BlackWolf Stage 2

Outline Plan

AUGUST 2014

APPENDICES

Stantec

Approved by the Muncipal Planning Commission September 9, 2014

Appendices Table of Contents

A

APPENDIX A

Certificates of Title

GOVERNMENT OF THE PROVINCE OF ALBERTA

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0022 173 348	4;21;9;17;;13	821 153 047 A .

LEGAL DESCRIPTION
MERIDIAN 4 RANGE 21 TOWNSHIP 9
SECTION 17
LEGAL SUBDIVISION 13
EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME
AREA: 16.2 HECTARES (40 ACRES) MORE OR LESS

ESTATE: FEE SIMPLE

MUNICIPALITY: CITY OF LETHBRIDGE

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
821 153 047	03/09/1982		$306,625	

OWNERS

THE CITY OF LETHBRIDGE.
OF 910 - 4TH AVE. SOUTH, LETHBRIDGE
ALBERTA

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
2834IC .	19/09/1960	UTILITY RIGHT OF WAY GRANTEE - CANADIAN WESTERN NATURAL GAS COMPANY LIMITED. AS TO PORTION OR PLAN:2602IC "0.89 OF AN ACRE"
831 079 200	03/05/1983	UTILITY RIGHT OF WAY GRANTEE - ALBERTA HOME MORTGAGE CORPORATION. AS TO PORTION OR PLAN:8211477
871 177 437	28/09/1987	UTILITY RIGHT OF WAY

(CONTINUED)

REGISTRATION
NUMBER DATE (D/M/Y) PARTICULARS

GRANTEE - THE CITY OF LETHBRIDGE.
AS TO PORTION OR PLAN:8711228
(DATA UPDATED BY: 951080304)

TOTAL INSTRUMENTS: 003

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 23 DAY OF APRIL, 2014 AT 03:09 P.M.

ORDER NUMBER: 25796446

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

THIS ELECTRONICALLY TRANSMITTED LAND TITLES PRODUCT IS INTENDED FOR THE SOLE USE OF THE ORIGINAL PURCHASER, AND NONE OTHER, SUBJECT TO WHAT IS SET OUT IN THE PARAGRAPH BELOW.

THE ABOVE PROVISIONS DO NOT PROHIBIT THE ORIGINAL PURCHASER FROM INCLUDING THIS UNMODIFIED PRODUCT IN ANY REPORT, OPINION, APPRAISAL OR OTHER ADVICE PREPARED BY THE ORIGINAL PURCHASER AS PART OF THE ORIGINAL PURCHASER APPLYING PROFESSIONAL, CONSULTING OR TECHNICAL EXPERTISE FOR THE BENEFIT OF CLIENT(S).

GOVERNMENT OF THE PROVINCE OF ALBERTA

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0022 352 389	4;21;9;17;;12	821 153 047 B .

LEGAL DESCRIPTION

MERIDIAN 4 RANGE 21 TOWNSHP 9
SECTION 17
LEGAL SUBDIVISION 12 IN THE NORTH WEST QUARTER
CONTAINING 16.2 HECTARES (40 ACRES) MORE OR LESS
EXCEPTING THEREOUT:
UNPATENTED CROWN ROAD SHOWN ON GRANT 804F
CONTAINING 0.809 OF A HECTARE (2.00 ACRES) MORE OR LESS
EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: CITY OF LETHBRIDGE

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
821 153 047	03/09/1982		$291,294	

OWNERS

THE CITY OF LETHBRIDGE.
OF 910-4 AVE S
LETHBRIDGE
ALBERTA

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
2834IC .	19/09/1960	UTILITY RIGHT OF WAY GRANTEE - CANADIAN WESTERN NATURAL GAS COMPANY LIMITED. AS TO PORTION OR PLAN:2602IC "FOR GAS PIPE LINES"

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
831 079 200	03/05/1983	UTILITY RIGHT OF WAY GRANTEE - ALBERTA HOME MORTGAGE CORPORATION. AS TO PORTION OR PLAN:8211477

TOTAL INSTRUMENTS: 002

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 23 DAY OF APRIL, 2014 AT 03:09 P.M.

ORDER NUMBER: 25796446

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

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GOVERNMENT OF THE PROVINCE OF ALBERTA

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0034 421 685	4;21;9;17;;11,14	101 239 380 +112

LEGAL DESCRIPTION

MERIDIAN 4 RANGE 21 TOWNSHIP 9
SECTION 17
LEGAL SUBDIVISIONS 11 AND 14
CONTAINING 32.4 HECTARES(80 ACRES) MORE OR LESS
EXCEPTING THEREOUT:

PLAN	NUMBER	HECTARES	ACRES	MORE OR LESS
SUBDIVISION	1013066	0.084	0.21	

EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: CITY OF LETHBRIDGE

REFERENCE NUMBER: 821 153 047

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
101 239 380	12/08/2010	SUBDIVISION PLAN		

OWNERS

THE CITY OF LETHBRIDGE.
OF 910 - 4TH AVE. SOUTH, LETHBRIDGE
ALBERTA

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
871 177 437	28/09/1987	UTILITY RIGHT OF WAY GRANTEE - THE CITY OF LETHBRIDGE. AS TO PORTION OR PLAN:8711228 "LSD 14"

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
101 239 384	12/08/2010	UTILITY RIGHT OF WAY GRANTEE - THE CITY OF LETHBRIDGE. AS TO PORTION OR PLAN:1013068
101 282 716	22/09/2010	UTILITY RIGHT OF WAY GRANTEE - THE CITY OF LETHBRIDGE. AS TO PORTION OR PLAN:1013532
121 055 314	06/03/2012	CAVEAT RE : DEFERRED RESERVE CAVEATOR - THE CITY OF LETHBRIDGE. 910 4TH AVENEUE SOUTH LETHBRIDGE ALBERTA AGENT - MAUREEN GAEHRING
121 255 933	01/10/2012	UTILITY RIGHT OF WAY GRANTEE - THE CITY OF LETHBRIDGE. AS TO PORTION OR PLAN:1212840

TOTAL INSTRUMENTS: 005

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 23 DAY OF APRIL, 2014 AT 03:09 P.M.

ORDER NUMBER: 25796446

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

B

APPENDIX B

Transportation Impact Assessment

April 29, 2014
File: 112945510

Attention: Mr. Ahmed Ali, P. Eng., PTOE
The City of Lethbridge
Infrastructure Services
City Hall, 910 – 4th Avenue South
Lethbridge, AB T1J 0P6

Dear Mr. Ali,

Reference: Blackwolf Stage 2 Transportation Impact Assessment – Comment Responses

Please find enclosed an update to our report entitled “Blackwolf Stage 2 Transportation Impact Assessment”, which was originally submitted to the City of Lethbridge on March 21, 2014. The updated reported, entitled “Blackwolf Stage 2 Transportation Impact Assessment, April 25, 2014” addresses the comments provided by the City following its review of the original document. A copy of the email received by Stantec on April 8, 2014 regarding the City’s review of the original document has been added to the correspondence section in the updated report (see **Appendix ‘A’**).

A brief review of the comments received and the means by which they were addressed follows:

1. *City’s Comment*: Section 4.3 - Comment on long queue lengths i.e., 44 Ave N/Uplands Blvd W 196m

   Response: The 44 Avenue / Uplands intersection has a queue of 196m on the westbound approach in the afternoon peak, comparing to that of 102m from the background condition. However, the approach is expected to operate with an level of service of C, and the intersection will continue to operate at acceptable levels of service during both the morning and afternoon peak hours.

   As a means of mitigating the potential for long queues, two additional configurations have been included in the analysis, specifically: addition of a designated westbound left turn lane; and implementation of a single-lane roundabout. Analysis of both options indicated that either would effectively reduce the potential queuing along 44 Avenue.

2. *City’s Comment* The 60m left turn bay length recommended for the WB left turn at 44 Av N/Scenic Dr N is shorter than the post dev queue length of 74m in Table 4.3

   Response: Acknowledged, the recommended westbound left turn lane storage of 44 Ave N and Scenic Dr. N intersection has been updated to 75m.

3. *City’s Comment* Show turn lane lengths in Figure 4.1

   Response: Acknowledged, Figure 4.1 has been revised to show turning lane lengths.

Reference: Blackwolf Stage 2 Transportation Impact Assessment – Comment Responses

4. *City's Comment* Figure 4.3: Road classification
   - 44 Ave N to be Super Collector/Community Entrance up to the first connection east of Scenic Dr N with the remaining being shown as a major collector road
   - The N-S road in the center of the OP area shall be a minor collector road (will make good sense for a good network planning)

   Response: Acknowledged, Figure 4.3 has been revised according to the comments.

Regards,

STANTEC CONSULTING LTD.

Cole Piechotta

Cole Piechotta, P. Eng.
Transportation Engineer
Phone: (403)-716-1462
Fax: (403)716-8129
cole.piechotta@stantec.com

Attachment: Blackwolf Stage 2 Transportation Assessment, April 25, 2014

c. Annie Wang – Stantec Consulting Ltd.
David Thatcher – Stantec Consulting Ltd.

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Blackwolf Stage 2 Transportation Impact Assessment

112945510

Prepared for:
City of Lethbridge
Real Estate and
Land Development

Prepared by:
Stantec Consulting Ltd.
200 – 325 – 25th Street SE
Calgary, AB T2A 7H8

Stantec Consulting Ltd.
290 – 220 – 4th Street S
Lethbridge, AB T1J 4J7

April 25, 2014

Sign-off Sheet

This document entitled Blackwolf Stage 2 Transportation Impact Assessment was prepared by Stantec Consulting Ltd. for the account of the City of Lethbridge Real Estate and Land Development. The material in it reflects Stantec's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made 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.

COLE PIECHOTTA

4/25/2014

Prepared by: **Cole Piechotta, P.Eng.**

DAVID THATCHER

4/29/2014

Reviewed by: **David Thatcher, P.Eng.**

PERMIT TO PRACTICE
STANTEC CONSULTING LTD.
Signature __________
Date April 29 2014
PERMIT NUMBER: P 0258
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

Corporate Authorization

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Executive Summary

Approximately 70 hectares of land in North Lethbridge is being prepared to support a residential development. The proposed development, known as Blackwolf Stage 2, will consist of 345 low density residential units and 232 medium density residential units. Additionally, an 80 acre regional park is being proposed as part of the development. These uses have been accounted for in the transportation analysis.

The development has been assessed for a full-build horizon that has been assumed to occur by the 2030 horizon. The transportation analysis includes all seven community access points, one internal intersection, and four surrounding arterial/collector or collector/collector intersections.

The objectives of the analysis included estimating the impacts of vehicular traffic on the roadway system at both horizons, and recommending appropriate improvements to accommodate the associated traffic volumes. The scope of the study was established through consultation with the City of Lethbridge Infrastructure Services using the City of Lethbridge Transportation Impact Study Guidelines as a reference.

The analysis contained within this TIA demonstrates that, with some infrastructure modifications, the surrounding road network will be able to support the development of the Blackwolf Stage 2 at the 2030 full-build horizon.

1.0 Introduction

1.1 BACKGROUND

Stantec Consulting Ltd. (Stantec) was retained by the City of Lethbridge Real Estate and Land Development (Lethbridge Land) to undertake a Transportation Impact Assessment (TIA) in support of the Outline Plan Application for Blackwolf Stage 2 in North Lethbridge. The proposed development comprises 59.8 HA of land within the Hardieville/Legacy Ridge/Uplands Area Structure Plan area. **Figure 1.1** illustrates the location of the subject site in the context of the City of Lethbridge.

The proposed development is bound to the west by 13 Street North (future Scenic Drive North), to the east by Uplands Boulevard, and to the south by the existing Uplands Development. To the north is an undeveloped area between the subject development and the Future 44 Avenue North. **Figure 1.2** illustrates the proposed land use for the development, which is made up entirely of low and medium density residential uses.

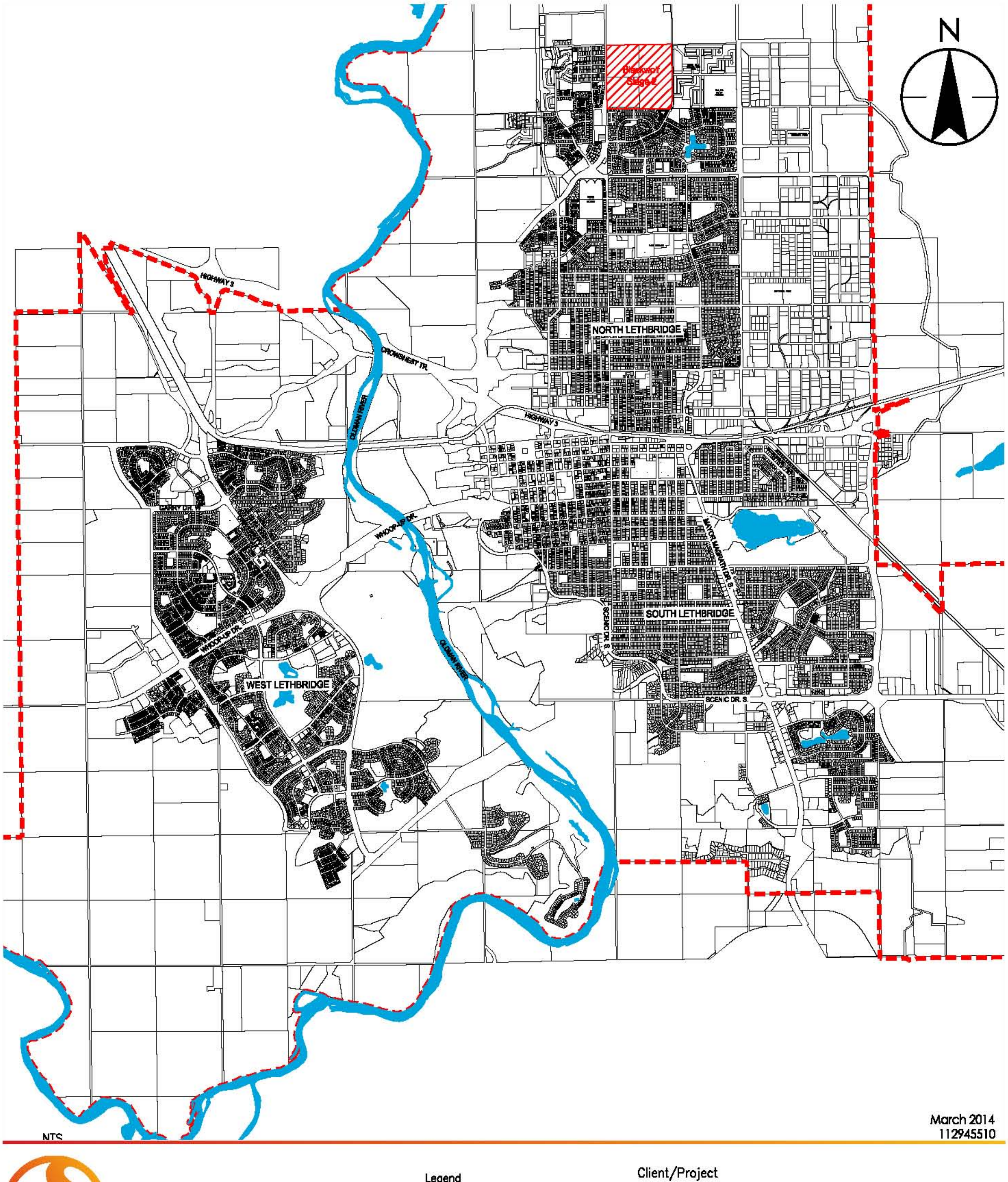
1.2 OBJECTIVES

The City of Lethbridge *Traffic Impact Study Guidelines* were used as a reference in developing the scope for the transportation impact assessment; the objectives of the study, as agreed to with the City of Lethbridge Infrastructure Services are to:

- Establish the 2030 background traffic conditions in the vicinity of the proposed development
- Estimate the magnitude and characteristics of peak hour traffic generated by the proposed development at the 2030 (full-build) horizon
- Evaluate the impacts of vehicular traffic generated by the proposed development on the roadway system at the 2030 (full-build) horizon
- Identify and recommend appropriate traffic operation and / or infrastructure improvements necessary to accommodate the 2030 (full-build) horizon traffic volumes
- Estimate the two-way traffic volumes to confirm the classification of the road network within the study area

1.3 STUDY AREA

The Study Area and study intersections, as agreed to by the City of Lethbridge Infrastructure Services department, are illustrated in **Figure 1.3**. Correspondence with Infrastructure Services regarding the scope of this study is documented in **Appendix A**.



