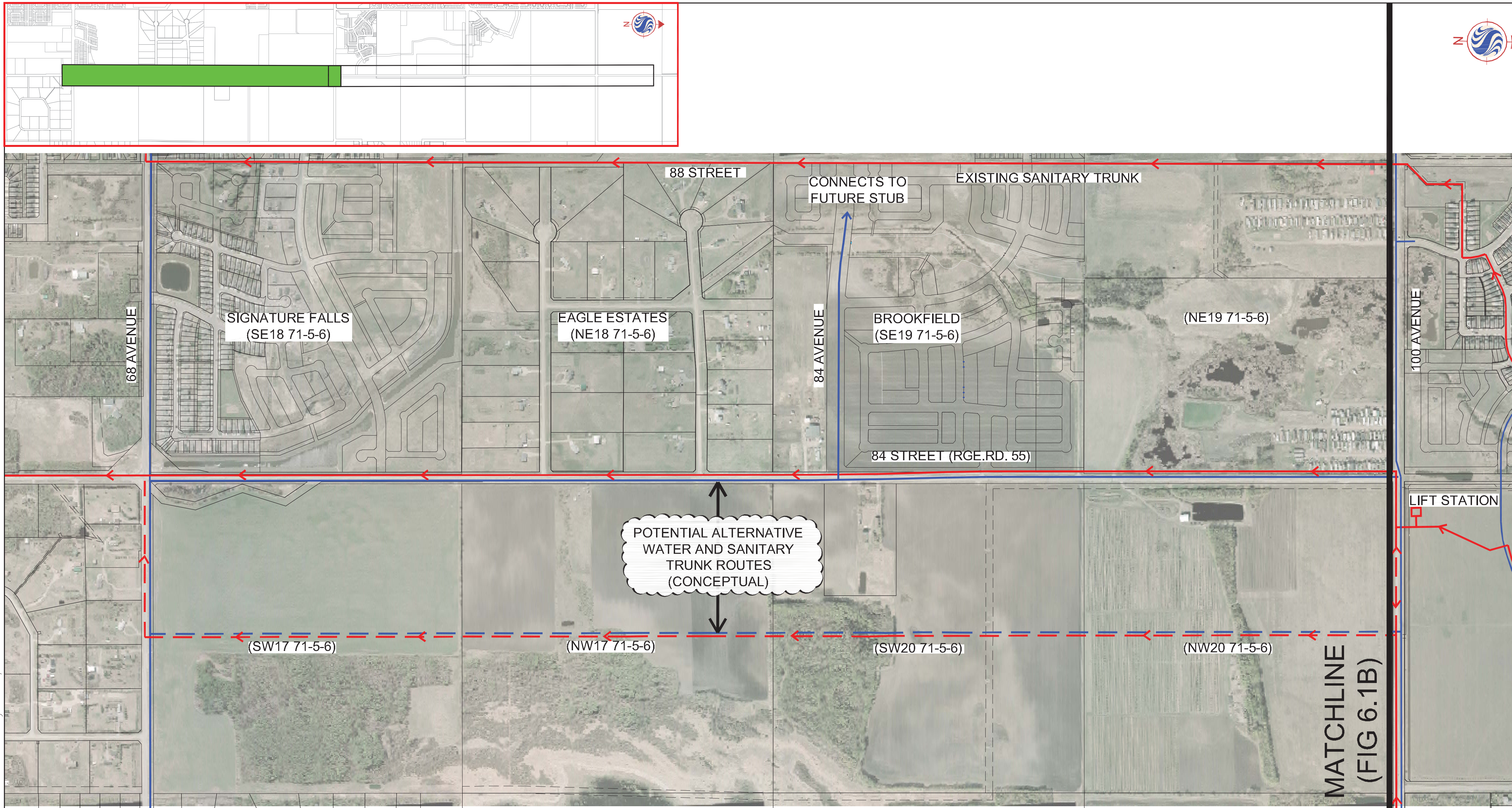
Alternatively, there is opportunity for the future ATCO Gas lines to remain within the future development areas.

6.4.3 TELUS

The existing TELUS lines that run along the west side of 84 Street will have to be relocated as part of the future twinning. The TELUS lines could run either within the 84 Street boulevard alongside the ATCO Electric , ATCO Gas, and East Link lines or alternatively, within the future development areas to the east of 84 Street.

6.4.4 Eastlink

Eastlink currently has no lines within the 84 Street right-of-way. All future Eastlink lines will be installed alongside ATCO Electric and Telus



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JUNE 2012
116239144

Legend

- PROPERTY LINE
- SANITARY MAIN ALIGNMENTS
- ALTERNATIVE SANITARY MAIN ALIGNMENTS
- WATER MAIN ALIGNMENTS
- ALTERNATIVE WATER MAIN ALIGNMENTS

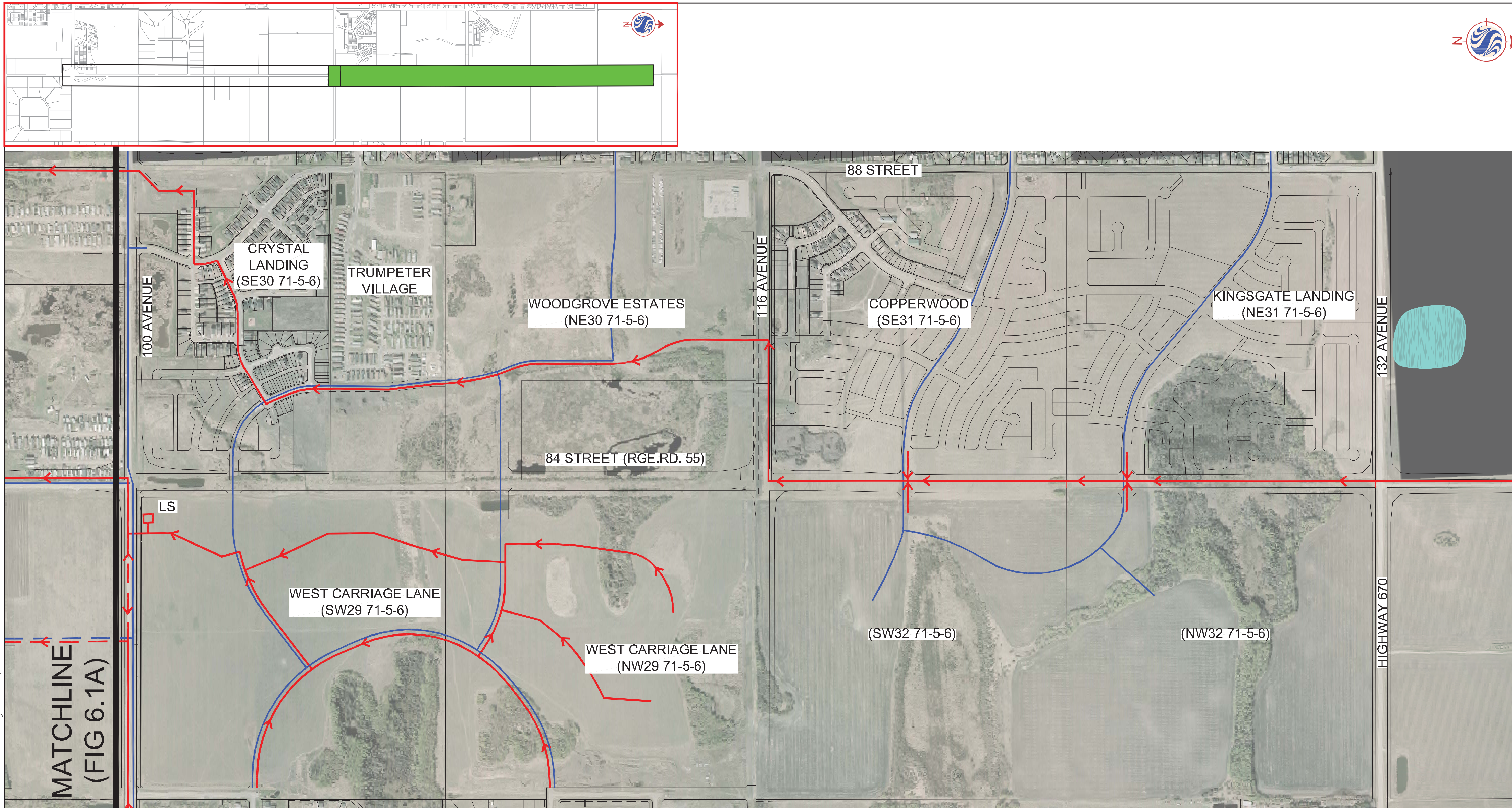
0 100 300 500m

Stantec

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
6.1A

Title
UTILITY DISTRIBUTION
TRANSMISSION CONCEPT
68 AVE TO 100 AVE



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ORIGINAL SHEET – ANSI B

JUNE 2012
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- PROPERTY LINE
- SANITARY MAIN ALIGNMENTS
- ALTERNATIVE SANITARY MAIN ALIGNMENTS
- WATER MAIN ALIGNMENTS
- ALTERNATIVE WATER MAIN ALIGNMENTS

0 100 300 500m

Client/Project

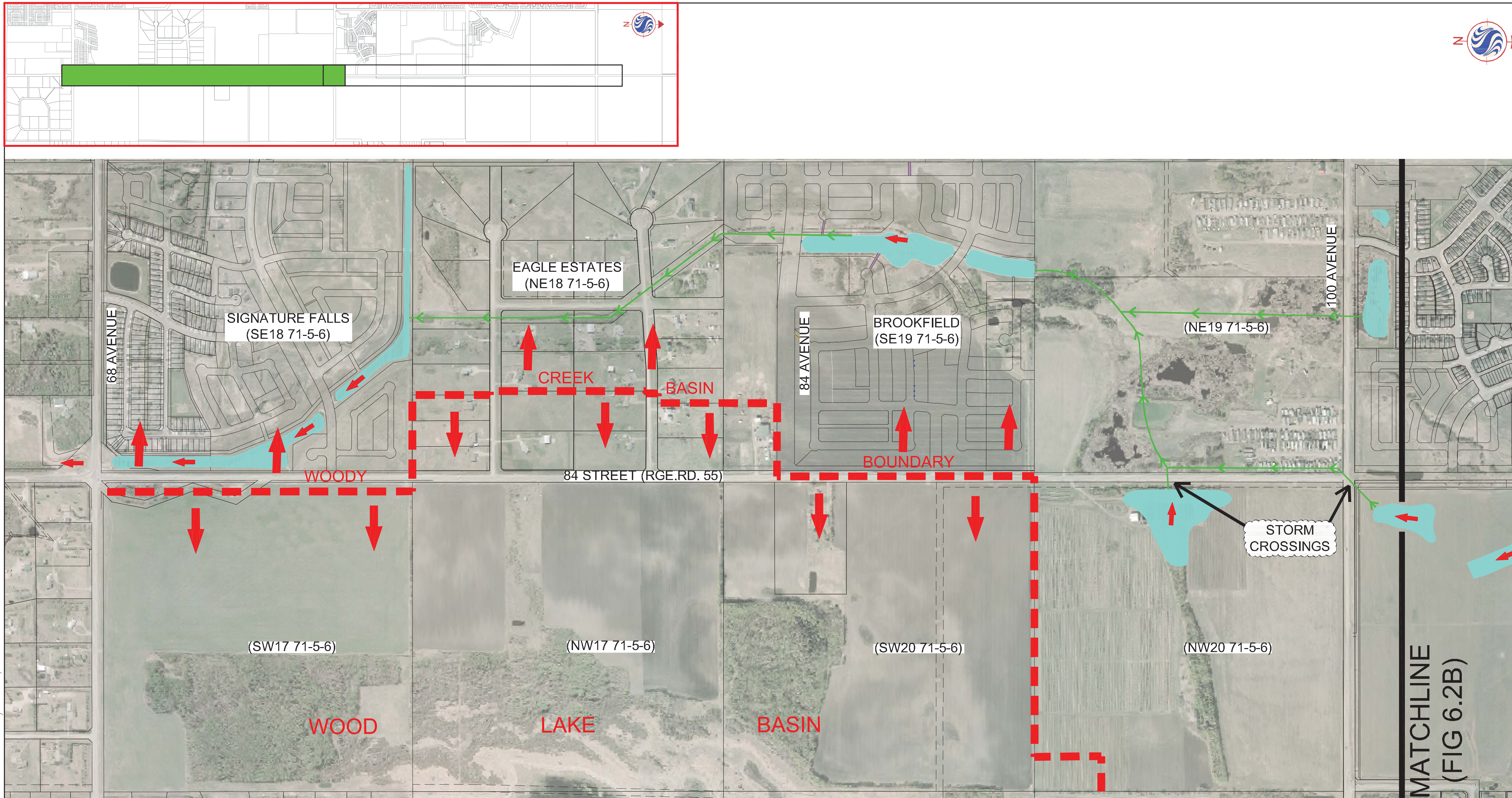
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.

6.1B

Title

UTILITY DISTRIBUTION
TRANSMISSION CONCEPT
100 AVE TO 132 AVE



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JUNE 2012
116239144

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Legend

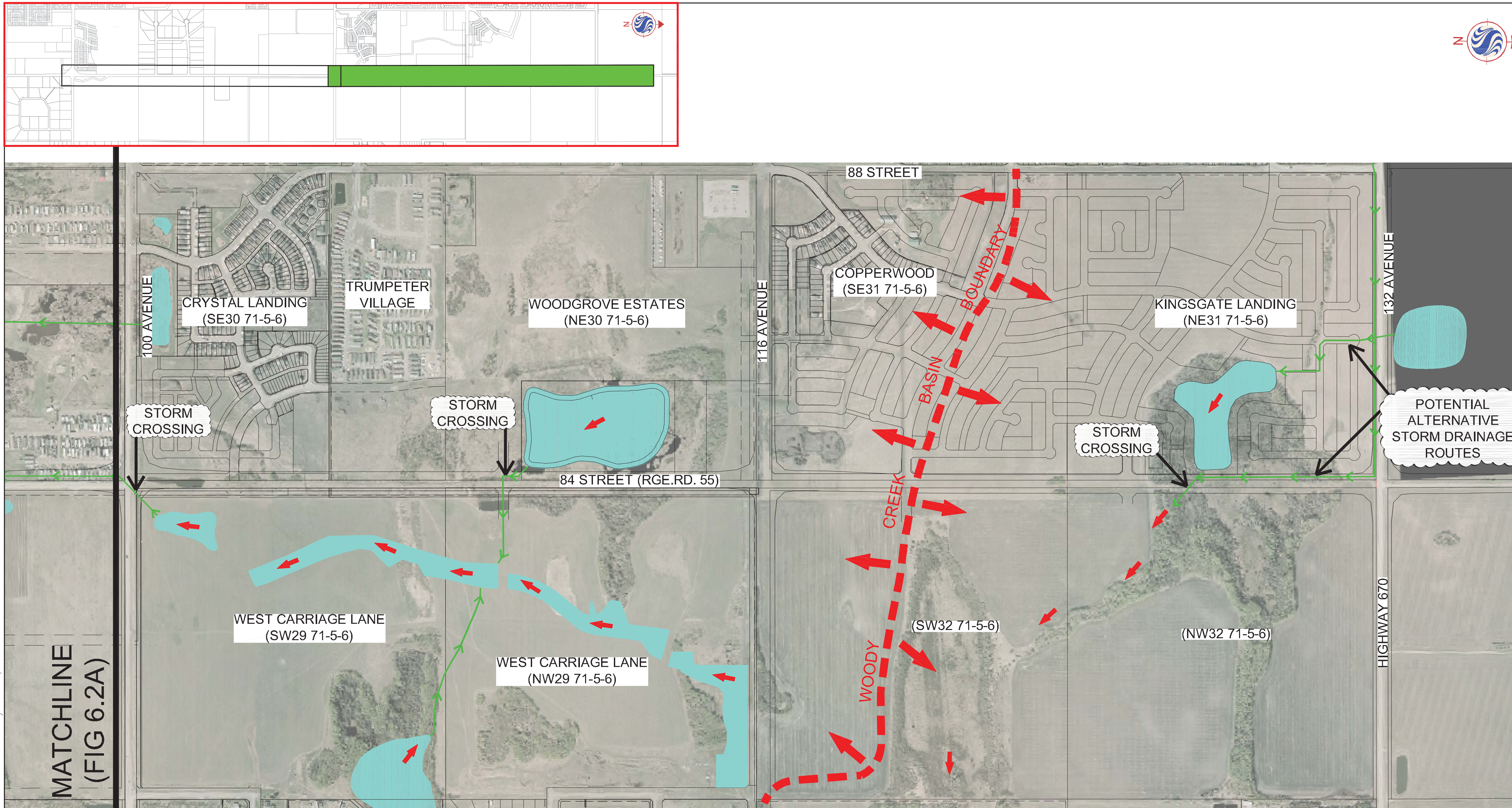
PROPERTY LINE
STORM MAIN
MAJOR OVERLAND DRAINAGE
STORMWATER MANAGEMENT FACILITY
STORM BASIN BOUNDARY

0 100 300 500m

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
6.2A

Title
STORM DRAINAGE CONCEPT 68 AVE TO 100 AVE



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ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

Stantec

Legend

PROPERTY LINE
STORM MAIN
MAJOR OVERLAND DRAINAGE
STORMWATER MANAGEMENT FACILITY
STORM BASIN BOUNDARY

0 100 300 500m

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
6.2B

Title
STORM DRAINAGE CONCEPT 100 AVE TO 132 AVE

7.0 Functional Planning Drawings

The functional planning drawings in this section include the typical cross-sections, horizontal and vertical alignments, detailed intersection configurations, and typical phasing strategies as outlined in the subsections below.

7.1 CROSS-SECTIONS

Figure 7.1 at the end of this section illustrates the four typical cross-sections proposed for 84 Street from 68 Avenue to 132 Avenue. All four cross-sections include the same basic design criteria, but vary based on existing right-of-way widths and boundary conditions. The criteria for the cross-section parameters are summarized in Table 7.1 below.

TABLE 7.1: CROSS-SECTION PARAMETERS

Cross-Section Parameter	Value
Total Right-of-Way Width	42.0 – 48.0m
Travel Lane Width	3.7m
Median Width / Turn Bay Width	6.0m / 3.5m
Curb and Gutter Width	0.5m
Cross Slope	2.5%
Boulevard Width	13.60m
Berm Width / Height	6.0m / 2.0m
Walkways	3.0m

The utilities shown in the cross section include water mains, sanitary mains, storm sewer, and typical shallow utilities. As described in Section 6, the extent of the future water mains and sanitary sewer along 84 Street is unknown. Storm sewer will be required along the full length of the roadway. In order to accommodate staging and ensure that consistent utility alignments will be held along 84 Street, the storm sewer will ideally be constructed within the ultimate southbound lanes when the roadway is urbanized and twinned in the future. Any sanitary and water mains could therefore be constructed in the ultimate northbound lanes. Shallow utilities could be installed in the boulevards, if necessary.

7.2 HORIZONTAL AND VERTICAL ALIGNMENTS

The horizontal and vertical alignment parameters are shown in the proposed functional plans, Figures 7.2a through 7.2h.

In general, the majority of 84 Street runs on a north/south tangent. The only horizontal curves along 84 Street are reverse curves located at the south and north ends of the ATCO Electric Transmission line, with approximate Stations of 2+400 and 5+100 respectively. The radii of the horizontal curves are 5000 metres, which is suitable for maintaining a constant cross-slope around the curves while maintaining driver comfort and safety without implementing superelevation around the curves.

In general, the vertical alignment grades vary from 0.5% to 2.0%. Although 0.60% is the preferred minimum, much of the existing rural roadway is constructed at a grade of 0.50% or less. Similarly, much of the native terrain north of 100 Avenue consists of wetland and other grades less than 0.5%.

For drainage and earthworks considerations, it is desirable that the grade of the arterial roadway be similar to that of the adjacent property lines to accommodate appropriate tie-ins, particularly at intersections. Special grade considerations should be provided in the vicinities of stormwater management facilities that are planned to be adjacent to 84 Street, particularly the ones in NW20 71-5-6, West Carriage Lane (SW29 71-5-6), Woodgrove Estates (NE30 71-5-6), and Kingsgate Landing (NE31 71-5-6). During the detailed design of 84 Street and/or the stormwater management facilities, the normal and high water levels should be further assessed in comparison to the 84 Street road grades to ensure that 84 Street will remain above the high water levels and that the storm outlets will be property addressed.

As per the City’s standard cross-section, the property lines will be located directly on top of the berms, requiring the adjacent lots to be graded to drain in a back-to-front manner. As such, future grading of the developments will be required to tie-in at elevations close to the proposed grades shown in Figures 7.2a through 7.2h to accommodate the drainage requirements for the lots adjacent to 84 Street.

7.3 INTERSECTION CONFIGURATIONS

Figures 7.3a through 7.3e illustrate the horizontal geometrics, including turning radii, turn bay lengths, and lane widths for each of the major arterial roadways as per the City of Grande Prairie’s arterial road standards (design speed of 80km/h). In general, the through lanes along 84 Street (north/south) are 3.7 metres wide and the intersecting east/west through lanes are 3.5 metres wide, which is the City’s standard for arterial roadways.

Right turn bays were designed to be 3.5 metres wide in the storage areas and 7.5 metres wide around the corners (5.5 metre lane, 1.0m shoulder, and 0.5 metre curb and gutters) to accommodate truck turning movements as well as to allow general traffic to flow through in the event that there is a stalled vehicle in the curve. All left turn lanes were designed to be 3.5 metres wide. The collector roadway intersections have been designed with 3.5m wide left turn bays and storage bay lengths of 60.0m.

As detailed in Section 5.0, the southbound right turning movements at the 100 Avenue and 116 Avenue intersections are projected to be high enough to warrant provisions larger than typical right-turn bays. Stantec recommends that free-flow lanes be constructed to accommodate those right turn movement volumes. Alternatively, dual-right turn bays were considered. However, dual right-turn bays should be utilized only in “last-resort” scenarios, as they require special traffic signalization timings and lead to driver confusion because they are uncommon.

7.4 TYPICAL PHASING STRATEGY

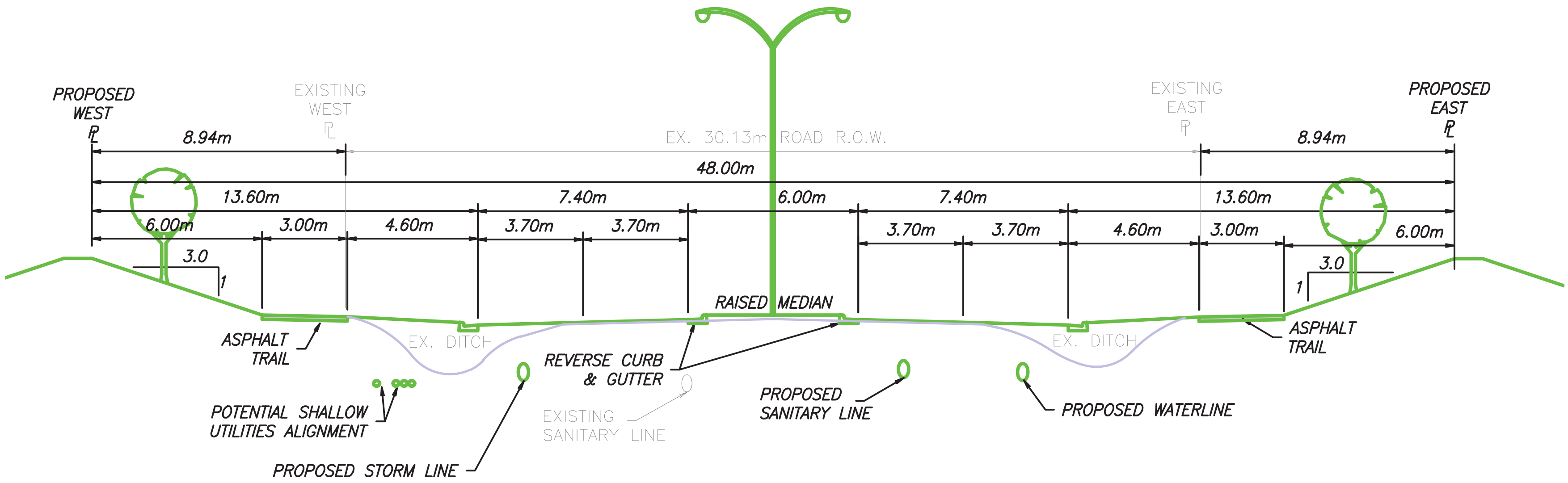
As described in Section 5, the phasing of 84 Street from its existing condition to the ultimate four lane urban divided roadway will take place over a time period that exceeds the horizons described in the Transportation Master Plan. As such, Figures 7.3a and 7.3b illustrate a general phasing strategy that is applicable to the entire project. The phasing is broken down into two components, Stage 1 and Stage 2.

Stage 1 is the interim connection of 84 Street from 100 Avenue to 132 Avenue. Intersection treatments at 100 Avenue, 116 Avenue, and 132 Avenue should be assessed at the time of detailed design to accommodate actual traffic volumes appropriately. The connection will be designed as a rural roadway with 3.7m wide lanes and 1.5m wide shoulders. To simplify urbanization in the future, the interim alignment will be centered with the future northbound lanes and the cross-slope of the roadway will be 2.5% sloping entirely to the east.

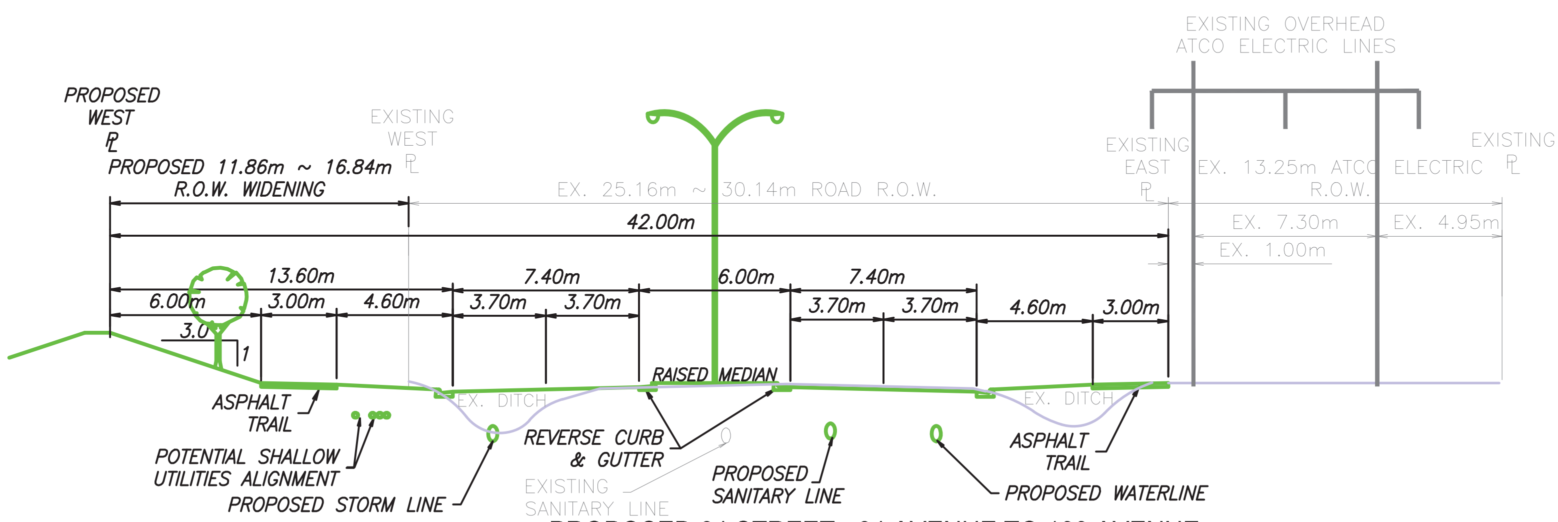
It is anticipated that when traffic volumes warrant the 84 Street to be twinned, the roadway will be constructed to the full urban build-out shown in Section 7.4. As such, Stage 2 is composed of two sub-phases, 2A and 2B, to address traffic accommodation during construction.

Stage 2A is the construction of the ultimate urban southbound lanes. During Stage 2A, traffic could be accommodated by the existing rural roadway while construction takes place adjacent to it. Stage 2A would include construction of the storm sewer. Upon completion of the southbound lanes, Phase 2B would initiate. As part of Phase 2B, traffic would be flopped onto the new southbound lanes to allow reconstruction and urbanization of the existing rural roadway to complete the urban standard. Traffic accommodation and upgrades to the intersections would be strategized on a case-by-case basis.

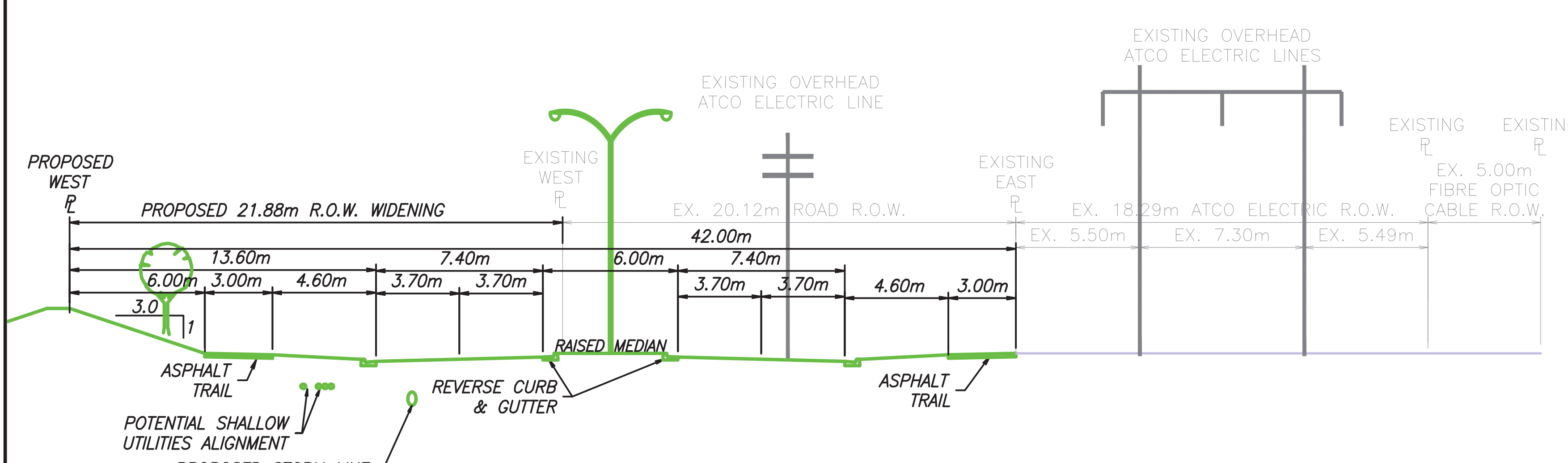
Depending on timing of the staging, there will likely be periods where transitions from four lane divided to two lane undivided roadways will be required. To minimize future throw-away costs, those transitions should be designed such that temporary and future tie-ins take place to alignments that are consistent for short term and long term designs. A typical transition for this is illustrated in Figure 7.4c.



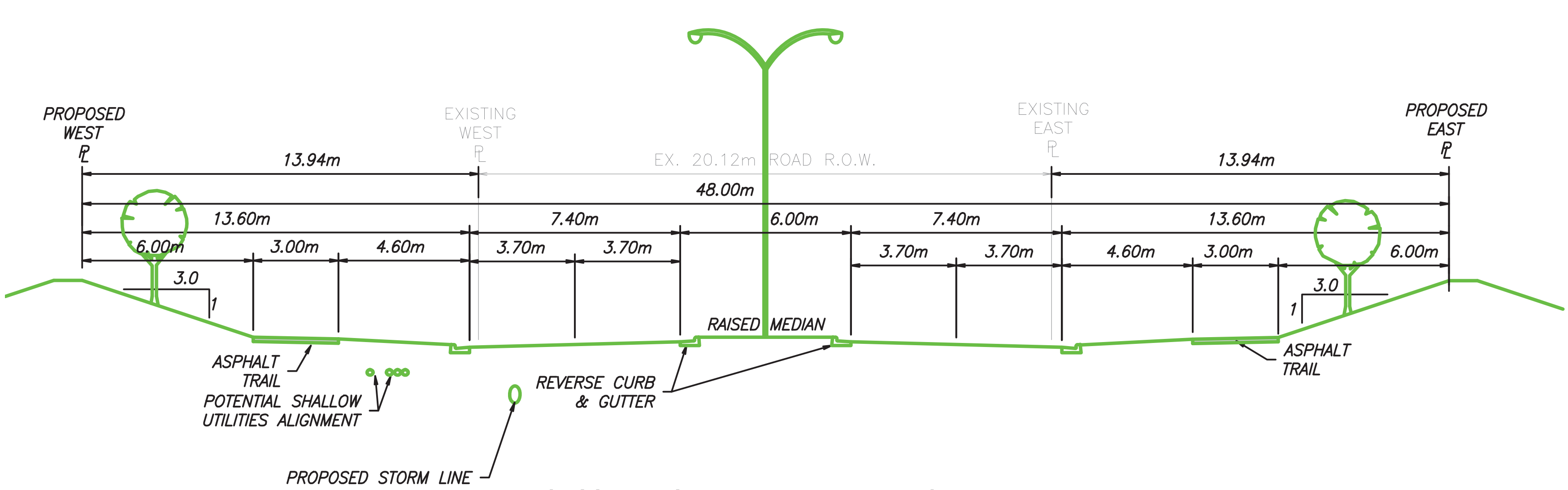
PROPOSED 84 STREET - 68 AVENUE TO 84 AVENUE



PROPOSED 84 STREET - 84 AVENUE TO 100 AVENUE



PROPOSED 84 STREET - 100 AVENUE TO 116 AVENUE



PROPOSED 84 STREET - 116 AVENUE TO 132 AVENUE

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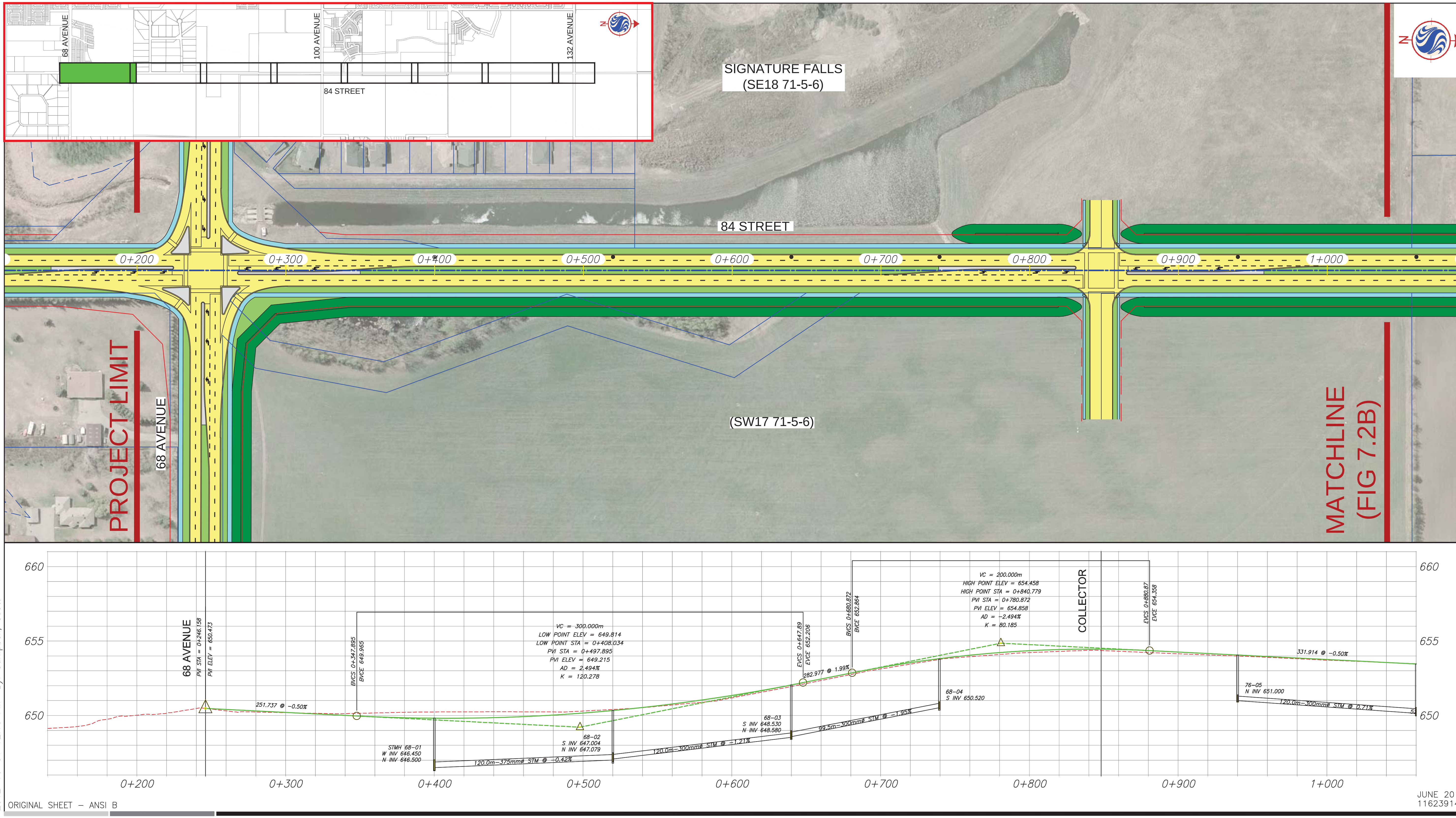
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.

7.1

Title

TYPICAL CROSS SECTIONS



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- EXISTING PROPERTY LINE
- PROPOSED PROPERTY LINE
- EXISTING CURBLINE
- PROPOSED CURBLINE
- CONTROL CENTRELINE
- TOP/TOE OF SLOPE
- PROPOSED TRAFFIC SIGNALS
- PROPOSED ROADWAY
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- PROPOSED BERM
- PROPOSED STORM MANHOLE

0 25 75 125m

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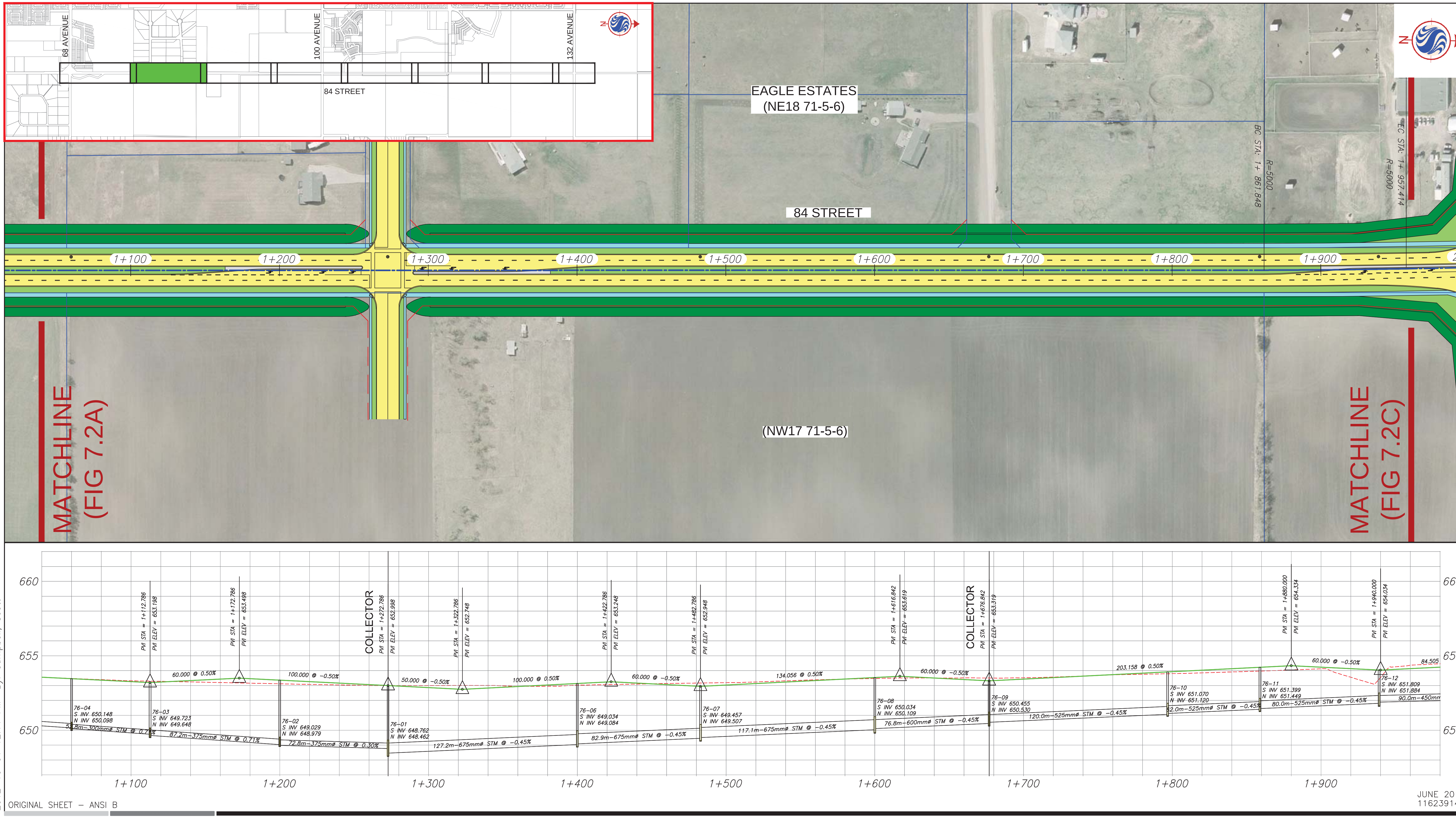
Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
7.2A

Title
HORIZONTAL AND
VERTICAL GEOMETRICS



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- TOP/TOE OF SLOPE
- PROPOSED TRAFFIC SIGNALS
- PROPOSED ROADWAY
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- PROPOSED BERM
- PROPOSED STORM MANHOLE

0 25 75 125m

Client/Project

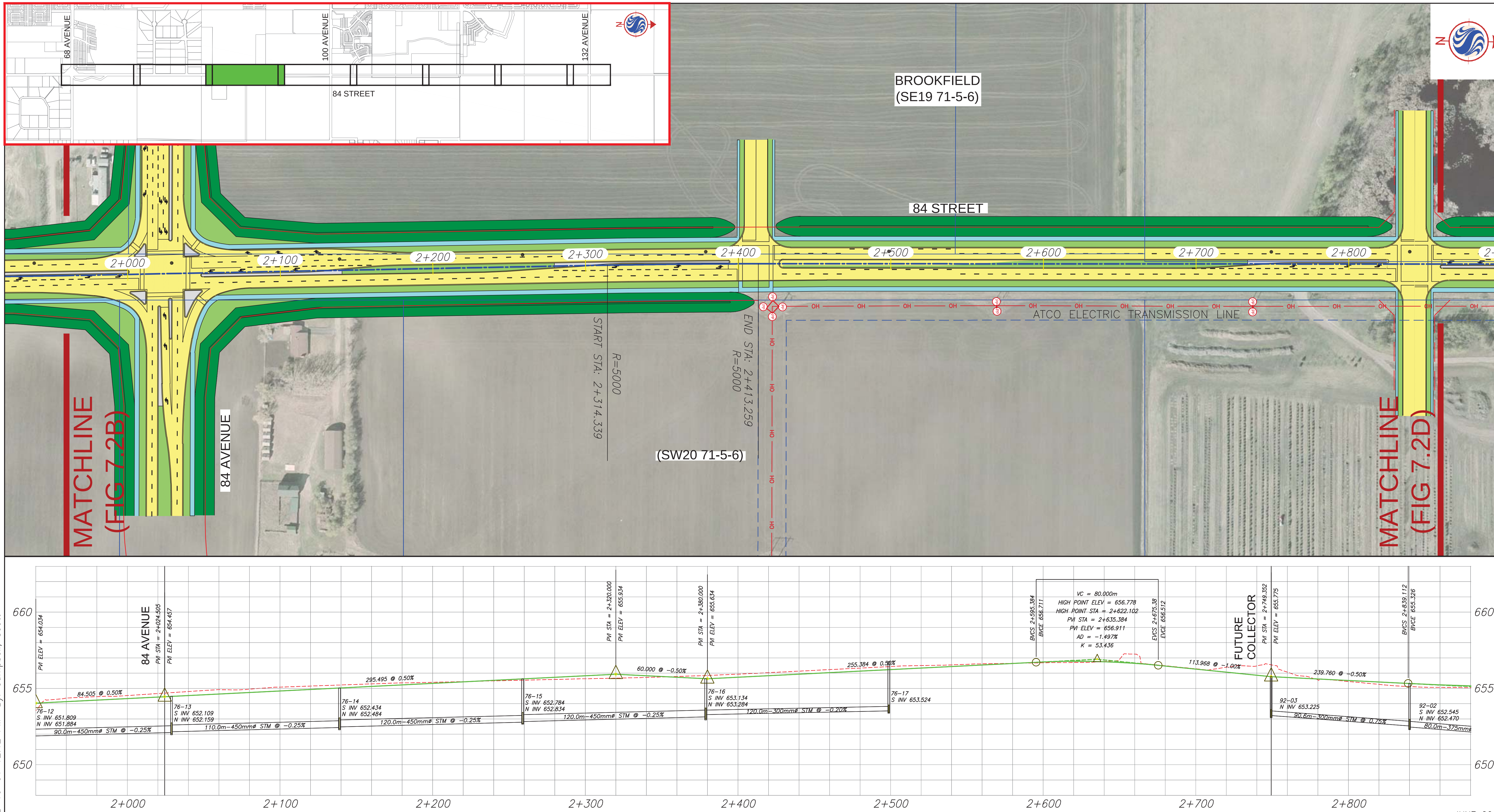
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.

7.2B

Title

HORIZONTAL AND
VERTICAL GEOMETRICS



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- PROPOSED CURBLINE
- CONTROL CENTRELINE
- TOP/TOE OF SLOPE
- PROPOSED TRAFFIC SIGNALS
- PROPOSED ROADWAY
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- PROPOSED BERM
- PROPOSED STORM MANHOLE

0 25 75 125m

Client/Project

CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.

7.2C

Title

HORIZONTAL AND
VERTICAL GEOMETRICS

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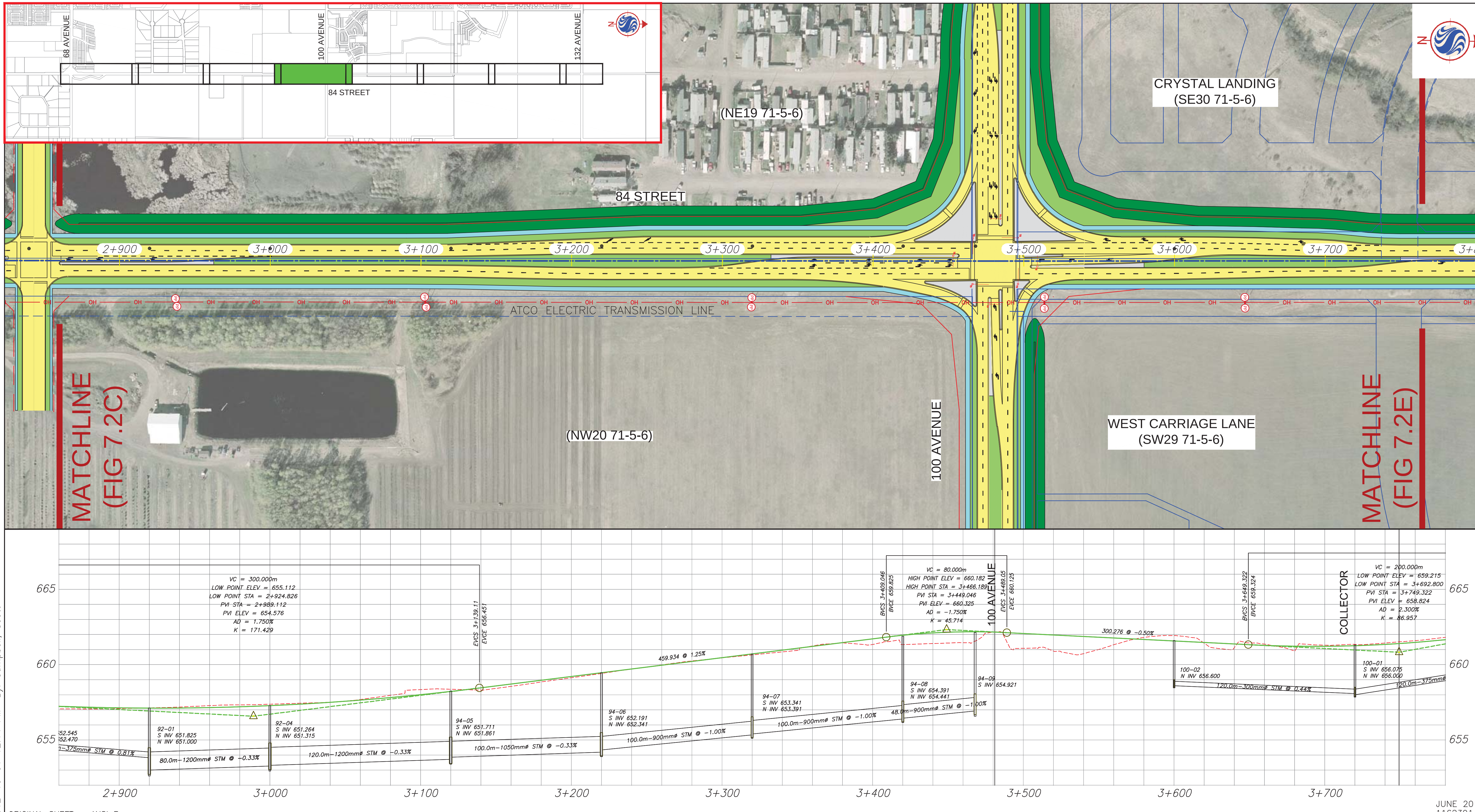

ORIGINAL SHEET – ANSI B

Stantec

Legend

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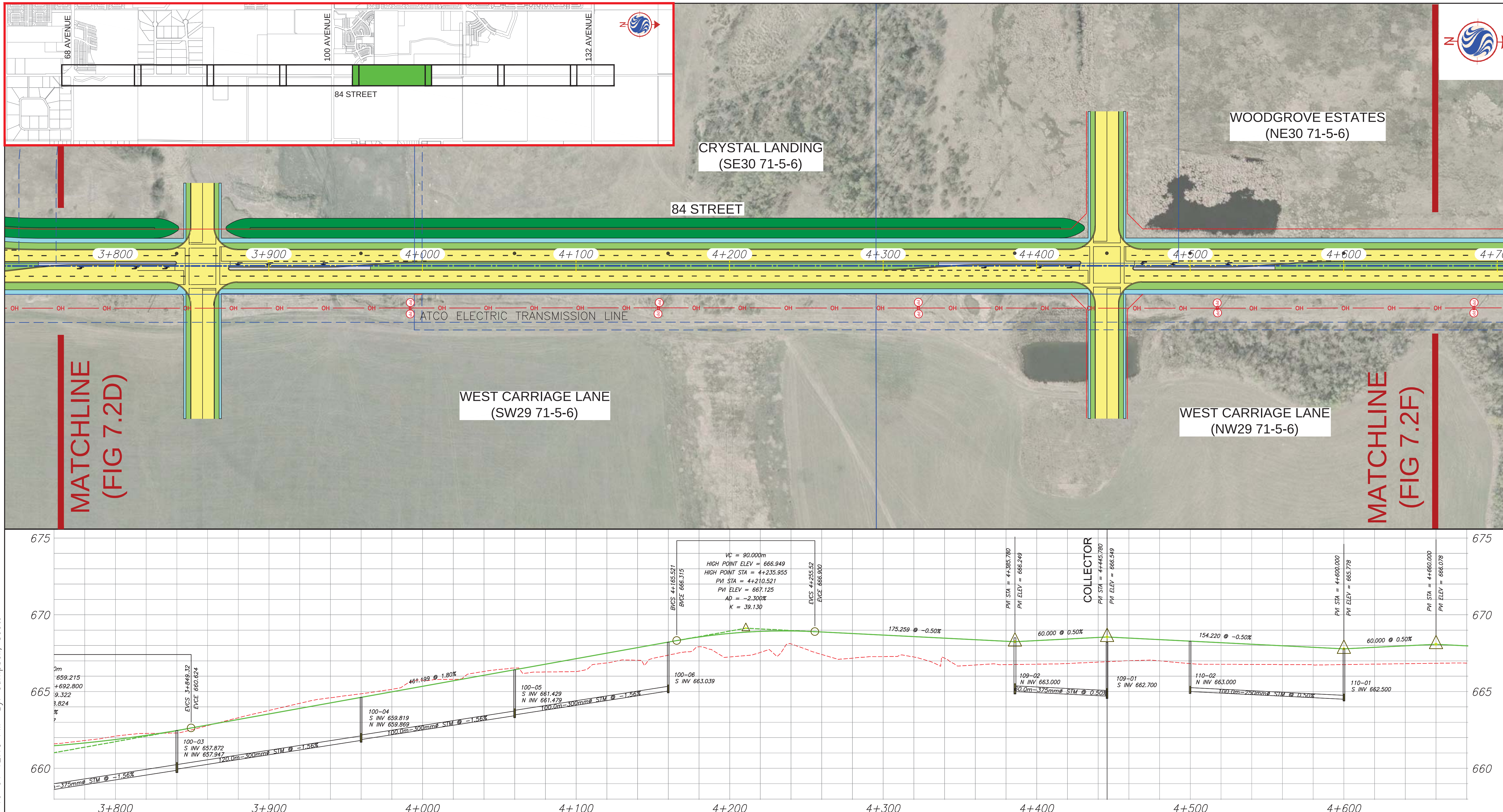
- PROPOSED PROPERTY LINE
- EXISTING CURBLINE
- PROPOSED CURBLINE
- CONTROL CENTRELINE
- TOP/TOE OF SLOPE
- PROPOSED TRAFFIC SIGNALS
- PROPOSED ROADWAY
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- PROPOSED BERM
- PROPOSED STORM MANHOLE

0 25 75 125m

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
7.2D

Title
HORIZONTAL AND VERTICAL GEOMETRICS



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2012-10-01 12:15 PM By: Campbell, Scott

ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

Legend

- EXISTING PROPERTY LINE
- PROPOSED PROPERTY LINE
- EXISTING CURBLINE
- PROPOSED CURBLINE
- CONTROL CENTRELINE
- TOP/TOE OF SLOPE
- PROPOSED TRAFFIC SIGNALS
- PROPOSED ROADWAY
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- PROPOSED BERM
- PROPOSED STORM MANHOLE

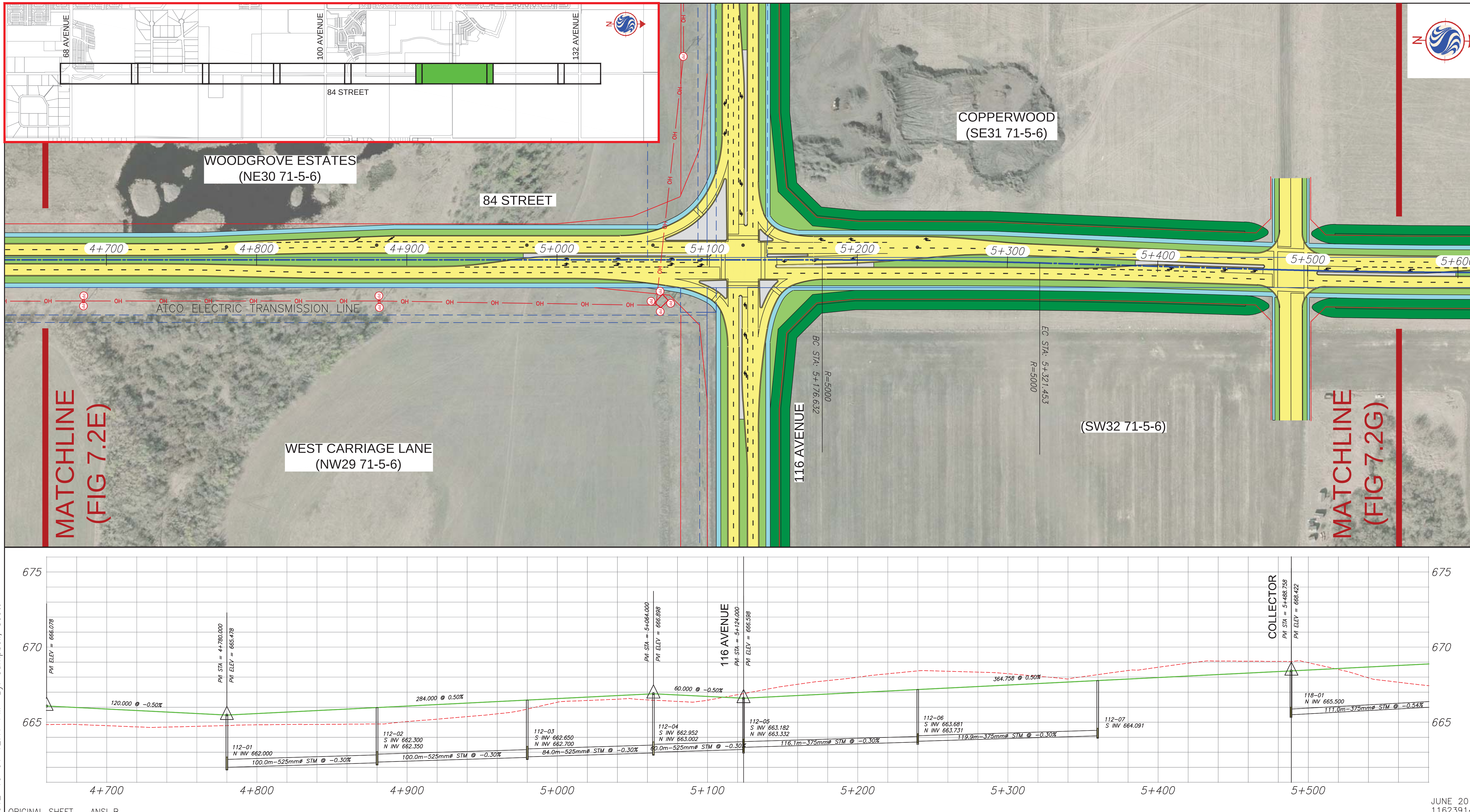
0 25 75 125m

Stantec

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
7.2E

Title
HORIZONTAL AND
VERTICAL GEOMETRICS



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116239144

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ORIGINAL SHEET – ANSI B

Stantec

Legend

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- PROPOSED PROPERTY LINE
- EXISTING CURBLINE
- PROPOSED CURBLINE
- CONTROL CENTRELINE
- TOP/TOE OF SLOPE
- PROPOSED TRAFFIC SIGNALS
- PROPOSED ROADWAY
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- PROPOSED BERM
- PROPOSED STORM MANHOLE

0 25 75 125m

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
7.2F

Title
HORIZONTAL AND
VERTICAL GEOMETRICS

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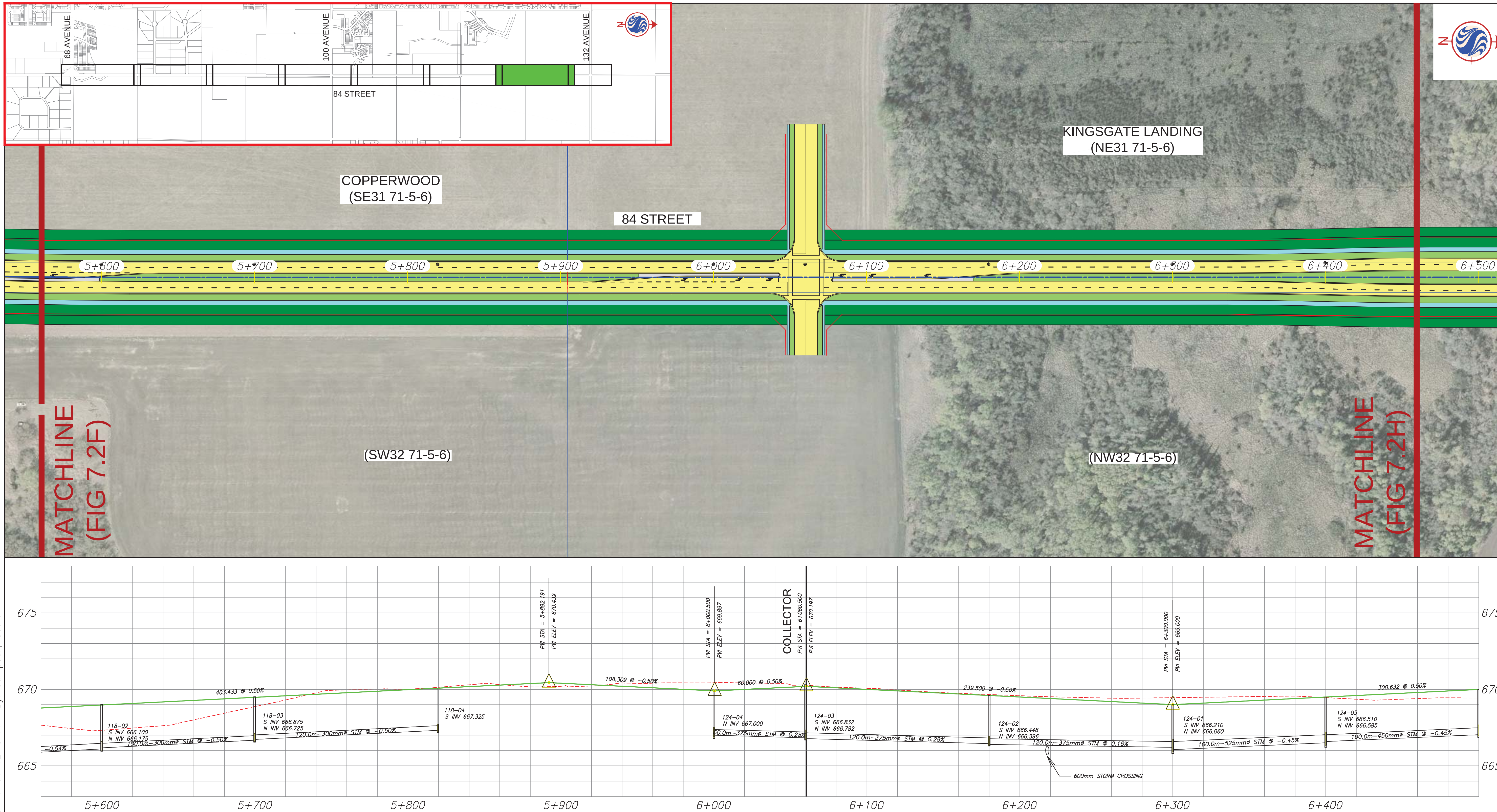

ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

Legend

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- PROPOSED PROPERTY LINE
- EXISTING CURBLINE
- PROPOSED CURBLINE
- CONTROL CENTRELINE
- TOP/TOE OF SLOPE
- PROPOSED TRAFFIC SIGNALS
- PROPOSED ROADWAY
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- PROPOSED BERM
- PROPOSED STORM MANHOLE

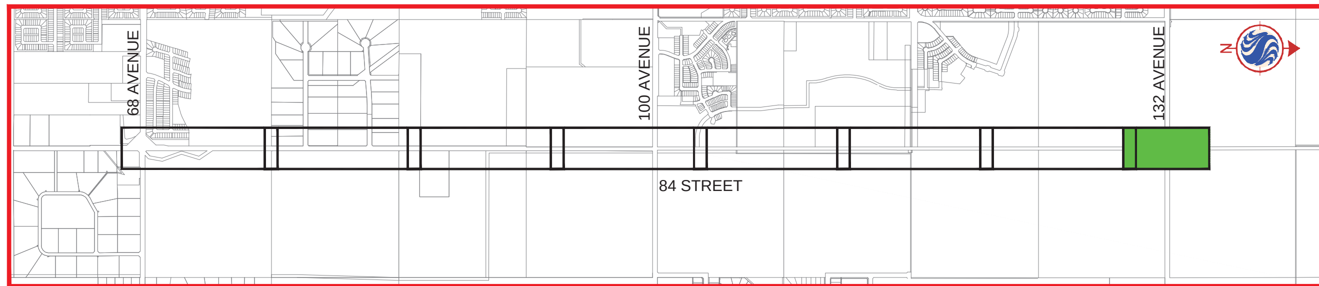
0 25 75 125m

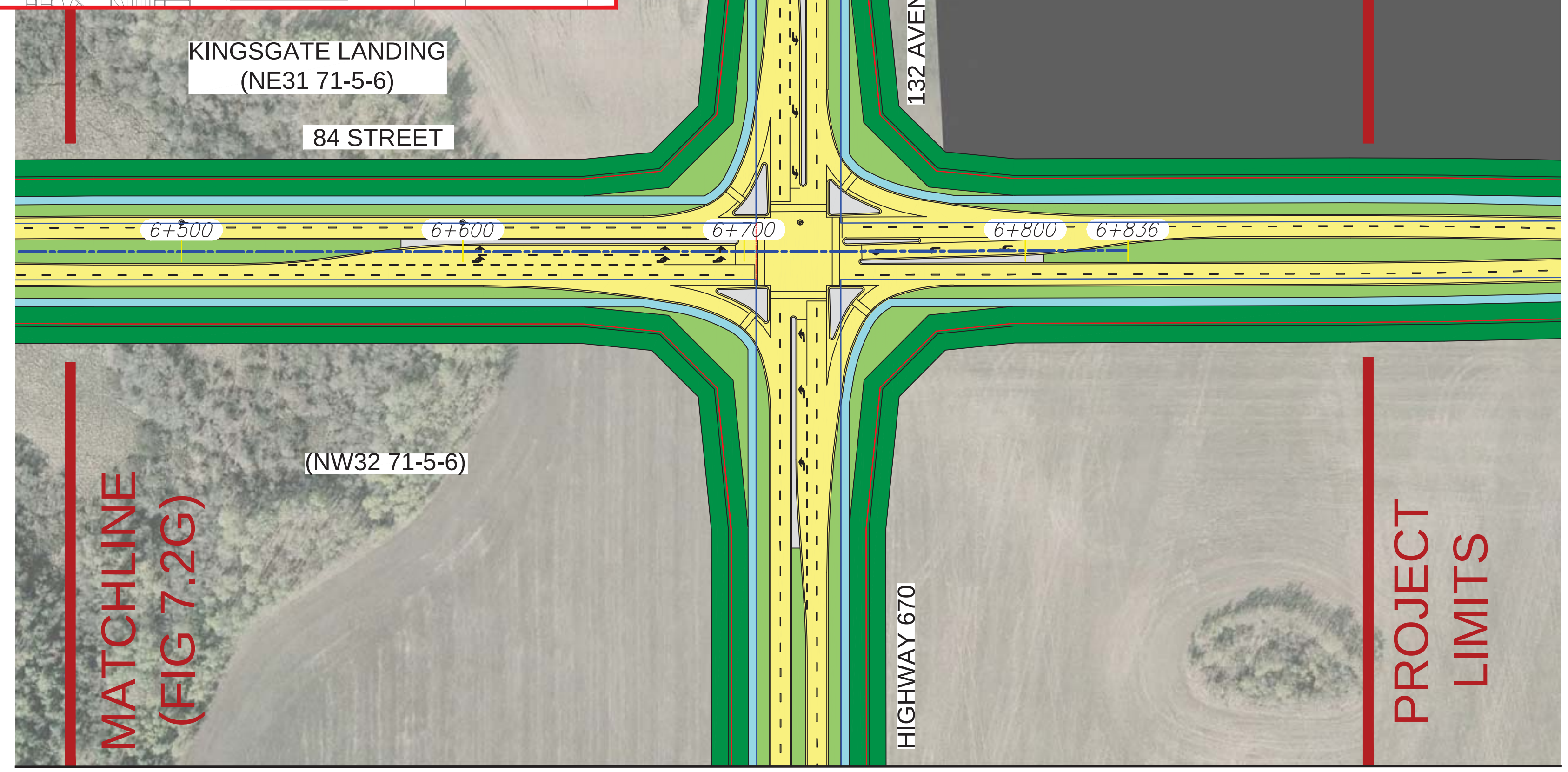
Stantec

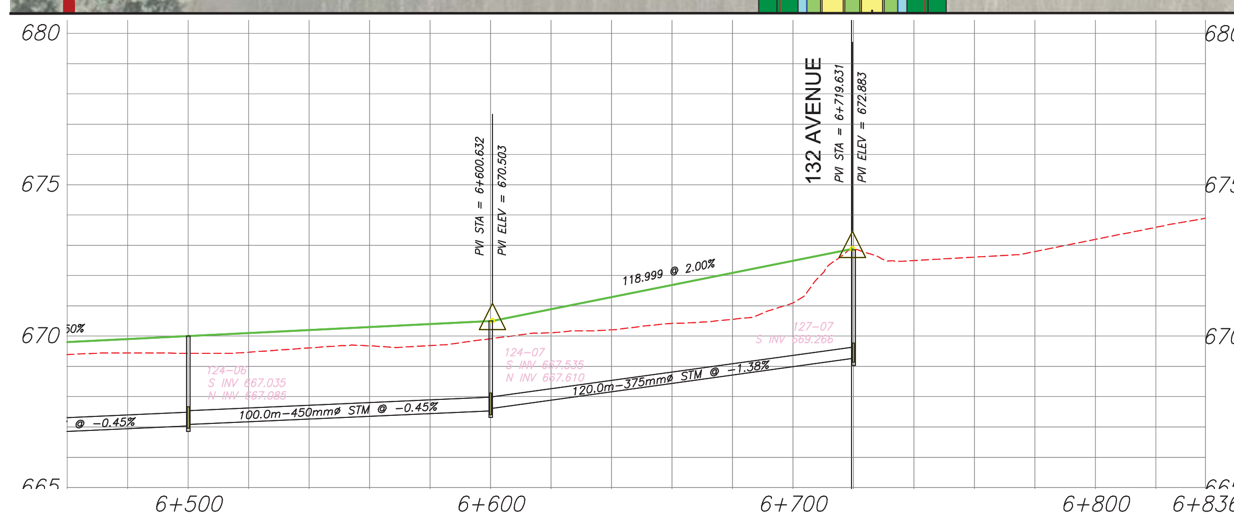
Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
7.2G

Title
HORIZONTAL AND
VERTICAL GEOMETRICS







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JUNE 2012
116239144

Stantec

Legend

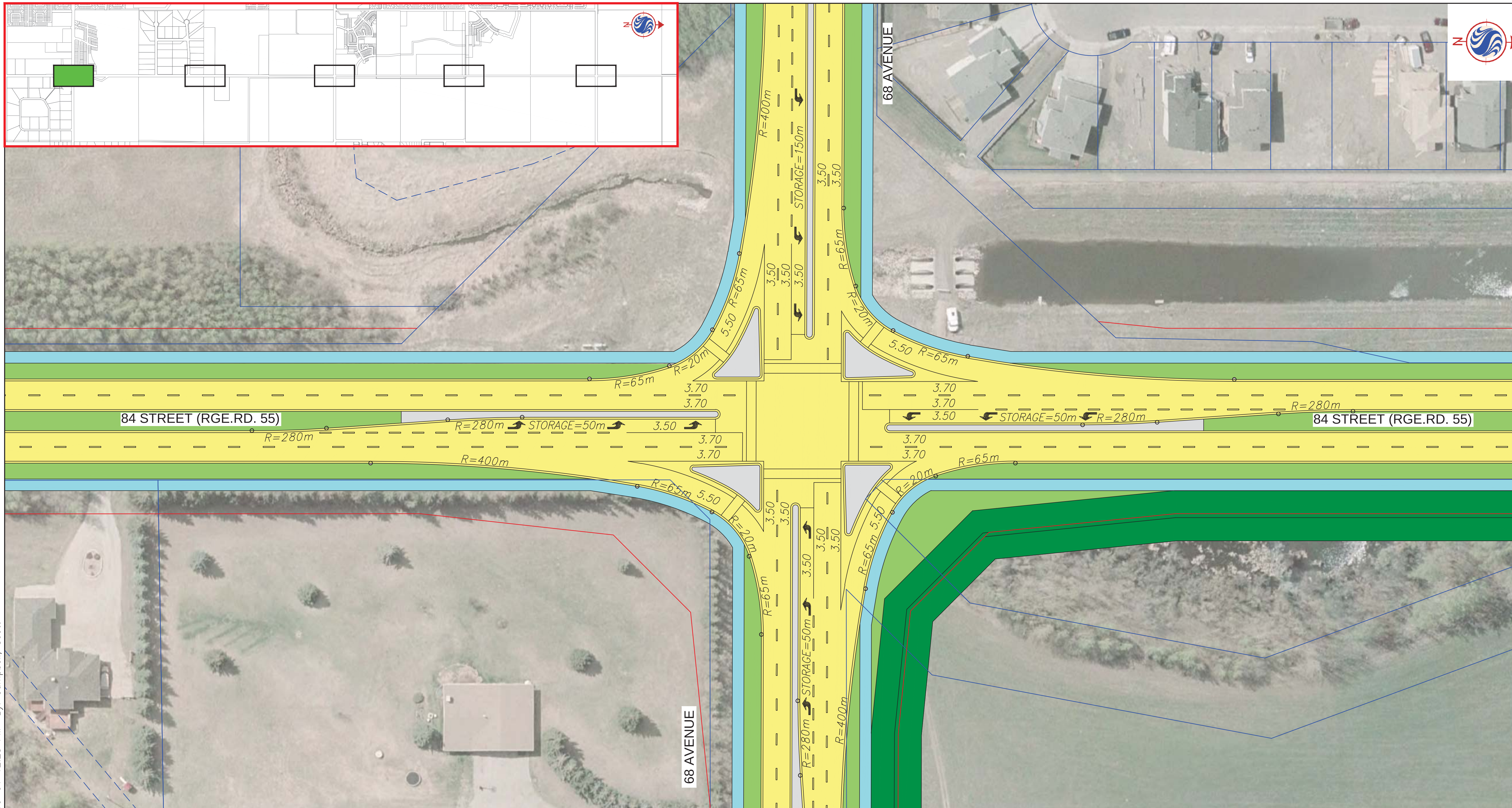
- EXISTING PROPERTY LINE
- PROPOSED PROPERTY LINE
- EXISTING CURBLINE
- PROPOSED CURBLINE
- CONTROL CENTRELINE
- TOP/TOE OF SLOPE
- PROPOSED TRAFFIC SIGNALS
- PROPOSED ROADWAY
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- PROPOSED BERM
- PROPOSED STORM MANHOLE

0 25 75 125m

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
7.2H

Title
HORIZONTAL AND
VERTICAL GEOMETRICS



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ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

Legend

EXISTING PROPERTY LINE	PROPOSED ROAD NETWORK
PROPOSED EASEMENT LINE	PROPOSED LANDSCAPING
PROPOSED PROPERTY LINE	PROPOSED CONCRETE MEDIAN/ISLAND CAPS
EXISTING CURBLINE	PROPOSED SIDEWALK/TRAIL
PROPOSED CURBLINE	PROPOSED BERM
PROPOSED FENCING	PROPOSED TRAFFIC SIGNALS

0 10 30 60m

Stantec

Client/Project

CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.