NTS

March 2014
112945510

Legend

- - - City of Lethbridge Limits
▨ Blackwolf Stage 2

200, 325-25th Street S.E.
Calgary AB Canada
T2A 7H8
Tel. (403)-716-8000
Fax. (403)-716-8129
www.stantec.com

Client/Project

LETHBRIDGE LAND
BLACKWOLF STAGE 2
TRANSPORTATION IMPACT ASSESSMENT

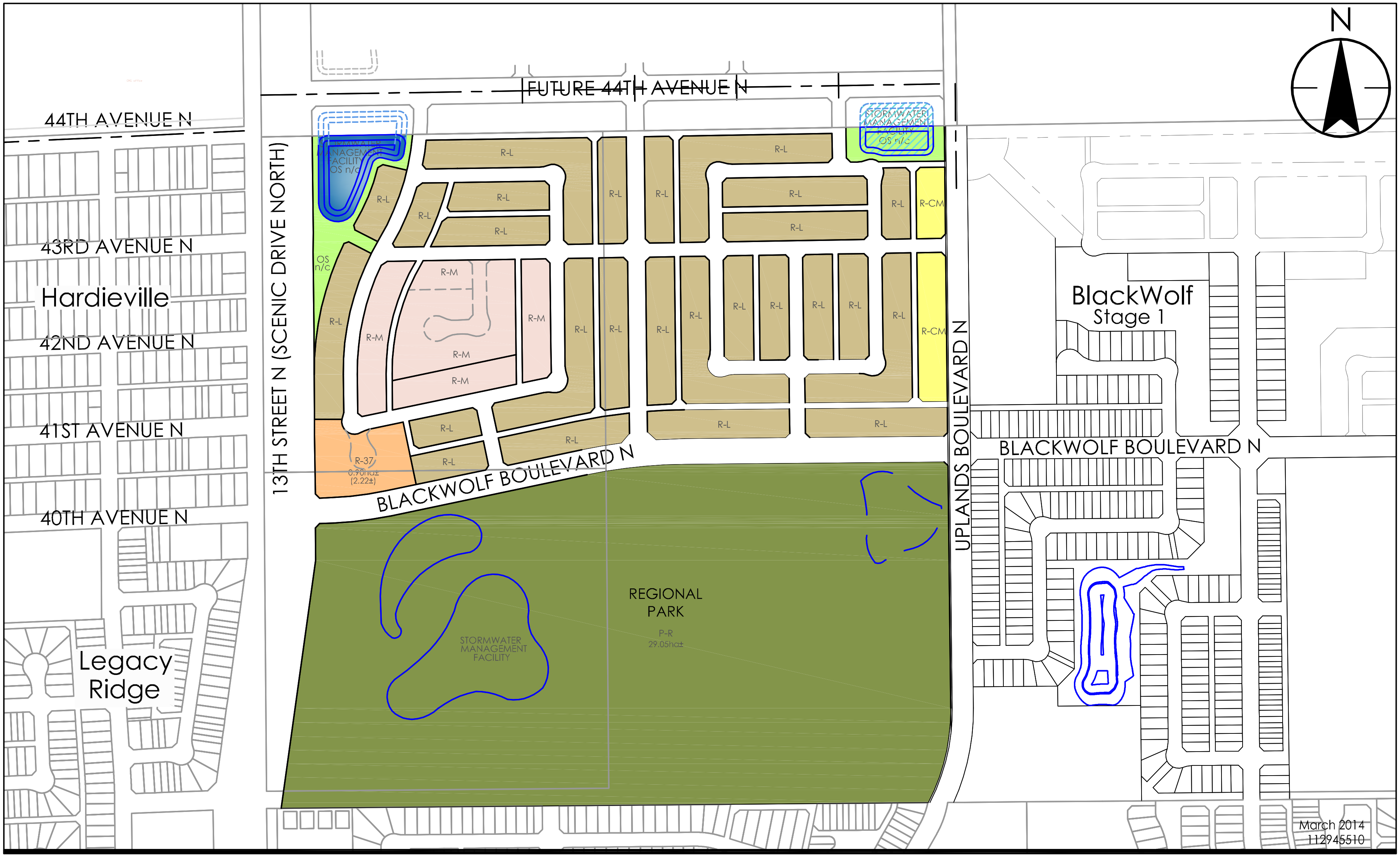
Figure No.

1.1

Title

SITE LOCATION

V:\1136\Active\112945510\02_planning\02_report\20140321_report\pdf\CAD\fig.dwg
2014/03/21 3:07 PM By: Wang, Annie (Calgary)



March 2014
112945510

200, 325-25th Street S.E.
Calgary AB Canada
T2A 7H8
Tel. (403)-716-8000
Fax. (403)-716-8129
www.stantec.com

Legend:

- 🟨 Comprehensively Planned Medium Residential (R-CM)
- 🟫 Low Density Residential (R-L)
- 🟧 Medium Density Residential (R-37)
- ▨ Mixed Density Residential (R-M)
- 🟩 Parks and Recreation (P-R)
- 🟩 Open Space - Non Credit (OS n/c)
- 🟦 Storm Water Management (to HWL)

Client/Project

LETHBRIDGE LAND
BLACKWOLF STAGE 2
TRANSPORTATION IMPACT ASSESSMENT

Figure No.

1.2

Title

PROPOSED DEVELOPMENT

V:\1136\Active\112945510\02_planning\02_report\20140321_report\pdf\CAD\fig.dwg
2014/03/21 3:05 PM By: Wang, Annie (Calgary)

200, 325-25th Street S.E.
Calgary AB Canada
T2A 7H8
Tel. (403)-716-8000
Fax. (403)-716-8129
www.stantec.com

Legend:

* Study Intersections

Client/Project

LETHBRIDGE LAND
BLACKWOLF STAGE 2
TRANSPORTATION IMPACT ASSESSMENT

Figure No.

1.3

Title

STUDY AREA

2.0 Background Traffic Volume

2.1 EXISTING TRAFFIC VOLUMES

Traffic counts were previously performed as a component of the 13 Street North/Hardieville Access Management Study (Stantec, draft report completed April 8, 2013). Count information was collected on Wednesday, March 7, 2012 at the following intersections:

- 13 Street / 40 Avenue North
- 12 Street / 40 Avenue North
- 13 Street / 41 Avenue North
- 13 Street / 42 Avenue North
- 13 Street / 43 Avenue North
- 13 Street / 44 Avenue North

The counts were conducted for the morning peak period (7:00 AM - 9:00 AM) and the afternoon peak period (4:00 PM - 6:00 PM). The traffic count data can be found in **Appendix B**.

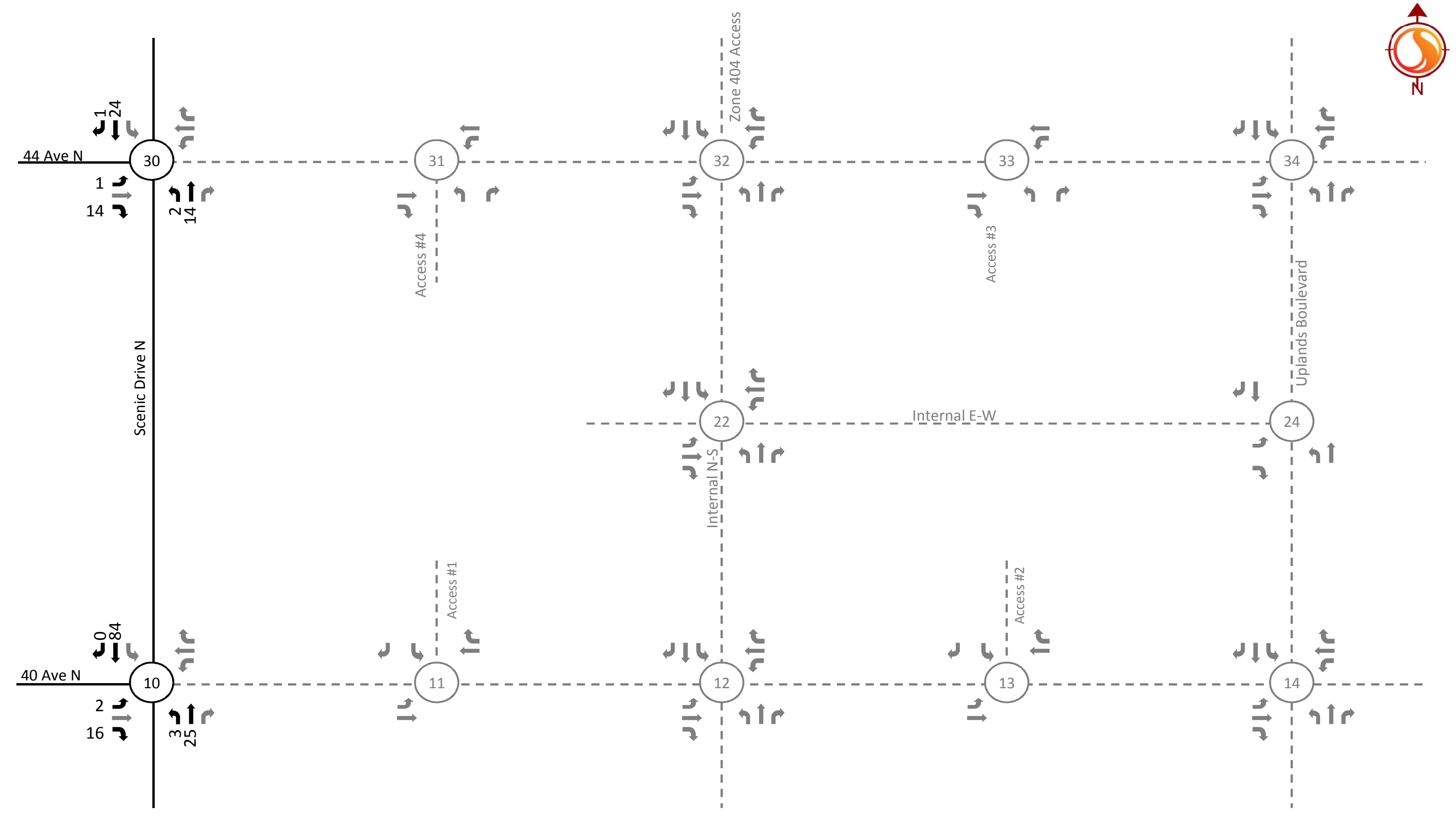
The City of Lethbridge Transportation Master Plan identifies an extension of Scenic Drive to the north. The proposed extension runs through the existing 13 Street North right of way. The existing 13 Street is will be made discontinuous, and access to the existing developments on the west side of 13 Street will be provided at two new intersections with Scenic Drive as described below.

The following adjustments were made to the existing volumes to establish future access conditions for the developments on the west side of 13 Street:

1. It was assumed that the two new intersections would be located approximately wehere the existing intersections of 13 Street with 40 Avenue and 44 Avenue are located.
2. All northbound traffic originating south of 40 Avenue that presently accesses Hardieville via 40 Avenue, 41, Avenue, 42 Avenue, and 43 Avenue was assigned to the new 40 Avenue access. Northbound traffic originating south of 40 Avenue that presently accesses Hardieville via 44 Avenue was assigned to the new 44 Avenue access.

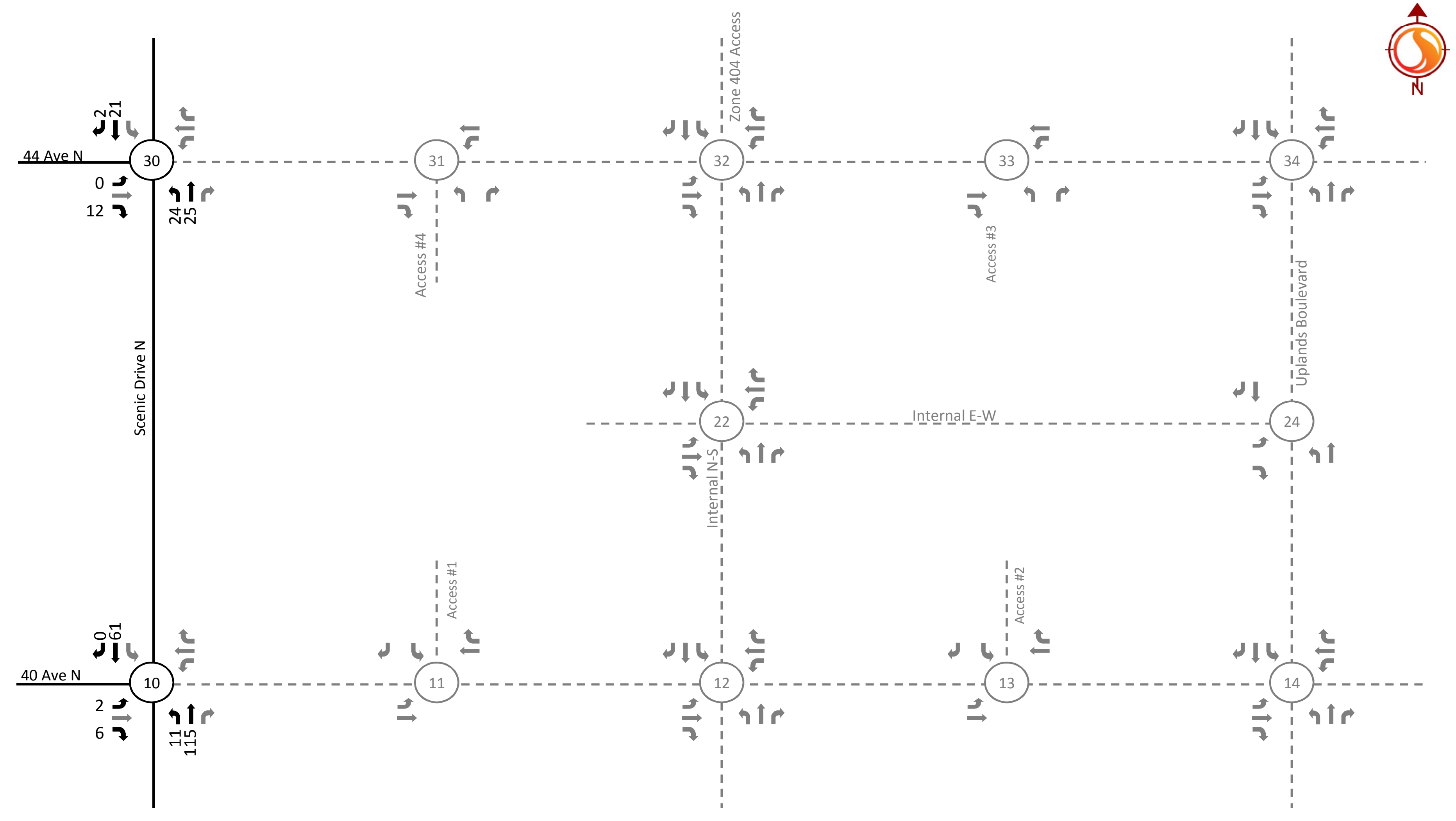
3. All southbound traffic originating north of 44 Avenue that presently accesses Hardieville via 41 Avenue, 42 Avenue, 43 Avenue, and 44 Avenue was assigned to the new 44 Avenue access. Southbound traffic originating north of 44 Avenue that presently accesses Hardieville via 40 Avenue was assigned to the new 40 Avenue access.

The existing AM and PM peak hour traffic volumes for 40 and 44 Avenue are summarized on **Figure 2.1** and **Figure 2.2**.The adjusted existing volumes are illustrated on **Figure 2.3** and **Figure 2.4**.



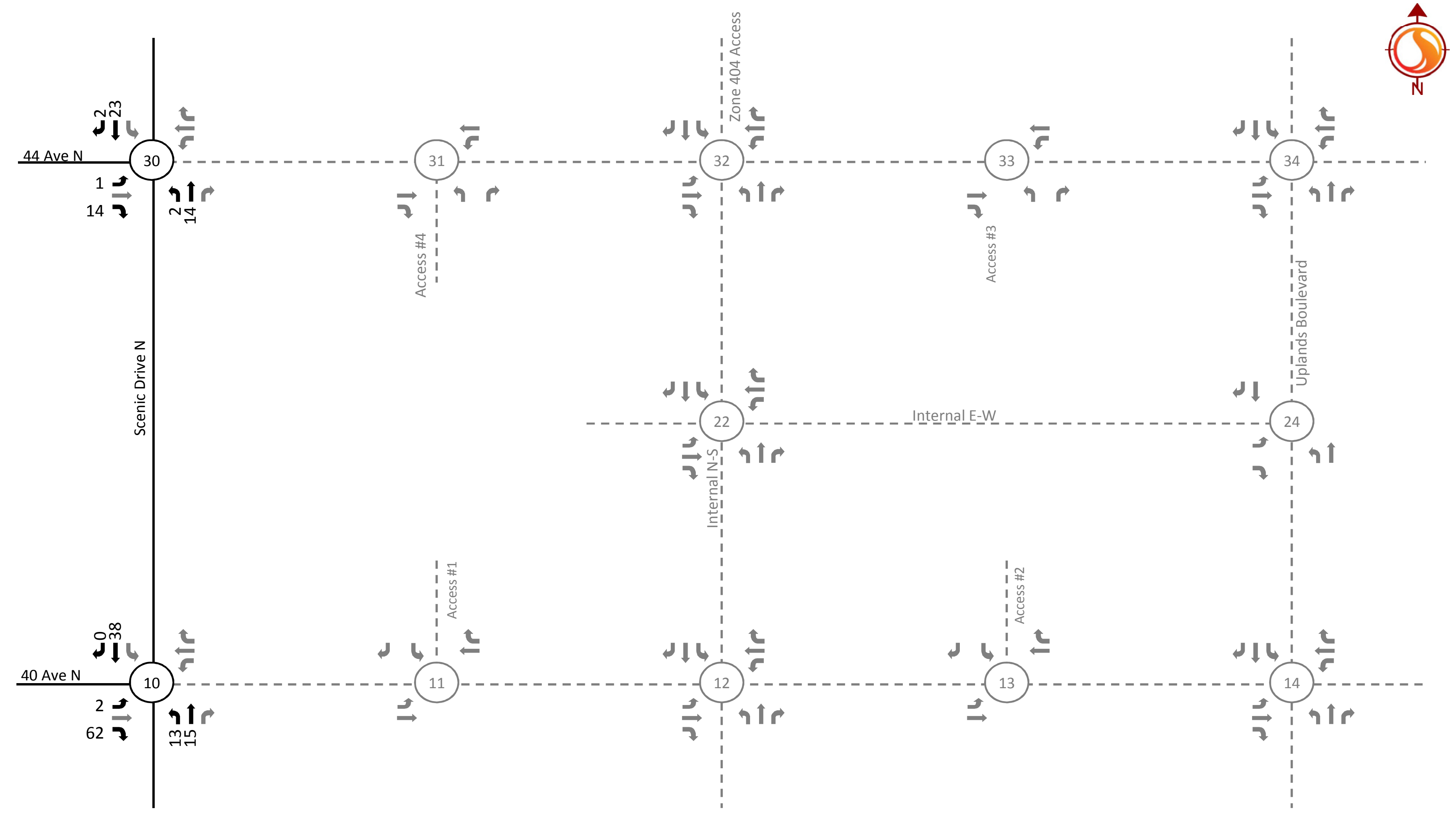
Lethbridge Land
Blackwolf Stage 2
Transportation Impact Assessment

Figure 2.1
Existing Traffic Volumes
AM Peak



Lethbridge Land
Blackwolf Stage 2
Transportation Impact Assessment

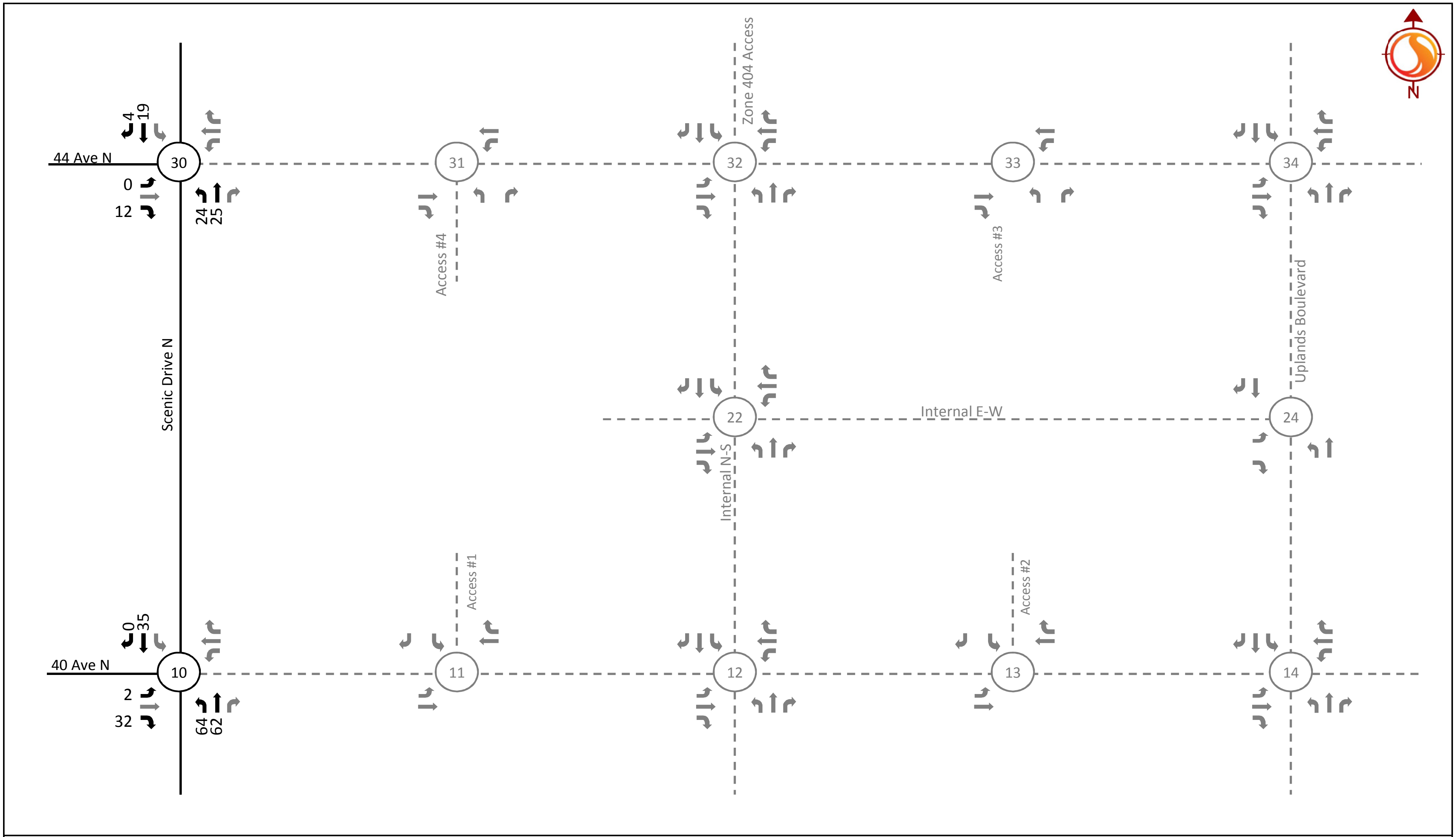
Figure 2.2
Existing Traffic Volumes
PM Peak



Lethbridge Land
Blackwolf Stage 2

Transportation Impact Assessment

Figure 2.3
Adjusted Existing Traffic Volumes
AM Peak



Lethbridge Land

Blackwolf Stage 2

Transportation Impact Assessment

Figure 2.4

Adjusted Existing Traffic Volumes

PM Peak

2.2 ADDITIONAL DEVELOPMENT TRAFFIC

To capture the full build out of the subject development, a horizon year of 2030 was selected. This will capture the build out of the subject development, the construction of 44th Avenue, and development/occupancy of some of the surrounding areas.

To establish assumptions for background traffic related to surrounding developments, a review of available studies and City land use assumptions was undertaken. The methodology for establishing the background traffic for the study area is described below.

The following developments in the surrounding area were considered (the City Transportation Zone numbers are shown below along with development names, in cases where they are known):

1. Zone 303 – Legacy Ridge
2. Zone 409 – Blackwolf Stage 1
3. Zone 301 (primarily residential lands)
4. Zone 404 (primarily residential lands)
5. Zone 405 (primarily residential lands)
6. Zone 402, 403, 406, 407 (primarily industrial lands)

For Zones 303 and 409 (Legacy Ridge and Blackwolf Stage 1), background traffic was established using information from the approved TIA reports.

For zones 301, 404, 405, and 402/403/406/407, background traffic was established by applying City of Lethbridge trip rates to City population/employment assumptions.

Appendix C contains a map of the City Transportation Zones as well as the population/employment assumptions for the 2020 and 2040 horizons. **Figure 2.5** illustrates the location of the zones that were considered in establishing background traffic volumes for the study.

For locations were residential trip estimates were required, City of Lethbridge trip generation rates for low and medium density residential units were applied. For the industrial uses, rates for Land Use 110: General Light Industrial from ITE Trip Generation, 9th Edition were applied. The trip generation rates are summarized in **Table 2.1.**

Table 2.1 Trip Generation Rates

Use	AM Peak Hour			PM Peak Hour		
		In	Out		In	Out
Low Density Residential	0.77 vph/unit	26%	74%	1.02 vph/unit	64%	36%
Medium Density Residential	0.75 vph/unit	29%	71%	0.92 vph/unit	61%	39%
Light Industrial	7.51 vph/acre	83%	17%	7.26 vph/acre	22%	78%

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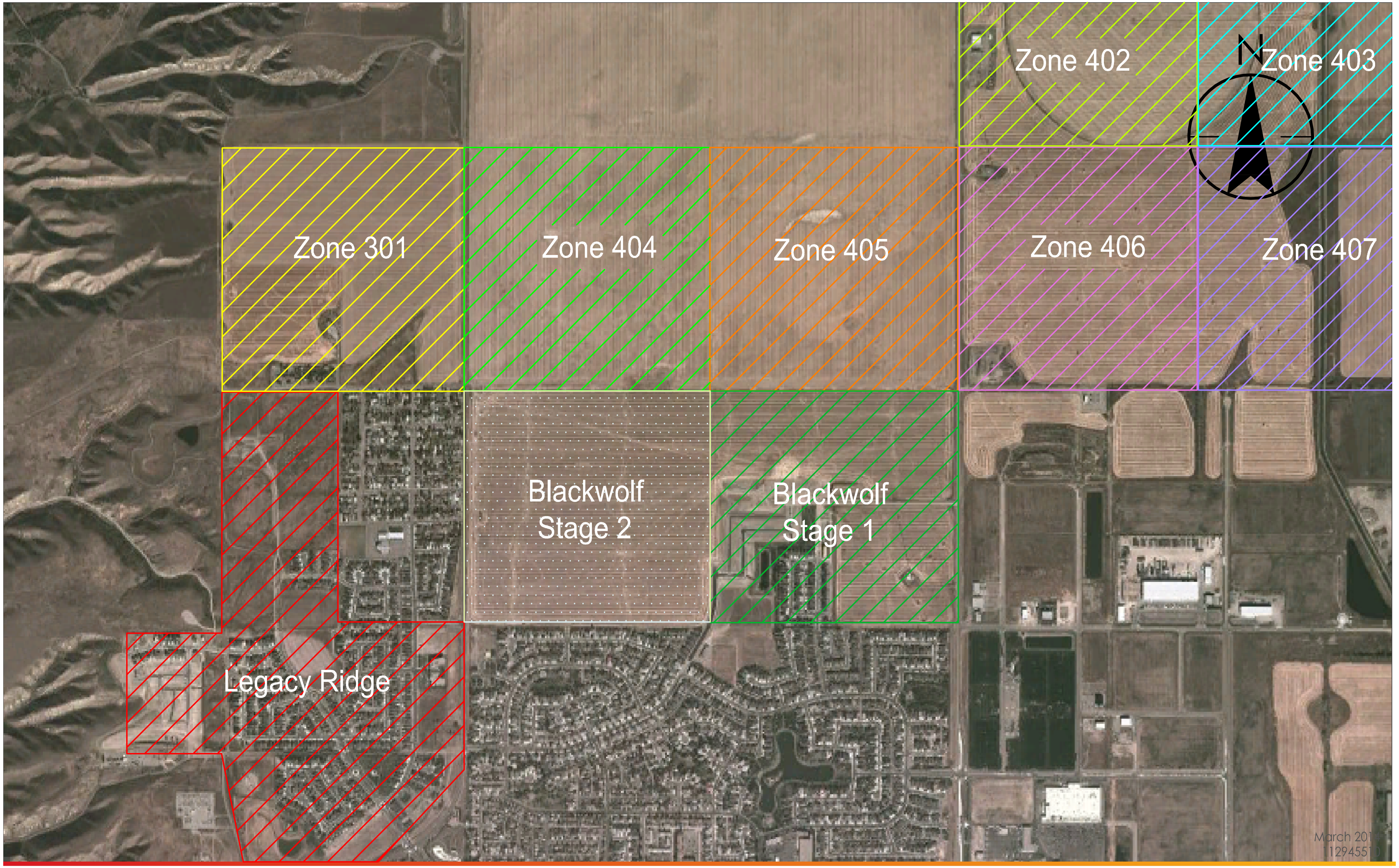
2014/03/18 4:56 PM By: Wang, Annie (Calgary)



Stantec
200, 325-25th Street S.E.
Calgary AB Canada
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Fax. (403)-716-8129
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Legend:

Client/Project
LETHBRIDGE LAND
BLACKWOLF STAGE 2
TRANSPORTATION IMPACT ASSESSMENT

Figure No.
2.5

Title
SURROUNDING AREA DEVELOPMENTS

The City of Lethbridge population/employment assumptions are based off of 2020 2040 horizon years. Population assumptions for zones 301, 404, and 405 were estimated for the 2030 horizon using linear interpolation of the 2020 and 2040 horizon populations. An estimated number of residential units for zones 301, 404, and 405 for the 2030 horizon were then calculated using a rate of 2.7 people/unit.

Employment assumptions for zones 402/403/406/407 were estimated for the 2030 horizon using linear interpolation of the 2020 and 2040 horizon employment numbers. Based on the level of employments for the 2030 horizon, it was estimated that approximately 160 acres of land would be developed within zones 402/403/406/407 by the 2030 horizon. **Table 2.2** summarizes the assumptions for population, employment, and development yields for zones 301, 404, 405, and 402/403/406/407.

Table 2.2 Lethbridge Transportation Zone Assumptions

Zone	2020 Population	2040 Population	2030 Population	Development Yield
301	49	1800	**925**	**342 SF Units**
404	0	886	**443**	**164 SF Units**
405	0	886	**443**	**164 SF Units**
Zone	**2020 Employment**	**2040 Employment**	**2030 Employment**	**Development Yield**
402	10	188	**99**	**160 Acres**
403	145	333	**239**	
406	0	847	**424**	
407	0	847	**424**	

The number of trips for zones 301, 404, 405, and 402/403/406/407 were estimated by applying the rates included in Table 2.1 to the development yields included in Table 2.2. The resulting 2030 horizon background trips for zones 301, 404, 405, and 402/403/406/407 are summarized in **Table 2.3**.

Table 2.3 Trip Generation – Zones 301, 404, 405, 402/403/406/407

Zone	AM Peak			PM Peak		
	Total	In	Out	Total	In	Out
301	263	68	195	349	223	126
404	126	33	93	167	107	60
405	126	33	93	167	107	60
402/403/406/407	1,201	997	204	1,162	256	906

The trip distribution and assignment assumptions for the six surrounding developments (Legacy Ridge, Blackwolf Stage 1, zone 301, zone 404, zone 404, zones 402/403/406/407) assumed to contribute background traffic at the 2030 horizon are summarized below.

1. For Legacy Ridge, the majority of the development was occupied at the time the traffic count data was collected. The remaining traffic (additional traffic associated with Legacy Ridge Stage 3) was established using volumes from the Legacy Ridge Stage 3 Transportation Impact Assessment, completed in March 2008 by Stantec, were used. The volumes from "Figure 4.2 – 2037 Development Traffic Volumes" were utilized as these illustrate the full-build horizon site traffic volumes for Legacy Ridge Stage 3. Figure 4.2 from the TIA is included in **Appendix D**. The volumes for Legacy Ridge Stage 3 are illustrated on **Figure 2.6** and **Figure 2.7**.

2. To establish the traffic associated with Blackwolf Stage 1, the Black Wolf Traffic Impact Study, completed in October 2009 by iTrans, was reviewed. "Table 6-1 – Site Peak Hour Trip Generation" summarizes the trips associated with Blackwolf Stage 1. The development was assumed to generate 834 trips (270 inbound/564 outbound) during the morning peak hour and 889 trips (548 inbound/341 outbound) during the afternoon peak hour. The report assumed approximately 50% of the trips would access the development to/from the east (primarily via 28 Street) and approximately 50% of the trips would access the development to/from the west (primarily via Uplands Boulevard and Scenic Drive North). The volumes for Blackwolf Stage 1 are illustrated on **Figure 2.8** and **Figure 2.9**.