7.3A

Title

68 AVENUE INTERSECTION CONFIGURATION

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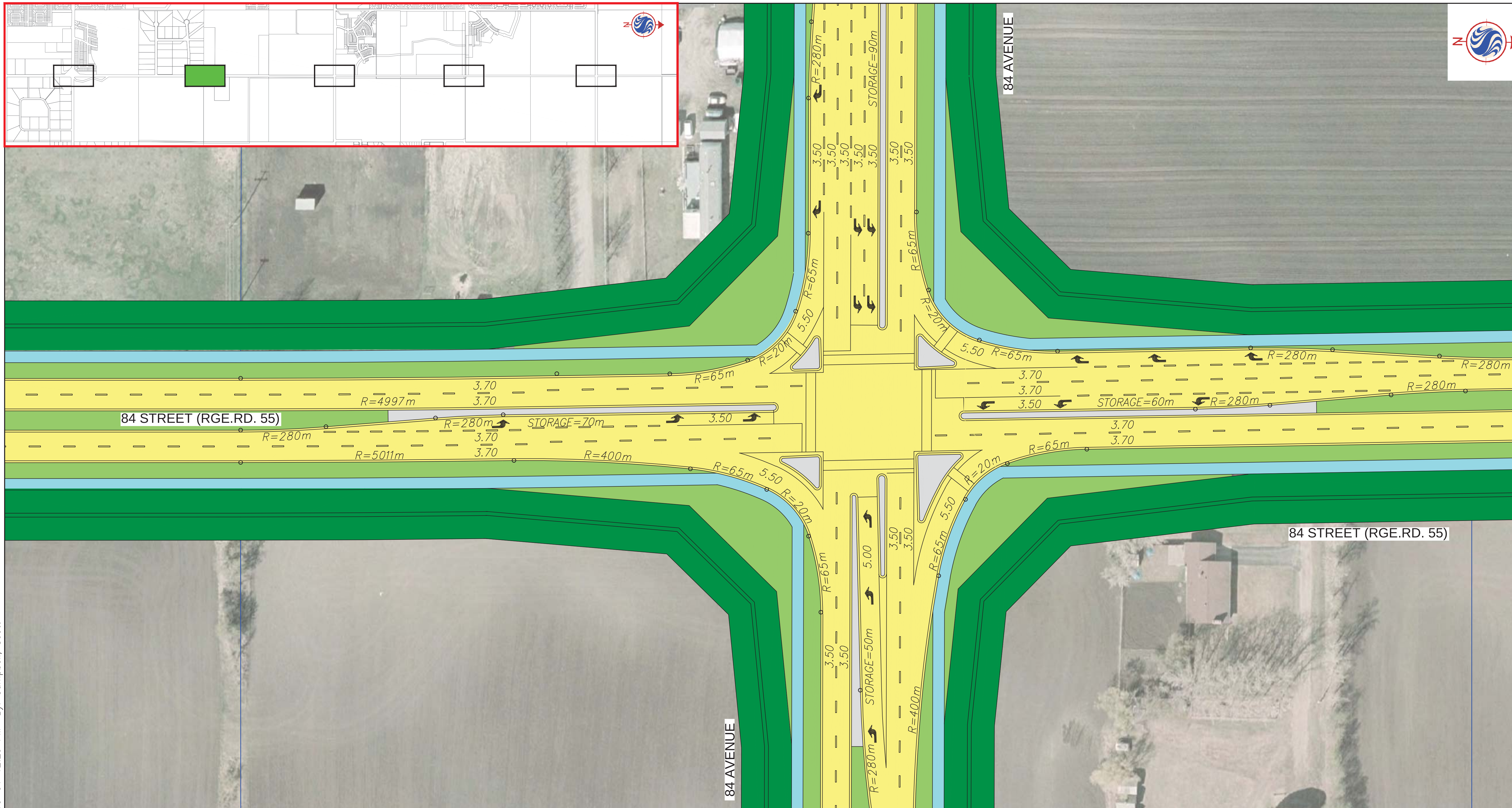


ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

Stantec

Legend

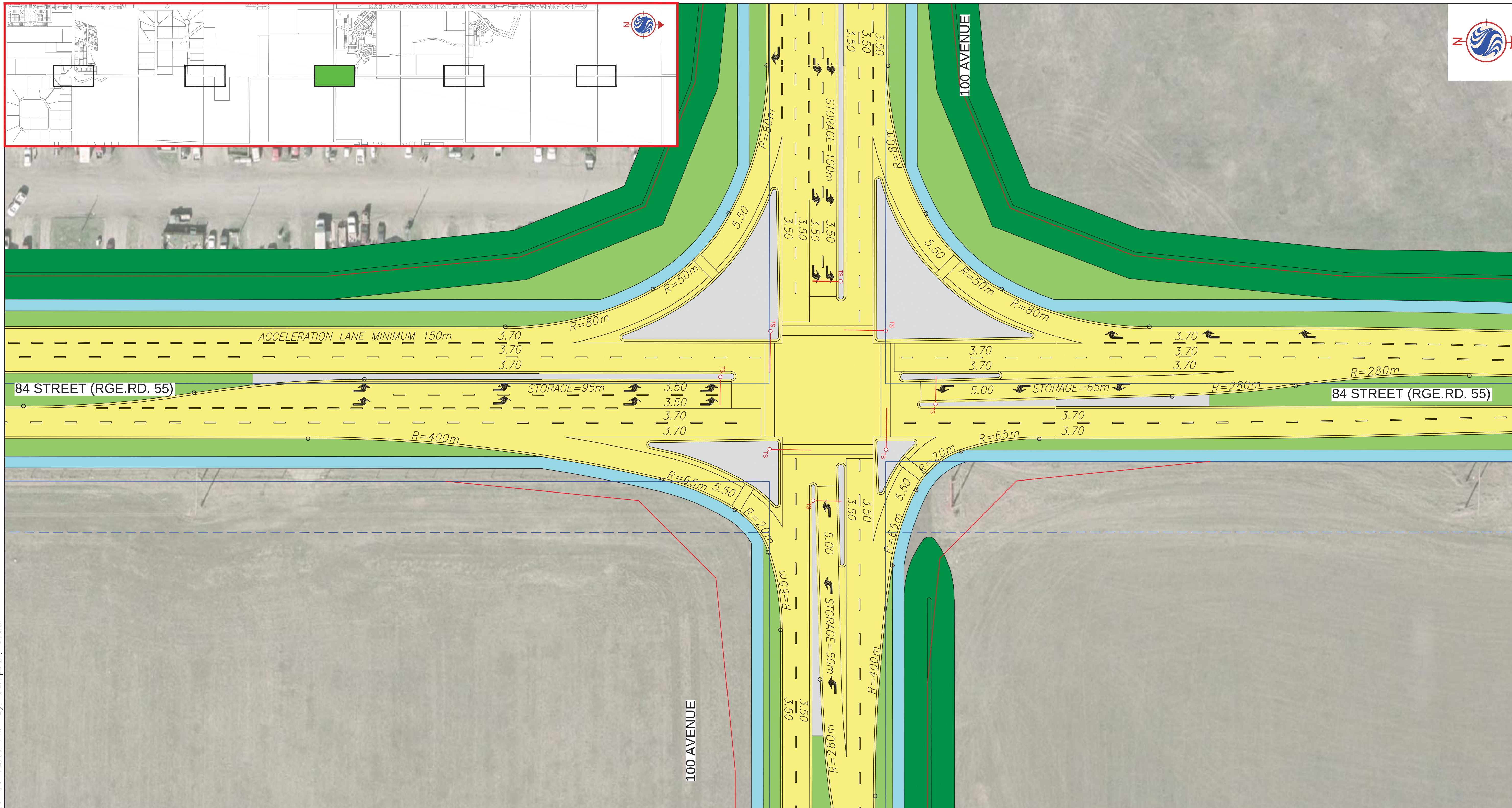
- EXISTING PROPERTY LINE
- PROPOSED EASEMENT LINE
- PROPOSED PROPERTY LINE
- EXISTING CURBLINE
- PROPOSED CURBLINE
- PROPOSED FENCING
- PROPOSED ROAD NETWORK
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- PROPOSED BERM
- PROPOSED TRAFFIC SIGNALS

0 10 30 60m

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
7.3B

Title
84 AVENUE INTERSECTION CONFIGURATION



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2012-10-01 12:30 PM By: Campbell, Scott

ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

Stantec

Legend

- EXISTING PROPERTY LINE
- PROPOSED EASEMENT LINE
- PROPOSED PROPERTY LINE
- EXISTING CURBLINE
- PROPOSED CURBLINE
- PROPOSED FENCING
- PROPOSED ROAD NETWORK
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- PROPOSED BERM
- PROPOSED TRAFFIC SIGNALS

0 10 30 60m

Client/Project

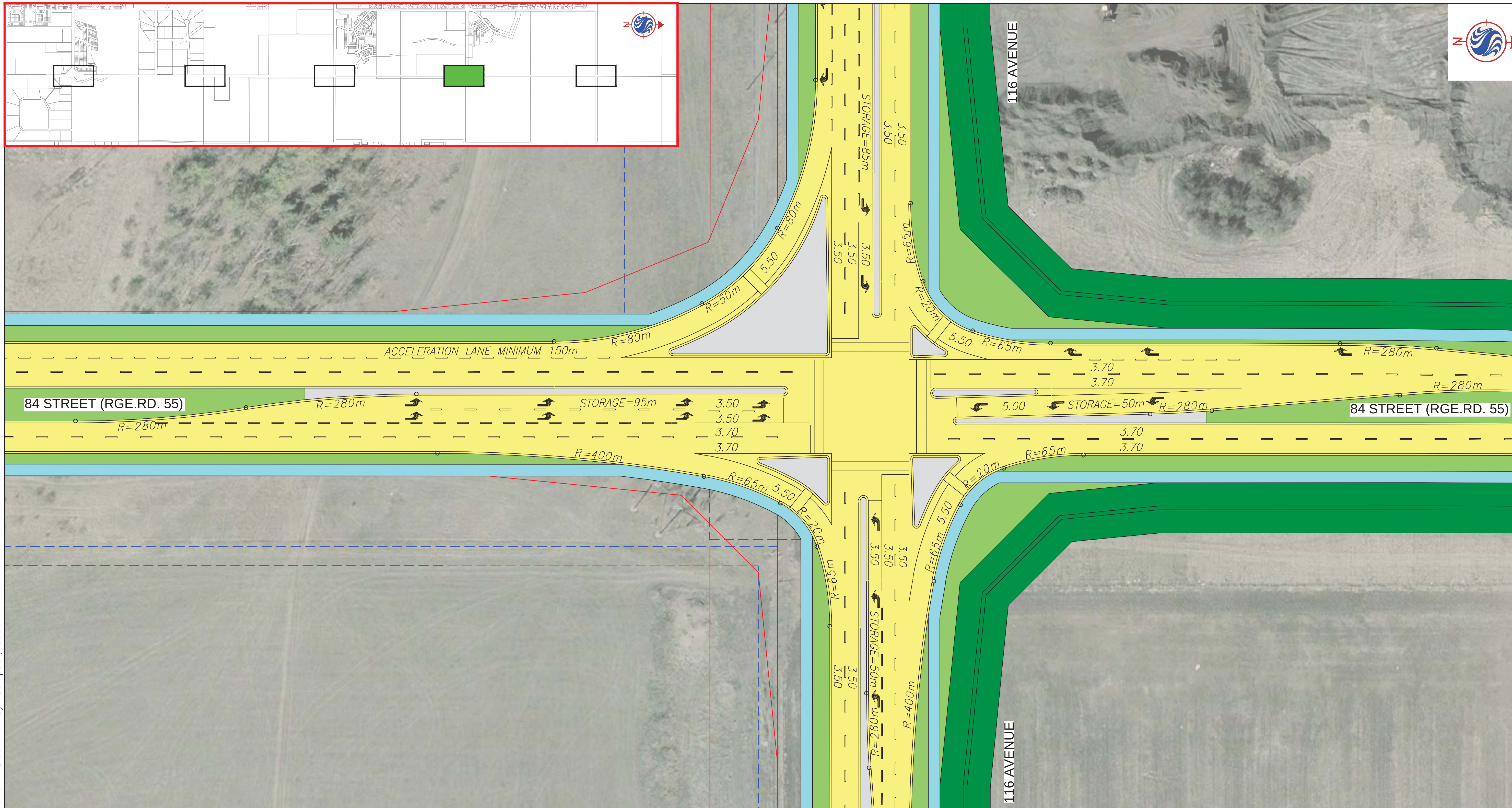
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.

7.3C

Title

100 AVENUE INTERSECTION CONFIGURATION



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2012-10-01 12:30 PM By: Campbell, Scott

ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

Stantec

Legend

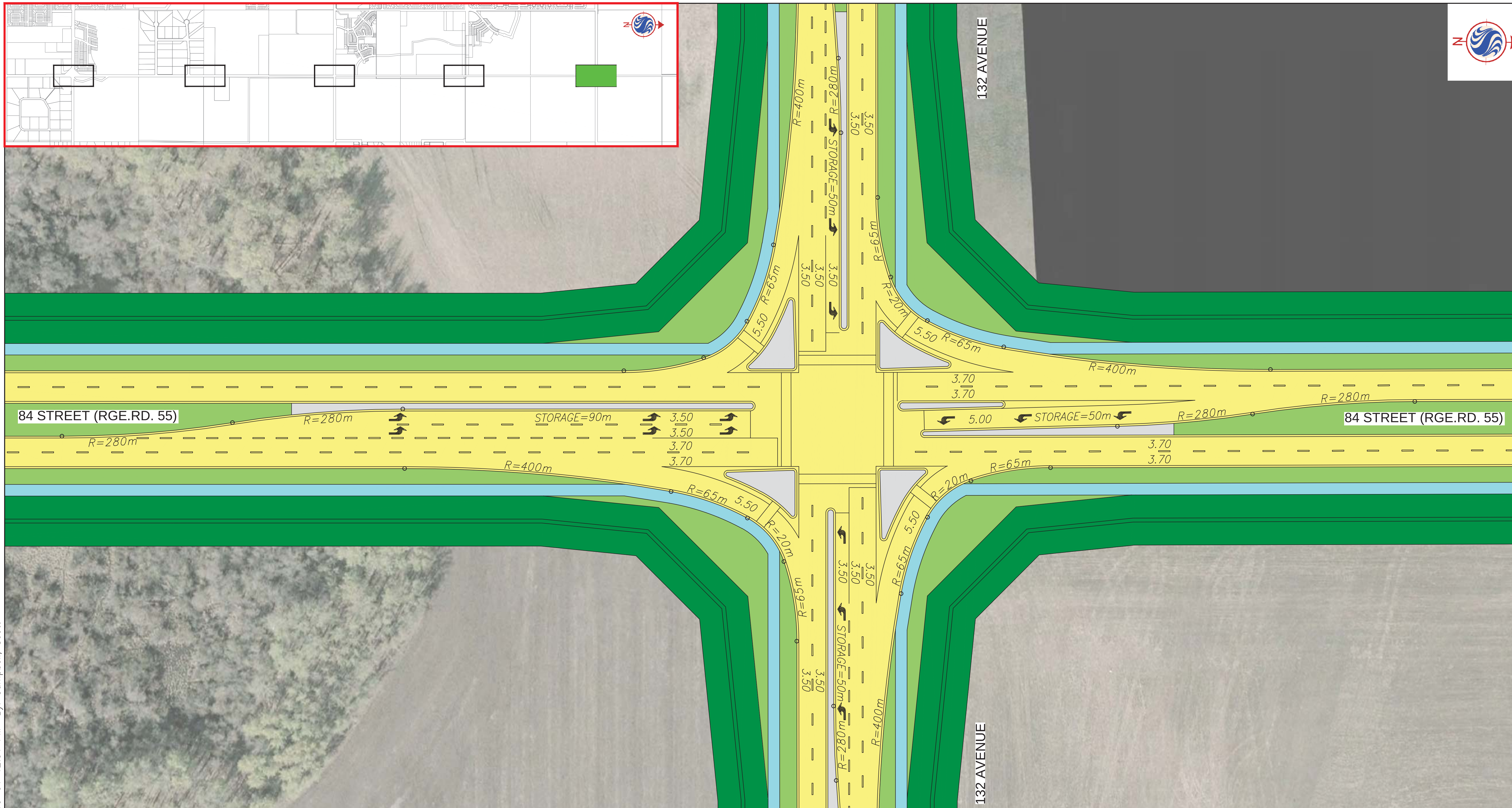
- EXISTING PROPERTY LINE
- PROPOSED EASEMENT LINE
- PROPOSED PROPERTY LINE
- EXISTING CURBLINE
- PROPOSED CURBLINE
- PROPOSED FENCING
- PROPOSED ROAD NETWORK
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- PROPOSED BERM
- PROPOSED TRAFFIC SIGNALS

0 10 30 60m

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
7.3D

Title
116 AVENUE INTERSECTION CONFIGURATION



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2012-10-01 12:31 PM By: Campbell, Scott

ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

Legend

EXISTING PROPERTY LINE
PROPOSED EASEMENT LINE
PROPOSED PROPERTY LINE
EXISTING CURBLINE
PROPOSED CURBLINE
PROPOSED FENCING

PROPOSED ROAD NETWORK
PROPOSED LANDSCAPING
PROPOSED CONCRETE MEDIAN/ISLAND CAPS
PROPOSED SIDEWALK/TRAIL
PROPOSED BERM

PROPOSED TRAFFIC SIGNALS

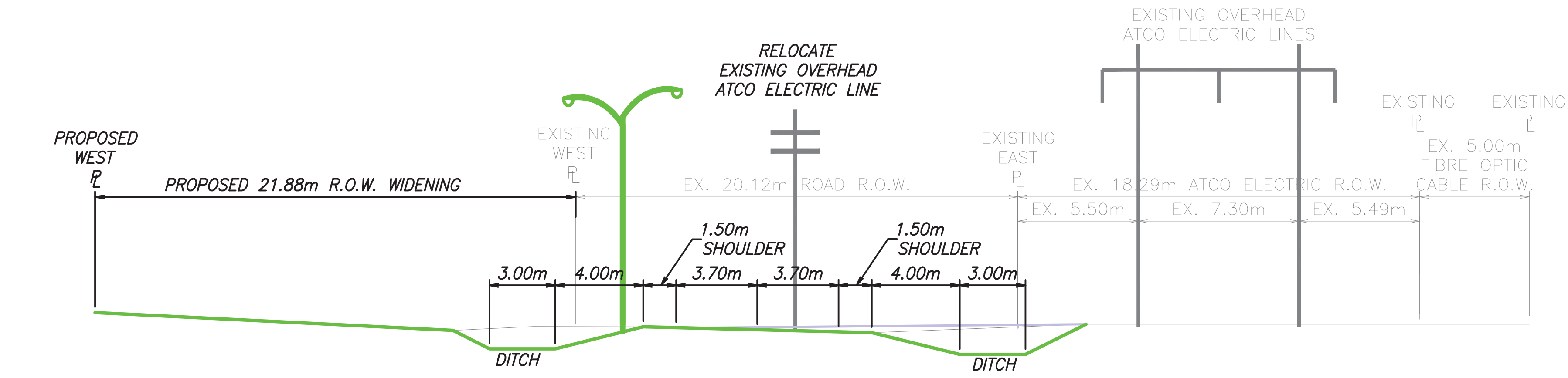
0 10 30 60m

Stantec

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

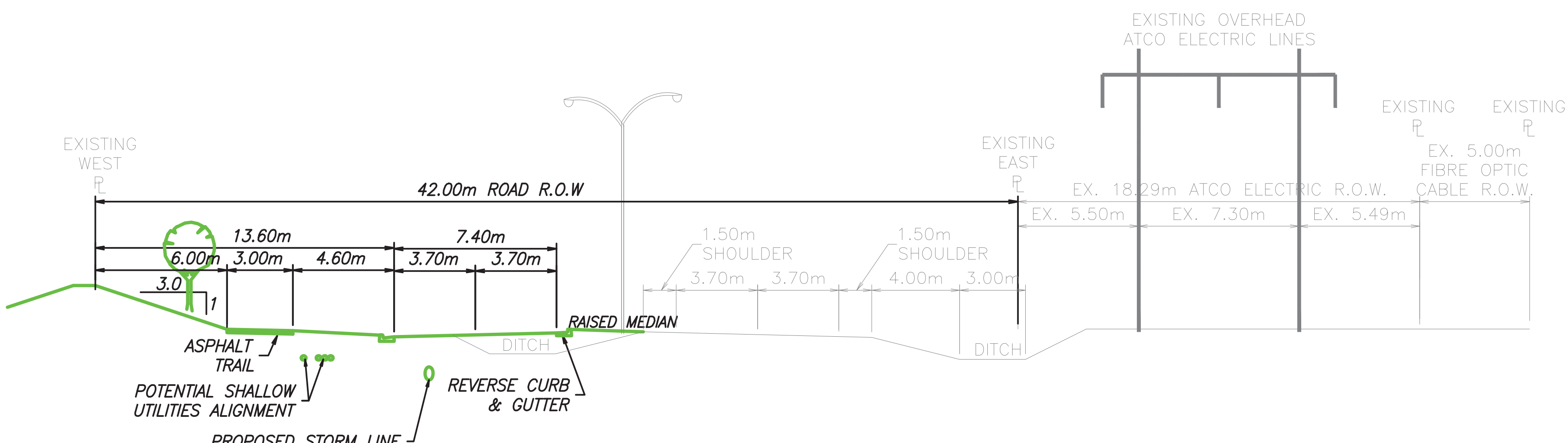
Figure No.
7.3E

Title
132 AVENUE INTERSECTION CONFIGURATION



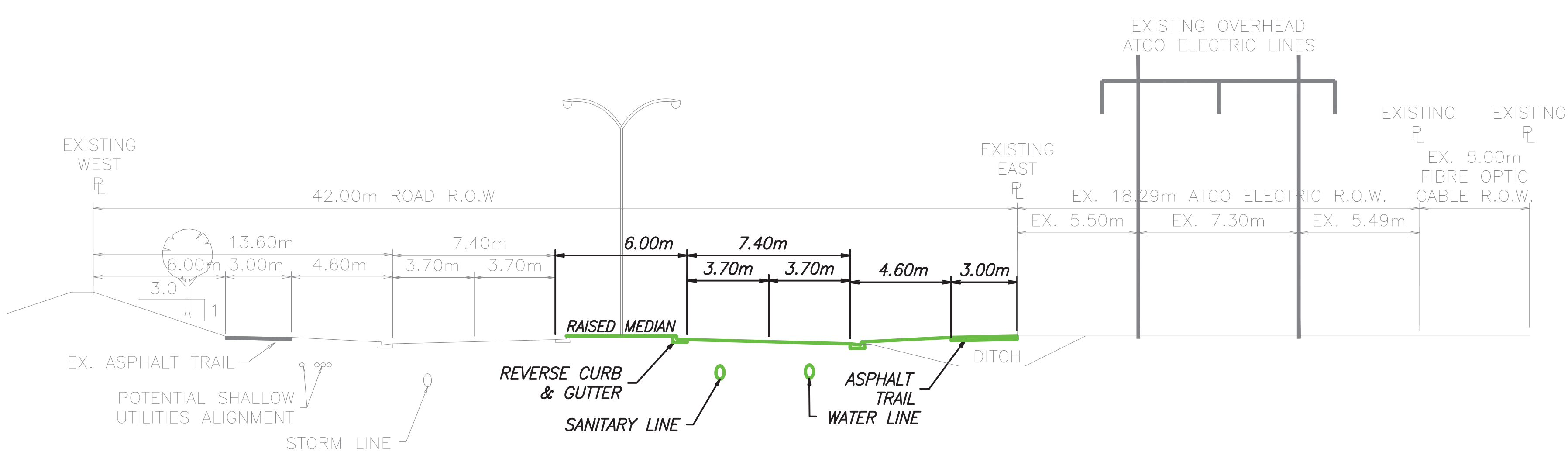
PROPOSED 84 STREET - 100 AVENUE TO 116 AVENUE

STAGE 1 - CONSTRUCT EAST LANES AS RURAL UNDIVIDED



PROPOSED 84 STREET - 100 AVENUE TO 116 AVENUE

STAGE 2A - CONSTRUCT WEST URBAN LANES AND SEWER



PROPOSED 84 STREET - 100 AVENUE TO 116 AVENUE

STAGE 2B - CONSTRUCT EAST URBAN LANES

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2010-07-06 07:00AM By: scampbell

ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

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Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
7.4a

Title
PHASING STRATEGY
CROSS SECTIONS

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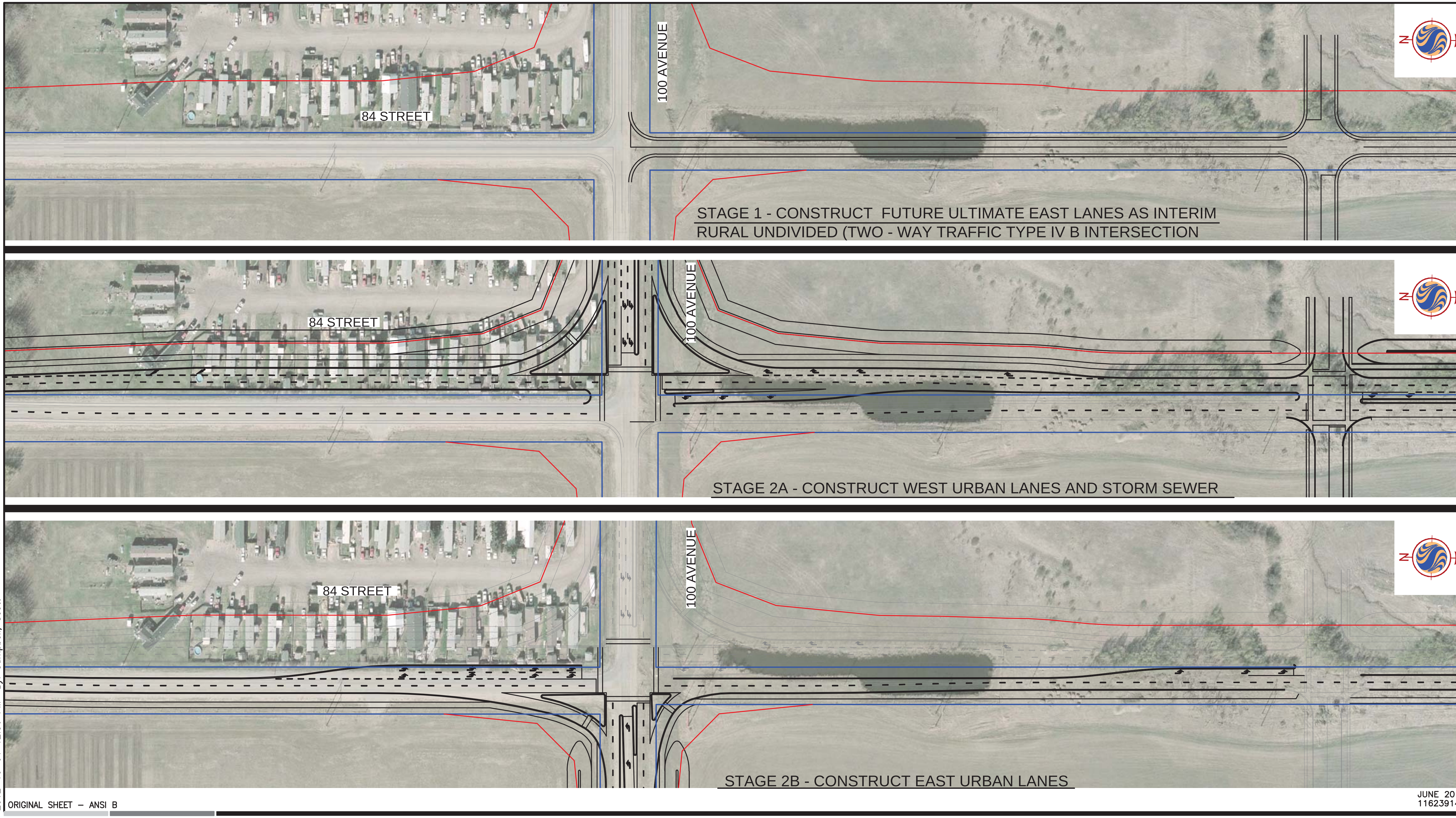

ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

Stantec

Legend

EXISTING PROPERTY LINE
EXISTING EASEMENT LINE
PROPOSED PROPERTY LINE
EXISTING CURBLINE
PROPOSED CURBLINE

NOTES.

THE RURAL ROADWAY IS PROPOSED TO REMAIN IN PLACE UNTIL FUTURE TWINNING.
THE FUTURE TWINNING WOULD BE COMPLETED IN TWO SUB–PHASES (2A & 2B) FOR CONSIDERATION OF TRAFFIC ACCOMMODATION DURING CONSTRUCTION. TO BE STAGED AS REQUIRED.

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
7.4B

Title
TYPICAL PHASING STRATEGY

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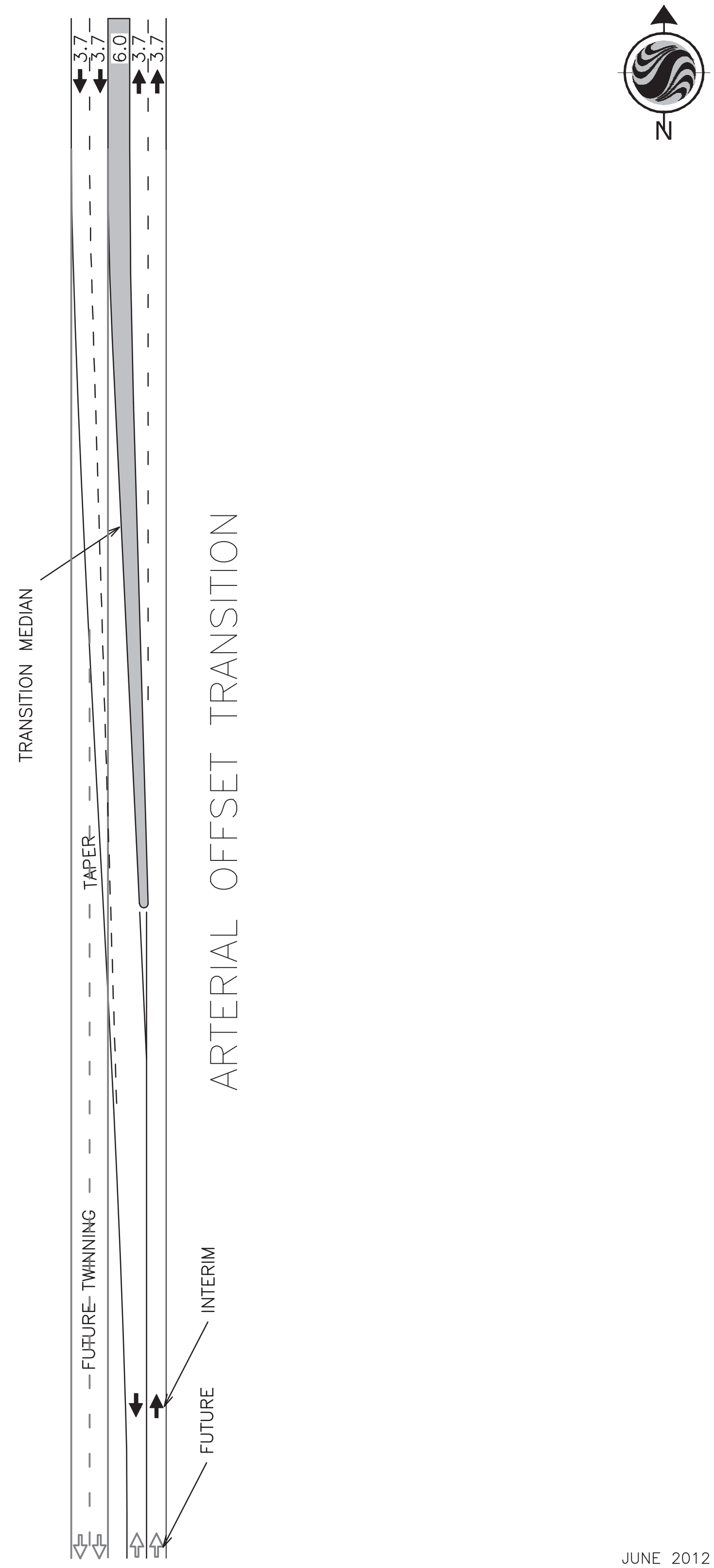

ORIGINAL SHEET – ANSI A

JUNE 2012

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Client/Project

CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.

7.4C

Title

DIVIDED TO UNDIVIDED ROAD TRANSITION

8.0 Land Acquisition Requirements

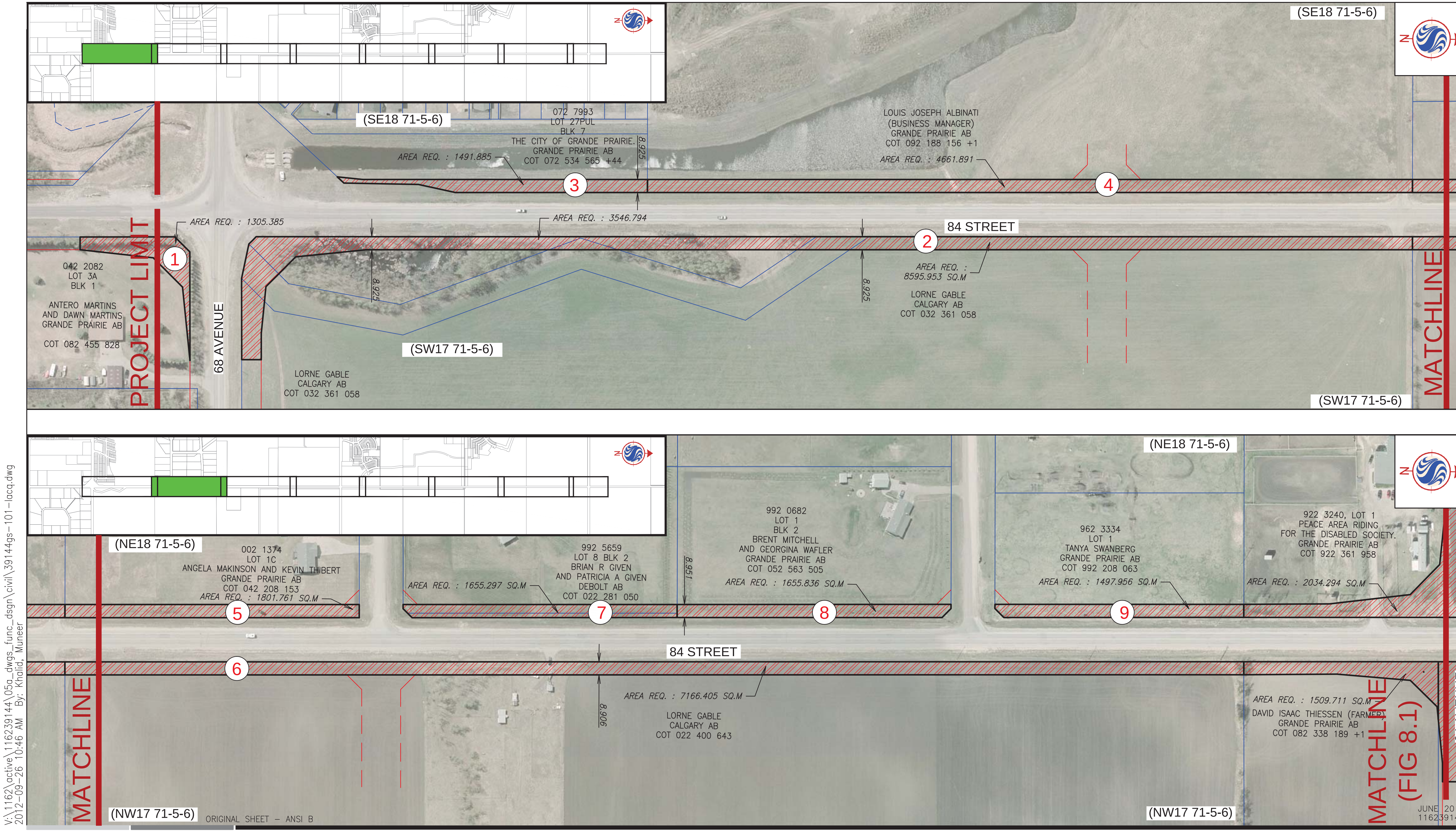
In order to accommodate the ultimate four lane divided roadway, land acquisition will be required to widen the right-of-way along the entire stretch of 84 Street from 68 Avenue to 132 Avenue. In general, the right-of-way will be required to be expanded to a width of 48.0m. The major intersections, including 68 Avenue, 84 Avenue, 100 Avenue, 116 Avenue, and 132 Avenue will require additional land acquisitions specific to the required turn bays.

Table 8.1 below summarizes the area of land required from each property. Figures 8.1 through 8.8 illustrate the dimensions and areas required for each parcel.

TABLE 8.1 – LAND ACQUISITION REQUIREMENTS

Parcel	Legal Land Description / Certificate of Title (COT)	Approx. Area (Ha)
1	Lot 3A, Bock 1, Plan 042 2082 (COT 082 455 828)	0.13
2	SW17 71-5-6 (COT 032 361 058)	0.86
3	SE18 71-5-6 (COT 072 534 565 +44)	0.15
4	SE18 71-5-6 (COT 092 188 156 +1)	0.47
5	Lot 1C Plan 002 1374 (COT 042 208 153)	0.18
6	NW17 71-5-6 (COT 022 400 643)	0.72
7	Lot 8 Block 2, Plan 992 5659	0.17
8	Lot 1 Block 2, Plan 992 0682 (COT 052 563 505)	0.17
9	Lot 1 Plan 962 3334 (COT 992 208 063)	0.15
10	SE19 71-5-6 (COT 062 206 593)	1.26
11	SW20 71-5-6 (COT 082 338 189)	0.73
12	Lot A, Plan 772 2082 (COT 922 177 158)	0.22
13	Lot A, Plan 762 0786 (COT 042 005 795)	1.93

Parcel	Legal Land Description / Certificate of Title (COT)	Approx. Area (Ha)
14	NW20 71-5-6 (COT 032 257 400)	0.13
15	SW29 71-5-6 (COT 072 440 740 + 120)	0.14
16	SE30 71-5-6 (COT 082 469 234 +68)	1.45
17	SE30 71-5-6 (COT 062 039 082)	0.67
18	NE30 71-5-6 (COT 042 397 348)	0.44
19	Lot F, Block 1, Plan 022 2435 (COT 022 153 881)	1.49
20	SE31 71-5-6 (COT 082 132 008 +89)	1.82
21	NW29 71-5-6 (COT 072 440 740 +120)	0.07
22	SW32 71-5-6 (COT 912 280 327)	1.31
23	NE31 71-5-6 (COT 072 546 156)	1.29
24	NW32 71-5-6 (COT 942 051 120 +4)	1.29
25	SE6 72-5-6 (COT 942 051 120 +1)	0.25
26	SW5 72-5-6 (COT 62Z264)	0.25
TOTAL		**17.74**



Legend RIGHT OF WAY REQUIRED

11 PARCEL NUMBER

0 25 75 125m

Stantec

Client/Project

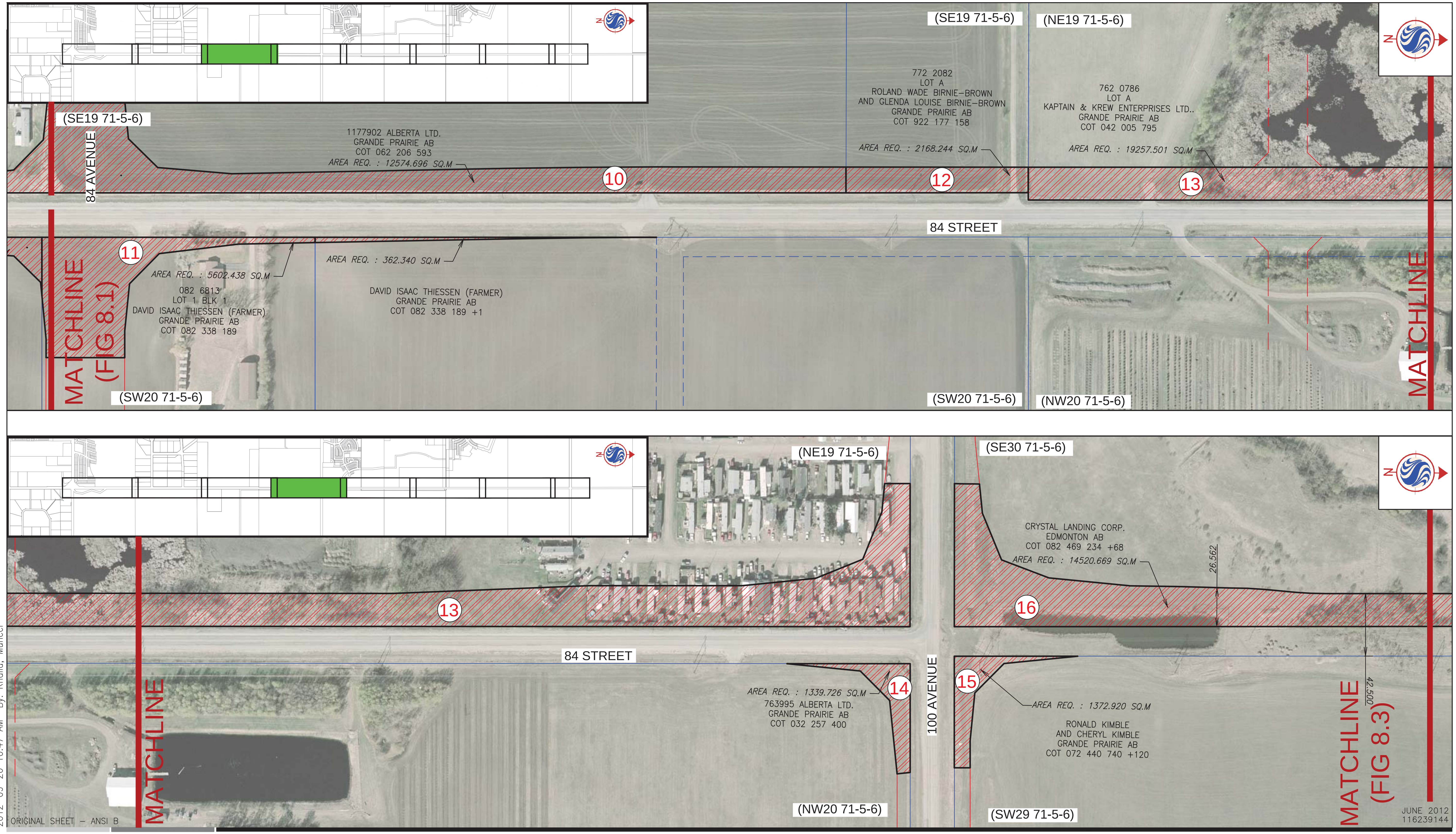
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.