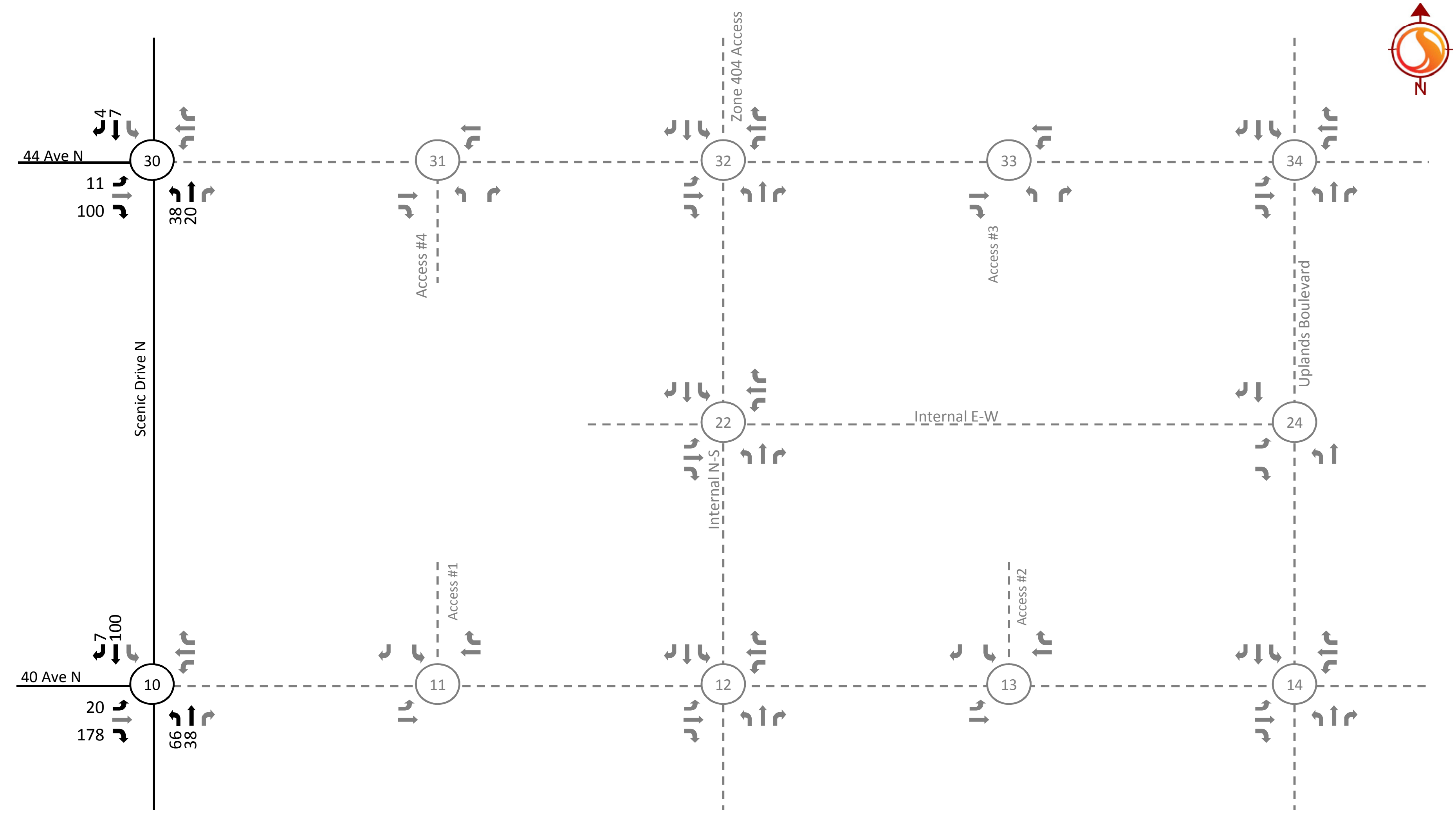
3. The traffic associated with zone 301 was assigned to the network using the following distribution: 70% to/from Scenic Drive and 26 Avenue, 10% to/from Uplands Boulevard; 20% to/from 44 Avenue. The volumes for zone 301 are illustrated on **Figure 2.10** and **Figure 2.11**.

4. The traffic associated with zone 404 was assigned to the network using the following distribution: 50% to/from Scenic Drive and 26 Avenue, 30% to/from Uplands Boulevard; 20% to/from 44 Avenue. The volumes for zone 404 are illustrated on **Figure 2.12** and **Figure 2.13**.

5. The traffic associated with zone 405 was assigned to the network using the following distribution: 70% to/from Scenic Drive and 26 Avenue, 30% to/from Uplands Boulevard. The volumes for zone 405 are illustrated on **Figure 2.14** and **Figure 2.15**.

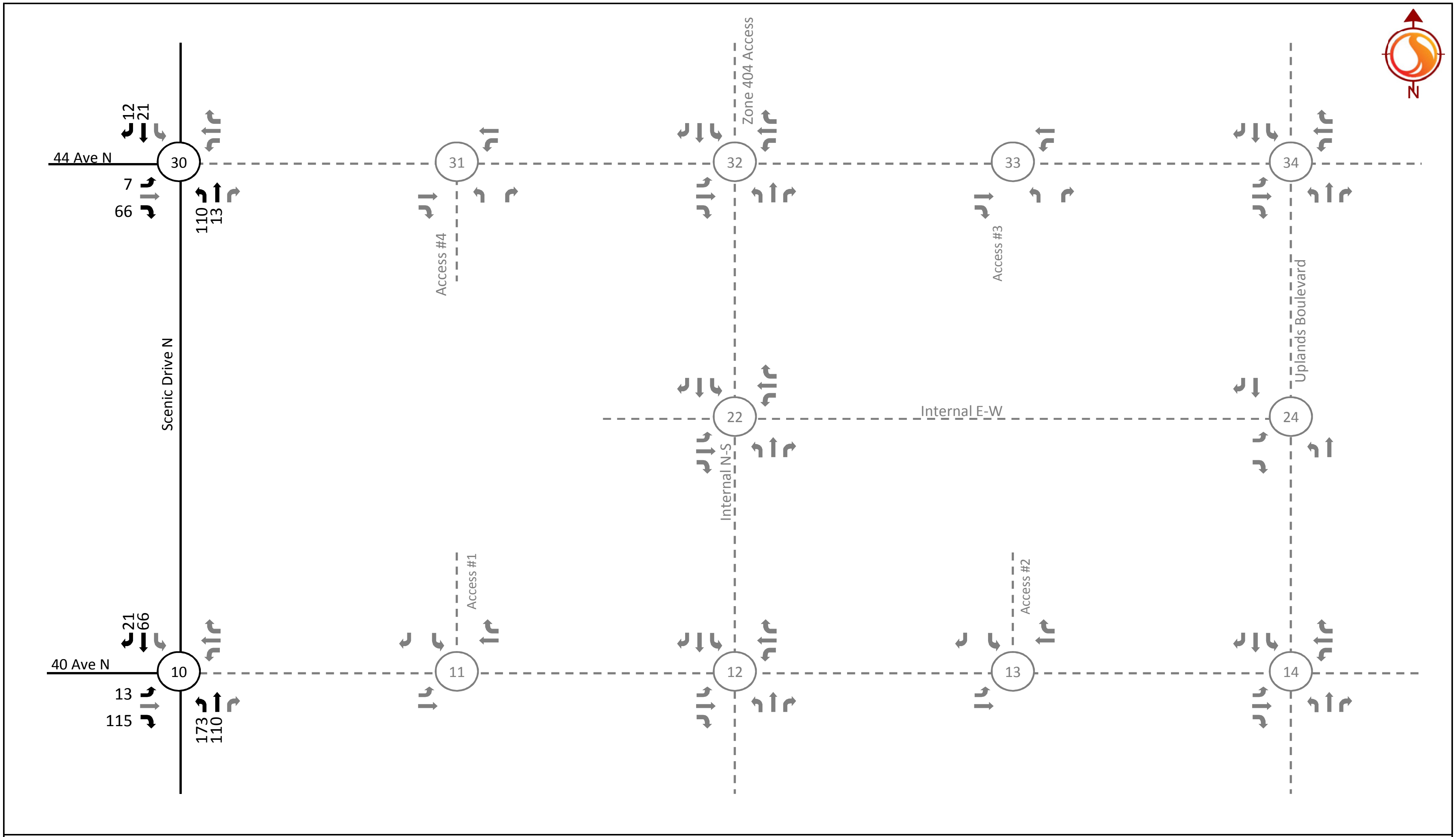
6. For zones 402/403/406/407, it was assumed that approximately 50% of the site traffic would access the development to/from the east (primarily via 28 Street or 43 Street). The remaining 50% of the site traffic was assigned to the network using the following distribution: 70% to/from Scenic Drive and 26 Avenue, 30% to/from Uplands Boulevard. The volumes for zones 402/403/406/407 are illustrated on **Figure 2.16** and **Figure 2.17**.

The traffic from the six surrounding development was combined with the adjusted existing traffic volumes. The resulting 2030 horizon background traffic volumes are illustrated on **Figure 2.18** and **Figure 2.19**.



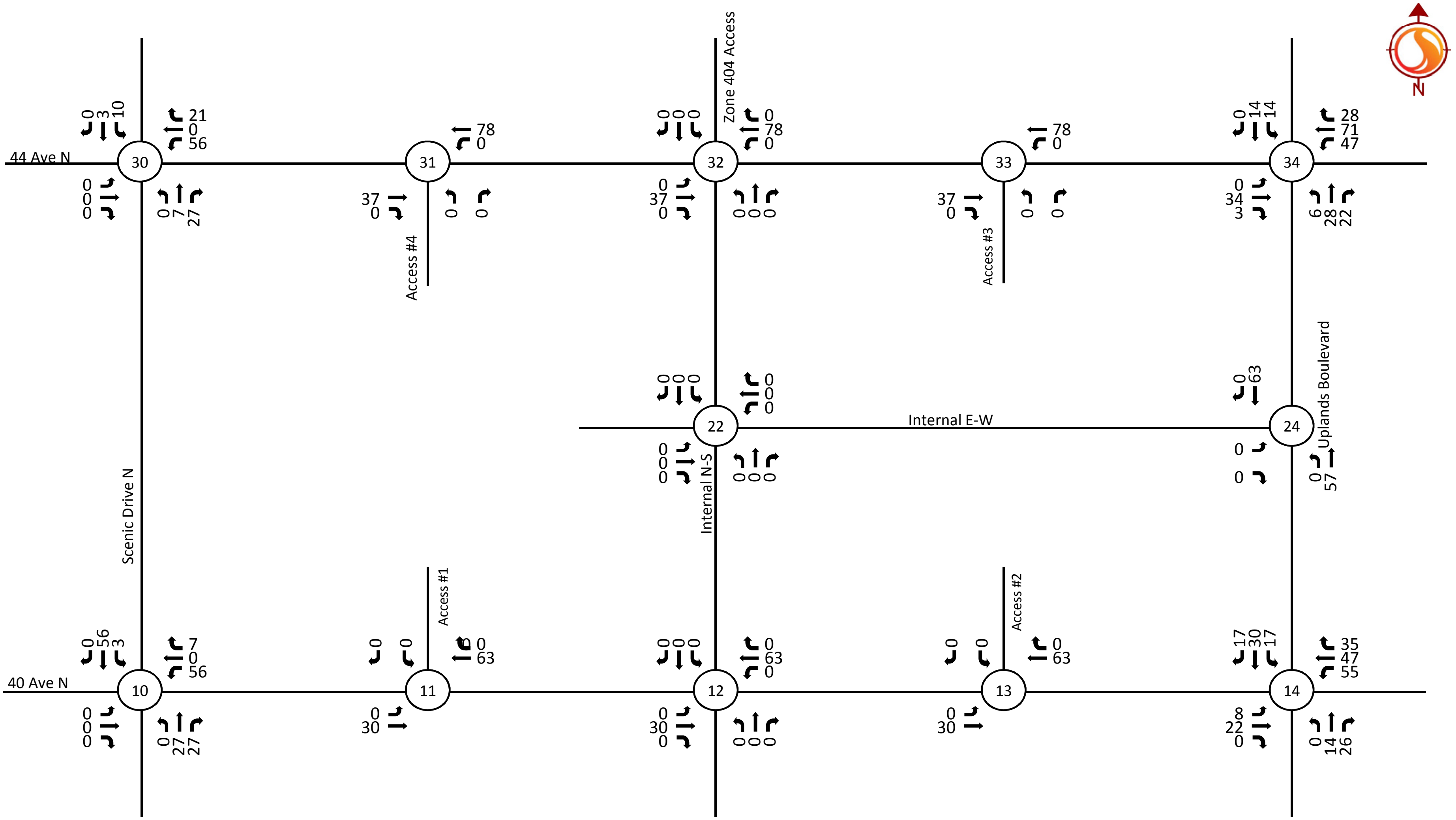
Lethbridge Land
Blackwolf Stage 2
Transportation Impact Assessment

Figure 2.6
Legacy Ridge Stage 3 Volumes
AM Peak



Lethbridge Land
Blackwolf Stage 2
Transportation Impact Assessment

Figure 2.7
Legacy Ridge Stage 3 Volumes
PM Peak



Lethbridge Land

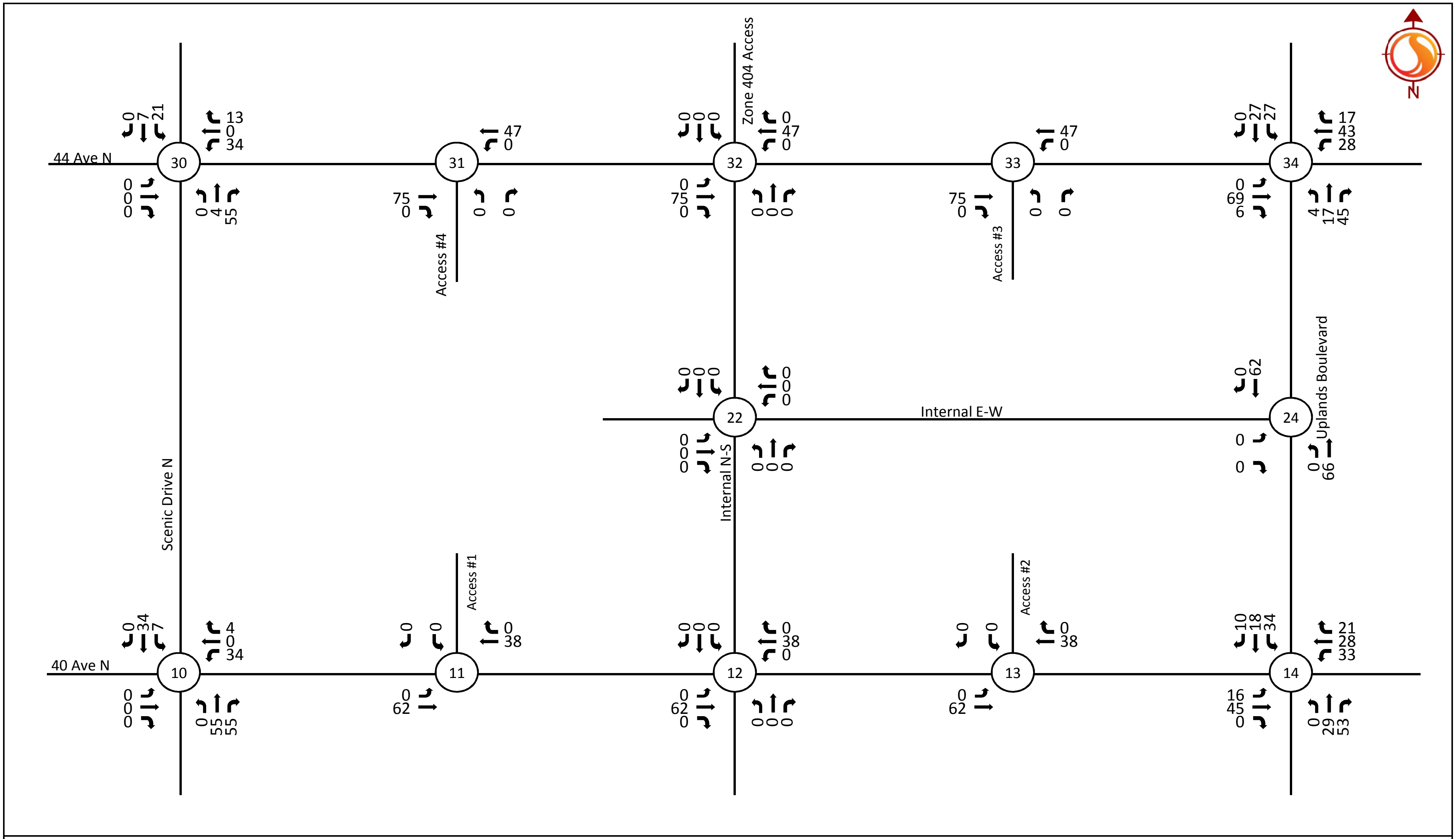
Blackwolf Stage 2

Transportation Impact Assessment

Figure 2.8

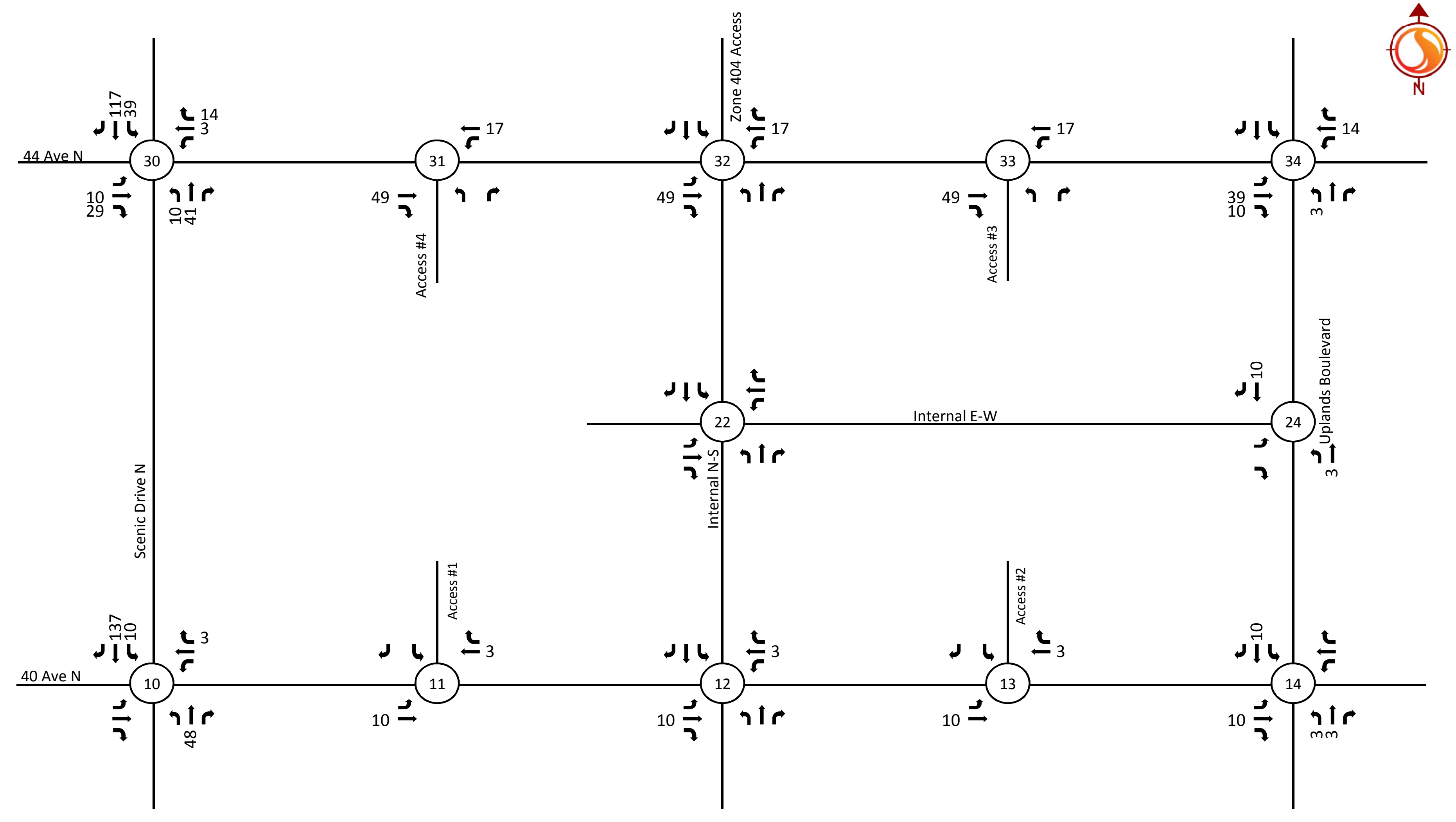
Blackwolf Stage 1 Volumes

AM Peak



Lethbridge Land
Blackwolf Stage 2
Transportation Impact Assessment

Figure 2.9
Blackwolf Stage 1 Volumes
PM Peak



Lethbridge Land

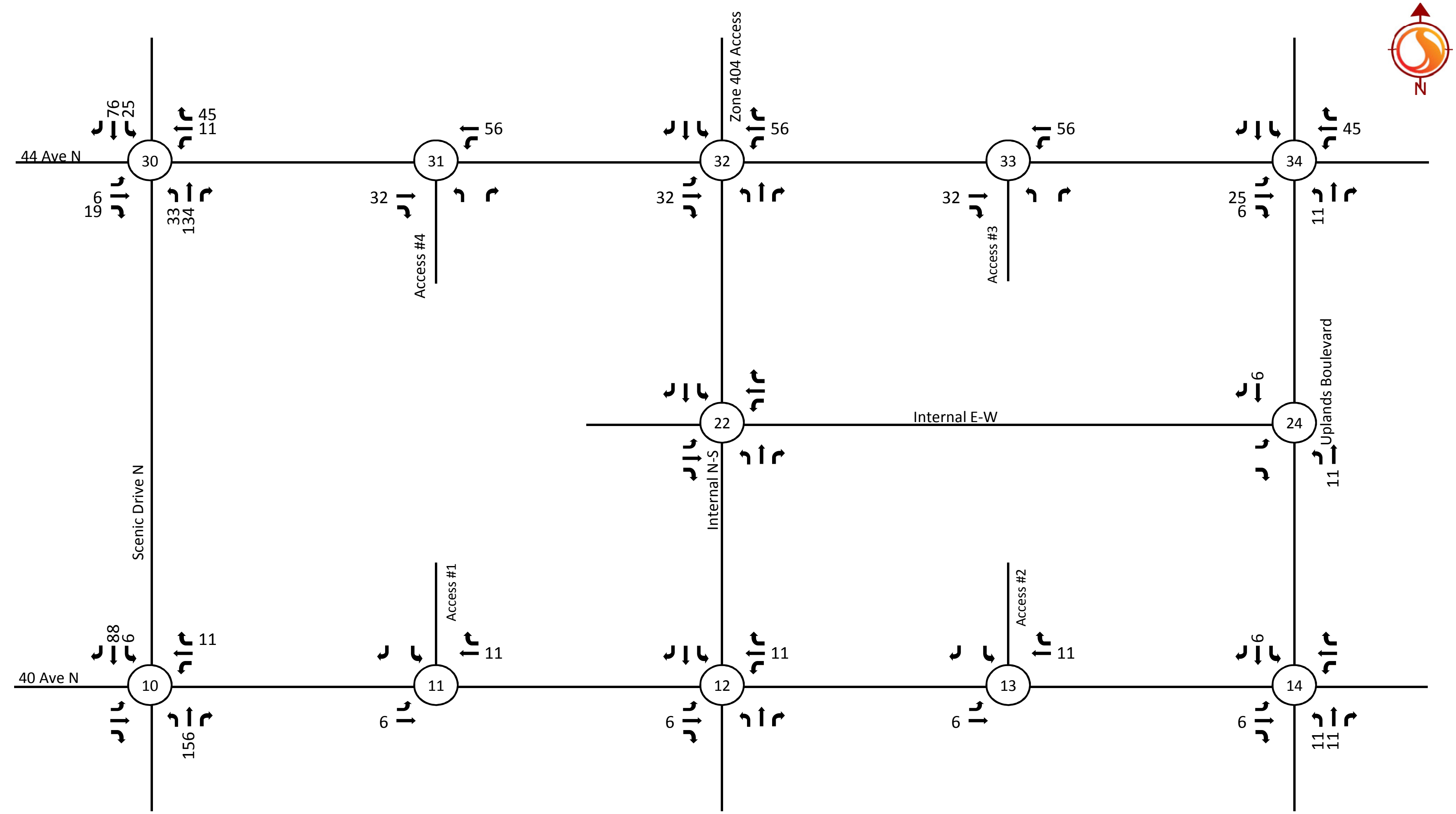
Blackwolf Stage 2

Transportation Impact Assessment

Figure 2.10

Zone 301 Volumes

AM Peak



Lethbridge Land

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Transportation Impact Assessment

Figure 2.11

Zone 301 Volumes

PM Peak

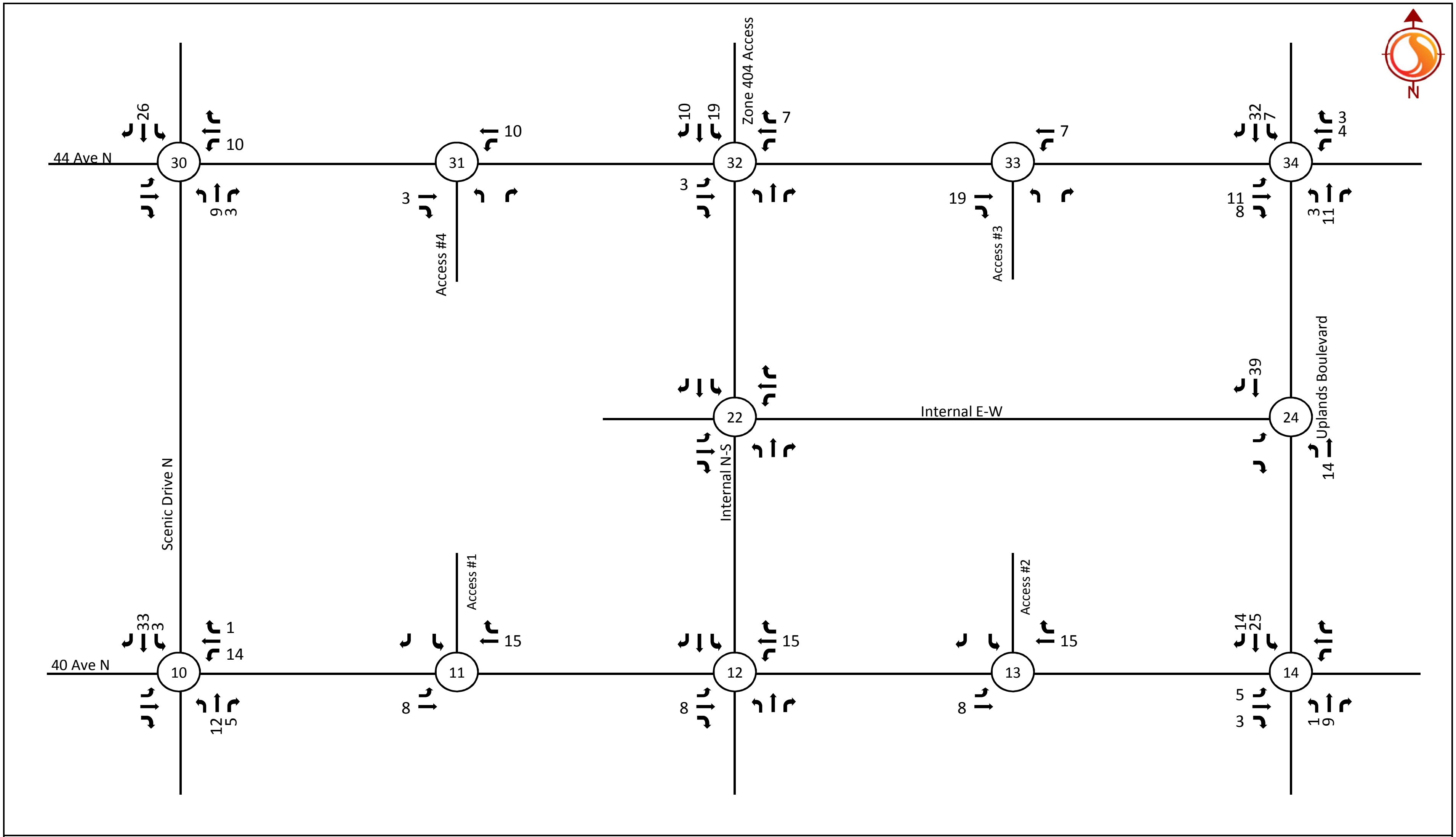

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Figure 2.12

Zone 404 Volumes

AM Peak

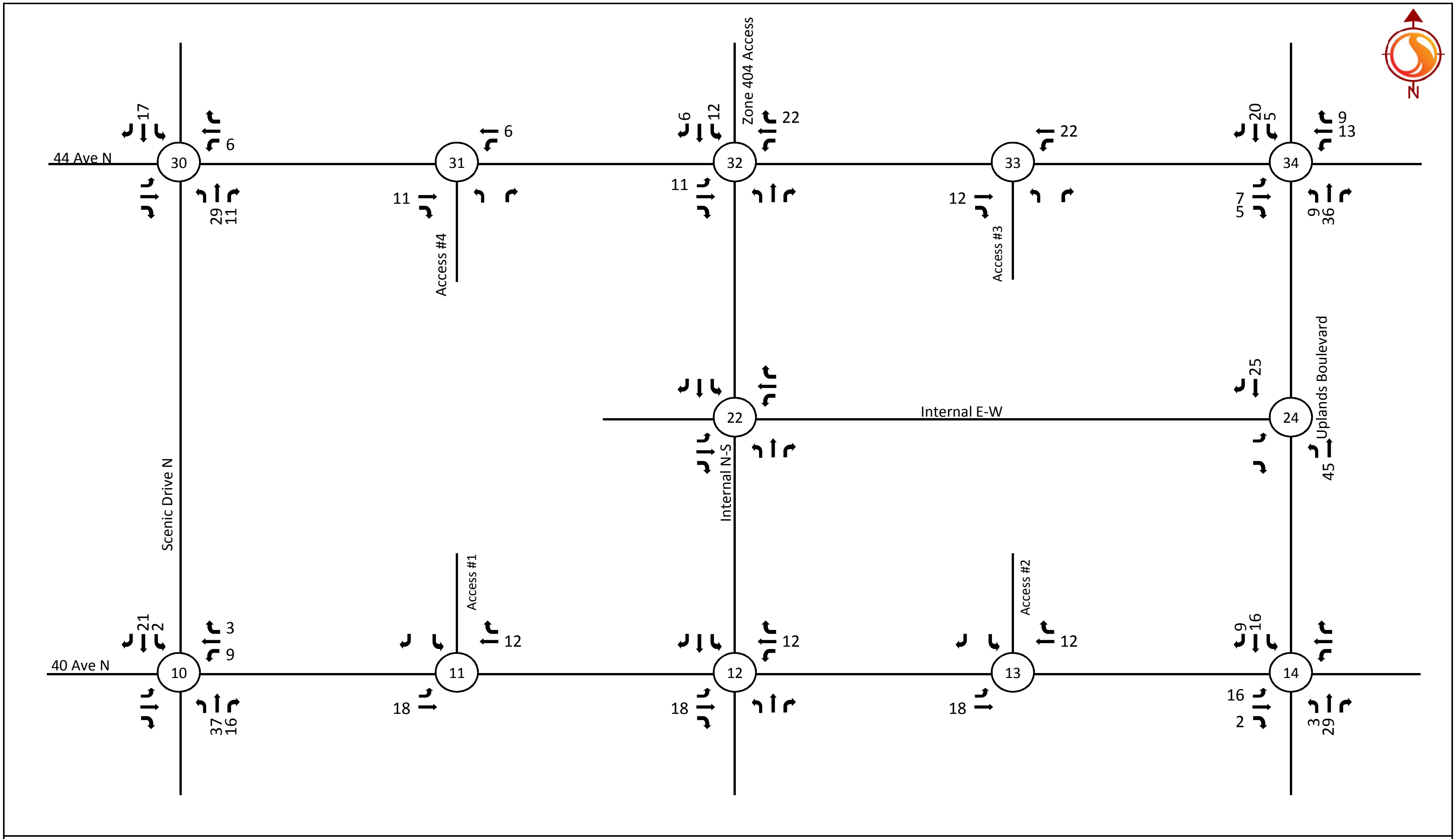

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Figure 2.13
Zone 404 Volumes
PM Peak