8.1

Title

LAND ACQUISITION



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2012-09-26 10:47 AM By: Khalid, Muneer

Legend — RIGHT OF WAY REQUIRED

11 — PARCEL NUMBER

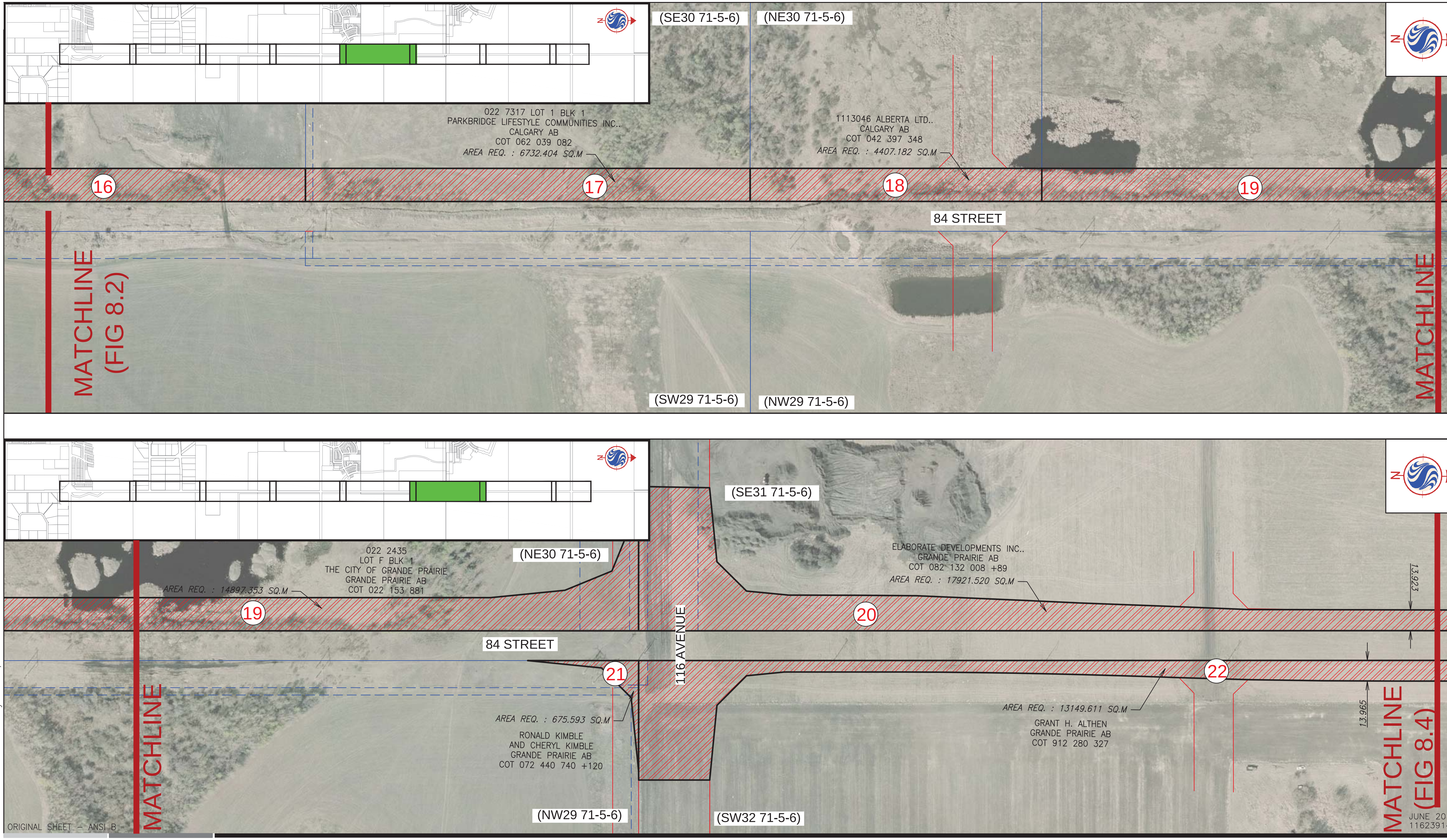
0 25 75 125m

Stantec

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
8.2

Title
LAND ACQUISITION



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2012-09-26 10:48 AM By: Khalid, Muneer

Legend
RIGHT OF WAY REQUIRED
11 PARCEL NUMBER

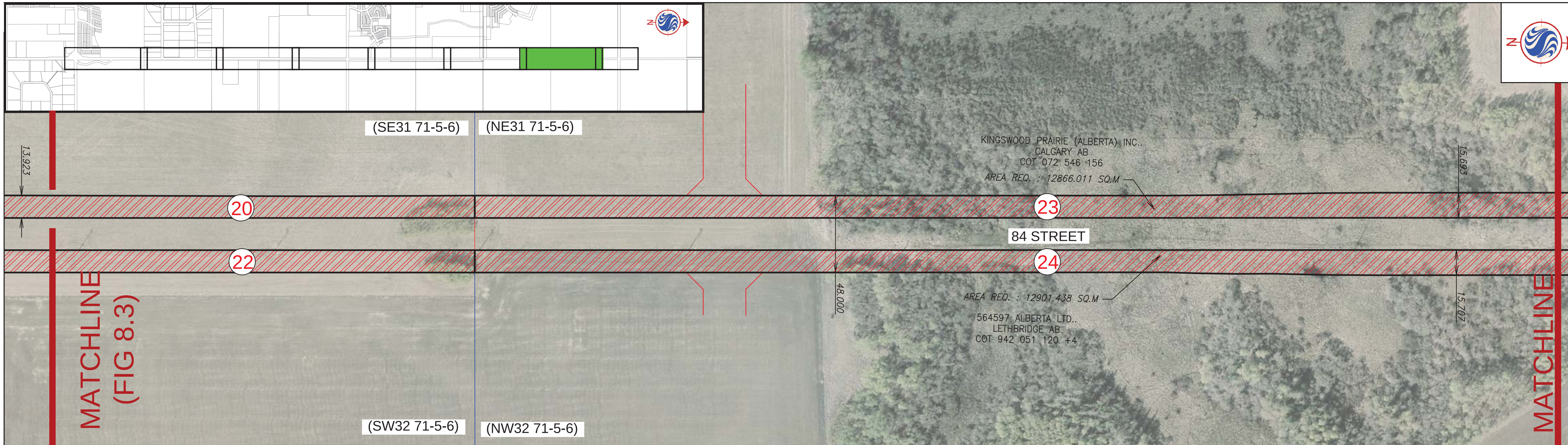
0 25 75 125m

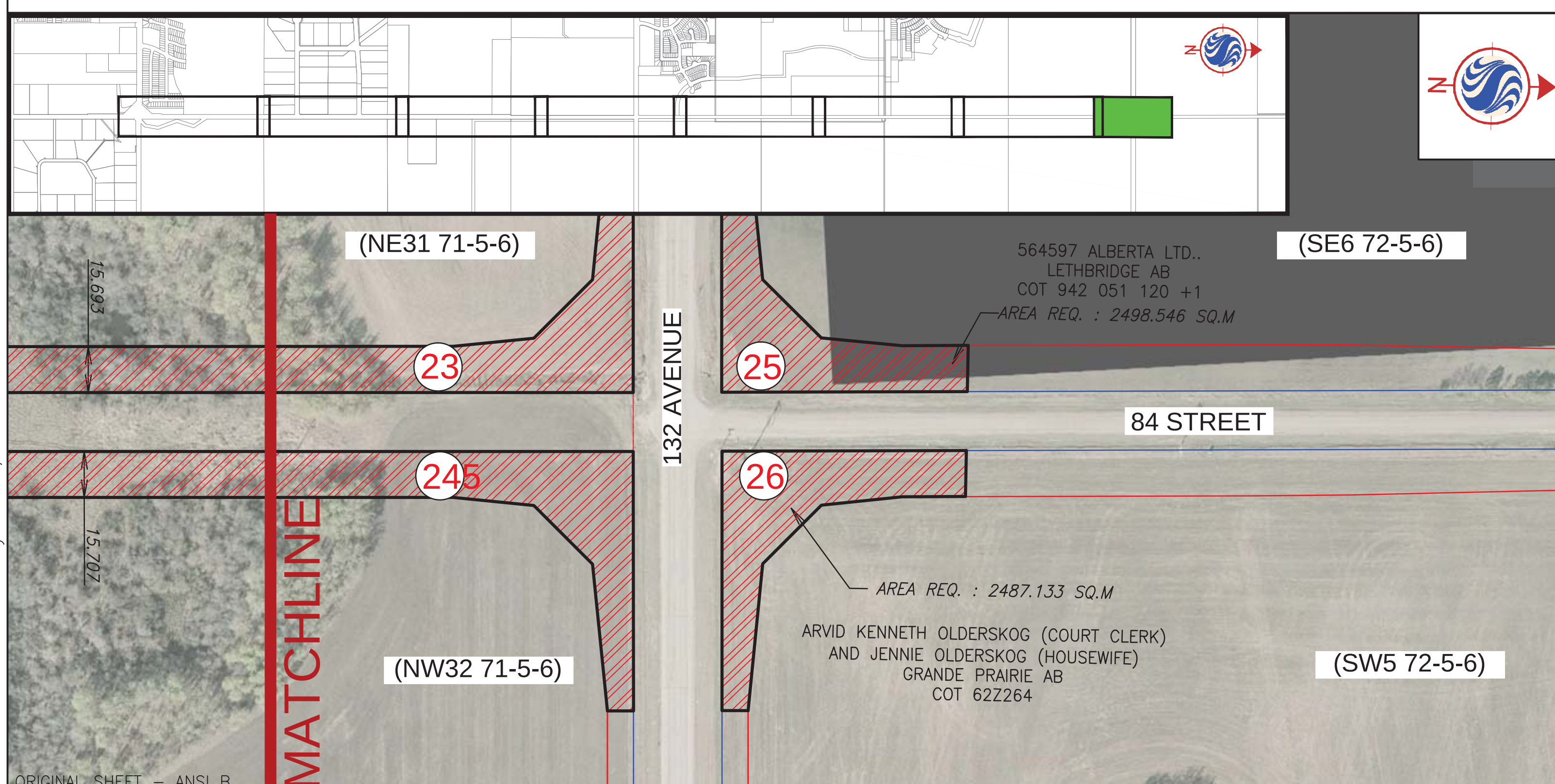
Stantec

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
8.3

Title
LAND ACQUISITION





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2012-09-26 10:49 AM By: Khalid, Muneer

JUNE 2012
116239144

Stantec

Legend
RIGHT OF WAY REQUIRED
11 PARCEL NUMBER

0 25 75 125m

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
8.4

Title
LAND ACQUISITION

9.0 Geotechnical Investigation Summary

9.1 OBJECTIVES & METHODOLOGY

ParklandGEO, Stantec's geotechnical engineering subconsultant for this project, completed a Desktop Geotechnical Investigation for the 84 Street roadway from 68 Avenue to 132 Avenue. This section provides a brief overview of the objectives, methodology, and recommendations outlined in the report. For additional detail, the full geotechnical investigation report completed by ParklandGEO is included in Appendix C.

The purpose of the desktop investigation was to assess at a high level the potential soil conditions, identify potential issues that could arise during construction, and provide recommendations regarding future underground and road surface construction. The scope of the investigation included:

- A review of historical Aerial Photographs obtained from Alberta Sustainable Resources and Development (SRD) for 1974, 1979, 1989, and 2008;
- An on-site assessment of the existing two lane roadway conditions;
- A review of historical geotechnical data; and
- A review of local water well records on file and publically available through Alberta Environment's Groundwater Information System.

9.2 RESULTS AND RECOMMENDATIONS

In general, the soil stratigraphy for the project area is quite consistent, consisting of topsoil or peat over lacustrine clay, over clay till. Some sandy silts can be expected in the southern zone of the project.

The groundwater level generally varies from approximately 1 metre to 6 metres in depth, with the shallower levels being encountered in the south zone of the project (SE 18 and SW 17-71-5-6) and the deeper levels encountered in the central and northern zones of the project.

The existing roadway is in fair condition with no major weak sections identified. Past maintenance and repairs to rehabilitate the roadway likely contribute positively to the reasonable condition that the road is in today.

The lacustrine clay layer will be subject to significant swelling if exposed freely to water. As such, ponding should be avoided along the roadway. The detailed design of the roadway should accommodate maintained dry conditions at the subgrade in the lacustrine clays to prevent saturation and swelling. This can be accommodated by increasing the elevation of the roadway or installing wick drains / subdrains, or a combination thereof.

During construction, moisture levels should be maintained close to the optimum moisture content, particularly for the fine grained clay soils. This may require drying the soil during wet conditions.

The soils in the south zone of the project (SE 18 and SW 17-71-5-6) are highly variable and are intermixed with silts, sands, and clays and are subject to high water table levels (<2m deep). The silts are highly susceptible to frost heave in these conditions. Further, the silts can increase the levels of seepage and sloughing during construction, become soft and spongy from construction traffic, provide less subgrade support to the road structure, and they have a tendency to intermix with the sub-base materials. As such, the road structure may need to be strengthened by increasing the depths of the asphalt and granular materials and/or placing woven geotextiles at the subgrade.

The soils contain high concentrations of sulphates. All concrete manholes, storm pipe, and curb and gutter should have sulphate resistant cement (Type MS or HS) to prevent deterioration of the materials.

All excavations with cut/fill slopes should be completed in accordance with the Alberta Occupational Health and Safety Code (OHS Code, 2006). The majority of the slopes should be limited to 1H:1V or flatter.

It is recommended that at the time of detailed design, detailed boring programs and field investigations should be completed to confirm the actual soil conditions to a higher level of accuracy and design the road structure accordingly.

10.0 Public Engagement Overview

As part of this project, two Public Open Houses were facilitated to present the functional plans to stakeholders and members of the public. Both open houses were arranged in two stages. The first stage of each open house was designated for internal stakeholders only. The internal stakeholders included City Departments and utility companies. The second stages were open to both internal and external stakeholders, including the general public.

Summaries of each of the open houses are outlined in the sections below. The attendance and comment forms are included in Appendix D.

10.1 PUBLIC OPEN HOUSE #1

On December 15, 2011 a Public Open House was held at Muskoseepi Park to present the 84 Street Functional Planning drawings to various City Departments, utility companies, landowners, and the general public interested in the project. Overall, the attendance was good, the discussions were constructive, and the proposed ultimate 84 Street road configuration was generally accepted.

The following is a summary of the comments received at the Open House:

- The cross-section will need to be revised from the 45.5m r/w configuration to the 48.0m r/w configuration adopted by the City. This includes changing the berms to 3:1 sideslopes with no flat top, removing the trees, increasing the median to 5.0m width, 3.0m wide walks on both sides, and other small adjustments. The landscaping along the berms will need to be reviewed.

- The street lights and traffic signals configurations will need to be reviewed in detail With ATCO Electric where in close proximity to the overhead transmission line. Secondary power line alignment and relocation requirements to be reviewed.

- The Woodgrove Outline Plan was appealed/rescinded and the outline plans for the quarter sections east of Kingsgate and Copperwood have not been approved. As such those plans should be removed from the drawings. Crystal Landing and other Outline Plans to be reviewed to ensure consistent with City’s approved plans.

- A resident of Eagle Estates was concerned about future noise levels.

- The conceptual collector road network shown in the drawings within quarter sections that have no Outline Plan has not been formally adopted and should not be shown on the drawings.

- Drainage in the north portion of the project will need to be as per the Northeast Storm Basin Study. In addition, there was interest in constructing a ditch along the east side of the 84 Street right-of-way in the quarter section east of Kingsgate Landing to accommodate runoff from land northwest of the 132 Avenue in lieu of major storm trunks within Kingsgate Landing.

- Final right-of-way requirements and detailed dimensions needed.

- All existing and proposed utilities to be assessed in next stage of project.

- ATCO Electric and Eastlink both expressed need for room to install vaults, cubicles, etc. at all intersections.

10.2 PUBLIC OPEN HOUSE #2

On April 26, 2012 a second Public Open House was held at Muskoseepi Park. Similarly to the first open house, the purpose was to present the 84 Street Functional Planning drawings to the various City Departments, utility companies, landowners, and the general public interested in the project. Further to what was presented at the initial open house, conceptual water, sanitary sewer, and storm drainage illustrations were provided.

No formal comments were received at the Open House.

11.0 Opinion of Probable Cost

11.1 METHODOLOGY

The opinion of probable cost was separated into sections of roadway based on appropriate future phasing assumptions and intersection spacing. Quantity take-offs were completed for each section with the costs shown in the tables included in Appendix E. The unit prices are based on similar projects recently completed within the City of Grande Prairie. The prices are subject to change in the future with varying market conditions and inflation considerations that are not included these costs. Costs relating to illumination, traffic signalization, and storm sewer were derived from projects that Stantec has completed in other areas.

All storm sewer costs are based on total costs and do not account for cost sharing between the City and private developers. Sanitary and water mains are under jurisdiction of Aquatera and are not included in the total cost.

11.2 OPINION OF PROBABLE COST SUMMARY

TABLE 11.1 – OPINION OF PROBABLE COST SUMMARY

Section & Description	Cost
Interim Rural Road from 100 Avenue to 132 Avenue	$6,730,000
Ultimate Roadway – 68 Avenue to South of 84 Avenue	$8,500,000
Ultimate Roadway – 84 Avenue to 100 Avenue	$10,700,000
Ultimate Roadway – North of 100 Avenue to 116 Avenue	$7,850,000
Ultimate Roadway – North of 116 Avenue to 132 Avenue	$4,400,000
Total	**$38,180,000**

The opinion of probable cost was based on the following assumptions:

- 30% allowance for contingency and professional services was included in the above costs. Costs for transitioning are unknown and included in the contingency allowance.
- GST was excluded from the above costs.

- The road structure (pitrun, crush, and asphalt) used for quantities is based on typical arterial roadway standards. Additional geotechnical design is required to confirm actual requirements.
- Shallow and overhead utility relocation costs are not included. It is anticipated that the overhead power distribution lines will be buried in the future.
- Construction of berms will be complete as part of future development, as it requires excess topsoil not available from within the right-of-way alone.
- Stripped topsoil will be stockpiled on adjacent lands.
- Land acquisition costs are not included.

12.0 Closing

This document entitled "84 Street Functional Planning Study" was prepared by Stantec Consulting Ltd. for the City of Grande Prairie. The material in it reflects Stantec Consulting Ltd.'s best judgment in light of the information available at the time of preparation. Any use which a third party makes of this report, reliance on, or decisions based on it are the responsibilities of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

PERMIT TO PRACTICE
STANTEC CONSULTING LTD.
Signature
Date Dec 13/2012
PERMIT NUMBER: [illegible]
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

PROFESSIONAL ENGINEER
BRADLEY J VANDER HYDEN
ALBERTA
December 13, 2012

PROFESSIONAL ENGINEER
NIKKI ELIZABETH BURKINSHAW
ALBERTA
Dec. 13/12

CORPORATE AUTHORIZATION | **PROJECT ENGINEER** | **TRAFFIC ENGINEER**

APPENDIX A

STORM SEWER – RATIONAL METHOD ANALYSIS

STORM SEWER

PROJECT : City of Grande Prairie - 84 Street Functional Design
JOB No. : 116239144
DATE : June 2012
DES. BY : Brad Vander Heyden

Stantec

Manning's n = 0.013

From MH	To MH	Storm Event	Area Added (ha)	Area Sub-Total (ha)	Area Total (ha)	C	CA	Sub-Total CA	Total CA	Initial Time (min)	Time in Pipe (min)	Total Time (min)	Int. (mm/hr)	Event Flow (m^3/s)	Added Flow (Enter)	Added Flow (m^3/s)	Design Flow (m^3/s)	Length (m)	Pipe Diameter (mm)	Slope %	Cap. (m^3/s)	Vel. (m/s)
		5-yr		0.00				0.00														
68-04	68-03	5-yr	0.48	0.48	0.48	0.51	0.24	0.24	0.24	10.00	0.87	10.87	54.12	0.037		0.000	0.037	100.00	300	1.95	0.135	1.910
68-03	68-02	5-yr	0.49	0.97	0.97	0.51	0.25	0.49	0.49	10.87	1.33	12.20	51.84	0.071		0.000	0.071	120.00	300	1.21	0.106	1.505
68-02	68-01	5-yr	0.59	1.56	1.56	0.51	0.30	0.80	0.80	12.20	1.94	14.15	48.75	0.108		0.000	0.108	120.00	375	0.42	0.114	1.029
68-01	68-00	5-yr	1.36	2.92	2.92	0.51	0.69	1.49	1.49	14.15	0.37	14.51	44.90	0.186		0.000	0.186	40.00	450	1.00	0.297	1.811
		5-yr		0.00				0.00														
76-17	76-16	5-yr	0.72	0.72	0.72	0.51	0.37	0.37	0.37	10.00	2.07	12.07	54.12	0.055		0.000	0.055	120.00	300	0.50	0.068	0.967
76-16	76-15	5-yr	0.96	1.68	1.68	0.51	0.49	0.86	0.86	12.07	1.92	13.99	49.04	0.117		0.000	0.117	120.00	450	0.33	0.171	1.040
76-15	76-14	5-yr	0.29	1.97	1.97	0.51	0.15	1.00	1.00	13.99	1.92	15.91	45.18	0.126		0.000	0.126	120.00	450	0.33	0.171	1.040
76-14	76-13	5-yr	0.61	2.58	2.58	0.51	0.31	1.32	1.32	15.91	1.76	17.67	41.94	0.153		0.000	0.153	110.00	450	0.33	0.171	1.040
76-13	76-12	5-yr	0.98	3.56	3.56	0.51	0.50	1.82	1.82	17.67	1.12	18.79	39.39	0.199		0.000	0.199	90.00	450	0.55	0.220	1.343
76-12	76-11	5-yr	0.59	4.15	4.15	0.51	0.30	2.12	2.12	18.79	0.90	19.69	37.95	0.223		0.000	0.223	80.00	525	0.55	0.332	1.488
76-11	76-10	5-yr	0.00	4.15	4.15	0.51	0.00	2.12	2.12	19.69	0.69	20.38	36.87	0.217		0.000	0.217	62.00	525	0.55	0.332	1.488
76-10	76-09	5-yr	0.41	4.56	4.56	0.51	0.21	2.33	2.33	20.38	1.34	21.72	36.08	0.233		0.000	0.233	120.00	525	0.55	0.332	1.488
76-09	76-08	5-yr	8.02	12.58	12.58	0.35	2.81	5.13	5.13	21.72	0.80	22.52	34.65	0.494		0.000	0.494	78.00	600	0.55	0.476	1.628
76-08	76-07	5-yr	0.00	12.58	12.58	0.51	0.00	5.13	5.13	22.52	1.12	23.64	33.86	0.483		0.000	0.483	118.00	675	0.55	0.651	1.761
76-07	76-06	5-yr	0.92	13.50	13.50	0.51	0.47	5.60	5.60	23.64	0.78	24.42	32.82	0.511		0.000	0.511	82.00	675	0.55	0.651	1.761
76-06	76-01	5-yr	0.00	13.50	13.50	0.51	0.00	5.60	5.60	24.42	1.21	25.63	32.14	0.500		0.000	0.500	128.00	675	0.55	0.651	1.761
76-05	76-04	5-yr	0.40	0.40	0.40	0.51	0.20	0.20	0.20	10.00	1.74	11.74	54.12	0.031		0.000	0.031	120.00	300	0.71	0.081	1.153
76-04	76-03	5-yr	0.61	1.01	1.01	0.51	0.31	0.52	0.52	11.74	0.68	12.41	49.79	0.071		0.000	0.071	47.00	300	0.71	0.081	1.153
76-03	76-02	5-yr	0.61	1.62	1.62	0.51	0.31	0.83	0.83	12.41	1.10	13.51	48.29	0.111		0.000	0.111	88.00	375	0.71	0.148	1.338
76-02	76-01	5-yr	0.00	1.62	1.62	0.51	0.00	0.83	0.83	13.51	0.90	14.41	46.08	0.106		0.000	0.106	72.00	375	0.71	0.148	1.338
76-01	76-00	5-yr	9.15	24.27	24.27	0.35	3.20	9.63	9.63	25.63	0.88	26.51	31.14	0.833		0.000	0.833	100.00	750	0.55	0.861	1.889
		5-yr		0.00				0.00														
92-09	92-08	5-yr	0.00	0.00	0.00	0.51	0.00	0.00	0.00	10.00	0.28	10.28	54.12	0.000	1.815	1.815	1.815	48.00	900	1.00	1.886	2.875
92-08	92-07	5-yr	0.00	0.00	0.00	0.51	0.00	0.00	0.00	10.28	0.58	10.86	53.37	0.000		1.815	1.815	100.00	900	1.00	1.886	2.875
92-07	92-06	5-yr	0.52	0.52	0.52	0.51	0.27	0.27	0.27	10.86	0.58	11.44	51.88	0.038		1.815	1.853	100.00	900	1.00	1.886	2.875
92-06	92-05	5-yr	0.64	1.16	1.16	0.51	0.33	0.59	0.59	11.44	0.74	12.18	50.47	0.083		1.815	1.898	100.00	1050	0.50	2.015	2.254
92-05	92-04	5-yr	0.63	1.79	1.79	0.51	0.32	0.91	0.91	12.18	1.00	13.18	48.80	0.124		1.815	1.939	120.00	1200	0.33	2.335	2.001
92-04	92-01	5-yr	0.58	2.37	2.37	0.51	0.30	1.21	1.21	13.18	0.67	13.84	46.73	0.157		1.815	1.972	80.00	1200	0.33	2.335	2.001
92-03	92-02	5-yr	0.78	0.78	0.78	0.51	0.40	0.40	0.40	10.00	1.13	11.13	54.12	0.060		0.000	0.060	80.00	300	0.75	0.084	1.185
92-02	92-01	5-yr	0.68	1.46	1.46	0.51	0.35	0.74	0.74	11.13	0.97	12.10	51.22	0.106		0.000	0.106	80.00	375	0.75	0.152	1.375
92-01	92-00	5-yr	0.77	4.60	4.60	0.51	0.39	2.35	2.35	13.84	0.42	14.26	45.45	0.296		1.815	2.111	50.00	1200	0.33	2.335	2.001
		5-yr		0.00				0.00														
100-02	100-01	5-yr	0.65	0.65	0.65	0.51	0.33	0.33	0.33	10.00	2.07	12.07	54.12	0.050		0.000	0.050	120.00	300	0.50	0.068	0.967
100-06	100-05	5-yr	0.37	0.37	0.37	0.51	0.19	0.19	0.19	10.00	0.98	10.98	54.12	0.028		0.000	0.028	100.00	300	1.56	0.121	1.709
100-05	100-04	5-yr	0.62	0.99	0.99	0.51	0.32	0.50	0.50	10.98	0.98	11.95	51.58	0.072		0.000	0.072	100.00	300	1.56	0.121	1.709
100-04	100-03	5-yr	0.62	1.61	1.61	0.51	0.32	0.82	0.82	11.95	1.17	13.12	49.30	0.112		0.000	0.112	120.00	300	1.56	0.121	1.709
100-03	100-01	5-yr	0.74	2.35	2.35	0.51	0.38	1.20	1.20	13.12	1.01	14.13	46.84	0.156		0.000	0.156	120.00	375	1.56	0.219	1.983
100-01	100-0	5-yr	1.52	4.52	4.52	0.51	0.78	2.31	2.31	14.13	0.70	14.83	44.93	0.288		0.000	0.288	60.00	525	0.50	0.317	1.419
		5-yr		0.00				0.00														
109-02	109-01	5-yr	1.40	1.40	1.40	0.51	0.71	0.71	0.71	10.00	0.89	10.89	54.12	0.107		0.000	0.107	60.00	375	0.50	0.124	1.123
		5-yr		0.00				0.00														
110-02	110-01	5-yr	0.42	0.42	0.42	0.51	0.21	0.21	0.21	10.00	1.38	11.38	54.12	0.032		0.000	0.032	80.00	300	0.50	0.068	0.967
110-01	100-00	5-yr	0.73	1.15	1.15	0.51	0.37	0.59	0.59	11.38	0.49	11.87	50.61	0.082		0.000	0.082	40.00	300	1.00	0.097	1.368
		5-yr		0.00				0.00														
112-07	112-06	5-yr	0.58	0.58	0.58	0.51	0.30	0.30	0.30	10.00	2.30	12.30	54.12	0.044		0.000	0.044	120.00	375	0.30	0.096	0.869
112-06	112-05	5-yr	0.64	1.22	1.22	0.51	0.33	0.62	0.62	12.30	2.30	14.60	48.54	0.084		0.000	0.084	120.00	375	0.30	0.096	0.869
112-05	112-04	5-yr	1.50	2.72	2.72	0.51	0.77	1.39	1.39	14.60	0.91	15.51	44.09	0.170		0.000	0.170	60.00	525	0.30	0.245	1.099
112-04	112-03	5-yr	0.00	2.72	2.72	0.51	0.00	1.39	1.39	15.51	1.32	16.83	42.58	0.164		0.000	0.164	87.00	525	0.30	0.245	1.099
112-03	112-02	5-yr	0.52	3.24	3.24	0.51	0.27	1.65	1.65	16.83	1.52	18.35	40.57	0.186		0.000	0.186	100.00	525	0.30	0.245	1.099
112-02	112-01	5-yr	0.63	3.87	3.87	0.51	0.32	1.97	1.97	18.35	1.52	19.86	38.51	0.211		0.000	0.211	100.00	525	0.30	0.245	1.099

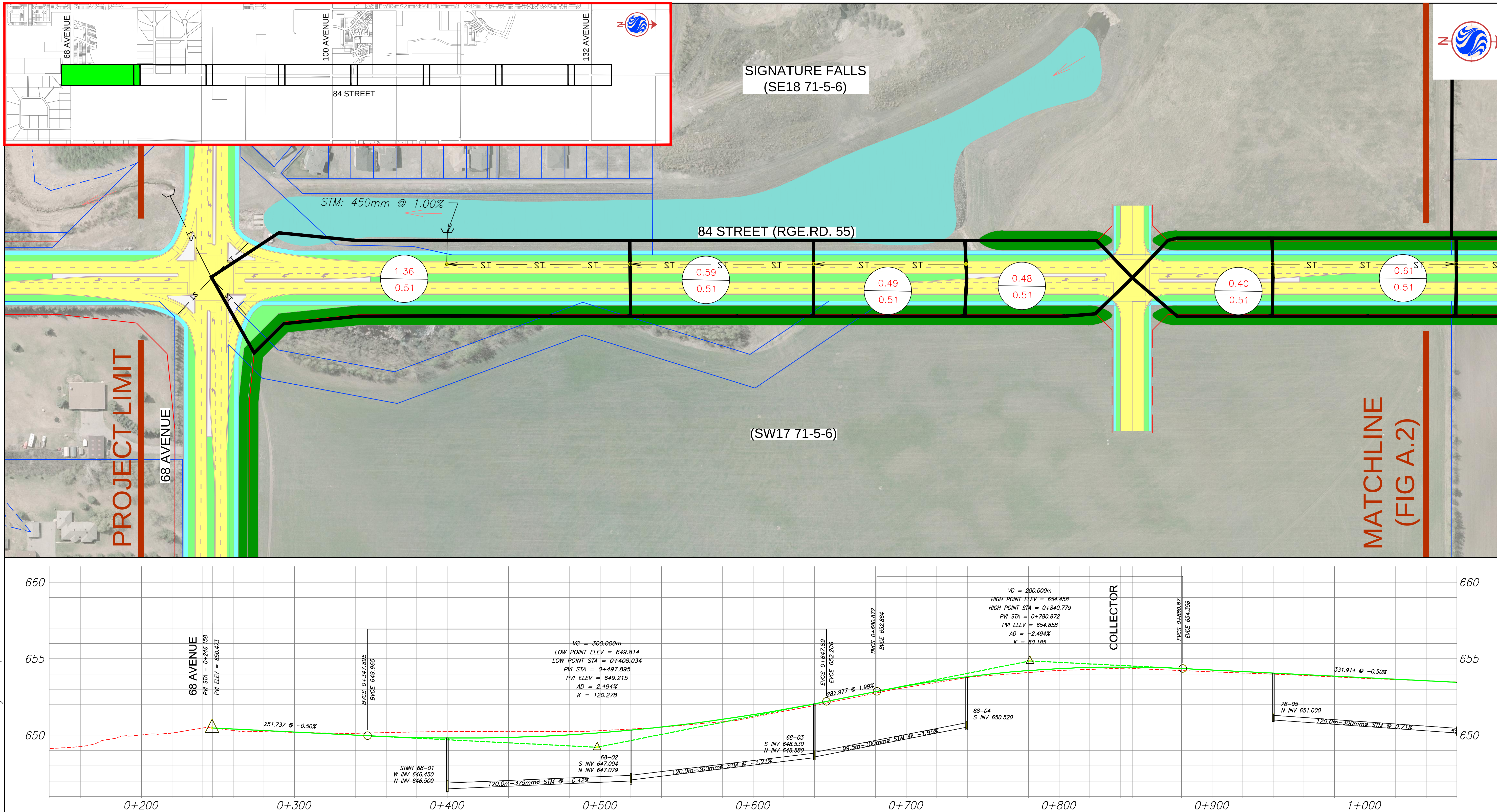
STORM SEWER

Stantec

PROJECT : City of Grande Prairie - 84 Street Functional Design
JOB No. : 116239144
DATE : June 2012
DES. BY : Brad Vander Heyden

Manning's n = 0.013

From MH	To MH	Storm Event	Area Added (ha)	Area Sub-Total (ha)	Area Total (ha)	C	CA	Sub-Total CA	Total CA	Initial Time (min)	Time in Pipe (min)	Total Time (min)	Int. (mm/hr)	Event Flow (m^3/s)	Added Flow (Enter)	Added Flow (m^3/s)	Design Flow (m^3/s)	Length (m)	Pipe Diameter (mm)	Slope %	Cap. (m^3/s)	Vel. (m/s)
112-01	112-00	5-yr	1.37	5.24	5.24	0.51	0.70	2.67	2.67	19.86	0.55	20.42	36.67	0.272		0.000	0.272	40.00	600	0.30	0.351	1.203
		5-yr		0.00				0.00														
118-04	118-03	5-yr	0.39	0.39	0.39	0.51	0.20	0.20	0.20	10.00	2.07	12.07	54.12	0.030		0.000	0.030	120.00	300	0.50	0.068	0.967
118-03	118-02	5-yr	0.61	1.00	1.00	0.51	0.31	0.51	0.51	12.07	1.72	13.79	49.04	0.069		0.000	0.069	100.00	300	0.50	0.068	0.967
118-02	118-01	5-yr	0.64	1.64	1.64	0.51	0.33	0.84	0.84	13.79	1.48	15.28	45.55	0.106		0.000	0.106	100.00	375	0.50	0.124	1.123
118-01	118-00	5-yr	0.64	2.28	2.28	0.51	0.33	1.16	1.16	15.28	0.52	15.80	42.96	0.139		0.000	0.139	40.00	450	0.50	0.210	1.281
		5-yr		0.00				0.00														
124-04	124-03	5-yr	0.81	0.81	0.81	0.51	0.41	0.41	0.41	10.00	1.19	11.19	54.12	0.062		0.000	0.062	60.00	375	0.28	0.093	0.840
124-03	124-02	5-yr	0.00	0.81	0.81	0.51	0.00	0.41	0.41	11.19	2.38	13.57	51.06	0.059		0.000	0.059	120.00	375	0.28	0.093	0.840
124-02	124-01	5-yr	0.58	1.39	1.39	0.51	0.30	0.71	0.71	13.57	2.38	15.95	45.97	0.091		0.000	0.091	120.00	375	0.28	0.093	0.840
124-08	124-07	5-yr	1.50	1.50	1.50	0.51	0.77	0.77	0.77	10.00	1.07	11.07	54.12	0.115		0.000	0.115	120.00	375	1.38	0.206	1.865
124-07	124-06	5-yr	0.61	2.11	2.11	0.51	0.31	1.08	1.08	11.07	1.37	12.44	51.35	0.153		0.000	0.153	100.00	450	0.45	0.199	1.215
124-06	124-05	5-yr	0.55	2.66	2.66	0.51	0.28	1.36	1.36	12.44	1.37	13.82	48.23	0.182		0.000	0.182	100.00	450	0.45	0.199	1.215
124-05	124-01	5-yr	0.54	3.20	3.20	0.51	0.28	1.63	1.63	13.82	1.24	15.05	45.50	0.206		0.000	0.206	100.00	525	0.45	0.300	1.346
124-01	124-00	5-yr	1.06	5.65	5.65	0.51	0.54	2.88	2.88	15.95	0.54	16.49	41.88	0.335		0.000	0.335	50.00	600	0.50	0.454	1.553



JUNE 2012
116239144

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2012-09-26 10:33 AM By: Khalid, Muneer

ORIGINAL SHEET – ANSI B

Stantec

Legend

EXISTING PROPERTY LINE	APPROX. DAYLIGHT/TOE OF SLOPE
PROPOSED EASEMENT LINE	REMOVALS
PROPOSED PROPERTY LINE	PROPOSED ROAD NETWORK
EXISTING CURBLINE	PROPOSED LANDSCAPING
PROPOSED CURBLINE	PROPOSED CONCRETE MEDIAN/ISLAND CAPS
PROPOSED FENCING	PROPOSED SIDEWALK/TRAIL
ST PROPOSED STORM	

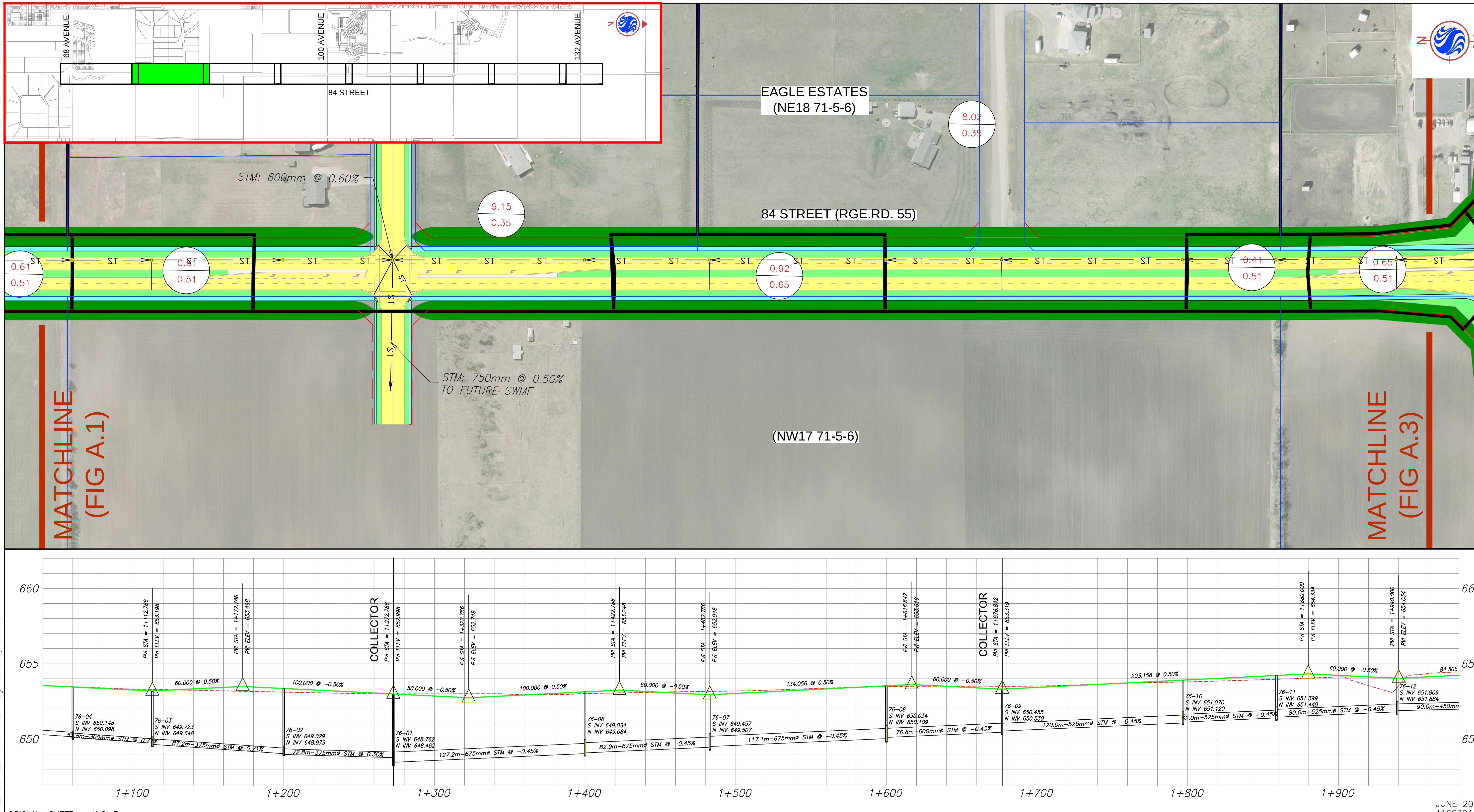
EXISTING TRAFFIC SIGNALS
PROPOSED TRAFFIC SIGNALS
EXISTING TRANSIT STOP

0 25 75 125m

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
A.1

Title
STORM CATCHMENT AREAS



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2012-09-26 10:34 AM By: Khalid, Muneer

ORIGINAL SHEET – ANSI B

Stantec

Legend

- EXISTING PROPERTY LINE
- PROPOSED EASEMENT LINE
- PROPOSED PROPERTY LINE
- EXISTING CURBLINE
- PROPOSED CURBLINE
- PROPOSED FENCING
- ST PROPOSED STORM
- APPROX. DAYLIGHT/TOE OF SLOPE
- REMOVALS
- PROPOSED ROAD NETWORK
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- EXISTING TRAFFIC SIGNALS
- PROPOSED TRAFFIC SIGNALS
- EXISTING TRANSIT STOP

0 25 75 125m

Client/Project

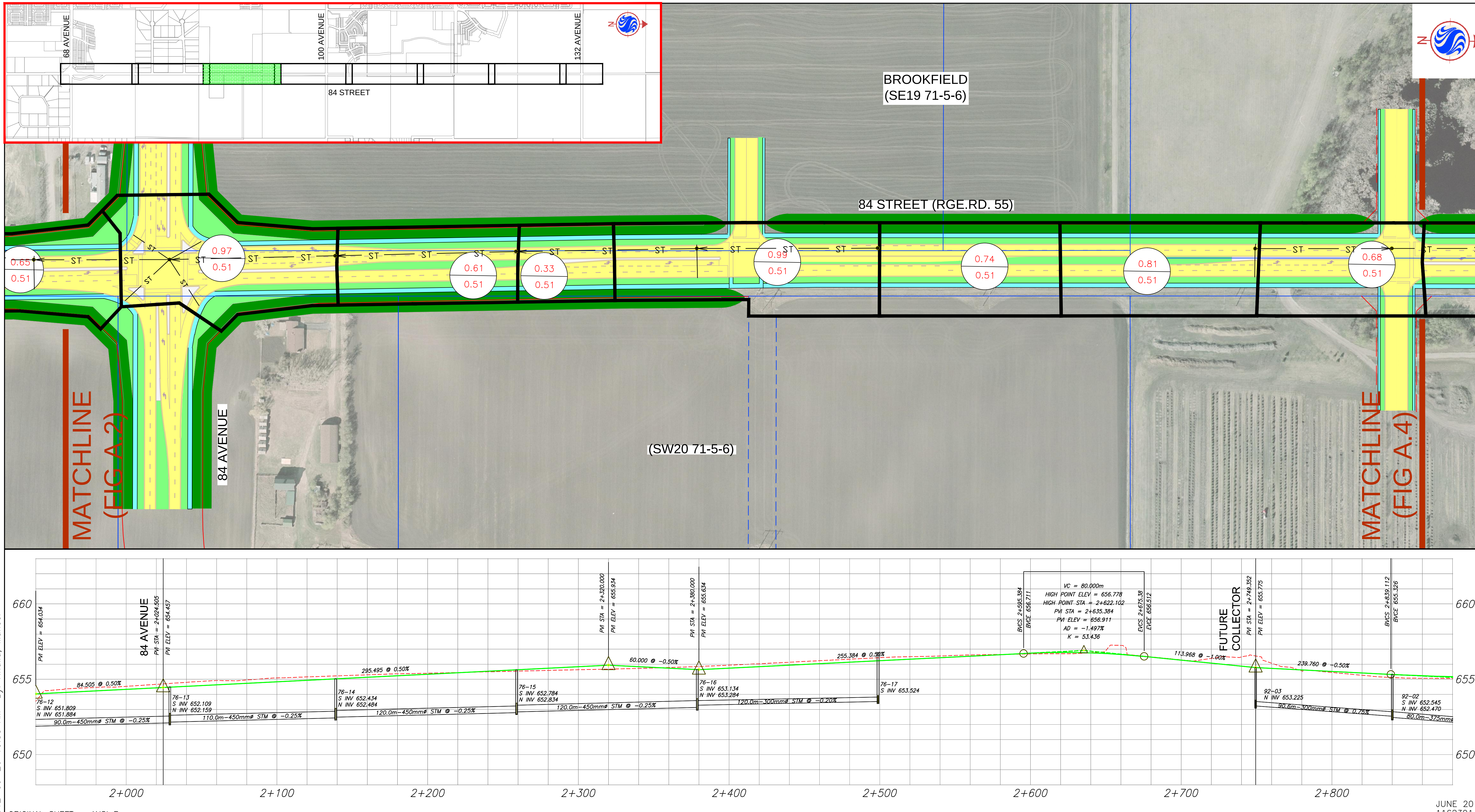
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.