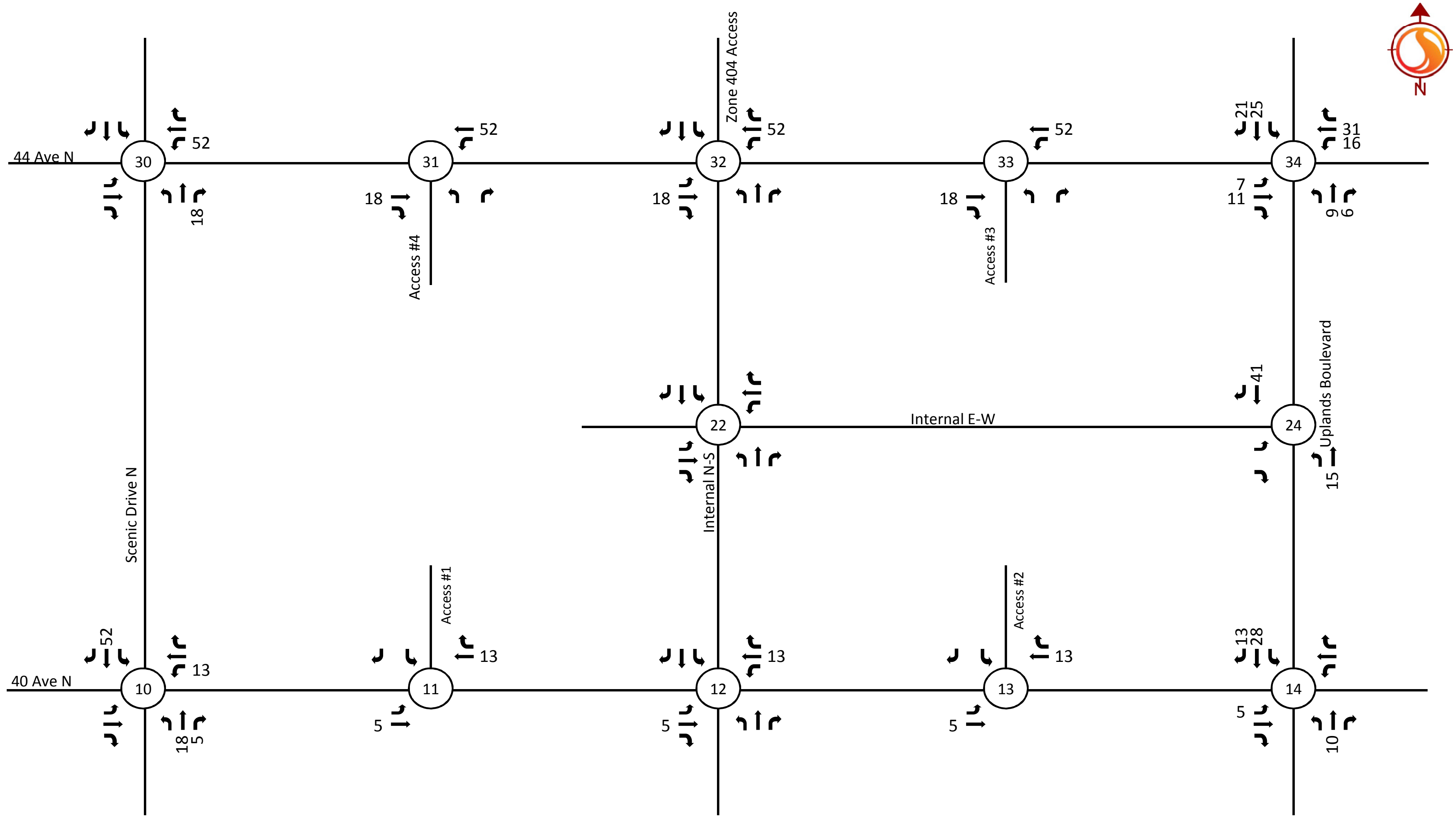

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Figure 2.14

Zone 405 Volumes

AM Peak

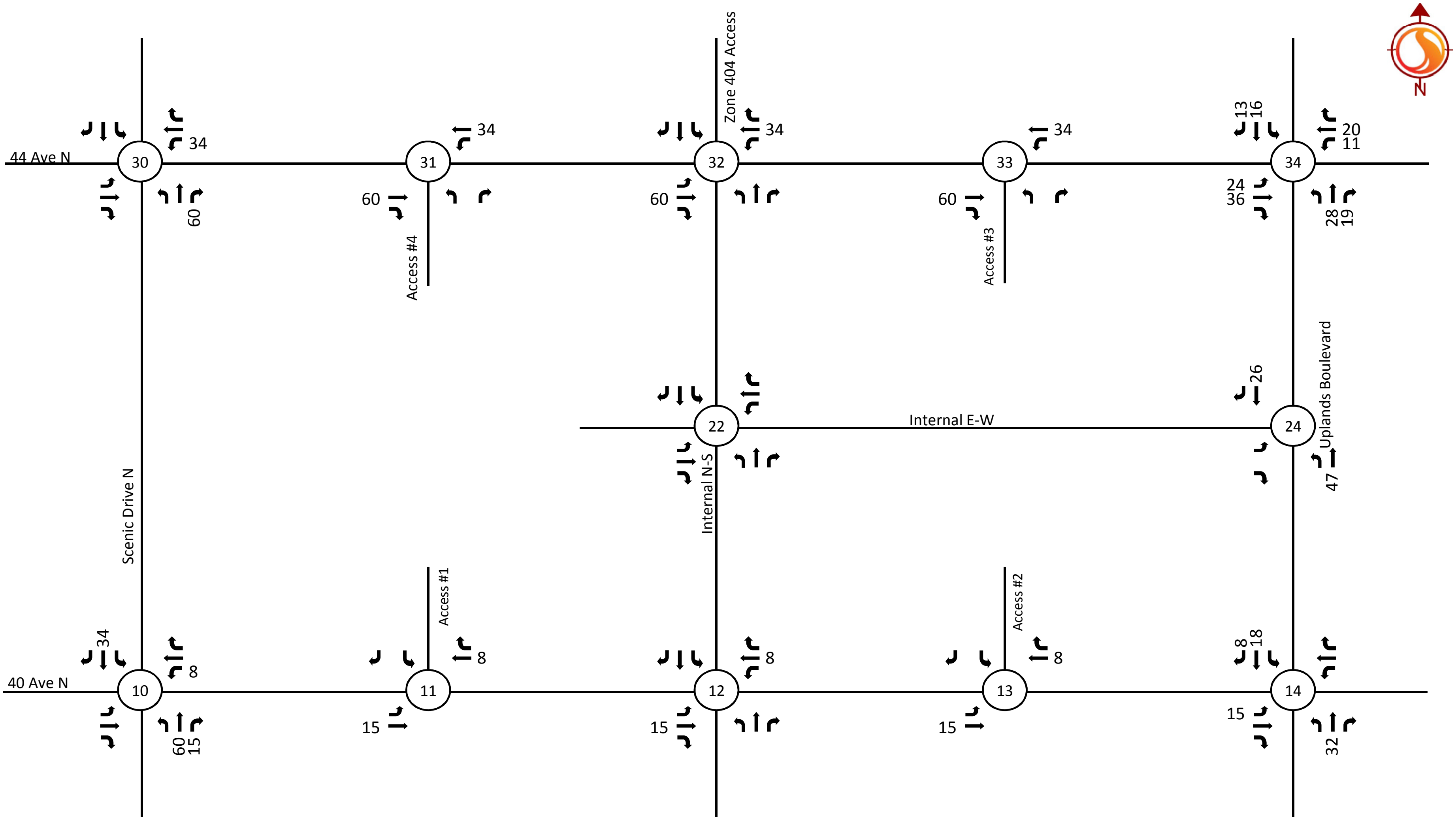

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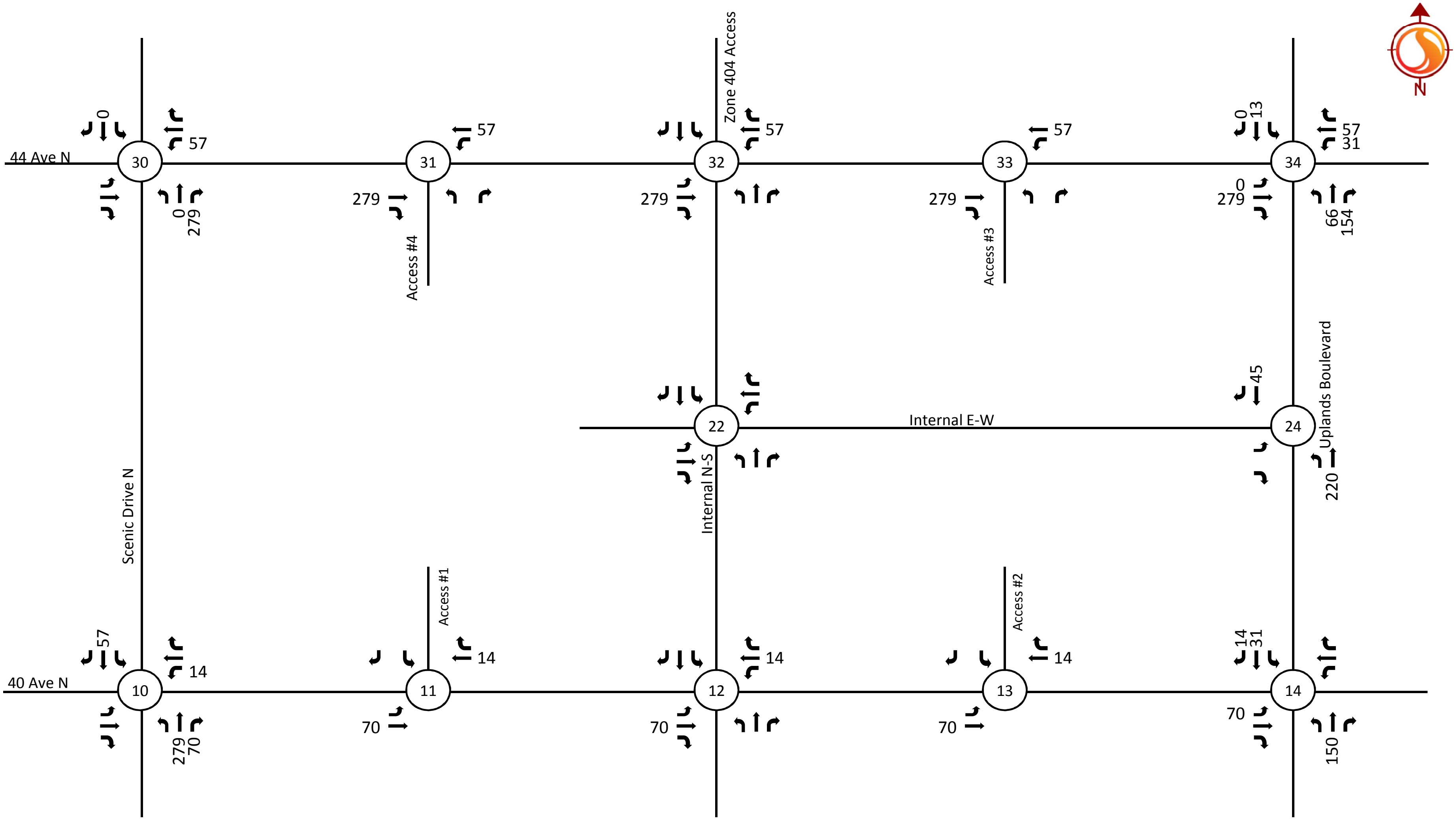
Figure 2.15