A.2

Title

STORM CATCHMENT AREAS



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2012-09-26 10:35 AM By: Khalid, Muneer

ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

Legend

- EXISTING PROPERTY LINE
- PROPOSED EASEMENT LINE
- PROPOSED PROPERTY LINE
- EXISTING CURBLINE
- PROPOSED CURBLINE
- PROPOSED FENCING
- ST PROPOSED STORM
- APPROX. DAYLIGHT/TOE OF SLOPE
- REMOVALS
- PROPOSED ROAD NETWORK
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- EXISTING TRAFFIC SIGNALS
- PROPOSED TRAFFIC SIGNALS
- EXISTING TRANSIT STOP

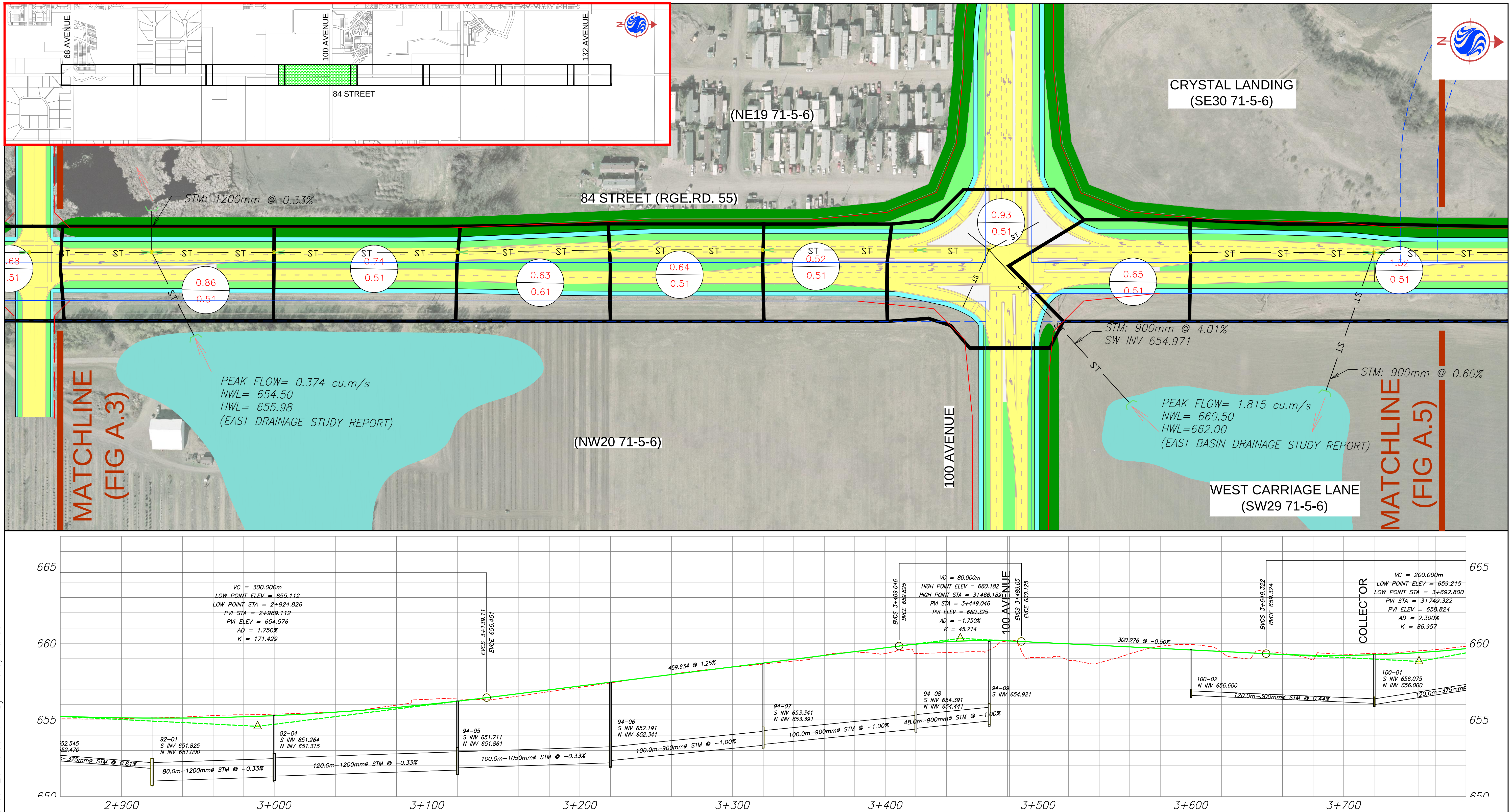
0 25 75 125m

Stantec

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
A.3

Title
STORM CATCHMENT AREAS



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2012-09-26 10:36 AM By: Khalid, Muneer

ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

Stantec

Legend

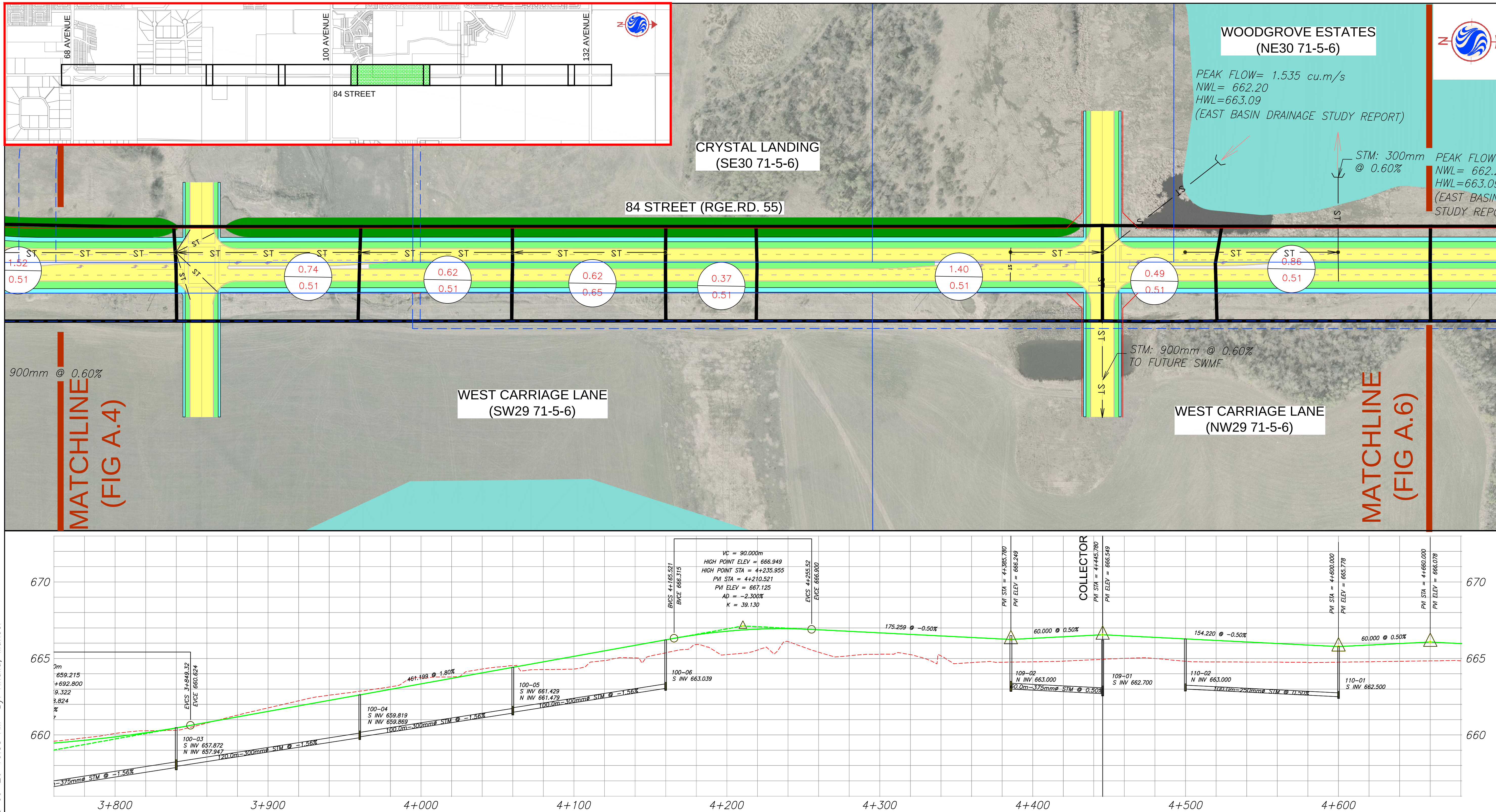
- EXISTING PROPERTY LINE
- PROPOSED EASEMENT LINE
- PROPOSED PROPERTY LINE
- EXISTING CURBLINE
- PROPOSED CURBLINE
- PROPOSED FENCING
- ST PROPOSED STORM
- APPROX. DAYLIGHT/TOE OF SLOPE
- REMOVALS
- PROPOSED ROAD NETWORK
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- EXISTING TRAFFIC SIGNALS
- PROPOSED TRAFFIC SIGNALS
- EXISTING TRANSIT STOP

0 25 75 125m

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
A.4

Title
STORM CATCHMENT AREAS



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2012-09-26 10:38 AM By: Khalid, Muneer

ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

Stantec

Legend

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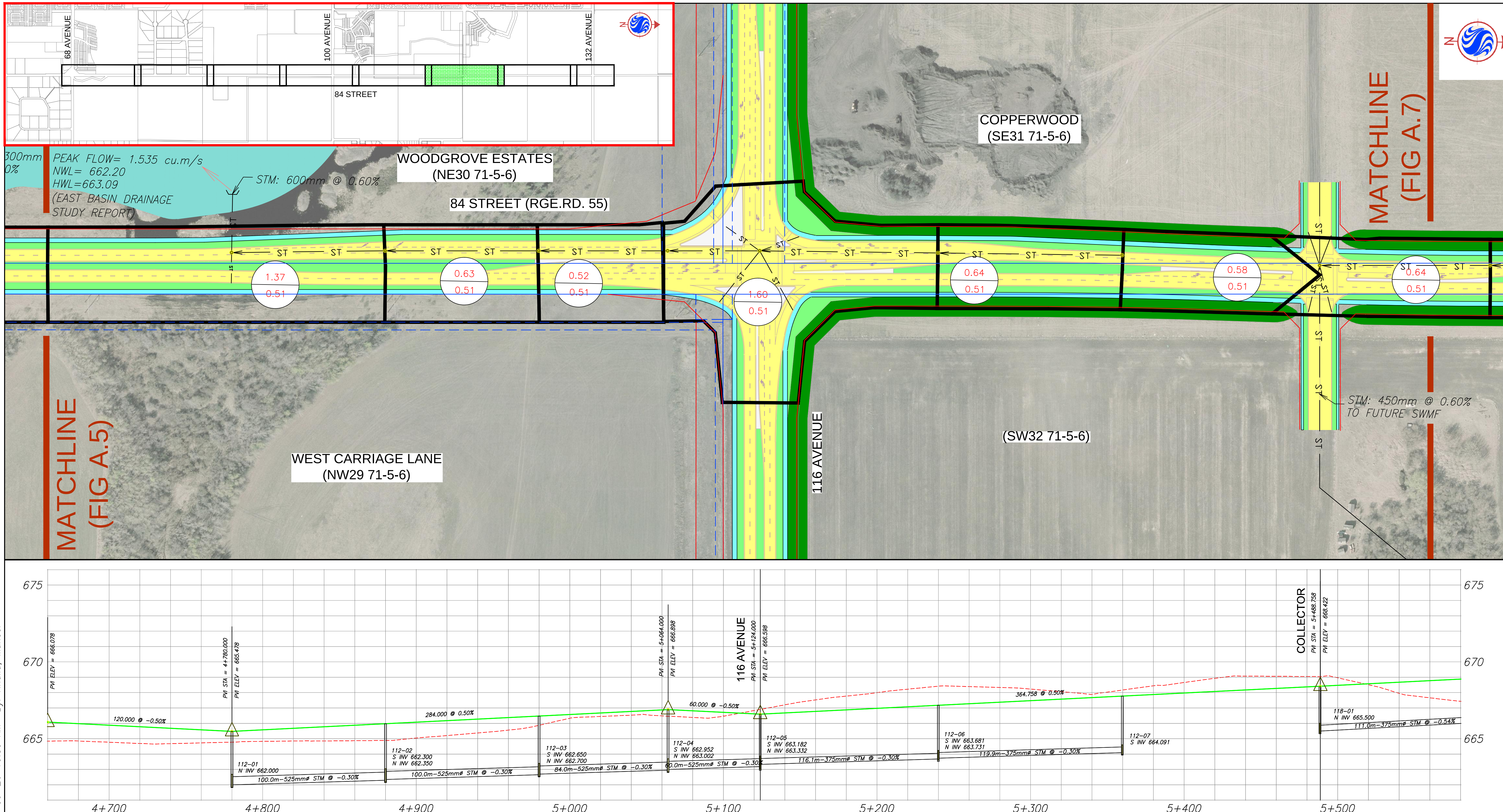
- PROPOSED PROPERTY LINE
- EXISTING CURBLINE
- PROPOSED CURBLINE
- PROPOSED FENCING
- PROPOSED STORM
- APPROX. DAYLIGHT/TOE OF SLOPE
- REMOVALS
- PROPOSED ROAD NETWORK
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- EXISTING TRAFFIC SIGNALS
- PROPOSED TRAFFIC SIGNALS
- EXISTING TRANSIT STOP

0 25 75 125m

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
A.5

Title
STORM CATCHMENT AREAS



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2012-09-26 10:39 AM By: Khalid, Muneer

ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

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- EXISTING CURBLINE
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- PROPOSED SIDEWALK/TRAIL
- EXISTING TRAFFIC SIGNALS
- PROPOSED TRAFFIC SIGNALS
- EXISTING TRANSIT STOP

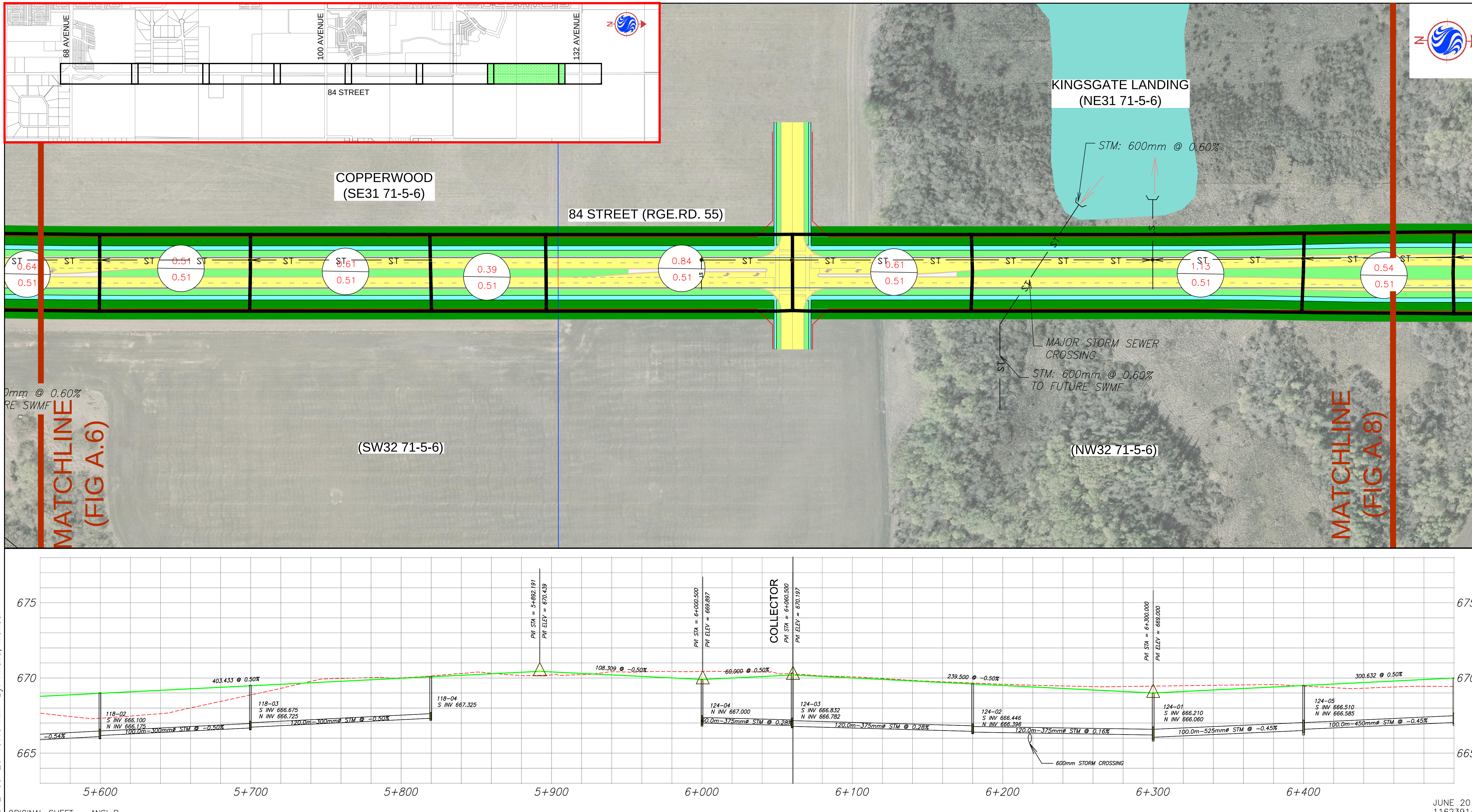
0 25 75 125m

Stantec

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
A.6

Title
STORM CATCHMENT AREAS



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2012-09-26 10:40 AM By: Khalid, Muneer

ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

Stantec

Legend

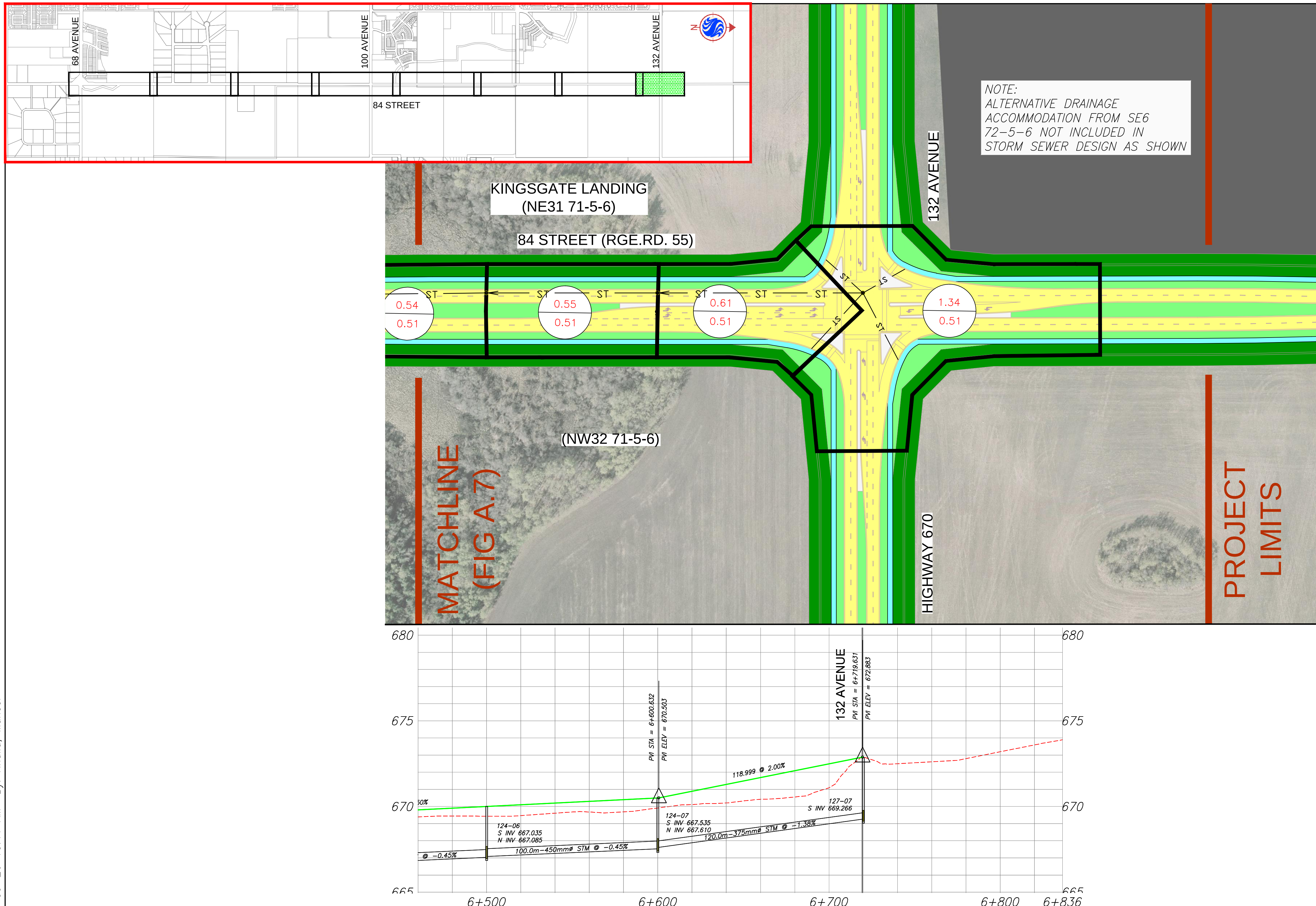
- EXISTING PROPERTY LINE
- PROPOSED EASEMENT LINE
- PROPOSED PROPERTY LINE
- EXISTING CURBLINE
- PROPOSED CURBLINE
- PROPOSED FENCING
- ST PROPOSED STORM
- APPROX. DAYLIGHT/TOE OF SLOPE
- REMOVALS
- PROPOSED ROAD NETWORK
- PROPOSED LANDSCAPING
- PROPOSED CONCRETE MEDIAN/ISLAND CAPS
- PROPOSED SIDEWALK/TRAIL
- EXISTING TRAFFIC SIGNALS
- PROPOSED TRAFFIC SIGNALS
- EXISTING TRANSIT STOP

0 25 75 125m

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
A.7

Title
STORM CATCHMENT AREAS



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2012-09-26 10:41 AM By: Khalid, Muneer

ORIGINAL SHEET – ANSI B

JUNE 2012
116239144

Stantec

Legend

EXISTING PROPERTY LINE	APPROX. DAYLIGHT/TOE OF SLOPE
PROPOSED EASEMENT LINE	REMOVALS
PROPOSED PROPERTY LINE	PROPOSED ROAD NETWORK
EXISTING CURBLINE	PROPOSED LANDSCAPING
PROPOSED CURBLINE	PROPOSED CONCRETE MEDIAN/ISLAND CAPS
PROPOSED FENCING	PROPOSED SIDEWALK/TRAIL
ST PROPOSED STORM	

EXISTING TRAFFIC SIGNALS
PROPOSED TRAFFIC SIGNALS
EXISTING TRANSIT STOP

0 25 75 125m

Client/Project
CITY OF GRANDE PRAIRIE
84 STREET
FUNCTIONAL PLANNING STUDY

Figure No.
A.8

Title
STORM CATCHMENT AREAS

APPENDIX B

TRAFFIC MODELING ANALYSIS

Stantec

Stantec Consulting Ltd.
600 - 4808 Ross Street
Red Deer AB T4N 1X5
Tel: (403) 341-3320
Fax: (403) 342-0969

March 1, 2012
File: 116239144-01

City of Grande Prairie
9505 112 Street
Grande Prairie, AB
T8V 6V3

Attention: **Mr. Norman Kyle, RET, P.L.Eng.**
Senior Transportation Analyst

Dear Norman:

Reference: **84 Street Functional Planning Study**
Population and Trip Distribution Assignment

Stantec is currently completing the Functional Planning for 84 Street from 68 Avenue to 132 Avenue. The existing Transportation Master Plan (ISL, August 2011) includes analysis up to the 90,000 population horizon. However, as shown on Exhibit 3.5 in the Transportation Master Plan, most of the parcels of land immediately adjacent to 84 Street are shown with minimal or no growth by the 90,000 population horizon.

In order to design 84 Street to be able to accommodate the growth that will occur adjacent to it, assumptions with regards to future populations and trip distribution for those parcels of land need to be made. The intent of this letter is to outline our initial assumptions prior to proceeding with the traffic analysis so as to avoid having to make changes during the analysis, which can become a timely process.

Once you have reviewed the assumptions presented in this letter, if you could please respond with approval to proceed with the traffic analysis portion of the Functional Planning or provide alternate assumptions for us to base that analysis on.

POPULATION ASSUMPTIONS

The number of dwellings in each parcel of land will determine the vehicle trips generated on the adjacent road network. Where available, the number of housing units (as well as other traffic generators such as neighbourhood commercial sites, schools, etc.) will be taken directly from existing Area Structure Plans (ASP). The parcels of land within the study area, as shown on the attached sketch, are summarized as follows:

- A – Kingsgate Landing – ASP available;
- B – portion of NE ASP;
- C – Copperwood – ASP available;
- D – portion of NE ASP;
- E – Woodgrove Estates – ASP available;
- F – West Carriage Lane (north portion) – ASP available;
- G – Crystal Landing – ASP available;

- H – West Carriage Lane (south portion) – ASP available;
- I – Meadow View (north portion) – ASP available;
- J – information available in the East Basin Study;
- K – Meadow View (south portion) – ASP available;
- L – information available in the East Basin Study;
- M – Eagle Estates (35 country residential lots);
- N – information available in the East Basin Study;
- O – Signature Falls – ASP available;
- P – information available in the East Basin Study;
- Q – Summerside – Outline Plan available; and
- R – existing development (27 country residential lots).

TRIP DISTRIBUTION ASSUMPTIONS

Once the number of vehicle trips has been calculated, based on the number of dwelling units per development, they will be distributed along the transportation network. Looking at the attached Sketch, there appear to be four main areas of commercial / industrial development in Grande Prairie, which will act as the trip attraction zones for those vehicle trips generated by the residential developments adjacent to 84 Street. In addition to those four areas, the two quarter-sections adjacent to 84 Street and north of 132 Avenue are planned to be industrial developments.

Based on the above information, and the relative sizes of the commercial / industrial areas, the following distribution is proposed for those trips generated by the 84 Street residential developments:

- 5% to/from Area 1;
- 10% to/from Area 2;
- 60% to/from Area 3;
- 20% to/from Area 4; and
- 5% to/from 84 Street industrial areas.

This proposed distribution appears to be consistent with Appendix 'I' in the Transportation Master Plan, which illustrates the expected PM peak hour traffic volumes along the major roadway network for the 90,000 population horizon.

Assumptions regarding the routes that vehicle will take to get to / from the trip attraction zones will also need to be made. Our initial assumptions regarding the distribution along the roadway network is as follows:

- For trips to / from Area 1 –
  - 70% on 100 Avenue; and
  - 30% on 116 Avenue or 84 Avenue (depending on whether the parcel of land is north or south of 100 Avenue).

- For trips to / from Area 2 –
  - 40% on 100 Avenue;
  - 40% on 84 Avenue; and
  - 20% on 68 Avenue.

Reference: 84 Street Functional Planning Study
Population and Trip Distribution Assumptions

- For trips to / from Area 3 –
  - 20% on 132 Avenue;
  - 20% on 116 Avenue;
  - 20% on 100 Avenue;
  - 20% on 84 Avenue; and
  - 20% on 68 Avenue.
- For trips to / from Area 4 –
  - 10% on 100 Avenue;
  - 50% on 116 Avenue; and
  - 40% on 132 Avenue.
- For trips to / from the new 84 Street industrial areas –
  - 100% on 84 Street, except for 50% of those trips from parcels A and B which will use 132 Avenue.

In addition to the above trip distribution, it is assumed that 60% of the trips generated by those parcels of land located west of 84 Street will not use that roadway. As the majority of trip destinations are located west of the developments, they will instead access the road network directly onto the east-west running avenues or will utilize collector roadways within adjacent residential developments as part of their trips.

ACCEPTANCE OF TRAFFIC ASSUMPTIONS

The City of Grande Prairie accepts the population and trip distribution assumptions outlined above for the 84 Street Functional Planning Study by signing and returning a copy of this document to Stantec.

Once we receive approval of the above assumptions, or are provided with alternative ones, we will proceed with the traffic modeling for the 84 Street Functional Planning Study. Should you have any questions regarding the above, please feel free to contact me directly.

Sincerely,

STANTEC CONSULTING LTD.

N Burkinshaw

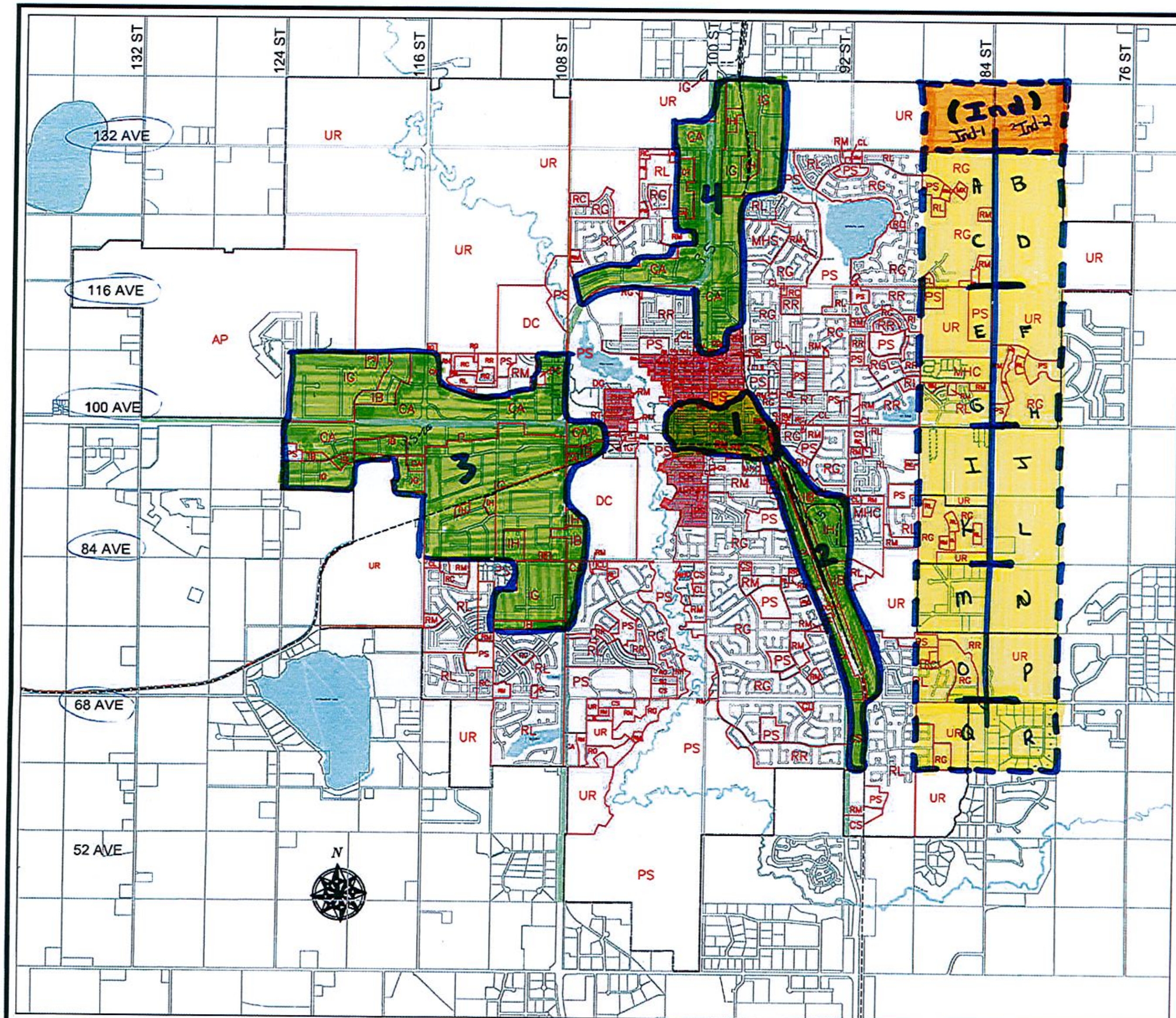
Niki Burkinshaw, P.Eng.
Project Engineer
Tel: (403) 341-3320
Fax: (403) 342-0969
niki.burkinshaw@stantec.com

CITY OF GRANDE PRAIRIE REPRESENTATIVE

Per:

Date: MAR 02/12

Attachment: LUB Sketch



GRANDE prairie

THE CITY OF GRANDE PRAIRIE

LAND USE BYLAW

Schedule "A"

BYLAW NO. C-1100

With Amendments in effect to C-1100-178 as of February 6, 2012

LEGEND

AP Airport District
CA Arterial Commercial
CC Central Commercial
CL Local Commercial
CS Commercial Service
CT Commercial Transition
DC Direct Control
IB Industrial Business
IG General Industrial
IH Heavy Industrial
MHC Manufactured Home Community
MHS Manufactured Home Subdivision
MX Mixed Use
PS Public Service
RC Combined Density Residential
RG General Residential
RH High Density Residential
RL Low Density Residential
RM Medium Density Residential
RR Restricted Residential
RSR Restricted Small Lot Residential
RT Residential Transition
UR Urban Reserve
City Boundary
Airport Vicinity Overlay
High Visibility Corridor Overlay
Swanavon Area Redevelopment Plan
College Park Area Redevelopment Plan
South Avondale Area Redevelopment Plan
VLA / Montrose Area Redevelopment Plan
Downtown Enhancement Plan Boundary

This map was prepared by the GIS DEPARTMENT, City of Grande Prairie, ALBERTA.
For additional copies or information, contact GIS DEPARTMENT at : (780) 538-0461.

The content of this map as indicated by the Title of this drawing, was last revised as per the revision date in the lower right corner of this drawing. The revision date does not reflect the revision date of the background data used to present the content of this map.