Zone 405 Volumes

PM Peak



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Blackwolf Stage 2

Transportation Impact Assessment

Figure 2.16

Zone 402/403/406/407 Volumes

AM Peak

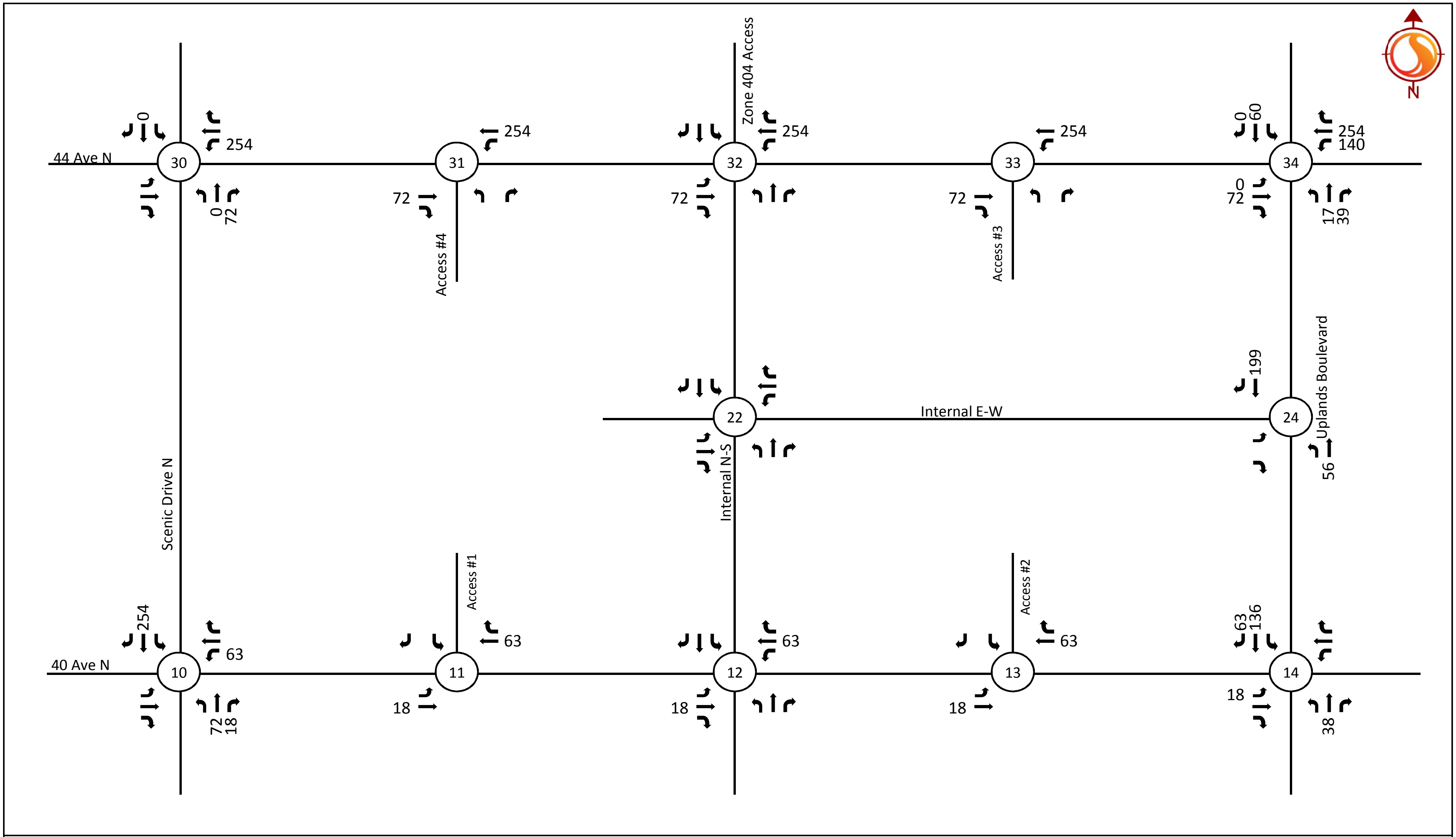

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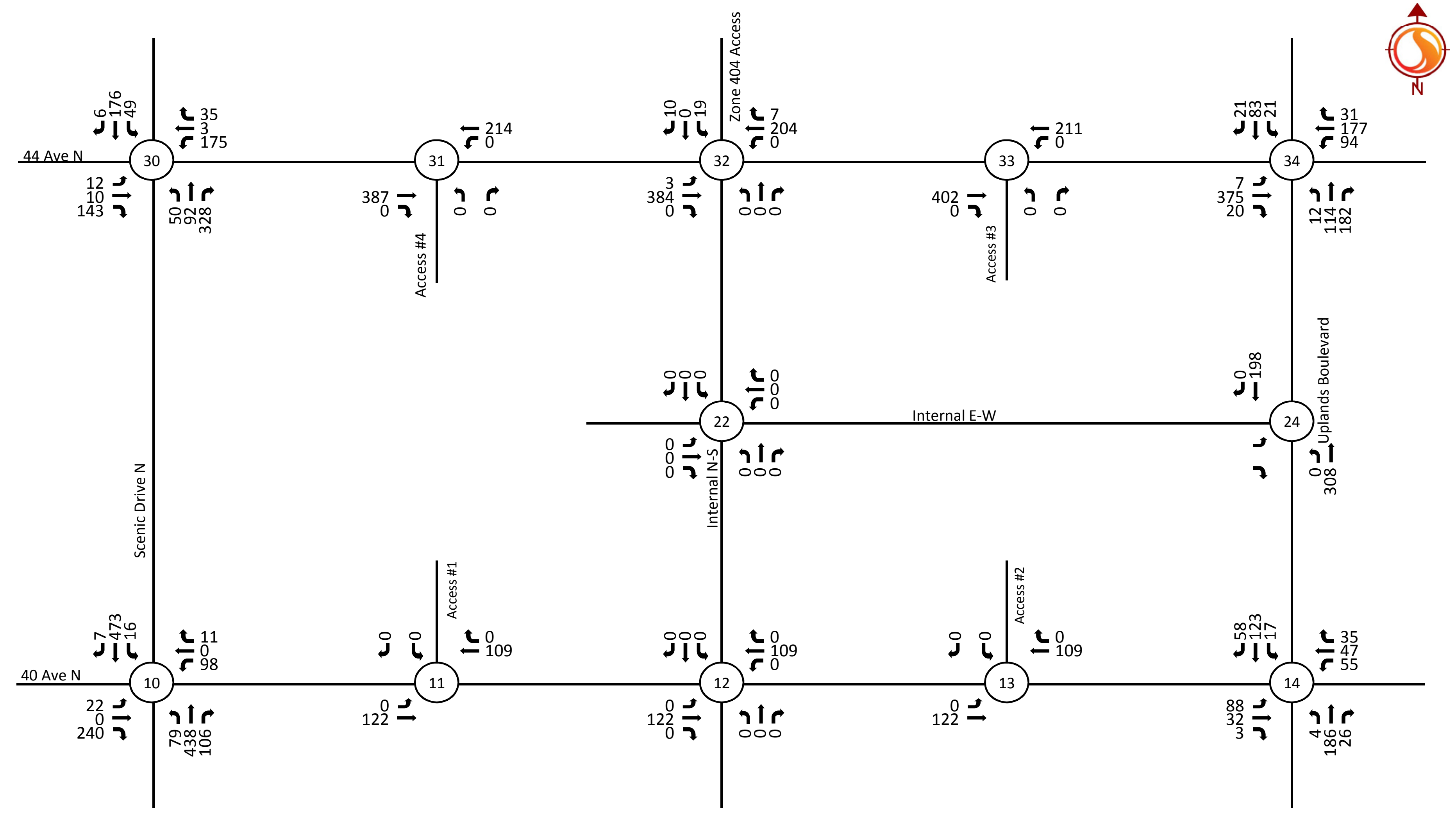
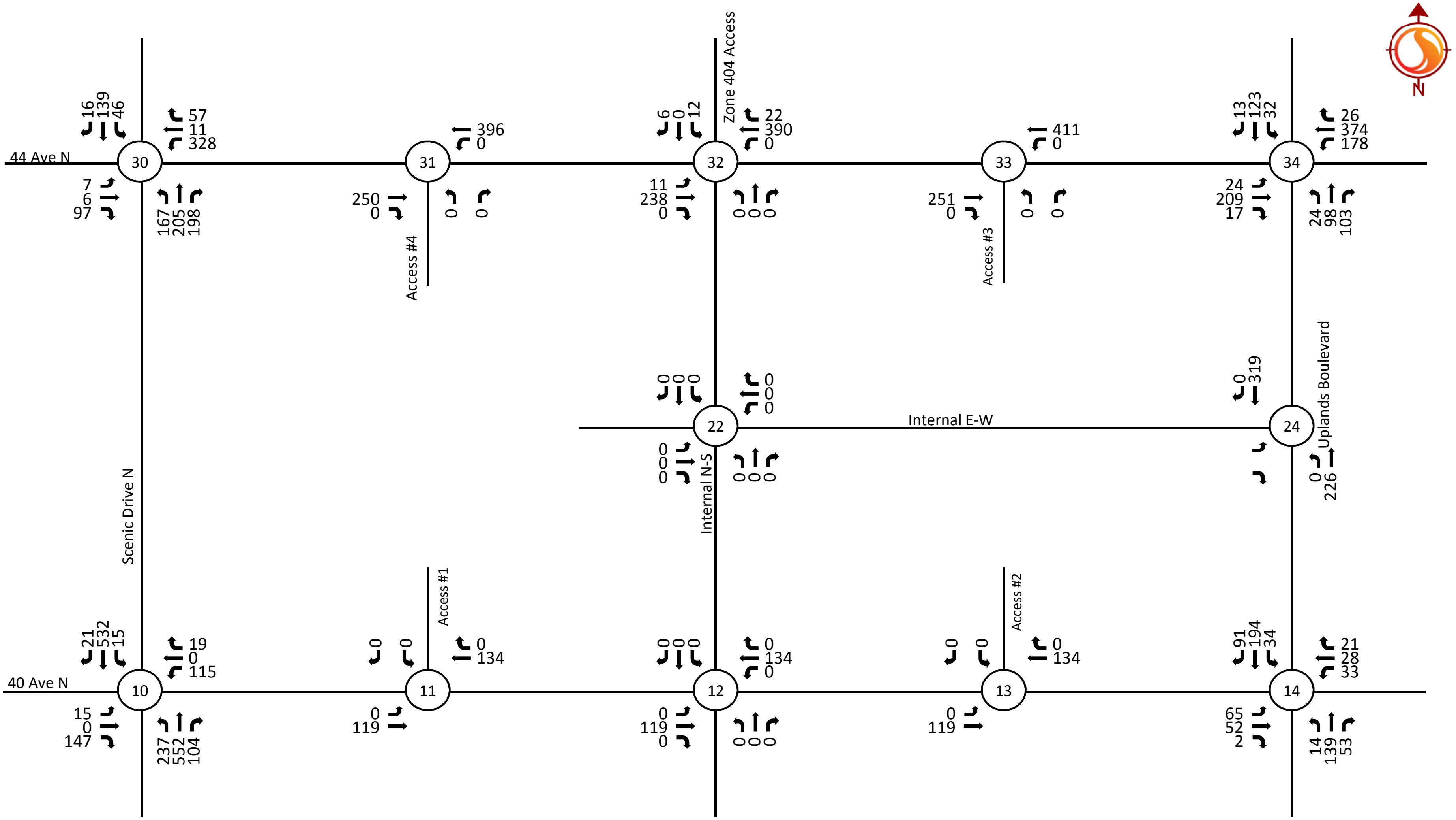
Figure 2.17
Zone 402/403/406/407 Volumes
PM Peak



Lethbridge Land
Blackwolf Stage 2
Transportation Impact Assessment

Figure 2.18
2030 Horizon Background Volumes
AM Peak



Lethbridge Land

Blackwolf Stage 2

Transportation Impact Assessment

Figure 2.19

2030 Horizon Background Volumes

PM Peak

3.0 Development Proposal

3.1 PROPOSED DEVELOPMENT

The Blackwolf Stage 2 development will consist primarily of low and medium density residential uses. The total site area is approximately 59.8 HA. There is also a large regional park proposed for the south half of the development lands (south side of 40 Avenue/Blackwolf Boulevard, between Scenic Drive and Uplands Boulevard). **Outline Plan Figure 7.1** is included in **Appendix E** to illustrate the proposed land use designations for Blackwolf Stage 2.

Table 3.1 summarizes the proposed composition of the community within the Outline Plan area. The development intensities shown in Table 3.1 reflect the build out of the community.

Table 3.1 Development Summary

Use	Intensity
Low Density Residential	345 units
Medium Density Residential	232 units
Regional Park	80 acres

Traffic generated by the proposed development will access the road network via the seven community entrance roads. Accesses include three accesses onto the future 44th Avenue, three accesses onto the future 40 Avenue/Blackwolf Boulevard and one access onto Uplands Boulevard.

3.2 TRIP GENERATION

In assessing the trip-generating potential of the proposed development, the City of Lethbridge trip generation rates for low and medium density residential units (previously summarized in Table 2.1) were used for the residential uses. For the regional park the peak hour of the generator rate for Land Use 412: County Park from ITE Trip Generation, 9th Edition was applied. This use was selected because it has a definition consistent with the proposed regional park, and because there is an appropriate amount of data available for the use. Although, the peak hour of the generator rate may conservatively estimate the number of trips accessing the park during the study area adjacent street peak hour, it was applied to provide a small buffer in terms of the overall trip generation for the site. The trip generation rates for the regional park are summarized in **Table 3.2.**

Table 3.2 Trip Rates for Regional Park

Use	AM Peak Hour			PM Peak Hour		
		In	Out		In	Out
Regional Park	0.52 vph/acre	71%	29%	0.59 vph/acre	35%	65%

The number of trips for Blackwolf Stage 2 was estimated by applying the rates included in Table 2.1 and Table 3.2 to the development yields included in Table 3.1. The resulting 2030 horizon site generated trips for Blackwolf Stage 2 are summarized in **Table 3.3**.

Table 3.3 Trip Generation – Blackwolf Stage 2

Zone	AM Peak			PM Peak		
	Total	In	Out	Total	In	Out
Single Family	266	69	197	352	225	127
Multi Family	174	50	124	213	130	83
Regional Park	42	30	12	47	17	30
Total	**482**	**149**	**333**	**612**	**372**	**240**

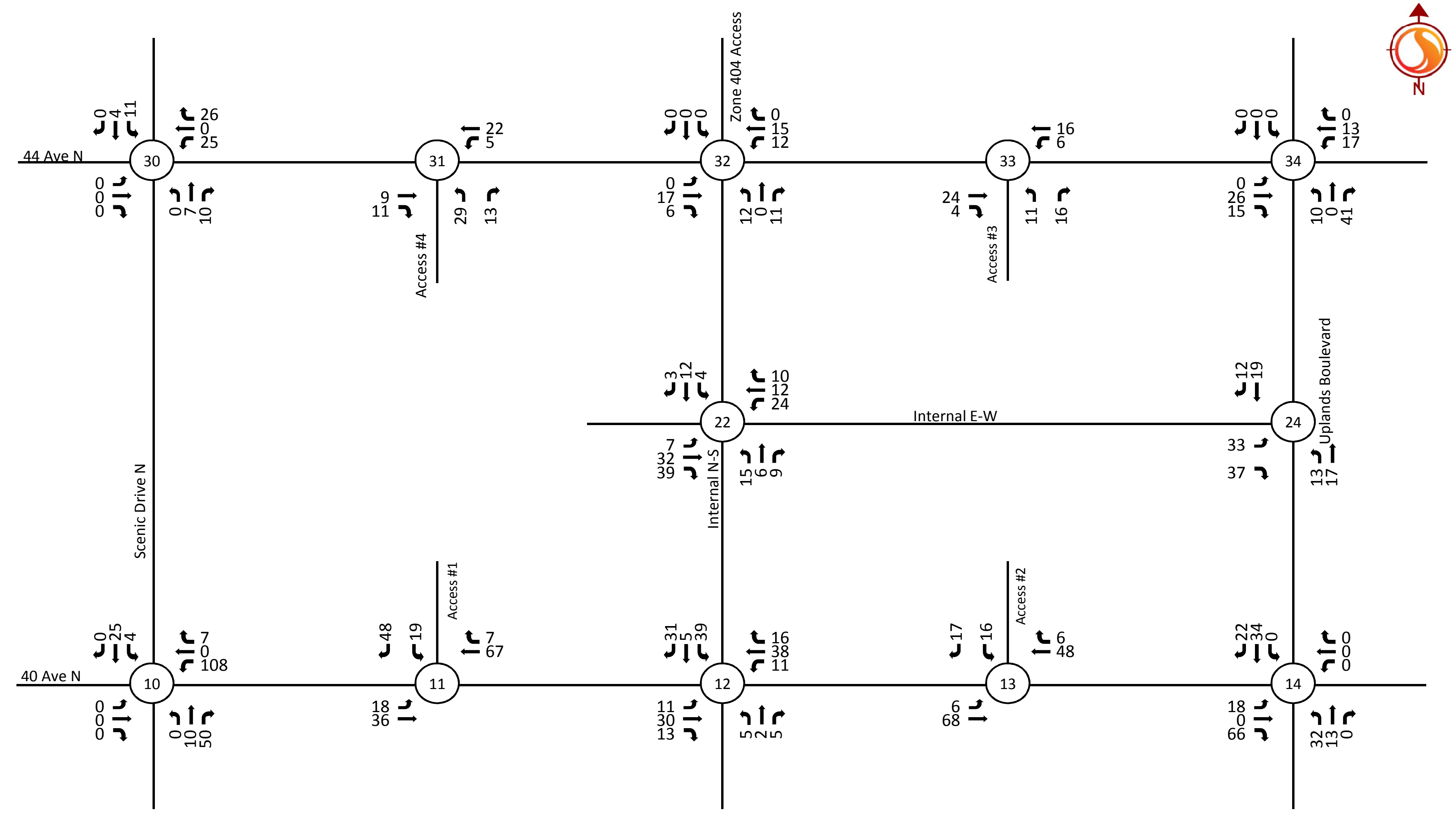
3.3 TRIP DISTRIBUTION AND ASSIGNMENT

The directional distribution patterns for trips generated by the development were established during the initial TIA sign-off period. The following summarizes the distribution patterns for the subject development:

- 40% to/from the Scenic Drive/26 Avenue Intersection (via Blackwolf Boulevard and Scenic Drive)
- 30% to/from the Scenic Drive/26 Avenue Intersection (via Uplands Boulevard)
- 20% to/from east 44 Avenue
- 10% to/from north 13 Street

The morning and afternoon peak hour traffic generated by the Blackwolf Stage 2 was assigned to the area road network based on the distribution patterns shown above. The 2030 horizon site generated traffic volumes are illustrated in **Figure 3.1** and **Figure 3.2**.

The residential and regional park site-generated traffic volumes were combined with the relevant background traffic volumes. The resulting 2030 horizon post development traffic volumes are illustrated in **Figure 3.3 Figure 3.4**.



Lethbridge Land

Blackwolf Stage 2

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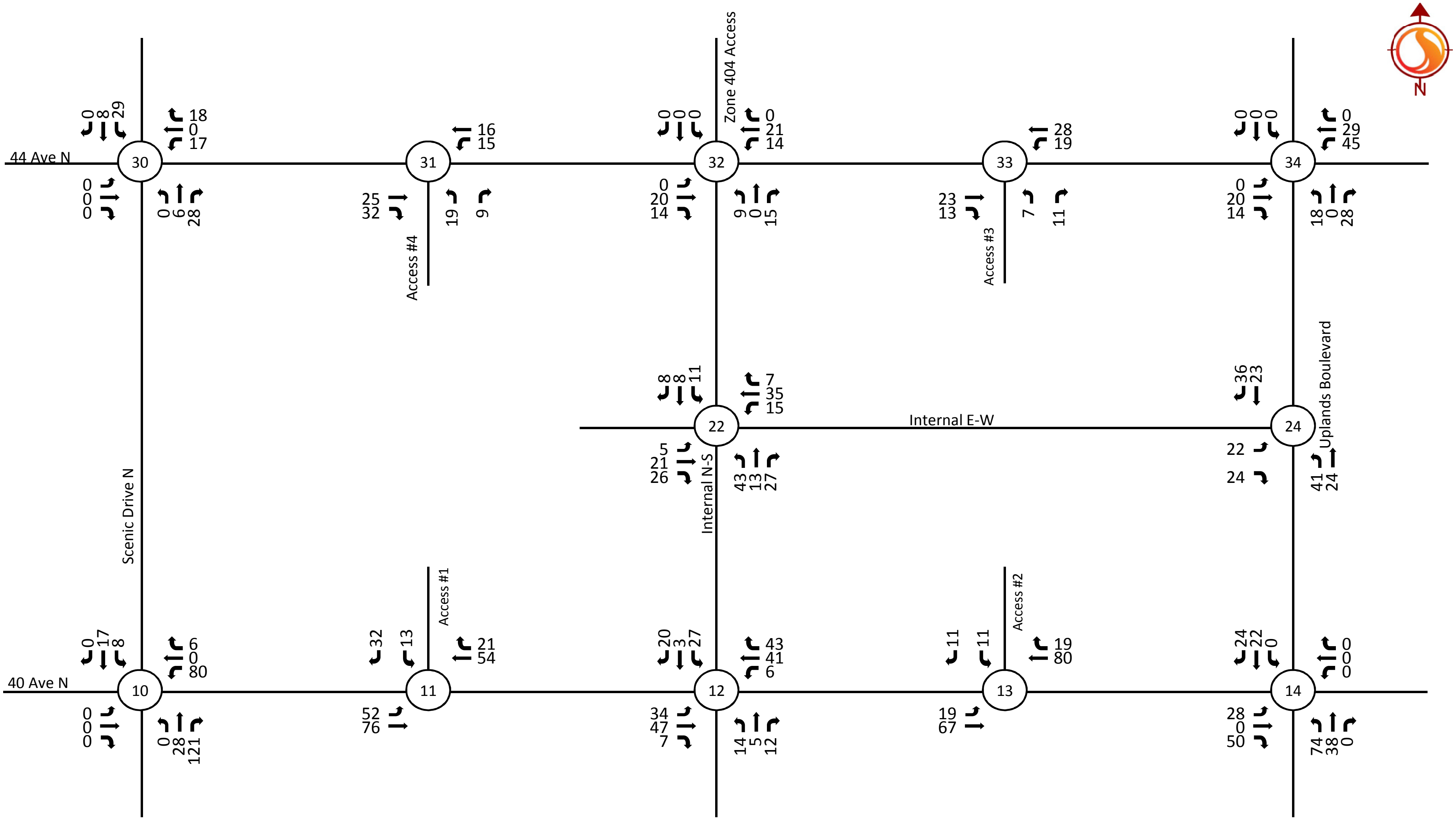
Figure 3.1