Scale: N.T.S.
Date: 12/02/13
File No.: C01275 11x17_color

City of Grande Prairie - 84 Street Functional Planning - Land Use Assumptions	
Single-Familly Residential = ITE Land Use 210 (Single-Family Detached Housing)	For Commercial: total area x 30% coverage = Gross Leasable Area
Multi-Family Residential = ITE Land Use 230 (Residential Condominium/Townhouse)	For Bed & Breakfast: 3 guest rooms + home-owner permitted = equivalent of 4 single-family dwellings
Mixed Use (Apartment) = ITE Land Use 220 (Apartment)	For School sites with unknown details: Use 500 students; elementary school
Mixed Use (Commercial) = ITE Land Use 820 (Shopping Centre)	For Recreational (PARDS) - 14 horses listed on website; classes 30 - 45 minutes long; 9am - 7:30pm Mon-Thurs
Commercial = ITE Land Use 820 (Shopping Centre)	Internal Trip Capture Rates:
Mobile Home Park = ITE Land Use 240 (Mobile Home Park)	- Residential / Commercial internal trip capture calculated using ITE's calculation method (PM peak).
Industrial Business = ITE Land Use 770 (Business Park)	- Residential / Commercial internal trip capture calculated using appropriate rate for AM peak (6% / 10%).
General Industrial = ITE Land Use 130 (Industrial Park)	- Schools calculated as 80% of trips internal to NASP area; remaining 20% to adjacent neighborhoods.

Table 5.1: City of Grande Prairie - 84 Street Functional Planning - External Trip Generation Calculations

Area Reference	Legal Land Description	Subdivision Name	Land Use Designation	Units	Measure	AM Peak Hour					PM Peak Hour				
						Trip Generation Rate / Formula	% Trips In	% Trips Out	Trips In	Trips Out	Trip Generation Rate / Formula	% Trips In	% Trips Out	Trips In	Trips Out
A	NE31 71-5-W6M	Kingsgate Landing	Single-Family Residential	670	dwellings	T = 0.70(X) + 9.74	25%	75%	113	337	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	341	196
			Multi-Family Residential	195	dwellings	Ln(T) = 0.80 Ln(X) + 0.26	17%	83%	14	69	Ln(T) = 0.82 Ln(X) + 0.32	67%	33%	70	34
			Mixed Use (Apartment)	94	dwellings	T = 0.49(X) + 3.73	20%	80%	9	38	T = 0.55(X) + 17.65	65%	35%	32	17
			Mixed Use (Commercial)	54.9	1,000 ft^2 GLA	Ln(T) = 0.59 Ln(X) + 2.32	61%	39%	59	38	Ln(T) = 0.67 Ln(X) + 3.37	49%	51%	190	191
									196	481				633	438
B	NW32 71-5-W6M	(NE ASP)	Single-Family Residential	700	dwellings	T = 0.70(X) + 9.74	25%	75%	125	375	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	381	224
			Multi-Family Residential	114	dwellings	Ln(T) = 0.80 Ln(X) + 0.26	17%	83%	10	48	Ln(T) = 0.82 Ln(X) + 0.32	67%	33%	45	22
									135	423				426	246
C	SE31 71-5-W6M	Copperwood	Single-Family Residential	712	dwellings	T = 0.70(X) + 9.74	25%	75%	119	358	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	364	210
			Multi-Family Residential	173	dwellings	Ln(T) = 0.80 Ln(X) + 0.26	17%	83%	13	62	Ln(T) = 0.82 Ln(X) + 0.32	67%	33%	63	31
			Commercial (1.41 ha)	45.5	1,000 ft^2 GLA	Ln(T) = 0.59 Ln(X) + 2.32	61%	39%	53	34	Ln(T) = 0.67 Ln(X) + 3.37	49%	51%	167	168
									186	454				594	409
D	SW32 71-5-W6M	(NE ASP)	Single-Family Residential	557	dwellings	T = 0.70(X) + 9.74	25%	75%	100	300	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	311	182
			Multi-Family Residential	54	dwellings	Ln(T) = 0.80 Ln(X) + 0.26	17%	83%	5	26	Ln(T) = 0.82 Ln(X) + 0.32	67%	33%	24	12
			School (Type?)	500	students	Ln(T) = 1.14 Ln(X) - 1.86	55%	45%	20	17	T = 0.15(X)	49%	51%	7	8
									125	343				342	202
E	NE30 71-5-W6M	Woodgrove Estates	Single-Family Residential	470	dwellings	T = 0.70(X) + 9.74	25%	75%	85	254	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	267	157
			Multi-Family Residential	60	dwellings	Ln(T) = 0.80 Ln(X) + 0.26	17%	83%	6	28	Ln(T) = 0.82 Ln(X) + 0.32	67%	33%	26	13
			Elementary School (3.78 ha)	500	students	Ln(T) = 1.14 Ln(X) - 1.86	55%	45%	20	17	T = 0.15(X)	49%	51%	7	8
									111	299				300	178
F	NW29 71-5-W6M	West Carriage Lane	Single-Family Residential	606	dwellings	T = 0.70(X) + 9.74	25%	75%	102	306	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	306	176
		(north portion)	Multi-Family Residential	148	dwellings	Ln(T) = 0.80 Ln(X) + 0.26	17%	83%	11	55	Ln(T) = 0.82 Ln(X) + 0.32	67%	33%	56	27
			Commercial (1.96 ha)	63.3	1,000 ft^2 GLA	Ln(T) = 0.59 Ln(X) + 2.32	61%	39%	65	41	Ln(T) = 0.67 Ln(X) + 3.37	49%	51%	208	210
									178	402				570	413
G	SE30 71-5-W6M	Crystal Landing	Single-Family Residential	403	dwellings	T = 0.70(X) + 9.74	25%	75%	73	219	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	232	136
			Multi-Family Residential	312	dwellings	Ln(T) = 0.80 Ln(X) + 0.26	17%	83%	22	106	Ln(T) = 0.82 Ln(X) + 0.32	67%	33%	102	50
			Bed & Breakfast (0.14 ha)	4	dwellings	T = 0.70(X) + 9.74	25%	75%	3	9	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	4	2
		Trumpeter Village	Mobile Home Park	281	dwellings	T = 0.44(X)	20%	80%	25	99	T = 0.57(X) + 2.06	62%	38%	101	62
									123	433				439	250
H	SW29 71-5-W6M	West Carriage Lane	Single-Family Residential	404	dwellings	T = 0.70(X) + 9.74	25%	75%	69	206	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	233	137
		(south portion)	Multi-Family Residential	445	dwellings	Ln(T) = 0.80 Ln(X) + 0.26	17%	83%	27	133	Ln(T) = 0.82 Ln(X) + 0.32	67%	33%	137	67
			School (Type?, 5.10 ha)	500	students	Ln(T) = 1.14 Ln(X) - 1.86	55%	45%	20	17	T = 0.15(X)	49%	51%	7	8
									116	355				377	212
I	NE19 71-5-W6M	Meadow View	Single-Family Residential	63	dwellings	T = 0.70(X) + 9.74	25%	75%	12	38	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	44	26
		(north portion)	Mobile Home Park	583	dwellings	T = 0.44(X)	20%	80%	48	193	T = 0.57(X) + 2.06	62%	38%	207	127
									60	230				251	153

Table 5.1: City of Grande Prairie - 84 Street Functional Planning - External Trip Generation Calculations

Area Reference	Legal Land Description	Subdivision Name	Land Use Designation	Units	Measure	AM Peak Hour					PM Peak Hour				
						Trip Generation Rate / Formula	% Trips In	% Trips Out	Trips In	Trips Out	Trip Generation Rate / Formula	% Trips In	% Trips Out	Trips In	Trips Out
J	NW20 71-5-W6M	(East Basin Study)	Single-Family Residential	688	dwellings	T = 0.70(X) + 9.74	25%	75%	116	347	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	354	205
			Multi-Family Residential	720	dwellings	Ln(T) = 0.80 Ln(X) + 0.26	17%	83%	40	196	Ln(T) = 0.82 Ln(X) + 0.32	67%	33%	203	100
			Commercial (1.3 ha)	42.0	1,000 ft^2 GLA	Ln(T) = 0.59 Ln(X) + 2.32	61%	39%	50	32	Ln(T) = 0.67 Ln(X) + 3.37	49%	51%	158	159
			K-12 School (2.7 ha)	500	students	Ln(T) = 1.14 Ln(X) - 1.86	55%	45%	20	17	T = 0.15(X)	49%	51%	7	8
									227	592				722	472
K	SE19 71-5-W6M	Brookfield	Single-Family Residential	634	dwellings	T = 0.70(X) + 9.74	25%	75%	106	320	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	331	192
			Multi-Family Residential	56	dwellings	Ln(T) = 0.80 Ln(X) + 0.26	17%	83%	6	25	Ln(T) = 0.82 Ln(X) + 0.32	67%	33%	25	12
			Commercial (1.0 ha)	32.3	1,000 ft^2 GLA	Ln(T) = 0.59 Ln(X) + 2.32	61%	39%	43	28	Ln(T) = 0.67 Ln(X) + 3.37	49%	51%	133	134
			Recreational - PARDS (8.1 ha)						30	15				45	30
									185	388				534	368
L	SW20 71-5-W6M	(East Basin Study)	Single-Family Residential	773	dwellings	T = 0.70(X) + 9.74	25%	75%	130	388	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	395	229
			Multi-Family Residential	420	dwellings	Ln(T) = 0.80 Ln(X) + 0.26	17%	83%	26	127	Ln(T) = 0.82 Ln(X) + 0.32	67%	33%	131	64
			Commercial (1.3 ha)	42.0	1,000 ft^2 GLA	Ln(T) = 0.59 Ln(X) + 2.32	61%	39%	50	32	Ln(T) = 0.67 Ln(X) + 3.37	49%	51%	158	159
			K-12 School (2.7 ha)	500	students	Ln(T) = 1.14 Ln(X) - 1.86	55%	45%	20	17	T = 0.15(X)	49%	51%	7	8
									227	564				691	460
M	NE18 71-5-W6M	Eagle Estates	Single-Family Residential	35	dwellings	T = 0.70(X) + 9.74	25%	75%	9	26	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	26	15
									9	26				26	15
N	NW17 71-5-W6M	(East Basin Study)	Single-Family Residential	652	dwellings	T = 0.70(X) + 9.74	25%	75%	110	329	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	339	196
			Multi-Family Residential	348	dwellings	Ln(T) = 0.80 Ln(X) + 0.26	17%	83%	23	109	Ln(T) = 0.82 Ln(X) + 0.32	67%	33%	112	55
			Commercial (1.1 ha)	35.5	1,000 ft^2 GLA	Ln(T) = 0.59 Ln(X) + 2.32	61%	39%	46	30	Ln(T) = 0.67 Ln(X) + 3.37	49%	51%	142	143
			K-9 School (2.3 ha)	500	students	Ln(T) = 1.14 Ln(X) - 1.86	55%	45%	20	17	T = 0.15(X)	49%	51%	7	8
									199	485				600	402
O	SE18 71-5-W6M	Signature Falls	Single-Family Residential	664	dwellings	T = 0.70(X) + 9.74	25%	75%	119	356	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	364	214
			Multi-Family Residential	67	dwellings	Ln(T) = 0.80 Ln(X) + 0.26	17%	83%	6	31	Ln(T) = 0.82 Ln(X) + 0.32	67%	33%	29	14
			School (Type?, 3.32 ha)	500	students	Ln(T) = 1.14 Ln(X) - 1.86	55%	45%	20	17	T = 0.15(X)	49%	51%	7	8
									145	404				400	236
P	SW17 71-5-W6M	(East Basin Study)	Single-Family Residential	641	dwellings	T = 0.70(X) + 9.74	25%	75%	108	323	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	298	168
			Multi-Family Residential	720	dwellings	Ln(T) = 0.80 Ln(X) + 0.26	17%	83%	40	196	Ln(T) = 0.82 Ln(X) + 0.32	67%	33%	203	100
			Commercial (5.0 ha)	161.5	1,000 ft^2 GLA	Ln(T) = 0.59 Ln(X) + 2.32	61%	39%	113	72	Ln(T) = 0.67 Ln(X) + 3.37	49%	51%	391	393
			K-9 School (2.8 ha)	500	students	Ln(T) = 1.14 Ln(X) - 1.86	55%	45%	20	17	T = 0.15(X)	49%	51%	7	8
									281	608				899	669
Q	NE7 71-5-W6M	Summerside	Single-Family Residential	177	dwellings	T = 0.70(X) + 9.74	25%	75%	33	100	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	111	65
									33	100				111	65
R	NW8 71-5-W6M	Ex. Residential	Single-Family Residential	30	dwellings	T = 0.70(X) + 9.74	25%	75%	8	23	Ln(T) = 0.90 Ln(X) + 0.51	63%	37%	22	13
									8	23				22	13
Total Trip Generation								**AM Peak (in/out):**	**2,545**	**6,610**			**PM Peak (in/out):**	**7,940**	**5,198**

Table 5.2 - Intersection Capacity Analysis Summary - 84 Street Functional Planning

Intersection Location - Peak Period	Intersection Movements												Overall Intersection	Comments
Description	EB			WB			NB			SB				
	L	T	R	L	T	R	L	T	R	L	T	R		
84 Street & 132 Avenue - AM Peak														
Intersection / Lane Characteristics	1	2	1	1	2	1	2	2	1	1	2	1		
Volumes(veh/h)	1	5	335	70	16	2	783	110	54	1	43	1		
Volume/Capacity Ratio (V/C)	0.00	0.01	0.52	0.20	0.02	0.00	0.63	0.06	0.06	0.00	0.07	0.00	52.4% ICU	Signalized
Level of Service (LOS)	C	C	A	C	C	B	C	A	A	C	C	C	LOS - C	Cycle = 90 s
Queue Length 95th (m)	2.2	4.5	15.0	25.3	8.4	-	74.9	14.5	-	1.6	14.4	-		
Proposed Storage Bay Length (m)	50.0	-	80.0	50.0	-	50.0	75.0	-	50.0	50.0	-	50.0		
84 Street & 132 Avenue - PM Peak														
Intersection / Lane Characteristics	1	2	1	1	2	1	2	2	1	1	2	1		
Volumes(veh/h)	1	16	963	77	10	1	661	88	85	2	133	2		
Volume/Capacity Ratio (V/C)	0.00	0.01	0.95	0.16	0.01	0.00	0.72	0.05	0.11	0.01	0.23	0.01	91.3% ICU	Signalized
Level of Service (LOS)	B	B	C	C	B	B	C	B	A	C	C	C	LOS - C	Cycle = 90 s
Queue Length 95th (m)	1.3	61.0	78.0	25.9	5.7	-	69.8	17.4	-	2.8	718.0	-		
Propsoed Storage Bay Length (m)	50.0	-	80.0	50.0	-	50.0	75.0	-	50.0	50.0	-	50.0		
84 Street & 116 Avenue - AM Peak														
Intersection / Lane Characteristics	1	2	1	1	2	1	2	2	1	1	2	1		
Volumes(veh/h)	88	12	282	67	31	33	667	845	27	13	687	197		
Volume/Capacity Ratio (V/C)	0.22	0.01	0.19	0.29	0.05	0.11	0.78	0.45	0.03	0.09	0.78	0.37	62.9% ICU	Signalized
Level of Service (LOS)	C	C	A	D	C	B	D	A	A	C	D	A	LOS - C	Cycle = 90 s
Queue Length 95th (m)	29.7	7.2	-	28.4	13.0	4.2	78.4	60.7	6.4	17.0	249.8	42.5		
Proposed Storage Bay Length (m)	80.0	-	50.0	50.0	-	50.0	85.0	-	50.0	50.0	-	120.0		
84 Street & 116 Avenue - PM Peak														
Intersection / Lane Characteristics	1	2	1	1	2	1	2	2	1	1	2	1		
Volumes(veh/h)	228	38	793	55	25	27	578	1034	82	40	1150	158		
Volume/Capacity Ratio (V/C)	0.74	0.05	0.54	0.33	0.06	0.12	0.80	0.47	0.08	0.21	0.82	0.22	80.9% ICU	Signalized
Level of Service (LOS)	D	D	A	D	D	B	D	A	A	C	D	A	LOS - C	Cycle = 120 s
Queue Length 95th (m)	76.9	39.1	6.6	26.3	12.5	4.3	81.2	65.1	-	33.0	245.0	122.3		
Propsoed Storage Bay Length (m)	80.0	-	50.0	50.0	-	50.0	85.0	-	50.0	50.0	-	120.0		
84 Street & 100 Avenue - AM Peak														
Intersection / Lane Characteristics	2	2	1	1	2	1	2	2	1	1	2	1		
Volumes(veh/h)	162	13	189	50	36	80	419	1113	19	29	858	359		
Volume/Capacity Ratio (V/C)	0.57	0.01	0.13	0.22	0.06	0.24	0.69	0.76	0.03	0.12	0.76	0.24	62.1% ICU	Signalized
Level of Service (LOS)	D	C	A	C	C	A	D	B	A	A	B	A	LOS - C	Cycle = 90 s
Queue Length 95th (m)	28.4	7.0	-	22.9	15.2	26.9	57.1	76.4	18.7	15.2	65.2	-		
Proposed Storage Bay Length (m)	100.0	-	50.0	50.0	-	50.0	110.0	-	50.0	65.0	-	120.0		
84 Street & 100 Avenue - PM Peak														
Intersection / Lane Characteristics	2	2	1	1	2	1	2	2	1	1	2	1		
Volumes(veh/h)	423	41	535	36	26	58	375	1362	60	91	1502	291		
Volume/Capacity Ratio (V/C)	0.93	0.04	0.36	0.21	0.06	0.24	0.94	0.92	0.09	0.34	1.01	0.20	84.3% ICU	Signalized
Level of Service (LOS)	E	C	A	D	D	B	E	C	A	B	D	A	LOS - D	Cycle = 120 s
Queue Length 95th (m)	97.2	63.8	-	18.3	13.1	26.5	110.6	134.8	32.3	63.6	1172.2	254.0		
Propsoed Storage Bay Length (m)	100.0	-	50.0	50.0	-	50.0	110.0	-	50.0	65.0	-	120.0		

Note:
SH = Shared

Table 5.2 - Intersection Capacity Analysis Summary - 84 Street Functional Planning

Intersection Location - Peak Period	Intersection Movements												Overall Intersection	Comments
Description	EB			WB			NB			SB				
	L	T	R	L	T	R	L	T	R	L	T	R		
<u>84 Street & 84 Avenue - AM Peak</u>														
Intersection / Lane Characteristics	2	2	1	1	2	1	1	2	1	1	2	1		
Volumes(veh/h)	193	13	72	26	29	129	148	773	10	51	532	438		
Volume/Capacity Ratio (V/C)	0.54	0.01	0.13	0.10	0.04	0.32	0.35	0.53	0.02	0.80	0.40	0.51	57.0% ICU	Signalized
Level of Service (LOS)	D	B	A	C	C	A	B	B	A	A	A	A	LOS - B	Cycle = 90 s
Queue Length 95th (m)	30.2	8.2	9.8	15.6	12.8	31.2	34.2	65.2	-	17.2	33.1	12.3		
Proposed Storage Bay Length (m)	90.0	-	60.0	50.0	-	50.0	60.0	-	50.0	60.0	-	65.0		
<u>84 Street & 84 Avenue - PM Peak</u>														
Intersection / Lane Characteristics	2	2	1	1	2	1	1	2	1	1	2	1		
Volumes(veh/h)	542	40	210	21	24	106	138	1006	32	155	1083	359		
Volume/Capacity Ratio (V/C)	0.75	0.03	0.31	0.13	0.05	0.37	0.68	0.75	0.05	0.69	0.81	0.45	73.0% ICU	Signalized
Level of Service (LOS)	D	C	A	D	D	B	D	C	B	C	C	A	LOS - C	Cycle = 120 s
Queue Length 95th (m)	87.7	63.1	55.5	14.8	11.4	39.8	60.0	109.5	27.0	55.4	102.2	61.1		
Propsoed Storage Bay Length (m)	90.0	-	60.0	50.0	-	50.0	60.0	-	50.0	60.0	-	65.0		
<u>84 Street & 68 Avenue - AM Peak</u>														
Intersection / Lane Characteristics	1	2	1	1	2	1	1	2	1	1	2	1		
Volumes(veh/h)	263	7	0	0	16	98	1	7	0	45	2	525		
Volume/Capacity Ratio (V/C)	0.43	0.00	0.00	0.00	0.02	0.21	0.00	0.01	0.00	0.10	0.00	0.61	64.2% ICU	Signalized
Level of Service (LOS)	B	A	-	-	B	A	B	B	-	B	B	A	LOS - A	Cycle = 60 s
Queue Length 95th (m)	44.1	4.1	-	-	7.6	-	-	5.9	-	15.8	196.7	18.8		
Proposed Storage Bay Length (m)	150.0	-	50.0	50.0	-	50.0	50.0	-	50.0	50.0	-	50.0		
<u>84 Street & 68 Avenue - PM Peak</u>														
Intersection / Lane Characteristics	1	2	1	1	2	1	1	2	1	1	2	1		
Volumes(veh/h)	646	23	1	0	17	105	1	4	0	142	7	469		
Volume/Capacity Ratio (V/C)	0.83	0.01	0.00	0.00	0.02	0.24	0.00	0.00	0.00	0.30	0.01	0.56	67.0% ICU	Signalized
Level of Service (LOS)	C	B	A	-	C	A	C	C	-	B	B	B	LOS - C	Cycle = 120 s
Queue Length 95th (m)	149.1	56.8	-	-	8.3	-	1.2	5.7	-	42.4	6.0	4.3		
Propsoed Storage Bay Length (m)	150.0	-	50.0	50.0	-	50.0	50.0	-	50.0	50.0	-	50.0		

Note:
SH = Shared

Intersection: 1: 84 St & 132 Ave

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	T	L	L	T	T	L
Maximum Queue (m)	4.2	7.1	6.1	34.6	30.4	8.9	10.0	82.2	82.5	26.5	17.6	2.7
Average Queue (m)	0.2	0.4	0.7	1.7	11.9	0.9	2.1	45.5	48.7	1.5	4.8	0.1
95th Queue (m)	2.2	3.3	4.5	15.0	25.3	5.1	8.4	73.8	74.9	14.5	13.7	1.6
Link Distance (m)		1202.3	1202.3			1220.2	1220.2			1544.3	1544.3	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (m)	50.0			80.0	50.0			90.0	90.0			50.0
Storage Blk Time (%)								0	0	0		
Queuing Penalty (veh)								0	0	0		

Intersection: 1: 84 St & 132 Ave

Movement	SB	SB
Directions Served	T	T
Maximum Queue (m)	15.2	17.2
Average Queue (m)	4.6	5.8
95th Queue (m)	12.2	14.4
Link Distance (m)	718.0	718.0
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 2: 84 St & 116 Ave

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	NB
Directions Served	L	T	T	L	T	T	R	L	L	T	T	R
Maximum Queue (m)	34.2	9.7	10.2	32.2	14.9	15.8	5.5	81.1	83.4	77.1	57.1	8.4
Average Queue (m)	15.6	0.5	1.6	14.4	2.7	4.5	0.2	54.0	56.4	35.0	30.1	0.3
95th Queue (m)	29.7	4.0	7.2	28.4	9.7	13.0	4.2	75.0	78.4	60.7	51.4	6.4
Link Distance (m)		1193.3	1193.3		1211.3	1211.3				103.8	103.8	
Upstream Blk Time (%)										0		
Queuing Penalty (veh)										1		
Storage Bay Dist (m)	85.0			50.0			50.0	95.0	95.0			50.0
Storage Blk Time (%)								0	0		1	0
Queuing Penalty (veh)								0	0		0	0

Intersection: 2: 84 St & 116 Ave

Movement	B18	B18	SB	SB	SB	SB
Directions Served	T	T	L	T	T	R
Maximum Queue (m)	5.4	238.6	32.8	89.9	337.1	46.8
Average Queue (m)	0.2	8.0	4.1	49.6	64.0	12.3
95th Queue (m)	4.2	183.5	17.0	77.9	249.8	42.5
Link Distance (m)	1428.2	1428.2		1544.3	1544.3	
Upstream Blk Time (%)		0			0	
Queuing Penalty (veh)		0			0	
Storage Bay Dist (m)			50.0			150.0
Storage Blk Time (%)			0	8		
Queuing Penalty (veh)			0	1		

Intersection: 3: 84 St & 100 Ave

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	L	T	T	L	T	T	R	L	L	T	T
Maximum Queue (m)	34.5	33.6	8.9	10.2	27.7	14.4	19.2	39.3	59.5	63.8	77.3	82.2
Average Queue (m)	15.9	17.3	0.8	1.5	10.3	3.2	5.8	5.7	36.8	38.7	50.5	50.1
95th Queue (m)	28.2	28.4	4.9	7.0	22.9	11.0	15.2	26.9	54.8	57.1	72.8	76.4
Link Distance (m)			106.5	106.5		1220.3	1220.3				103.9	103.9
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (m)	100.0	100.0			50.0			50.0	100.0	100.0		
Storage Blk Time (%)												9
Queuing Penalty (veh)												2

Intersection: 3: 84 St & 100 Ave

Movement	NB	B19	SB	SB	SB
Directions Served	R	T	L	T	T
Maximum Queue (m)	43.6	236.8	17.6	69.4	79.3
Average Queue (m)	2.0	7.9	6.3	35.7	41.5
95th Queue (m)	18.7	182.1	15.2	57.8	65.2
Link Distance (m)		1417.3		1428.2	1428.2
Upstream Blk Time (%)		0			
Queuing Penalty (veh)		0			
Storage Bay Dist (m)	50.0		65.0		
Storage Blk Time (%)	0			0	
Queuing Penalty (veh)	0			0	

Intersection: 4: 84 St & 84 Ave

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	L	T	T	R	L	T	T	R	L	T	T
Maximum Queue (m)	31.2	33.4	7.3	10.2	17.4	20.8	15.1	13.7	44.7	46.8	71.5	73.0
Average Queue (m)	16.7	18.5	0.5	2.0	0.9	5.5	3.2	4.8	7.0	18.6	38.7	42.3
95th Queue (m)	28.7	30.2	3.8	8.2	9.8	15.6	11.1	12.8	31.2	34.2	60.0	65.2
Link Distance (m)			1195.1	1195.1			1222.2	1222.2			1528.9	1528.9
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (m)	90.0	90.0			60.0	50.0			50.0	70.0		
Storage Blk Time (%)									0		0	3
Queuing Penalty (veh)									0		0	0

Intersection: 4: 84 St & 84 Ave

Movement	SB	SB	SB	SB	B19
Directions Served	L	T	T	R	T
Maximum Queue (m)	19.9	35.4	39.2	18.1	18.6
Average Queue (m)	8.4	14.0	19.2	1.3	0.6
95th Queue (m)	17.2	27.1	33.1	12.3	14.3
Link Distance (m)		1417.3	1417.3		103.9
Upstream Blk Time (%)					0
Queuing Penalty (veh)					0
Storage Bay Dist (m)	60.0			75.0	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 5: 84 St & 68 Ave

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB	SB	SB
Directions Served	L	T	T	T	T	T	T	L	T	T	R
Maximum Queue (m)	53.1	1.4	7.2	9.0	12.4	2.9	9.0	18.2	4.3	261.1	41.9
Average Queue (m)	25.9	0.1	0.6	1.5	1.6	0.2	1.2	6.5	0.3	8.9	2.6
95th Queue (m)	44.1	1.5	4.1	7.0	7.6	1.9	5.9	15.8	2.6	196.7	18.8
Link Distance (m)		1195.1	1195.1	1222.1	1222.1	317.6	317.6		1528.9	1528.9	
Upstream Blk Time (%)										0	
Queuing Penalty (veh)										0	
Storage Bay Dist (m)	150.0							50.0			50.0
Storage Blk Time (%)											0
Queuing Penalty (veh)											0

Zone Summary

Zone wide Queuing Penalty: 5

Intersection: 1: 84 St & 132 Ave

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	T	L	L	T	T	L
Maximum Queue (m)	1.4	7.3	100.4	81.7	33.6	7.2	9.8	73.1	72.8	13.9	21.0	6.9
Average Queue (m)	0.1	0.8	10.8	30.4	11.7	0.4	1.0	41.4	46.1	2.5	7.5	0.3
95th Queue (m)	1.3	4.7	61.0	78.0	25.9	3.4	5.7	66.7	69.8	9.8	17.4	2.8
Link Distance (m)		1202.3	1202.3			1220.2	1220.2			1544.3	1544.3	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (m)	50.0			80.0	50.0			90.0	90.0			50.0
Storage Blk Time (%)			0	1					0			
Queuing Penalty (veh)			2	0					0			

Intersection: 1: 84 St & 132 Ave

Movement	SB	SB
Directions Served	T	T
Maximum Queue (m)	34.3	28.2
Average Queue (m)	14.9	11.3
95th Queue (m)	26.9	22.2
Link Distance (m)	718.0	718.0
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)	0	
Queuing Penalty (veh)	0	

Intersection: 2: 84 St & 116 Ave

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	T	T	R	L	T	T	R	L	L	T	T
Maximum Queue (m)	83.9	74.7	45.0	8.6	32.4	12.0	16.6	5.6	86.5	86.6	87.3	66.0
Average Queue (m)	46.5	7.0	7.2	0.3	12.6	2.7	4.2	0.2	51.6	54.2	24.0	16.6
95th Queue (m)	76.9	39.1	26.6	6.6	26.3	9.7	12.5	4.3	79.1	81.2	65.1	42.9
Link Distance (m)		1193.3	1193.3			1211.3	1211.3				103.8	103.8
Upstream Blk Time (%)											0	
Queuing Penalty (veh)											0	
Storage Bay Dist (m)	85.0			50.0	50.0			50.0	95.0	95.0		
Storage Blk Time (%)	1	0		0	0				0	0	0	0
Queuing Penalty (veh)	0	0		0	0				0	0	0	0

Intersection: 2: 84 St & 116 Ave

Movement	SB	SB	SB	SB
Directions Served	L	T	T	R
Maximum Queue (m)	46.3	238.4	256.1	152.4
Average Queue (m)	11.0	138.7	147.7	35.6
95th Queue (m)	33.0	232.3	245.0	122.3
Link Distance (m)		1544.3	1544.3	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)	50.0			150.0
Storage Blk Time (%)	0	40	12	0
Queuing Penalty (veh)	0	16	19	1

Intersection: 3: 84 St & 100 Ave

Movement	EB	EB	EB	EB	B20	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	L	T	T	T	L	T	T	R	L	L	T
Maximum Queue (m)	96.4	99.8	90.7	49.3	10.4	22.1	10.1	16.7	40.7	84.9	102.3	119.1
Average Queue (m)	59.4	61.5	13.0	7.7	0.9	7.8	1.6	4.4	5.3	44.9	60.4	96.1
95th Queue (m)	95.1	97.2	63.8	31.0	10.5	18.3	7.4	13.1	26.5	78.3	110.6	134.8
Link Distance (m)			106.5	106.5	1067.4		1220.3	1220.3				103.9
Upstream Blk Time (%)		0	1	0						0	0	6
Queuing Penalty (veh)		0	0	0						0	0	47
Storage Bay Dist (m)	100.0	100.0				50.0			50.0	100.0	100.0	
Storage Blk Time (%)	0	1	1						0	0	0	6
Queuing Penalty (veh)	0	0	3						0	1	3	23

Intersection: 3: 84 St & 100 Ave

Movement	NB	NB	B19	B19	SB	SB	SB	SB	B18	B18	B18
Directions Served	T	R	T	T	L	T	T	R	T	T	
Maximum Queue (m)	120.1	52.4	84.1	80.2	67.4	1116.0	1113.3	202.5	105.8	125.1	111.0
Average Queue (m)	100.8	5.7	14.0	17.1	25.5	551.2	562.0	88.6	42.4	62.4	4.9
95th Queue (m)	139.4	32.3	52.9	58.0	63.6	1163.2	1172.2	254.0	121.8	151.9	42.1
Link Distance (m)	103.9		1417.3	1417.3		1428.2	1428.2		103.8	103.8	103.8
Upstream Blk Time (%)	8					0	0		0	4	0
Queuing Penalty (veh)	66					1	1		1	25	1
Storage Bay Dist (m)		50.0			65.0			200.0			
Storage Blk Time (%)	23	0			0	46	33	1			
Queuing Penalty (veh)	14	1			0	42	97	5			

Intersection: 4: 84 St & 84 Ave

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	L	T	T	R	L	T	T	R	L	T	T
Maximum Queue (m)	86.7	89.2	119.3	17.7	52.2	18.3	12.1	14.4	44.6	72.4	116.6	119.9
Average Queue (m)	55.7	58.8	10.8	4.9	21.6	5.1	2.5	3.7	11.3	27.9	74.3	77.0
95th Queue (m)	84.1	87.7	63.1	14.0	55.5	14.8	9.3	11.4	39.8	60.0	106.1	109.5
Link Distance (m)			1195.1	1195.1			1222.2	1222.2			1528.9	1528.9
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (m)	90.0	90.0			60.0	50.0			50.0	70.0		
Storage Blk Time (%)	0	1	0		0				0	0	10	25
Queuing Penalty (veh)	0	0	1		0				0	0	14	8

Intersection: 4: 84 St & 84 Ave

Movement	NB	SB	SB	SB	SB	B19	B19	B19
Directions Served	R	L	T	T	R	T	T	
Maximum Queue (m)	52.4	61.8	107.3	122.2	77.4	104.7	122.3	15.1
Average Queue (m)	4.0	26.7	60.1	66.6	13.2	17.9	31.9	0.5
95th Queue (m)	27.0	55.4	92.4	102.2	61.1	80.2	115.0	11.6
Link Distance (m)			1417.3	1417.3		103.9	103.9	103.9
Upstream Blk Time (%)						0	2	
Queuing Penalty (veh)						1	12	
Storage Bay Dist (m)	50.0	60.0			75.0			
Storage Blk Time (%)	0	1	3	2	0			
Queuing Penalty (veh)	0	4	5	8	1			

Intersection: 5: 84 St & 68 Ave

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB	SB	SB
Directions Served	L	T	T	T	T	L	T	L	T	T	R
Maximum Queue (m)	151.4	145.4	10.2	10.0	11.3	1.3	7.3	47.3	7.2	9.1	5.6
Average Queue (m)	97.6	6.1	1.9	1.4	2.0	0.1	1.2	24.1	0.6	1.3	0.2
95th Queue (m)	149.1	56.8	8.1	6.7	8.3	1.2	5.7	42.4	3.8	6.0	4.3
Link Distance (m)		1195.1	1195.1	1222.1	1222.1		317.6		1528.9	1528.9	
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (m)	150.0					50.0		50.0			50.0
Storage Blk Time (%)	1	0						0			
Queuing Penalty (veh)	0	0						0			

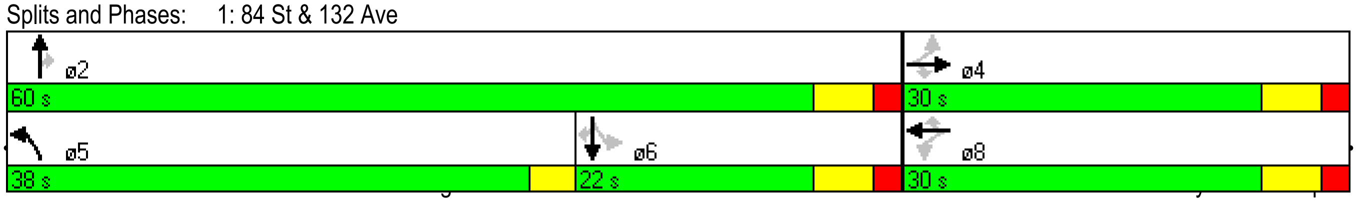
Zone Summary

Zone wide Queuing Penalty: 424

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	5	335	70	16	2	783	110	54	1	43	1
Lane Group Flow (vph)	1	5	364	76	17	2	851	120	59	1	47	1
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA	Perm	Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8			2	6		6
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0	11.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	38.0	60.0	60.0	22.0	22.0	22.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%	42.2%	66.7%	66.7%	24.4%	24.4%	24.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead			Lag	Lag	Lag
Lead-Lag Optimize?							Yes			Yes	Yes	Yes
Act Effct Green (s)	24.0	24.0	24.0	24.0	24.0	24.0	35.0	54.0	54.0	16.0	16.0	16.0
Actuated g/C Ratio	0.27	0.27	0.27	0.27	0.27	0.27	0.39	0.60	0.60	0.18	0.18	0.18
v/c Ratio	0.00	0.01	0.52	0.20	0.02	0.00	0.63	0.06	0.06	0.00	0.07	0.00
Control Delay	24.0	24.4	6.1	27.4	24.5	17.5	15.0	2.7	0.3	31.0	31.3	24.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.0	24.4	6.1	27.4	24.5	17.5	15.0	2.7	0.3	31.0	31.3	24.0
LOS	C	C	A	C	C	B	B	A	A	C	C	C
Approach Delay		6.4			26.6			12.7			31.1	
Approach LOS		A			C			B			C	
Queue Length 50th (m)	0.1	0.3	0.0	10.2	1.1	0.0	21.2	1.2	0.3	0.2	3.5	0.0
Queue Length 95th (m)	1.3	1.6	19.7	21.2	3.6	1.7	54.7	2.3	0.1	1.5	8.2	1.3
Internal Link Dist (m)		1191.0			1209.0			1542.1			704.9	
Turn Bay Length (m)	50.0		80.0	50.0		50.0	90.0		50.0	50.0		50.0
Base Capacity (vph)	375	954	694	379	954	428	1350	2147	984	226	636	285
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.01	0.52	0.20	0.02	0.00	0.63	0.06	0.06	0.00	0.07	0.00

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Natural Cycle: 60	
Control Type: Pretimed	
Maximum v/c Ratio: 0.63	
Intersection Signal Delay: 12.6	Intersection LOS: B
Intersection Capacity Utilization 52.4%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 1: 84 St & 132 Ave



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	88	12	282	67	31	33	667	845	27	13	687	197
Lane Group Flow (vph)	96	13	307	73	34	36	725	918	29	14	747	214
Turn Type	pm+pt	NA	Free	Perm	NA	Perm	Prot	NA	Perm	Perm	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		Free	8		8			2	6		6
Minimum Split (s)	11.0	22.0		22.0	22.0	22.0	11.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	11.0	33.0		22.0	22.0	22.0	27.0	57.0	57.0	30.0	30.0	30.0
Total Split (%)	12.2%	36.7%		24.4%	24.4%	24.4%	30.0%	63.3%	63.3%	33.3%	33.3%	33.3%
Yellow Time (s)	3.0	4.0		4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0		2.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag	Lag	Lead			Lag	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes	Yes	Yes			Yes	Yes	Yes
Act Effct Green (s)	30.0	27.0	90.0	16.0	16.0	16.0	24.0	51.0	51.0	24.0	24.0	24.0
Actuated g/C Ratio	0.33	0.30	1.00	0.18	0.18	0.18	0.27	0.57	0.57	0.27	0.27	0.27
v/c Ratio	0.22	0.01	0.19	0.29	0.05	0.11	0.78	0.45	0.03	0.09	0.78	0.37
Control Delay	22.6	22.2	0.3	35.7	31.1	11.9	37.5	6.0	1.4	23.2	33.7	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.6	22.2	0.3	35.7	31.1	11.9	37.5	6.0	1.4	23.2	33.7	3.9
LOS	C	C	A	D	C	B	D	A	A	C	C	A
Approach Delay		6.1			28.6			19.6			27.0	
Approach LOS		A			C			B			C	
Queue Length 50th (m)	11.6	0.8	0.0	11.1	2.5	0.0	42.4	16.1	0.3	1.7	58.6	0.0
Queue Length 95th (m)	22.5	2.9	0.0	23.4	6.6	7.7	64.7	21.3	m0.1	m4.6	67.3	9.4
Internal Link Dist (m)		1182.0			1200.0			95.9			1542.1	
Turn Bay Length (m)	85.0		50.0	50.0		50.0	95.0		50.0	50.0		150.0
Base Capacity (vph)	444	1074	1601	251	636	314	926	2028	920	156	954	584
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.22	0.01	0.19	0.29	0.05	0.11	0.78	0.45	0.03	0.09	0.78	0.37

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Pretimed
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 20.5 Intersection LOS: C
Intersection Capacity Utilization 62.9% ICU Level of Service B
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: 84 St & 116 Ave

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	162	13	189	50	36	80	419	1113	19	29	858	359
Lane Group Flow (vph)	176	14	205	54	39	87	455	1210	21	32	933	390
Turn Type	Prot	NA	Free	Perm	NA	Perm	Prot	NA	Perm	pm+pt	NA	Free
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases			Free	8		8			2	6		Free
Minimum Split (s)	11.0	22.0		22.0	22.0	22.0	11.0	22.0	22.0	11.0	22.0	
Total Split (s)	11.0	33.0		22.0	22.0	22.0	20.0	46.0	46.0	11.0	37.0	
Total Split (%)	12.2%	36.7%		24.4%	24.4%	24.4%	22.2%	51.1%	51.1%	12.2%	41.1%	
Yellow Time (s)	3.0	4.0		4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
All-Red Time (s)	0.0	2.0		2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	3.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	
Lead/Lag	Lead			Lag	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Act Effct Green (s)	8.0	27.0	90.0	16.0	16.0	16.0	17.0	40.0	40.0	42.0	31.0	90.0
Actuated g/C Ratio	0.09	0.30	1.00	0.18	0.18	0.18	0.19	0.44	0.44	0.47	0.34	1.00
v/c Ratio	0.57	0.01	0.13	0.22	0.06	0.24	0.69	0.76	0.03	0.12	0.76	0.24
Control Delay	47.1	22.2	0.2	34.3	31.2	9.4	39.8	23.0	5.3	8.4	24.3	0.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.1	22.2	0.2	34.3	31.2	9.4	39.8	23.0	5.3	8.4	24.3	0.3
LOS	D	C	A	C	C	A	D	C	A	A	C	A
Approach Delay		21.9			21.6			27.4			17.0	
Approach LOS		C			C			C			B	
Queue Length 50th (m)	15.3	0.8	0.0	8.1	3.0	0.0	30.3	99.6	0.0	0.9	87.1	0.0
Queue Length 95th (m)	25.4	3.1	0.0	18.3	7.3	11.9	45.1	126.5	m1.3	m2.0	107.8	m0.0
Internal Link Dist (m)		100.4			1209.0			97.8			1422.1	
Turn Bay Length (m)	100.0		50.0	50.0		50.0	100.0		50.0	65.0		200.0
Base Capacity (vph)	309	1074	1601	250	636	356	656	1591	722	259	1233	1601
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.57	0.01	0.13	0.22	0.06	0.24	0.69	0.76	0.03	0.12	0.76	0.24

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Pretimed
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 22.6 Intersection LOS: C
Intersection Capacity Utilization 62.1% ICU Level of Service B
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: 84 St & 100 Ave

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	193	13	72	26	29	129	148	773	10	51	532	438
Lane Group Flow (vph)	210	14	78	28	32	140	161	840	11	55	578	476
Turn Type	Prot	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases			4	8		8	2		2	6		6
Minimum Split (s)	11.0	22.0	22.0	22.0	22.0	22.0	11.0	22.0	22.0	7.0	22.0	22.0
Total Split (s)	13.0	37.0	37.0	24.0	24.0	24.0	11.0	46.0	46.0	7.0	42.0	42.0
Total Split (%)	14.4%	41.1%	41.1%	26.7%	26.7%	26.7%	12.2%	51.1%	51.1%	7.8%	46.7%	46.7%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	6.0	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Act Effct Green (s)	10.0	31.0	31.0	18.0	18.0	18.0	50.0	40.0	40.0	43.0	36.0	36.0
Actuated g/C Ratio	0.11	0.34	0.34	0.20	0.20	0.20	0.56	0.44	0.44	0.48	0.40	0.40
v/c Ratio	0.54	0.01	0.13	0.10	0.04	0.32	0.35	0.53	0.02	0.18	0.40	0.51
Control Delay	43.6	19.5	5.7	30.6	29.4	7.9	12.0	19.7	7.6	5.3	10.5	6.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.6	19.5	5.7	30.6	29.4	7.9	12.0	19.7	7.6	5.3	10.5	6.6
LOS	D	B	A	C	C	A	B	B	A	A	B	A
Approach Delay		32.7			14.5			18.3			8.6	
Approach LOS		C			B			B			A	
Queue Length 50th (m)	17.9	0.8	0.0	4.0	2.3	0.0	12.7	53.7	0.0	1.0	31.8	51.3
Queue Length 95th (m)	28.8	2.8	8.8	11.1	6.1	14.4	22.3	70.5	2.8	m1.6	38.1	m90.6
Internal Link Dist (m)		1182.0			1209.0			1528.5			1411.2	
Turn Bay Length (m)	90.0		60.0	50.0		50.0	70.0		50.0	60.0		75.0
Base Capacity (vph)	386	1233	603	282	716	432	462	1591	718	306	1432	926
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.01	0.13	0.10	0.04	0.32	0.35	0.53	0.02	0.18	0.40	0.51

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 70
Control Type: Pretimed
Maximum v/c Ratio: 0.54
Intersection Signal Delay: 15.6 Intersection LOS: B
Intersection Capacity Utilization 57.0% ICU Level of Service B
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

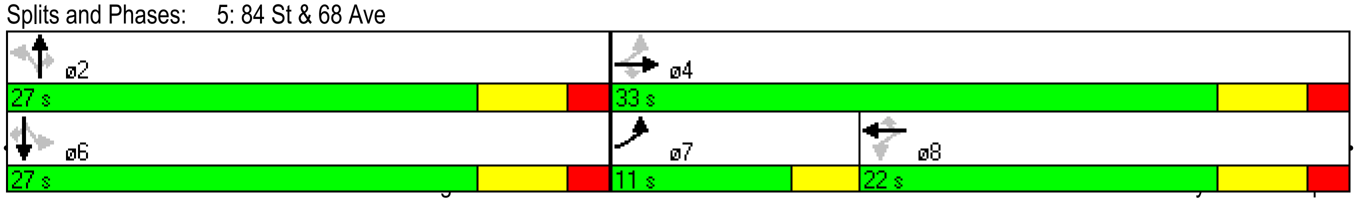
Splits and Phases: 4: 84 St & 84 Ave

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	263	7	16	98	1	7	45	2	525
Lane Group Flow (vph)	286	8	17	107	1	8	49	2	571
Turn Type	pm+pt	NA	NA	Perm	Perm	NA	Perm	NA	Perm
Protected Phases	7	4	8			2		6	
Permitted Phases	4			8	2		6		6
Minimum Split (s)	11.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	11.0	33.0	22.0	22.0	27.0	27.0	27.0	27.0	27.0
Total Split (%)	18.3%	55.0%	36.7%	36.7%	45.0%	45.0%	45.0%	45.0%	45.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead		Lag	Lag					
Lead-Lag Optimize?	Yes		Yes	Yes					
Act Effct Green (s)	30.0	27.0	16.0	16.0	21.0	21.0	21.0	21.0	21.0
Actuated g/C Ratio	0.50	0.45	0.27	0.27	0.35	0.35	0.35	0.35	0.35
v/c Ratio	0.43	0.00	0.02	0.21	0.00	0.01	0.10	0.00	0.61
Control Delay	11.3	9.1	16.4	5.6	13.0	12.7	13.9	12.5	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.3	9.1	16.4	5.6	13.0	12.7	13.9	12.5	4.8
LOS	B	A	B	A	B	B	B	B	A
Approach Delay		11.2	7.1			12.7		5.6	
Approach LOS		B	A			B		A	
Queue Length 50th (m)	17.3	0.3	0.7	0.0	0.1	0.3	3.5	0.1	0.0
Queue Length 95th (m)	30.6	1.2	2.6	9.3	0.9	1.4	9.5	0.6	17.5
Internal Link Dist (m)		1182.0	1209.0			304.5		1528.5	
Turn Bay Length (m)	150.0			50.0	50.0		50.0		50.0
Base Capacity (vph)	672	1611	954	505	498	1253	496	1253	932
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.00	0.02	0.21	0.00	0.01	0.10	0.00	0.61

Intersection Summary

Cycle Length: 60
Actuated Cycle Length: 60
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 55
Control Type: Pretimed
Maximum v/c Ratio: 0.61
Intersection Signal Delay: 7.4 Intersection LOS: A
Intersection Capacity Utilization 64.2% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: 84 St & 68 Ave

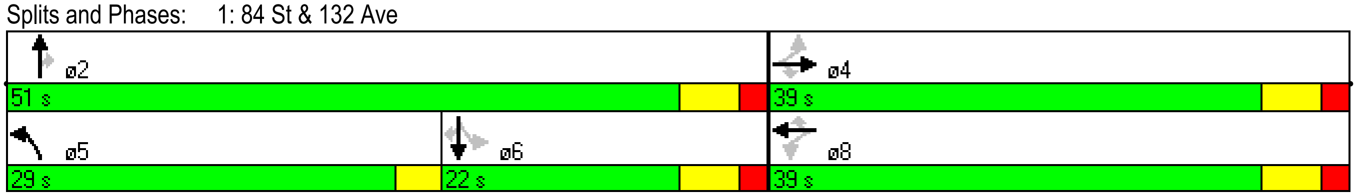


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	16	963	77	10	1	661	88	85	2	133	2
Lane Group Flow (vph)	1	17	1047	84	11	1	718	96	92	2	145	2
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA	Perm	Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8			2	6		6
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0	11.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	39.0	39.0	39.0	39.0	39.0	39.0	29.0	51.0	51.0	22.0	22.0	22.0
Total Split (%)	43.3%	43.3%	43.3%	43.3%	43.3%	43.3%	32.2%	56.7%	56.7%	24.4%	24.4%	24.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead			Lag	Lag	Lag
Lead-Lag Optimize?							Yes			Yes	Yes	Yes
Act Effct Green (s)	33.0	33.0	33.0	33.0	33.0	33.0	26.0	45.0	45.0	16.0	16.0	16.0
Actuated g/C Ratio	0.37	0.37	0.37	0.37	0.37	0.37	0.29	0.50	0.50	0.18	0.18	0.18
v/c Ratio	0.00	0.01	0.95	0.16	0.01	0.00	0.72	0.05	0.11	0.01	0.23	0.01
Control Delay	18.0	18.2	24.5	20.3	18.2	14.0	33.4	11.7	3.1	30.5	32.8	22.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.0	18.2	24.5	20.3	18.2	14.0	33.4	11.7	3.1	30.5	32.8	22.5
LOS	B	B	C	C	B	B	C	B	A	C	C	C
Approach Delay		24.4			20.0			28.1			32.6	
Approach LOS		C			C			C			C	
Queue Length 50th (m)	0.1	0.9	40.9	9.6	0.6	0.0	57.1	4.2	0.0	0.3	11.4	0.0
Queue Length 95th (m)	1.1	3.1	#154.2	19.6	2.3	1.0	76.3	8.1	7.0	2.2	19.6	1.9
Internal Link Dist (m)		1191.0			1209.0			1542.1			704.9	
Turn Bay Length (m)	50.0		80.0	50.0		50.0	90.0		50.0	50.0		50.0
Base Capacity (vph)	518	1312	1106	515	1312	588	1003	1790	847	232	636	286
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.01	0.95	0.16	0.01	0.00	0.72	0.05	0.11	0.01	0.23	0.01

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Pretimed
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 26.3 Intersection LOS: C
Intersection Capacity Utilization 91.3% ICU Level of Service F
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: 84 St & 132 Ave



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	228	38	793	55	25	27	578	1034	82	40	1150	158
Lane Group Flow (vph)	248	41	862	60	27	29	628	1124	89	43	1250	172
Turn Type	pm+pt	NA	Free	Perm	NA	Perm	Prot	NA	Perm	Perm	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		Free	8		8			2	6		6
Minimum Split (s)	11.0	22.0		22.0	22.0	22.0	11.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	11.0	33.0		22.0	22.0	22.0	30.0	87.0	87.0	57.0	57.0	57.0
Total Split (%)	9.2%	27.5%		18.3%	18.3%	18.3%	25.0%	72.5%	72.5%	47.5%	47.5%	47.5%
Yellow Time (s)	3.0	4.0		4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0		2.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag	Lag	Lead			Lag	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes	Yes	Yes			Yes	Yes	Yes
Act Effct Green (s)	30.0	27.0	120.0	16.0	16.0	16.0	27.0	81.0	81.0	51.0	51.0	51.0
Actuated g/C Ratio	0.25	0.22	1.00	0.13	0.13	0.13	0.22	0.68	0.68	0.42	0.42	0.42
v/c Ratio	0.74	0.05	0.54	0.33	0.06	0.12	0.80	0.47	0.08	0.21	0.82	0.22
Control Delay	55.0	36.8	1.3	52.7	45.8	16.9	42.2	2.1	0.4	25.4	36.1	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.0	36.8	1.3	52.7	45.8	16.9	42.2	2.1	0.4	25.4	36.1	3.8
LOS	D	D	A	D	D	B	D	A	A	C	D	A
Approach Delay		14.1			42.1			15.7			32.0	
Approach LOS		B			D			B			C	
Queue Length 50th (m)	51.1	4.0	0.0	13.0	2.9	0.0	61.2	21.0	0.5	6.3	134.5	0.0
Queue Length 95th (m)	#82.4	8.8	0.0	26.5	7.4	8.7	m71.9	m19.3	m0.6	15.2	163.2	12.6
Internal Link Dist (m)		1182.0			1200.0			95.9			1542.1	
Turn Bay Length (m)	85.0		50.0	50.0		50.0	95.0		50.0	50.0		150.0
Base Capacity (vph)	334	805	1601	183	477	239	781	2416	1110	203	1521	779
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.74	0.05	0.54	0.33	0.06	0.12	0.80	0.47	0.08	0.21	0.82	0.22

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Pretimed
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 21.2 Intersection LOS: C
Intersection Capacity Utilization 80.9% ICU Level of Service D
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: 84 St & 116 Ave

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	423	41	535	36	26	58	375	1362	60	91	1502	291
Lane Group Flow (vph)	460	45	582	39	28	63	408	1480	65	99	1633	316
Turn Type	Prot	NA	Free	Perm	NA	Perm	Prot	NA	Perm	pm+pt	NA	Free
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases			Free	8		8			2	6		Free
Minimum Split (s)	11.0	22.0		22.0	22.0	22.0	11.0	22.0	22.0	11.0	22.0	
Total Split (s)	20.0	42.0		22.0	22.0	22.0	18.0	60.0	60.0	18.0	60.0	
Total Split (%)	16.7%	35.0%		18.3%	18.3%	18.3%	15.0%	50.0%	50.0%	15.0%	50.0%	
Yellow Time (s)	3.0	4.0		4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
All-Red Time (s)	0.0	2.0		2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	3.0	6.0		6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	
Lead/Lag	Lead			Lag	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Act Effct Green (s)	17.0	36.0	120.0	16.0	16.0	16.0	15.0	54.0	54.0	72.0	54.0	120.0
Actuated g/C Ratio	0.14	0.30	1.00	0.13	0.13	0.13	0.12	0.45	0.45	0.60	0.45	1.00
v/c Ratio	0.93	0.04	0.36	0.21	0.06	0.24	0.94	0.92	0.09	0.34	1.01	0.20
Control Delay	78.5	30.0	0.6	49.8	45.9	13.7	72.5	36.6	9.3	11.0	60.6	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	78.5	30.0	0.6	49.8	45.9	13.7	72.5	36.6	9.3	11.0	60.6	0.2
LOS	E	C	A	D	D	B	E	D	A	B	E	A
Approach Delay		34.8			31.5			43.2			48.9	
Approach LOS		C			C			D			D	
Queue Length 50th (m)	55.9	3.9	0.0	8.3	3.1	0.0	49.1	194.6	5.7	9.6	~218.0	0.0
Queue Length 95th (m)	#86.3	8.4	0.0	19.0	7.5	12.7	#78.0	#222.2	m8.9	m12.7	#261.1	m0.0
Internal Link Dist (m)		100.4			1209.0			97.8			1422.1	
Turn Bay Length (m)	100.0		50.0	50.0		50.0	100.0		50.0	65.0		200.0
Base Capacity (vph)	492	1074	1601	182	477	268	434	1611	739	290	1611	1601
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.93	0.04	0.36	0.21	0.06	0.24	0.94	0.92	0.09	0.34	1.01	0.20

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 110
Control Type: Pretimed
Maximum v/c Ratio: 1.01
Intersection Signal Delay: 43.4 Intersection LOS: D
Intersection Capacity Utilization 84.3% ICU Level of Service E
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: 84 St & 100 Ave

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	542	40	210	21	24	106	138	1006	32	155	1083	359
Lane Group Flow (vph)	589	43	228	23	26	115	150	1093	35	168	1177	390
Turn Type	Prot	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases			4	8		8	2		2	6		6
Minimum Split (s)	11.0	22.0	22.0	22.0	22.0	22.0	11.0	22.0	22.0	7.0	22.0	22.0
Total Split (s)	30.0	52.0	52.0	22.0	22.0	22.0	13.0	55.0	55.0	13.0	55.0	55.0
Total Split (%)	25.0%	43.3%	43.3%	18.3%	18.3%	18.3%	10.8%	45.8%	45.8%	10.8%	45.8%	45.8%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	6.0	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Act Effct Green (s)	27.0	46.0	46.0	16.0	16.0	16.0	62.0	49.0	49.0	62.0	49.0	49.0
Actuated g/C Ratio	0.22	0.38	0.38	0.13	0.13	0.13	0.52	0.41	0.41	0.52	0.41	0.41
v/c Ratio	0.75	0.03	0.31	0.13	0.05	0.37	0.68	0.75	0.05	0.69	0.81	0.45
Control Delay	50.5	23.3	5.9	47.9	45.8	12.0	45.1	25.8	9.4	22.1	35.3	11.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.5	23.3	5.9	47.9	45.8	12.0	45.1	25.8	9.4	22.1	35.3	11.5
LOS	D	C	A	D	D	B	D	C	A	C	D	B
Approach Delay		37.3			22.4			27.6			28.7	
Approach LOS		D			C			C			C	
Queue Length 50th (m)	67.2	3.2	3.7	4.9	2.8	0.0	19.9	62.8	0.6	19.9	148.3	42.3
Queue Length 95th (m)	87.0	7.1	19.5	12.8	7.2	16.5	m33.9	101.9	m3.2	m23.2	m152.7	m52.6
Internal Link Dist (m)		1182.0			1209.0			1528.5			1411.2	
Turn Bay Length (m)	90.0		60.0	50.0		50.0	70.0		50.0	60.0		75.0
Base Capacity (vph)	781	1372	739	183	477	313	220	1461	667	243	1461	859
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.75	0.03	0.31	0.13	0.05	0.37	0.68	0.75	0.05	0.69	0.81	0.45

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Pretimed
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 29.9 Intersection LOS: C
Intersection Capacity Utilization 73.0% ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: 84 St & 84 Ave

Lane Group	EBL	EBT	EBR	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	646	23	1	17	105	1	4	142	7	469
Lane Group Flow (vph)	702	25	1	18	114	1	4	154	8	510
Turn Type	pm+pt	NA	Perm	NA	Perm	Perm	NA	Perm	NA	Perm
Protected Phases	7	4		8			2		6	
Permitted Phases	4		4		8	2		6		6
Minimum Split (s)	11.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	35.0	70.0	70.0	35.0	35.0	50.0	50.0	50.0	50.0	50.0
Total Split (%)	29.2%	58.3%	58.3%	29.2%	29.2%	41.7%	41.7%	41.7%	41.7%	41.7%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead			Lag	Lag					
Lead-Lag Optimize?	Yes			Yes	Yes					
Act Effct Green (s)	67.0	64.0	64.0	29.0	29.0	44.0	44.0	44.0	44.0	44.0
Actuated g/C Ratio	0.56	0.53	0.53	0.24	0.24	0.37	0.37	0.37	0.37	0.37
v/c Ratio	0.83	0.01	0.00	0.02	0.24	0.00	0.00	0.30	0.01	0.56
Control Delay	29.7	13.2	10.0	34.9	7.9	24.0	24.2	27.8	19.3	18.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.7	13.2	10.0	34.9	7.9	24.0	24.2	27.8	19.3	18.7
LOS	C	B	A	C	A	C	C	C	B	B
Approach Delay		29.1		11.6			24.2		20.8	
Approach LOS		C		B			C		C	
Queue Length 50th (m)	114.8	1.4	0.0	1.7	0.0	0.2	0.3	36.6	0.0	74.1
Queue Length 95th (m)	159.6	3.5	0.9	4.7	14.1	1.3	1.5	m46.5	m1.1	m105.0
Internal Link Dist (m)		1182.0		1209.0			304.5		1528.5	
Turn Bay Length (m)	150.0		50.0		50.0	50.0		50.0		50.0
Base Capacity (vph)	848	1909	854	865	473	519	1312	521	1312	910
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.83	0.01	0.00	0.02	0.24	0.00	0.00	0.30	0.01	0.56

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 24.0 Intersection LOS: C
Intersection Capacity Utilization 67.0% ICU Level of Service C
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: 84 St & 68 Ave

APPENDIX C

GEOTECHNICAL INVESTIGATION REPORT

Parkland Geotechnical Ltd.
10010 - 98 Street, PO Box 7623
Peace River, AB, T8S 1T2
www.parklandgeo.com
T: 780 539 5102
F: 780 539 5106

January 21, 2010
Project No. GP1657

brad.vanderheyden@stantec.com
Original will remain on file

City of Grande Prairie c/o
Stantec Consulting Ltd.
#600, 4808 Ross Street
Red Deer, Alberta
T4N 1X5

ATTN: Mr. Brad Vander Heyden, E.I.T.
Project Engineer

RE: Desktop Geotechnical Investigation
84 Street Functional Planning Study
Grande Prairie, Alberta

Dear Mr. Vander Heyden:

1.0 INTRODUCTION

A city bypass route is being proposed on the east side of Grande Prairie, Alberta. The proposed 6.54 km route will be located at 84 Street, between 68 Avenue and 132 Avenue. Parkland Geotechnical Ltd. (ParklandGEO) has undertaken a desktop geotechnical study for this project. The scope of the approved work was provided in ParklandGEO's proposal letter (PRO-GP09-023) dated February 19, 2009. Authorization to proceed with this investigation was given by Mr. Vander Heyden of Stantec Consulting Ltd (Stantec).

This geotechnical desktop study was conducted to provide a summary of the geotechnical data gathered to identify geotechnical issues related to construction of the proposed road, and to discuss general recommendations for various construction techniques which may be required along the proposed route. This review provides recommendations regarding future investigation along the proposed alignment.

2.0 OFFICE REVIEW METHODOLOGY

This study was a desk-top review of the available information for the areas along the proposed route. The primary components of this office review would include:

1. A review of aerial photography and geological data for the proposed alignment;

2. A visual review of the existing 2 lane road;

3. A selection of relevant historical geotechnical data has been compiled along the proposed route based on available file records known to ParklandGEO. ParklandGEO personnel contacted the City of Grande Prairie to obtain geotechnical information available along the proposed route to supplement information in ParklandGEO files; and

4. ParklandGEO has reviewed local water well records on file and publically available through Alberta Environment's Groundwater Information System.

This information was compiled and used to identify areas of limited information and locations of concern to guide in planning a cost effective geotechnical drilling program.

The information which has been compiled has come from a number of sources related to both public and private projects. In general, file information from public projects undertaken for the City of Grande Prairie has been taken as fully available for this study. Whereas, Parkland has not undertaken to obtain releases of geotechnical data from private files so the information available is in terms of general experience of Parkland personnel. The compiled information is also subject to a wide range of detail and accuracy from very accurate boreholes to water well records which can be suspect terms of both log description and location. To acknowledge this situation, all geotechnical data has been assigned an accuracy rating of low, medium, high and very high as described below.

- Low: These would include percolation test data and water well records which are often logged very poorly;

- Medium: These would include geotechnical information provided or available to ParklandGEO without supporting logs (eg. text from a geotechnical report or verbal descriptions provided by others);

- High: These would include unsurveyed borehole information which is available on file and could be produced for this project; and surveyed borehole information from private files that is not presently available for this project (without obtaining a release from the Owner); and

- Very High: These would include borehole logs at surveyed location and elevation that are available on file and could be produced for this project.

3.0 SITE DESCRIPTION

On November 12, 2009, ParklandGEO completed a field assessment along 84 Street.

At the time of the assessment, a two-lane paved road with a 1 m wide shoulder on each direction of traffic was constructed at the location of 84 Street between 68 Avenue and 100 Avenue. The road was in good condition, with occasional crack repair. No potholes, ruts, heaving or sagging was noted in the pavement.

The existing road has a typical rural road cross-section with ditches on both sides of the road. The ditches were approximately 1 m deep and 1.5 m wide, and standing water was not observed in these ditches. Roadside approaches were provided with culverts that appeared to be in good condition.

A very wide ditch was constructed on the west side of the street, near 68 Avenue, on SE 18-71-5-W6M. The ditch, which was approximately 4 m wide and 3 m deep, was filled with water to within 3 m of the top of the edge of the road. It appeared to have been constructed to divert Woody Creek around a residential development, and ran parallel to 84 Street for a short distance only, approximately 500 m, before diverting underneath 68 Avenue via three large culverts.

The adjacent land was primarily agricultural on the east, and a mix of agricultural and residential to the west. The landscape was generally flat and level, with some low rolling hills located on the east side of 84 Street, near 68 Avenue, on the SW 1/4 of 17-71-5-W6M.

The 84 Street right-of-way between 132 Avenue and 100 Avenue was not developed with a road. The east of the right-of-way was primarily undeveloped land, and the west was farmed. Treed areas were located along the east and west of the right-of-way at NE 1/4 30-71-5-W6M, NW 29-71-5-W6M, NE 31-71-5-W6M and NW 32-71-5-W6M. Power transmission lines were located along this northern portion of the 84 Street right-of-way. A worn walking or farm-access trail was located on the east side of the power lines, north approximately 1 km from 100 Street. A deep ditch, approximately 1.5 m deep, and 1.5 m wide, was present from approximately 1 km north of 100 Street, though it was not determined how far north the ditch extended, as there was no access past this point until 132 Avenue.

3.1 GEOGRAPHIC FEATURES

Generally, the 6.5 km study area was relatively level, with very gradual grade changes. In SW 17-71-5-W6M, gently rolling hills were present.

A low-lying slough was located adjacent to 84 Street on the west side, at SE 19-71-5-W6M. The slough was generally small and localized. Sewage lagoons were located just north of the slough. The berms for the lagoons were built up approximately 2 m above grade.

3.2 GEOTECHNICAL INFORMATION

ParklandGEO has reviewed nine relevant geotechnical reports which were available along the study area (ie. data from within 1 km of the proposed road alignment). For areas of the proposed alignment where geotechnical data was not available, ParklandGEO reviewed the Alberta Environment Groundwater Information System for available water well records.

3.3 AERIAL PHOTOGRAPH REVIEW

Aerial photographs were obtained from Alberta Sustainable Resources and Development (SRD) for 1974, 1979, 1989 and 2008. Aerial photographs for 1979, 1989 and 2008 are attached as Figures 3 through 5.

By 1974, 68 Avenue, 100 Avenue and 84 Street were present. The roads were narrow, and may have been unpaved. The quarter sections adjacent to the 84 Street right-of-way were mainly cultivated agricultural land, with a residential mobile home neighborhood on the northeast corner of the NE 19-71-5-W6M, and a second mobile home neighborhood on the northeast corner of the NE 30-71-5-W6M. Lagoons were located adjacent to these neighborhoods to the south and east respectively. A small lake was present on the east edges of the SW 20-71-5-W6M and the W ½ of 17-71-5-W6M. Treed or marshy areas were present on the NW 31, the W ½ of 32, the NE 19 and the SW 29-71-5-W6M. Woody Creek was visible on the SE 18-71-5-W6M, and 84 Street skirted the creek slightly on the south end of this quarter section.

By 1979, a peat mining operation was visible on the NE30-71-5-W6M. Some farm residences were added across the subject area, and the remaining area remained relatively unchanged.

84 Street no longer skirted Woody Creek at the border between the SE18 and SW17 71-5-W6M by 1989, but instead was directed straight along the border. It appeared as though 84 Street, 100 Avenue and 68 Avenue were widened and paved.

In the most recent aerial photograph (2008), 132 Avenue was widened and paved. The peat mining operation on the NE30 71-5-W6M no longer appeared to be in operation. More residential development was present on the SE30, NE19, NE18 and SE 18 71-5-W6M, as well as south of 68 Avenue. Woody Creek on the SE18 71-5-W6M appeared to be diverted through large ditches, and the trees adjacent to the creek were removed.

4.0 TYPICAL SOILS

The soil profile along the alignment is fairly consistent across the northern 14 quarter sections, with a general stratigraphy of topsoil or peat overlying lacustrine clay over clay till. The southern 2 quarter section show some variability, with topsoil underlain by silt and sand, with underlying clay. The following is a brief description of the soil types encountered and typical characteristics which might impact the proposed road project.

4.1 PEAT

Peat would be expected in E 31-71-5-W6 and NE 30-71-5-W6M, where some marsh areas are present. The peat depth would likely vary from 0.3 m to 1.5 m in depth.

4.2 TOPSOIL

Natural topsoil is generally abundant in this area, except in the marsh areas as described in Section 4.1. In developed areas the topsoil would have been stripped and redistributed for landscaping. The topsoil is topically moderately organic and loose, and would vary in thickness from 0.05 m to 0.25 m.

4.3 CLAY

Firm to hard glacio-lacustrine clay containing little silt would extend below the topsoil and peat layers for a depth ranging from typically 2 m to 5 m. The clay would typically be high plastic in the upper 1.5 to 2 m, and medium plastic and till-like in the deeper deposits. The high plastic clays have the potential for swelling. The moisture is expected to range from moist to very moist, with high moisture near low-lying areas, and low moisture in areas grown with poplar trees, such as those growing on the edges of the marshes on NE 31 and W 32-71-5-W6M.

4.4 SILT

Compact clayey silt is expected to be encountered beneath the topsoil on SE 18 and SW 17-71-5-W6M. The silt would be typically non plastic or low plastic, wet to saturated below the groundwater table, and dry to moist above the groundwater table. Seepage or sloughing would be expected below the groundwater table.

4.5 SAND

It is also likely that sand would be encountered beneath the topsoil or the silty layers on SE 18 and SW 17-71-5-W6M SE18. The sand would be loose to compact, coarse, and dry to saturated depending on the location with respect to the groundwater table.

4.6 CLAY TILL

Sandy or silty clay till is expected to be found beneath the surface layers along the entire road alignment. The clay till could vary in plasticity from low to high plastic, and be stiff to hard and moist. Typical inclusions would be fine gravel, crystals, rust and coal.

4.7 GROUNDWATER

The groundwater table within the proposed alignment generally varies between 1 m and 6 m below ground level, with the deeper table existing on the central and north side of the alignment, and the shallower table on the south side, specifically in SE 18 and SW 17-71-5-W6M.

Groundwater levels will fluctuate seasonally at this site and will be highest after periods of snow-melt and prolonged or heavy precipitation.

5.0 PRELIMINARY GEOTECHNICAL EVALUATION

Based on the findings of the geotechnical review, local experience, and inspection of current road conditions, the subgrade soil conditions along the proposed alignment are expected to range from poor to good. Based on a desktop review of available information the main geotechnical considerations for new road construction at this site are expected to include:

1. The existing road pavement was in fair condition, but there were no identifiable weak sections. Normally this would indicate that the subgrade conditions are consistent. However, it is worth noting that this road embankment has been in place for many years and was probably a gravel surfaced road for an extended period prior to paving. This past service has probably resulted in maintenance to repair and rehabilitate areas of soft or sensitive subgrade.

2. The upper soil unit along most of the road alignment is a high plastic clay, which is considered to have a high potential for swelling and shrinking with changes in soil moisture content. The existing moisture content is at or less than the plastic limit, which suggests the lacustrine clay will swell significantly if exposed to free water.

3. Fine grained clay soils are typically weather sensitive and may be susceptible to softening or weakening when wet. Special construction measures will likely be required during prolonged periods of heavy rain or snow-melt.

3. The SE18 and SW17 71-5-W6M are characterized by highly variable soils, with intermixed areas of sand, silt and clay, as well as a high water table (<2 m below grade). It is recommended that several boreholes be advanced along the road alignment in this area to determine the placement of these problem soils. Problems associated with these types of soils are as follows:

    - Silt is highly susceptible to frost heave due to ice lensing within a shallow watertable, and differential heaving can be exceptionally problematic when the silty soils are located next to soils that are less susceptible to heaving.

    - Seepage and sloughing can be expected when excavating silts and sand within the groundwater table.

    - These soils have the potential to become soft and spongy from heavy construction traffic, which may lead to construction disturbance or delays.

    - These soils typically provide a low level of subgrade support, and pavement may need to be thicker in this region.

- Fine sands and silts directly below the subgrade have the tendency to intermix with the subgrade materials. This can be mitigated by underlaying the subgrade with a filter cloth.

4. Preliminary information suggests moderate to high water soluble sulphate concentrations are present in the area. Sulphates concentrations are expected to vary and will migrate around with groundwater movement. High water soluble sulphate concentrations can lead to potential for sulphate attack on subsurface concrete such as foundations, manholes and concrete pipe. Sulphate attack is generally counteracted by using sulphate resistant (Type MS or HS) Portland cement in the concrete.

5. This road was originally believed to be constructed as a County road embankment. Historically, it was a common local practice to build road embankments without removing topsoil and other organics, provided there was enough embankment cover to bridge localized soft spots. The old Alberta Transportation practice was that organics more than 1 m below final grade were generally left in place. There are three areas where peat is likely to be located along the road alignment: at the border between NE31 and NW32 71-5-W6M, at NE 30 and NW29 71-5-W6M, and at NE19 and NW20 71-5-W6M. The depth of peat was determined during previous investigations at the first two locations, though no investigation has been completed at the NE 19-71-5-W6M location. The soil beneath the peat would be saturated, which may pose problems during construction. It is recommended that several probes be advanced through the peat areas to identify the depth of peat, and characterize the soils beneath.

7. Excavations and cut-fill slopes should be carried out in accordance with the Alberta Occupational Health and Safely Code (OHS Code, 2006). The majority of subsurface clays at this site are considered to be firm to stiff which would require excavations to be sloped to the bottom of the excavation at an angle of 1H:1V or flatter. Localized sections of harder soil may be present which would allow vertical walls up to 1.5 m high before sideslopes are required.

Local experience suggests that soil conditions vary in localized areas and conditions can change seasonally depending on precipitation. Soil conditions which are often considered to be poor can be reasonably stable under favorable groundwater and precipitation conditions. The recommended construction approach is to undertake close supervision of the actual subgrade conditions at the times of construction of the road. This observational approach is the best way to optimize costs and minimize problems by identifying problem areas before construction activity leads to subgrade failure.

6.0 CLOSURE

The recommendations presented in this report, and any subsequent correspondence, are based on an evaluation of information derived from nine (9) geotechnical reports and from other sources of information mentioned in this report. The conditions found are thought to be reasonably representative of the site. If conditions are noted during construction which are believed to be at variance with the conditions described in this report, this office should be contacted immediately.

This report has been prepared for the exclusive use of **Stantec Consulting Ltd. and their approved agents** for specific application to the project and site described in this report. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. It has been prepared in accordance with generally accepted geotechnical engineering practices. No other warranty is made either express or implied. Parkland Geotechnical Ltd. and The ParklandGEO Consulting Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The recommendations in this report should not be used for any other development on this site nor for any other site. Any persons attempting to apply these recommendations to any other project or any other site, do so at their peril.

We trust that this report meets with your current requirements. If you have any questions or comments, please do not hesitate to contact our office.

Yours truly,

PARKLAND GEOTECHNICAL LTD.
APEGGA Permit to Practice No. P09516

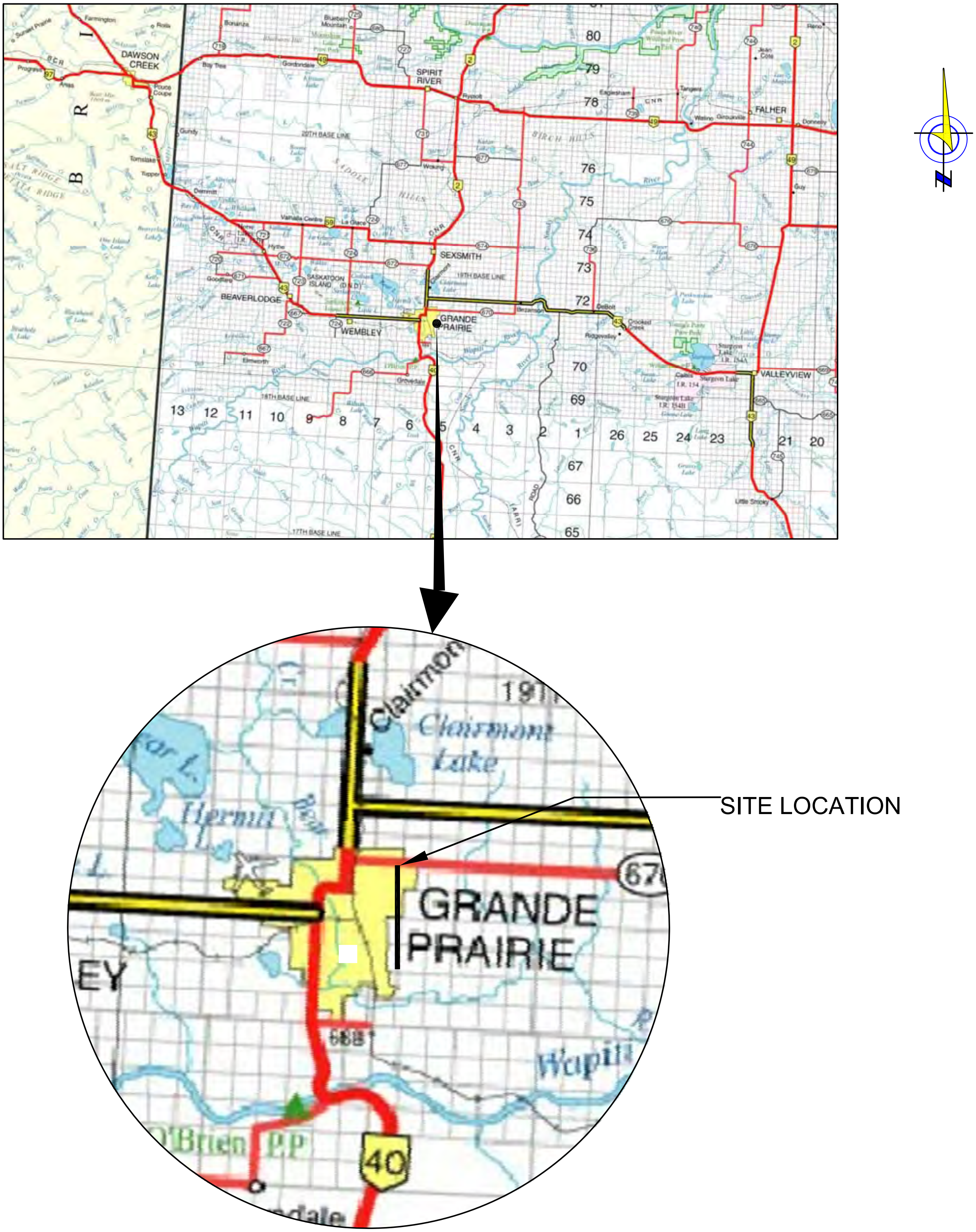
PROFESSIONAL ENGINEER
Mark D. Brotherton
ALBERTA

January 21, 2010

Tanis Searle, E.I.T.
Geo-Environmental Engineer

Mark Brotherton, P. Eng.
Principal Geotechnical Engineer

attach/area plan, site plan, aerial photographs, site photos



ParklandGEO

CLIENT:

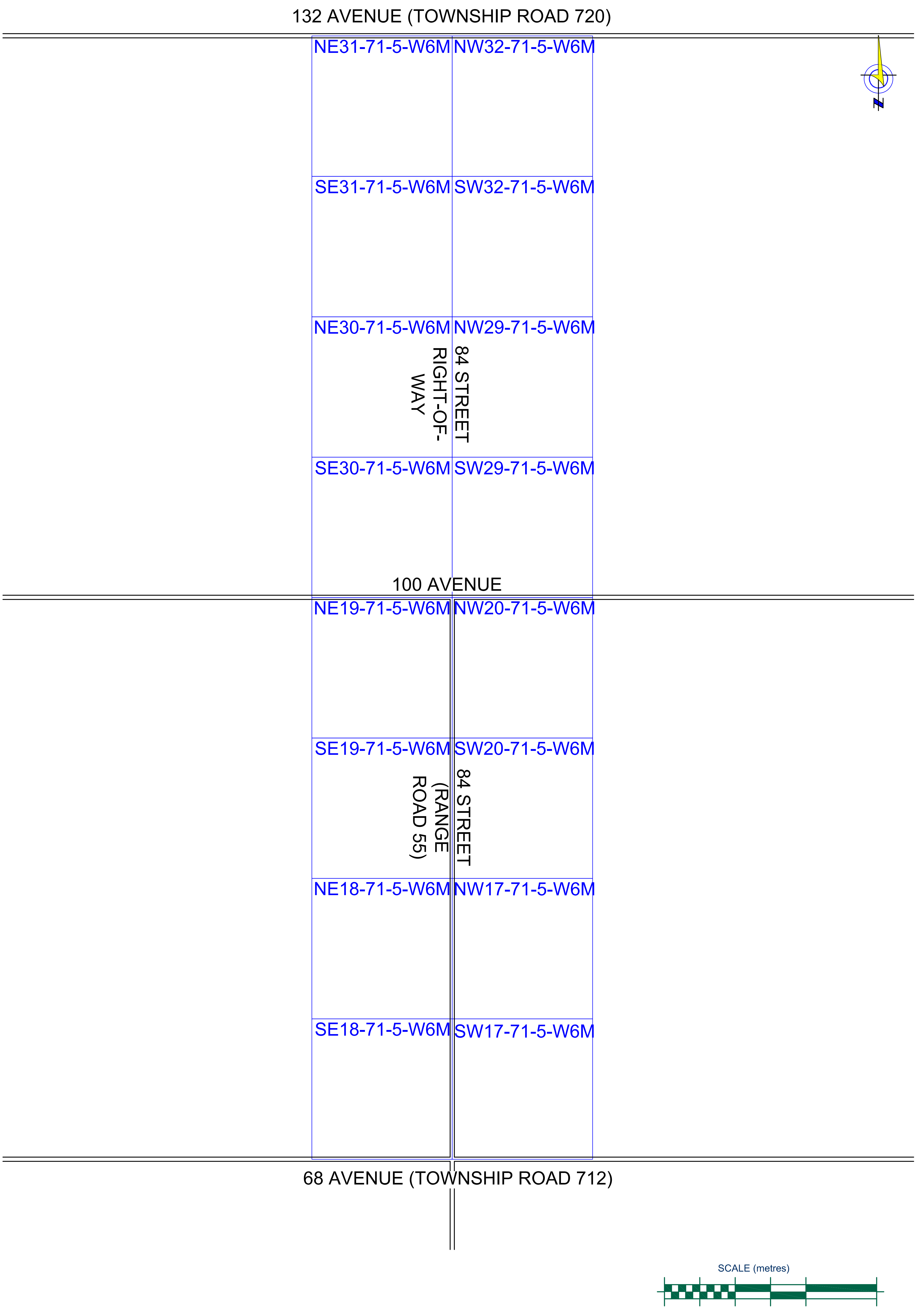
CITY OF GRANDE PRAIRIE

AREA PLAN

GEOTECHNICAL REVIEW
84 STREET FROM 68 TO 132 AVENUE, GRANDE PRAIRIE

DRAWN:	CHK'D.:	REV #:	DATE:
TS	MB	0	DECEMBER 10, 2009

SCALE:	JOB NO.	DRAWING NO.
NTS	GP1657	FIGURE 1



REV #	DATE	DETAILS

DRAWN:	CHK'D.:	REV #:	DATE:
TS	MB	0	DECEMBER 10, 2009

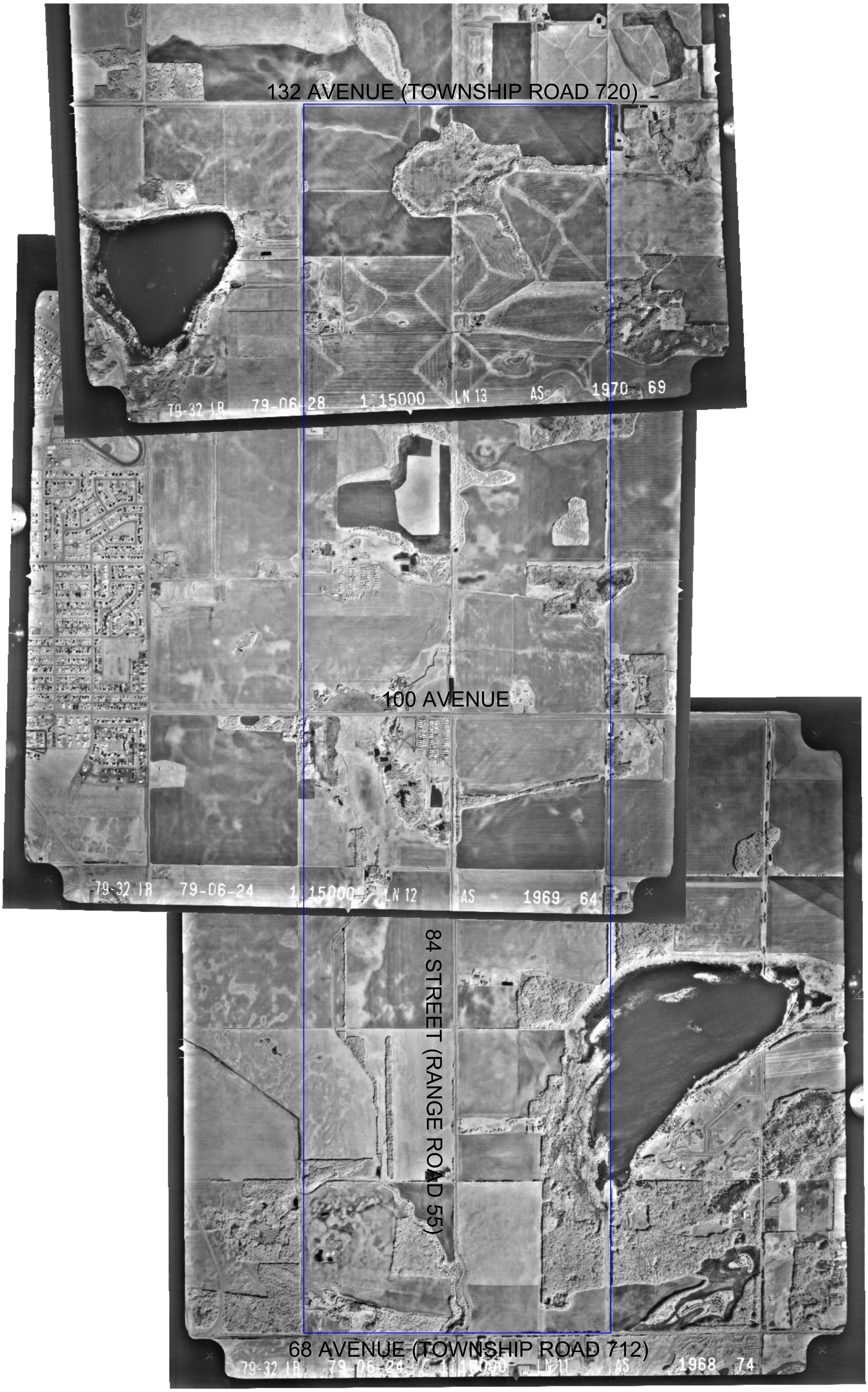
ParklandGEO

CLIENT:
THE CITY OF GRANDE PRAIRIE

SITE PLAN

GEOTECHNICAL REVIEW
84 STREET FROM 68 TO 132 AVENUE, GRANDE PRAIRIE

SCALE:	JOB NO.	DRAWING NO.
1:200	GP1657	FIGURE 2



NOTE:

AIR PHOTOS OBTAINED FROM ALBERTA SUSTAINABLE RESOURCES AND DEVELOPMENT (FILES 1968_074-ep, 1969_064-ep AND 1970_069-ep, JUNE, 1979).

SCALE (metres)

-400 -200 0 200 400 800

REV #	DATE	DETAILS

DRAWN:	CHK'D.:	REV #:	DATE:
TS	MB	0	DECEMBER 10, 2009

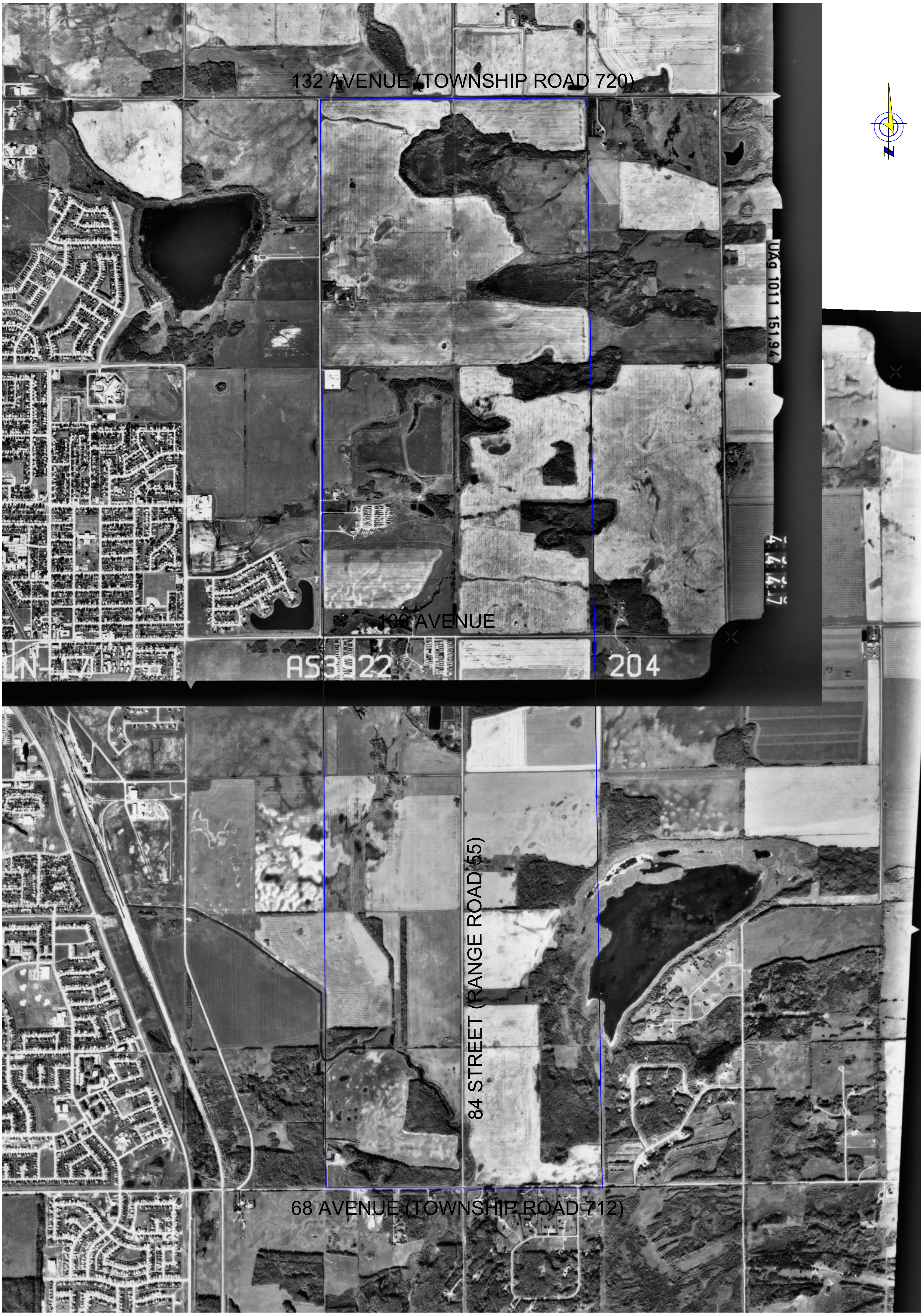
ParklandGEO

CLIENT:
THE CITY OF GRANDE PRAIRIE

1979 AERIAL PHOTOGRAPH

GEOTECHNICAL REVIEW
84 STREET FROM 68 TO 132 AVENUE, GRANDE PRAIRIE

SCALE:	JOB NO.	DRAWING NO.
1:200	GP1657	FIGURE 3



NOTE:

AIR PHOTOS OBTAINED FROM ALBERTA SUSTAINABLE RESOURCES AND DEVELOPMENT (FILES 3922_124-EP AND 3922_204-EP, SEPTEMBER 11, 1989).

SCALE (metres)

-400 -200 0 200 400 800

REV #	DATE	DETAILS

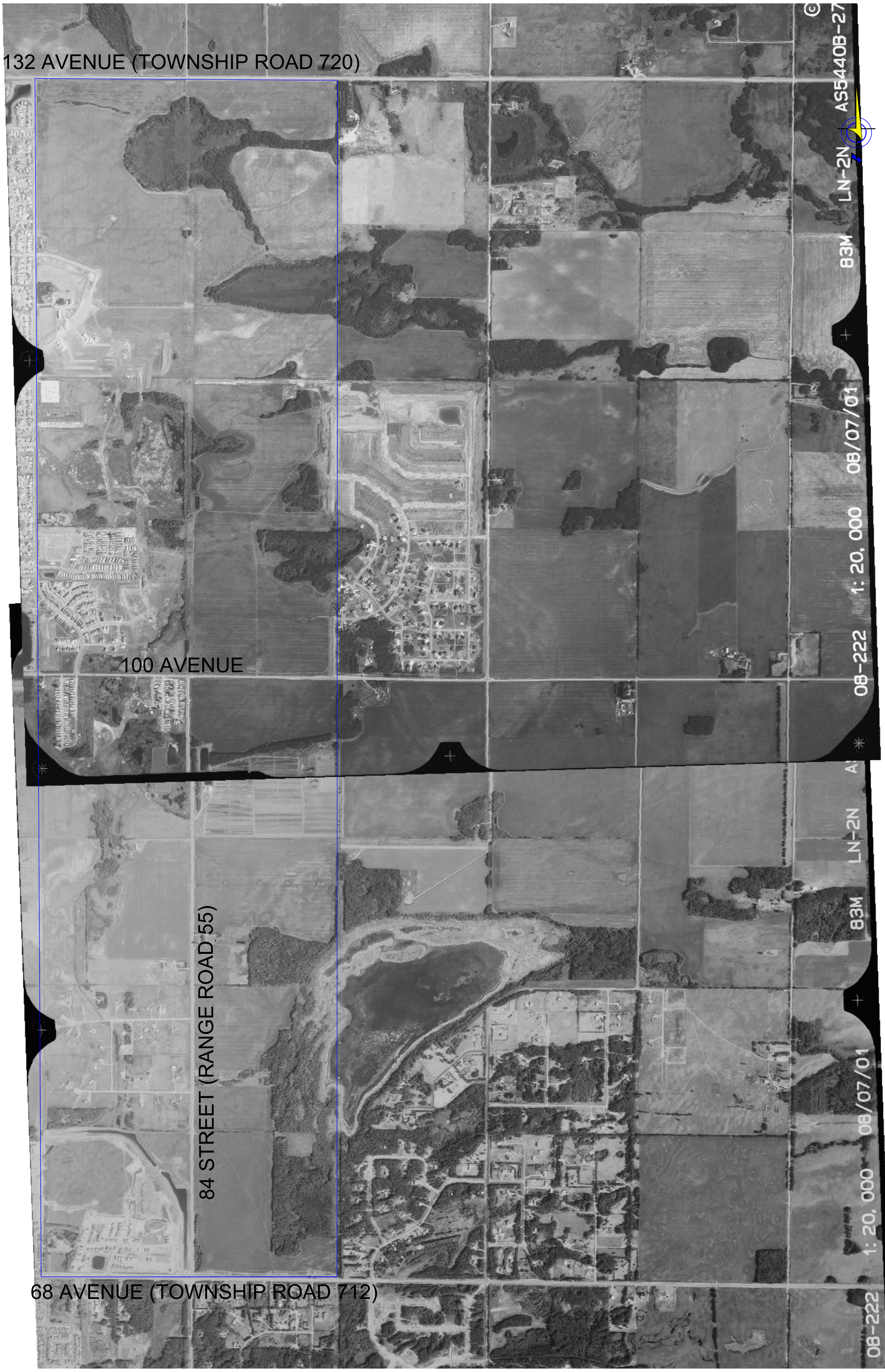
Parkland GEO

CLIENT:
THE CITY OF GRANDE PRAIRIE

1989 AERIAL PHOTOGRAPH

GEOTECHNICAL REVIEW
84 STREET FROM 68 TO 132 AVENUE, GRANDE PRAIRIE

DRAWN:	CHK'D.:	REV #:	DATE:	SCALE:	JOB NO.	DRAWING NO.
TS	MB	0	DECEMBER 10, 2009	1:200	GP1657	FIGURE 4



NOTE:

AIR PHOTOS OBTAINED FROM ALBERTA SUSTAINABLE RESOURCES AND DEVELOPMENT (FILES 5440_271-ps AND 5440_269-ps, JULY 1, 2008).

SCALE (metres)

-400 -200 0 200 400 800

REV #	DATE	DETAILS

Parkland GEO

CLIENT: THE CITY OF GRANDE PRAIRIE

2008 AERIAL PHOTOGRAPH

GEOTECHNICAL REVIEW
84 STREET FROM 68 TO 132 AVENUE, GRANDE PRAIRIE

DRAWN:	CHK'D.:	REV #:	DATE:	SCALE:	JOB NO.	DRAWING NO.
TS	MB	0	DECEMBER 10, 2009	1:200	GP1657	FIGURE 5

Photograph 1: Facing south along 84 Street from 100 Avenue.

Photograph 2: Facing south to the intersection of 84 Street and 68 Avenue, showing three culverts on right.

Photograph 3: Facing southwest towards a low-lying area on the west side of 84 Street, approximately 1 km south of 100 Avenue.

Photograph 4: Facing north along the 84 Street right-of-way from 100 Avenue.

Photograph 5: Facing north along the 84 Street right-of-way from approximately 1 km north of 100 Avenue, showing a deep ditch.

Photograph 6: Facing south along the 84 Street right-of-way from 132 Avenue.

APPENDIX D

PUBLIC OPEN HOUSE COMMENTS

Attendance Form

Stantec

Open House Information Session - 84th Street Functional Study

December 15, 2011

	Name (and Organization)	Contact Information
1	Brad Vander Heyden (Stantec)	
2	Jody Noël (Parkbridge).	780-532-0510.
3	Grant Althen	780-831-7500
4	Dennis Hussey	780-933-8795
5	BRUCE BEAIRSTO	780 532 4919
6	IAN KETCHUM (BLKENG)	780 532 4919
7	Todd De Haan	780-538-0555
8	Norris Paquin	780-296-3753
9	Sylvain Cadieux	780-518-0562
10	DAVE THIESSEN	780-532-0121
11	Dave Logan	978-1141
12	RANDY GLENN	539-3222
13	MIKE FREDRICKSON	"
14	JOHN SAMPSON	780 513-3951
15	CHERI & KERRY REIEVE	780-539-1842
16	Sean Germain	780-402-8094
17	GREG CARLSON.	780-532-0303 · 780-876-1989
18		
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PUBLIC OPEN HOUSE

City of Grande Prairie – 84th Street Functional Design
December 15, 2011

If you have any comments in regards to the 84th Street Functional Design following today's discussions, please take a moment to write them down before you leave.

The information you provide will be reviewed and taken into consideration in further discussions on this matter.

COMMENTS

Would like to put plans in place to put in burm and plant trees. Wondering about time line. (2014?).

You may wish to provide the following information as applicable; this is strictly optional.

The personal information contained on this form is collected to solely be used for the purpose(s) of identifying issues from the various stakeholders and the public for the planning of the 84 Street Roadway.

Name: Jody Noël **Company/Organization:** Parkbridge.

Phone: 780-532-0510 **Email:** Jodysilverpointe@telus.net

Thank you for attending the Open House and for providing us with your valuable feedback. Please leave your completed form with an Open House facilitator today, or return via fax or email by no later than January 12, 2012 to:

Attn: Brad Vander Heyden | Stantec Consulting Ltd.
Tel: (403) 341-3320 | Fax: (403) 342-0969
Email: ***brad.vanderheyden@stantec.com***

PUBLIC OPEN HOUSE

City of Grande Prairie – 84th Street Functional Design
December 15, 2011

Stantec

If you have any comments in regards to the 84th Street Functional Design following today's discussions, please take a moment to write them down before you leave.

The information you provide will be reviewed and taken into consideration in further discussions on this matter.

COMMENTS

- berms 3:1 max, current practice no flat space at top of berm
- cross section recently approved wider than 45.5m Difficult to use now in areas planning complete
- Woodgrove Outline Plan appealed remove
- use single davit street lights near high voltage power lines
- reference NE storm Basin study for drainage
- confirm land obtained from planned dev. consistent with what proposed
- remove stuff east of Kingsgate & Copperwood as not adopted
- remove internal red dotted lines that don't conform to adopted ASP's

You may wish to provide the following information as applicable; this is strictly optional.

- crystal Landing doesn't appear current

The personal information contained on this form is collected to solely be used for the purpose(s) of identifying issues from the various stakeholders and the public for the planning of the 84 Street Roadway.

* send adopted cross sections

Name: KD **Company/Organization:** City

Phone: **Email:**

Thank you for attending the Open House and for providing us with your valuable feedback. Please leave your completed form with an Open House facilitator today, or return via fax or email by no later than January 12, 2012 to:

Attn: Brad Vander Heyden | Stantec Consulting Ltd.
Tel: (403) 341-3320 | Fax: (403) 342-0969
Email: ***brad.vanderheyden@stantec.com***

PUBLIC OPEN HOUSE

City of Grande Prairie – 84th Street Functional Design
December 15, 2011

Stantec

If you have any comments in regards to the 84th Street Functional Design following today's discussions, please take a moment to write them down before you leave.

The information you provide will be reviewed and taken into consideration in further discussions on this matter.

COMMENTS

- STREET LIGHTS IN MIDDLE.
- FOR LANDSCAPING TREES DON'T DO WELL ON BERMS, MAYBE ALTERNATELY PROPOSED SHRUB BEDS ALONG BERMS
- CONFIRM X-SECS WITH CITY STANDARDS.
- FINALIZE SECONDARY POWER LOCATION.
- PROVIDE DIMENSIONS ON FINAL ROW REQUIREMENTS FOR ADDITIONAL WIDENING @ INTERSECTIONS.
- CONSIDER INVERTED X SEC FOR STAGING & DRAINAGE.
- SHOW EX. UTILITIES (FORCEMAIN CARRIAGE LANE PH 1 OFFSITE, TAYLOR PH 1 OFFSITE & MAPLE RIDGE PH 1 OFFSITE)
- ~~check west Carriage lane - plan is wrong - see Norman~~

You may wish to provide the following information as applicable; this is strictly optional.

YOU NEED KINGSGATE STORM DESIGN BERM

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- TRUNK SEWER NORTH of 116 AVE IN ROW AND LOCATION DESIGN ON AQUATERA WEB SITE.

Name: NORMAN KYLE **Company/Organization:** OWNER

Phone: 780 830-7448 **Email:** YES

Thank you for attending the Open House and for providing us with your valuable feedback. Please leave your completed form with an Open House facilitator today, or return via fax or email by no later than January 12, 2012 to:

Attn: Brad Vander Heyden | Stantec Consulting Ltd.
Tel: (403) 341-3320 | Fax: (403) 342-0969
Email: ***brad.vanderheyden@stantec.com***

PUBLIC OPEN HOUSE

City of Grande Prairie – 84th Street Functional Design
December 15, 2011

If you have any comments in regards to the 84th Street Functional Design following today's discussions, please take a moment to write them down before you leave.

The information you provide will be reviewed and taken into consideration in further discussions on this matter.

COMMENTS

as a resident near 84 Street, Auto Noise is an issue
at 50 KPH it not as bad, but at 80 KPH it is
quite noticeable
With the plan For a Four Lane,
Sound Barriers would be a concern if not considered

You may wish to provide the following information as applicable; this is strictly optional.

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Name: DAVE RIDGEWAY **~~Company/Organization~~:** RESIDENT! RR# 1 Site 24, Box 15 T8V-2Z8

Phone: 1-978-2518 **Email:** DAVNAFG@Telus.NET

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PUBLIC OPEN HOUSE

City of Grande Prairie – 84th Street Functional Design
December 15, 2011

Stantec

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COMMENTS

(68, 84, 100, 116 & 132 AVE)
INITIALLY, I PROPOSE THAT EASTLINK WOULD NEED (ON EVERY INTERSECTION) A VAULT WITH 2 X 100mm (4") CONDUITS PREFERABLY ON SAME TRENCH WITH TEL. ON LONG HAUL, WE PREFER TO USE 1.5" DUCTS CONNECTED TO PEDESTAL (SIZE TO BE SPECIFIED).

WE WILL DO A STUDY OF OUR REQUIREMENTS AS PER OUR EXISTING PLANT AND BASED ON THIS NEW PROPOSAL WE WILL COMMUNICATE WITH RICK GREEN OF STANTEC.

You may wish to provide the following information as applicable; this is strictly optional.

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Name: JOB GACURA **Company/Organization:** SYSTEM DESIGNER / EASTLINK

Phone: 780-863-7195 **Email:** Job.Gacura@corp.eastlink.ca

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COMMENTS

Reg. 84 ST.

yes please put this in.

This plan makes good use of that power write of way.

It will help move trafic North & South.

You may wish to provide the following information as applicable; this is strictly optional.

The personal information contained on this form is collected to solely be used for the purpose(s) of identifying issues from the various stakeholders and the public for the planning of the 84 Street Roadway.

Name: Kerry Reeve **Company/Organization:** kerco Consulting.

Phone: 780-402-9057 **Email:** kerryb.reeve@gmail.com

Thank you for attending the Open House and for providing us with your valuable feedback. Please leave your completed form with an Open House facilitator today, or return via fax or email by no later than January 12, 2012 to:

Attn: Brad Vander Heyden | Stantec Consulting Ltd.
Tel: (403) 341-3320 | Fax: (403) 342-0969
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Stantec

PUBLIC OPEN HOUSE

City of Grande Prairie – 84th Street Functional Design
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COMMENTS

- Cross Section 116th Ave to 132ND Avenue please Review the Kingsgate Storm Water Design Report. Options were presented to allow storm water north of 132ND to be contained within a Ditch/Parkway along the 84th Street Right of way

You may wish to provide the following information as applicable; this is strictly optional.

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Name: Dennis Hussey **Company/Organization:** BLK

Phone: 780-532-4919 **Email:** dennish@blkeng.com.

Thank you for attending the Open House and for providing us with your valuable feedback. Please leave your completed form with an Open House facilitator today, or return via fax or email by no later than January 12, 2012 to:

Attn: Brad Vander Heyden | Stantec Consulting Ltd.
Tel: (403) 341-3320 | Fax: (403) 342-0969
Email: ***brad.vanderheyden@stantec.com***

Share info with Sylvan

Stantec

PUBLIC OPEN HOUSE

City of Grande Prairie – 84th Street Functional Design
December 15, 2011

If you have any comments in regards to the 84th Street Functional Design following today's discussions, please take a moment to write them down before you leave.

The information you provide will be reviewed and taken into consideration in further discussions on this matter.

COMMENTS

Great to see the study underway. 84 ST is an important north south link to the region. It will provide an economic stimulus to the North east area of the City and provide a huge benefit to those folks living on the south and east side of the City. Every effort should be made to build as soon as possible.

You may wish to provide the following information as applicable; this is strictly optional.

The personal information contained on this form is collected to solely be used for the purpose(s) of identifying issues from the various stakeholders and the public for the planning of the 84 Street Roadway.

Name: JOHN SIMPSON **Company/Organization:** COUNTY OF GRANDE PRAIRIE
Phone: 780-513-3951 **Email:** jsimpson@countygp.ab.ca

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Attn: Brad Vander Heyden | Stantec Consulting Ltd.
Tel: (403) 341-3320 | Fax: (403) 342-0969
Email: ***brad.vanderheyden@stantec.com***

No formal comments were received as part of Public Open House #2

APPENDIX E

OPINION OF PROBABLE COST

STAGE 1 - INTERIM RURAL ROAD FROM 100 AVENUE TO 132 AVENUE

OPINION OF PROBABLE COST SUMMARY

ITEM A	MOBILIZATION / DEMOBILIZATION	$	470,000.00
ITEM B	SITE WORK	$	80,000.00
ITEM C	EARTHWORK	$	750,000.00
ITEM D	ROADWAYS	$	2,610,000.00
ITEM E	LANDSCAPING	$	263,000.00
ITEM F	MISCELLANEOUS	$	990,000.00
	SUBTOTAL	**$**	**5,170,000.00**
	30% CONTINGENCY AND PROFESSIONAL SERVICES	$	1,551,000.00
	TOTAL	**$**	**6,730,000.00**

OPINION OF PROBABLE COST

Item No.	Item of Work	Measurement Unit	Est. Quantity	Unit Price	Amount
A. MOBILIZATION / DEMOBILIZATION		**L.S.**	**1**	**$470,000.00**	**$ 470,000.00**
B. SITE WORK					
0.1	Traffic accommodation, detouring & signage	L.S.	1	$25,000.00	$ 25,000.00
0.2	Demolition - Tree Clearing, fence removals, etc.	L.S.	1	$50,000.00	$ 50,000.00
	TOTAL ITEM B				**$ 80,000.00**
C. EARTHWORK					
0.1	Topsoil Stripping - Excavation, Hauling, and Stockpiling.	m^3	50,000	$5.00	$ 250,000.00
0.2	Common Excavation - Excavation, Hauling, Placing and Compaction to 95% S.P.D.	m^3	125,000	$4.00	$ 500,000.00
	TOTAL ITEM C				**$ 750,000.00**
D. ROADWAYS					
0.1	Subgrade Preparation / Woven Geotextile	m^2	57,000	$2.00	$ 114,000.00
0.2	Granular Base and Subbase				
	a) 150mm Pitrun Granular Subbase - 400mm depth	m^2	52,000	$11.50	$ 598,000.00
	b) 20mm minus Crushed Granular Base: 200mm depth	m^2	43,500	$8.50	$ 369,750.00
0.3	Additional 150mm Pitrun Gravel, Including Excavation, to Replace Unsuitable Subgrade	m^3	6,000	$45.00	$ 270,000.00
0.4	Asphalt Hot Mix Surface				
	a) 75mm Bottom Lift	Tonne	7,500	$100.00	$ 750,000.00
	b) 50mm Top Lift	Tonne	4,750	$105.00	$ 498,750.00
	TOTAL ITEM D				**$ 2,610,000.00**

OPINION OF PROBABLE COST

Item No.	Item of Work	Measurement Unit	Est. Quantity	Unit Price	Amount
E. LANDSCAPING					
0.1	Topsoil Replacement - 150mm Thickness	m^3	20,000	$5.00	$ 100,000.00
0.2	Fine grade topsoil, seed, and fertilize	m^2	130,000	$1.25	$ 162,500.00
	TOTAL ITEM E				**$ 263,000.00**
F. MISCELLANEOUS					
0.1	Pavement Markings				
	a) White Solid Line (100mm)	m	6,400	$2.00	$ 12,800.00
	b) Stop Lines	m	15	$6.50	$ 97.50
	c) Yellow Solid Line (100mm)	m	3,200	$2.00	$ 6,400.00
0.2	Illumination	m	3,200	$300.00	$ 960,000.00
0.3	Traffic Signs	each	8	$500.00	$ 4,000.00
	TOTAL ITEM F				**$ 990,000.00**

STAGE 2: ULTIMATE BUILD-OUT OF 84 STREET

TENDER SUMMARY

ITEM A	MOBILIZATION / DEMOBILIZATION	$ 2,600,000.00
ITEM B	SITE WORK	$ 950,000.00
ITEM C	EARTHWORK	$ 875,000.00
ITEM D	STORM SEWER	$ 3,010,000.00
ITEM E	CONCRETE	$ 8,030,000.00
ITEM F	ROADWAYS	$ 7,750,000.00
ITEM G	LANDSCAPING	$ 1,900,000.00
ITEM H	MISCELLANEOUS	$ 2,620,000.00
	SUBTOTAL	**$ 24,190,000.00**
	30% CONTINGENCY AND PROFESSIONAL SERVICES	$ 7,257,000.00
	TOTAL	**$ 31,450,000.00**

OPINION OF PROBABLE COST

Item No.	Item of Work	Measurement Unit	Est. Quantity	Unit Price	Amount
A. MOBILIZATION / DEMOBILIZATION		**L.S.**	**1**	**$ 2,600,000.00**	**$ 2,600,000.00**
B. SITE WORK					
0.1	Traffic accommodation, detouring & signage (Assumed 180 Construction Days)	L.S.	1	$900,000.00	$ 900,000.00
0.2	Demolition - Tree Clearing, fence removals, etc.	L.S.	1	$50,000.00	$ 50,000.00
	TOTAL ITEM B				**$ 950,000.00**
C. EARTHWORK					
0.1	Topsoil Stripping - Excavation, Hauling, and Stockpiling.	m^3	35,000	$5.00	$ 175,000.00
0.2	Common Excavation - Excavation, Hauling, Placing and Compaction to 95% S.P.D.	m^3	175,000	$4.00	$ 700,000.00
	TOTAL ITEM C				**$ 875,000.00**
D. STORM SEWER					
0.1	Trench excavation, backfill and compaction to 97% S.P.D. - 0.0m to 5.0m Depth	m	5570	$110.00	$ 620,000.00
0.2	Screened gravel to replace unsuitable material (Provisional)	m^3	1671	$40.00	$ 70,000.00
0.3	Storm Sewer Pipe c/w Class B Bedding				
	a) 300mm Dia. - PVC U/R	m	1475	$40.00	$ 59,000.00
	b) 375mm Dia. - PVC PVC U/R	m	1400	$55.00	$ 77,000.00
	c) 450mm Dia. - PVC PVC U/R	m	720	$75.00	$ 54,000.00
	d) 525mm Dia. - PVC PVC U/R	m	700	$95.00	$ 66,500.00
	e) 600mm Dia. - PVC PVC U/R	m	240	$120.00	$ 28,800.00
	f) 675mm Dia. - Class IV Concrete	m	325	$180.00	$ 58,500.00
	g) 750mm Dia. - Class IV Concrete	m	80	$270.00	$ 21,600.00
	h) 900mm Dia. - Class IV Concrete	m	630	$380.00	$ 239,400.00
	i) 1050mm Dia. - Class IV Concrete	m	100	$495.00	$ 49,500.00
	j) 1200mm Dia. - Class IV Concrete	m	225	$625.00	$ 140,625.00

Item No.	Item of Work	Measurement Unit	Est. Quantity	Unit Price	Amount
0.4	Manholes and Catchbasins: Supply & installation of:				
	a) Type 5A 1200mm dia. manholes (52)	v.m.	180	$2,200.00	$ 396,000.00
	b) Type 1S - 1.2m Vault Manhole (3)	v.m.	15	$2,500.00	$ 37,500.00
	c) Type 1S - 1.5m Vault Manhole (2)	v.m.	9	$3,000.00	$ 27,000.00
	d) Type 1S - 1.8m Vault Manhole (4)	v.m	18	$4,000.00	$ 72,000.00
	e) Type K1 Catchbasin c/w frame and grate	ea.	137	$4,000.00	$ 548,000.00
0.5	Catchbasin Leads - 250mm PVC Ultra-Rib c/w trenching, bedding, backfill and compaction	m	2000	$185.00	$ 370,000.00
0.6	Plugs / Flared end outlets				
	a) 300mm	each	2	$400.00	$ 800.00
	b) 375mm	each	1	$600.00	$ 600.00
	c) 450mm	each	1	$2,200.00	$ 2,200.00
	d) 600mm	each	3	$2,500.00	$ 7,500.00
	e) 750mm	each	1	$3,000.00	$ 3,000.00
	f) 900mm	each	4	$3,700.00	$ 14,800.00
	g) 1200mm	each	1	$4,000.00	$ 4,000.00
0.7	Flush & Video Inspection	m	5570	$6.00	$ 34,000.00
	TOTAL ITEM D				**$ 3,010,000.00**
E. CONCRETE					
0.1	0.50m Curb and Gutter	m	38,500	$170.00	$ 6,545,000.00
0.3	Pararamps	each	140	$950.00	$ 133,000.00
0.4	Concrete Median Capping	m²	7,700	$175.00	$ 1,347,500.00
	TOTAL ITEM E				**$ 8,030,000.00**

OPINION OF PROBABLE COST

Item No.	Item of Work	Measurement Unit	Est. Quantity	Unit Price	Amount
F. ROADWAYS					
0.1	Subgrade Preparation / Woven Geotextile	m^2	60,000	$2.00	$ 120,000.00
0.2	Granular Base and Subbase				
	a) 150mm Pitrun Granular Subbase - 400mm depth	m^2	60,000	$11.50	$ 690,000.00
	b) 20mm minus Crushed Granular Base: 200mm depth	m^2	60,000	$8.50	$ 510,000.00
0.3	Additional Pitrun Gravel, Including Excavation, to Replace Unsuitable Subgrade	m^3	6,000	$45.00	$ 270,000.00
0.4	Asphalt Hot Mix Surface				
	a) 75mm Bottom Lift	Tonne	32,000	$100.00	$ 3,200,000.00
	b) 50mm Top Lift	Tonne	21,500	$105.00	$ 2,257,500.00
	c) 50mm Mill and Overlay of Interim Rural Roadway from 100 Avenue to 132 Avenue	m^2	28,000	$25.00	$ 700,000.00
	TOTAL ITEM F				**$ 7,750,000.00**
G. LANDSCAPING					
0.1	3.0m wide paved trail - Includes 200mm Crushed Granular Base and Subgrade Preparation	m	12,500	$120.00	$ 1,500,000.00
0.2	Topsoil Replacement - 150mm Thickness	m^3	30,000	$5.00	$ 150,000.00
0.3	Fine grade topsoil, seed, and fertilize	m^2	200,000	$1.25	$ 250,000.00
	TOTAL ITEM G				**$ 1,900,000.00**

Item No.	Item of Work	Measurement Unit	Est. Quantity	Unit Price	Amount
H. MISCELLANEOUS					
0.1	Illumination	m	3,200	$300.00	$ 960,000.00
0.2	Pavement Markings				
	a) 100mm Pavement Markings	m	20,000	$1.50	$ 30,000.00
	b) Stop Lines (600mm)	m	500	$11.00	$ 5,500.00
	c) White Left/Right Marking	each	90	$500.00	$ 45,000.00
0.3	Traffic Signals				
	a) 68 Avenue	LS	1	$300,000.00	$ 300,000.00
	b) 84 Avenue	LS	1	$250,000.00	$ 250,000.00
	c) 100 Avenue	LS	1	$450,000.00	$ 450,000.00
	d) 116 Avenue	LS	1	$250,000.00	$ 250,000.00
	e) 132 Avenue	LS	1	$300,000.00	$ 300,000.00
0.4	Traffic Signs	each	50	$500.00	$ 25,000.00
	TOTAL ITEM H				**$ 2,620,000.00**