2030 Site Generated Traffic Volumes

AM Peak



Lethbridge Land

Blackwolf Stage 2

Transportation Impact Assessment

Figure 3.2

2030 Site Generated Traffic Volumes

PM Peak

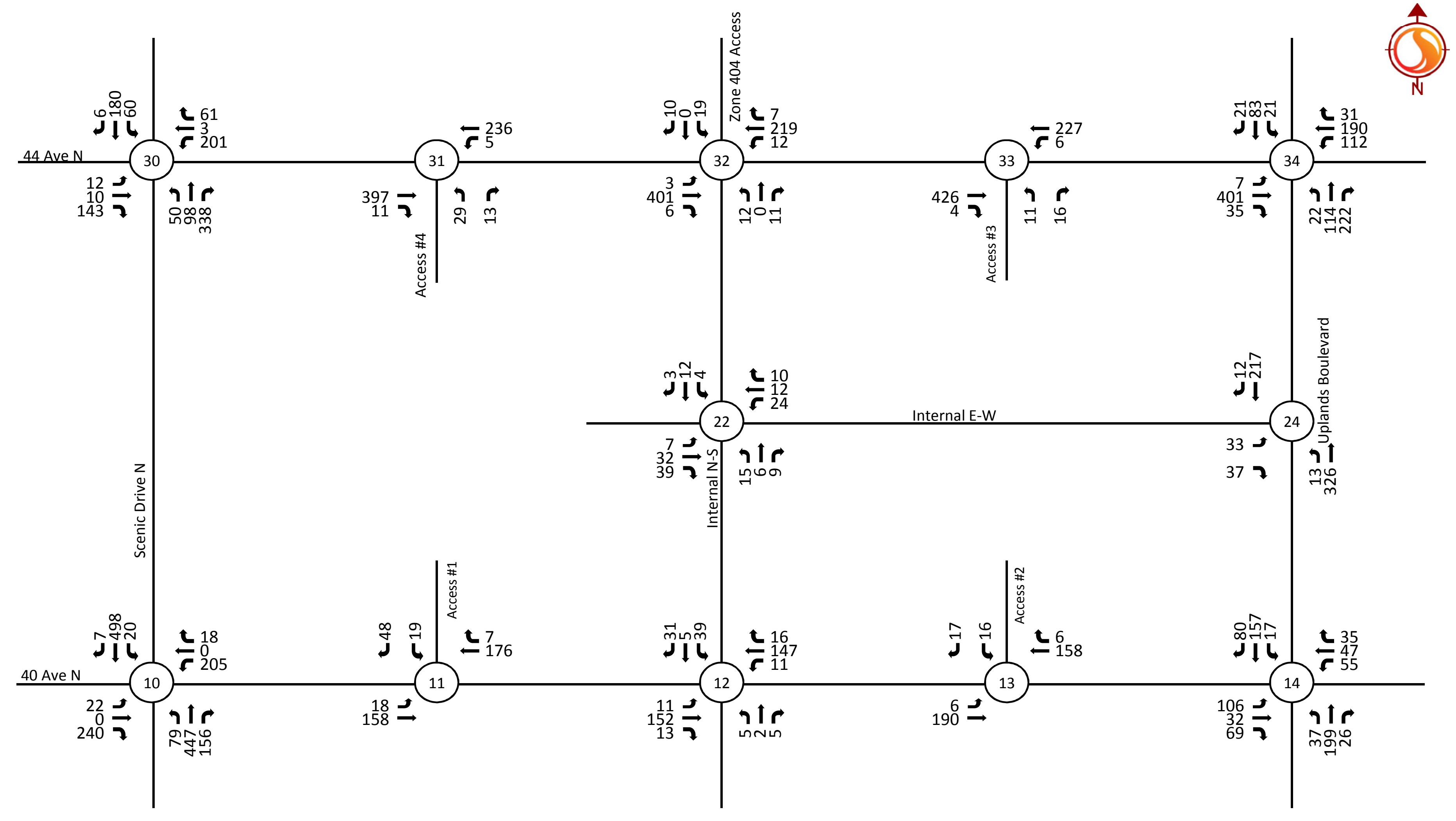


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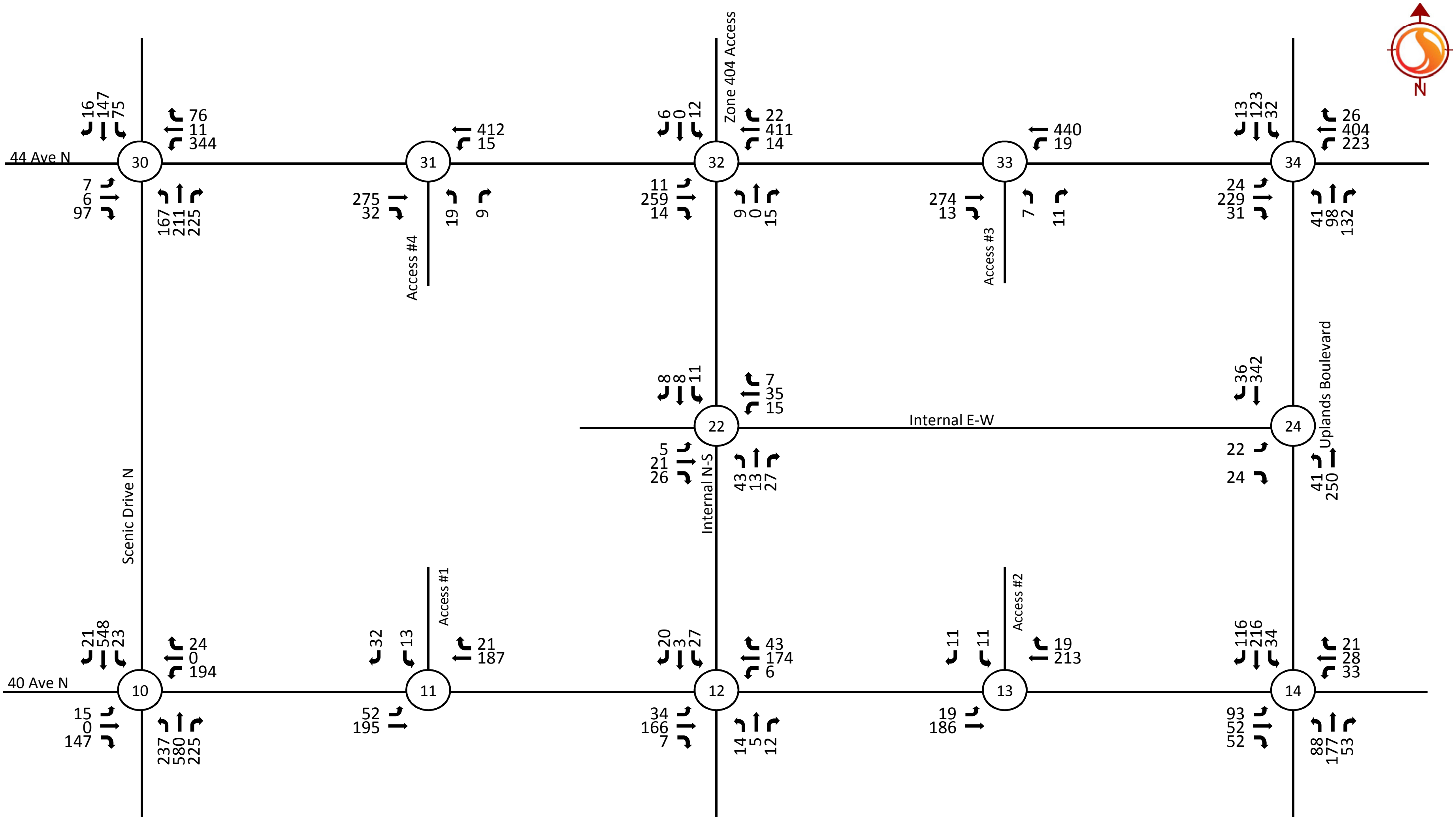
Figure 3.3
2030 Post Development Traffiv Volumes
AM Peak



Lethbridge Land
Blackwolf Stage 2
Transportation Impact Assessment

Figure 3.4
2030 Post Development Traffiv Volumes
PM Peak

4.0 Intersection Analysis

4.1 ANALYSIS CRITERIA

Analysis for conventional signalized/unsignalized intersections was undertaken using the Synchro 8 software package, which is based on the Highway Capacity Manual (HCM 2000). For unsignalized intersections, the methodology considers the intersection geometry, the traffic volumes, the posted speed limit and the type of intersection control. The average delay for each individual movement from the minor street, the major street left-turn movements and the overall intersection are calculated. An operation level of service (LOS) is then assigned based on the calculated average delay. Roundabout Analysis was performed using SIDRA Intersection 5. The level of service criteria for both signalized and unsignalized intersections is described in **Table 4.1**.

Table 4.1 Level of Service Criteria

Level of Service	Average Control Delay (seconds per vehicle)		Comment
	Signalized Intersection/ Roundabout	Unsignalized Intersection	
A	10.0 or less	10.0 or less	Very good operation
B	10.1 to 20.0	10.1 to 15.0	Good operation
C	20.1 to 35.0	15.1 to 25.0	Acceptable operation
D	35.1 to 55.0	25.1 to 35.0	Congestion
E	55.1 to 80.0	35.1 to 50.0	Significant congestion
F	More than 80.0	More than 50.0	Unacceptable operation
Breakdown	Very high	Very high	Conditions so poor that capacity calculations are meaningless

4.2 2030 BACKGROUND OPERATING CONDITIONS

The operating conditions for the 2030 background horizon were analyzed for the morning and afternoon peak hours to determine configurations for the intersections within the scope area. The volumes illustrated in Figure 2.18 and Figure 2.19 were analyzed. Although it is recognized that Scenic Drive may be a full four lane arterial beyond 44 Avenue by 2030, for the analysis, it was assumed that Scenic Drive is constructed as a four-lane arterial road to the intersection with 40 Avenue only. All other roadways are assumed to be two-lane at the 2030 horizon. **Table 4.2** summarizes the results of the 2030 background horizon capacity analysis. The Synchro outputs for this scenario are included in **Appendix F**.

Table 4.2 - 2030 Background Operating Conditions

Intersection	Intersection Control Device	Interval	Measure	Eastbound			Westbound			Northbound			Southbound			Overall Intersection LOS
				Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
44 Ave N / Scenic Drive N	Signalized	AM	Volumes (vph)	12	10	143	175	3	35	50	92	328	49	176	6	B
			Level of Service	A			B	A		B	A		B			
			V/C Ratio by Movement	0.47			0.46	0.08		0.12	0.57		0.40			
			Queue Length (in metres)	14			22	4		9	35		43			
		PM	Volumes (vph)	7	6	97	328	11	57	167	205	198	46	139	16	B
			Level of Service	B			C	A		B	B		B			
			V/C Ratio by Movement	0.46			0.77	0.13		0.36	0.55		0.31			
			Queue Length (in metres)	16			68	8		0	102		46			
44 Ave N / Uplands Blvd N	Signalized	AM	Volumes (vph)	7	375	20	94	177	31	12	114	182	21	83	21	B
			Level of Service	B			B			B			B			
			V/C Ratio by Movement	0.57			0.54			0.64			0.31			
			Queue Length (in metres)	55			43			35			19			
		PM	Volumes (vph)	24	209	17	178	374	26	24	98	103	32	123	13	C
			Level of Service	A			C			C			C			
			V/C Ratio by Movement	0.32			0.85			0.63			0.51			
			Queue Length (in metres)	26			102			47			41			
40 Ave N / Scenic Drive N	Signalized	AM	Volumes (vph)	22	5*	240	98	5*	11	79	438	106	16	473	7	B
			Level of Service	A			D			A	A	A	C			
			V/C Ratio by Movement	0.57			0.78			0.19	0.48	0.13	0.70			
			Queue Length (in metres)	17			31			10	59	6	117			
		PM	Volumes (vph)	15	5*	147	115	5*	19	237	552	104	15	532	21	B
			Level of Service	A			E			A	B	A	B			
			V/C Ratio by Movement	0.45			0.87			0.52	0.54	0.12	0.73			
			Queue Length (in metres)	18			46			34	102	6	164			
40 Ave N / Uplands Blvd N	Four-way Stop Conttrolled	AM	Volumes (vph)	88	32	3	55	47	35	4	186	26	17	123	58	B
			Level of Service	B			A			B			B			
			V/C Ratio by Movement	0.21			0.23			0.34			0.31			
			Queue Length (in metres)													
		PM	Volumes (vph)	65	52	2	33	28	21	14	139	53	34	194	91	B
			Level of Service	B			A			B			B			
			V/C Ratio by Movement	0.21			0.14			0.32			0.48			
			Queue Length (in metres)													

Notes:

1. 95th percentile queues are based on Synchro results.
2. Manually added volumes: 5*

The results illustrated in Table 4.2 indicate the following:

- The Blackwolf Boulevard (40 Avenue) / Scenic Drive N intersection is expected to operate at acceptable levels of service during both the morning and afternoon peak hours as a signalized intersection. A designated northbound left turn lane was assumed to provide access to Hardieville and Legacy Ridge Stage 3. The following minimum storage lengths are recommended based on the analysis:
    - Northbound left turn lane – 60 meters
- The 44 Avenue / Scenic Drive N intersection was observed to be approaching capacity as an unsignalized intersection. Therefore the intersection was reviewed assuming signals are in place. Designated northbound and westbound left turn lanes were also identified for provision of access to/from zones 301, 404, and 405. Based on this configuration, the intersection is anticipated to operate at acceptable levels of service during both the morning and afternoon peak hours. The following minimum storage lengths are recommended based on the analysis:
    - Northbound left turn lane – 60 meters
    - Westbound left turn lane – 70 meters
- The 44 Avenue / Uplands Boulevard intersection was observed to be over capacity as an unsignalized intersection. Therefore the intersection was reviewed assuming signals are in place. Based on this configuration, the intersection is anticipated to operate at acceptable levels of service during both the morning and afternoon peak hours.
- The Blackwolf Boulevard / Uplands Boulevard intersection was analyzed as a four way stop configuration since it is located at the intersection of two main collector roadways. Based on this configuration, the intersection is anticipated to operate at acceptable levels of service during both the morning and afternoon peak hours.

4.3 2030 POST DEVELOPMENT OPERATING CONDITIONS

The operating conditions for the 2030 post development horizon were analyzed for the morning and afternoon peak hours to determine configurations for the intersections within the scope area. The volumes illustrated in Figure 3.3 and Figure 3.4 were analyzed.

summarizes the results of the 2030 background horizon capacity analysis. The Synchro and SIDRA outputs for this scenario are included in **Appendix F**.

Table 4.3 - 2030 Post Development Operating Conditions

Intersection	Intersection Control Device	Interval	Measure	Eastbound			Westbound			Northbound			Southbound			Overall Intersection LOS
				Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
44 Ave N / Scenic Drive N	Signalized	AM	Volumes (vph)	12	10	143	201	3	61	50	98	338	60	180	6	B
			Level of Service	B			D	A		A	A		B			
			V/C Ratio by Movement	0.53			0.68	0.16		0.10	0.52		0.35			
			Queue Length (in metres)	17			40	8		4	94		41			
		PM	Volumes (vph)	7	6	97	344	11	76	167	211	225	75	147	16	B
			Level of Service	B			D	A		A	A		C			
			V/C Ratio by Movement	0.46			0.80	0.16		0.38	0.60		0.47			
			Queue Length (in metres)	16			74	9		17	39		61			
44 Ave N / Access #4	Stop-Controlled on Access	AM	Volumes (vph)		397	11	5	236		29		13				A
			Level of Service		A		A			B						
			V/C Ratio by Movement		0.27		0.01			0.11						
			Queue Length (in metres)		0		0			3						
		PM	Volumes (vph)		275	32	15	412		19		9				A
			Level of Service		A		A			B						
			V/C Ratio by Movement		0.21		0.01			0.08						
			Queue Length (in metres)		0		0			2						
44 Ave N / Internal N-S	Stop-Controlled on Side Streets	AM	Volumes (vph)	3	401	6	12	219	7	12	5*	11	19	5*	10	A
			Level of Service	A			A			C			C			
			V/C Ratio by Movement	0.00			0.01			0.08			0.10			
			Queue Length (in metres)	0			0			2			3			
		PM	Volumes (vph)	11	259	14	14	411	22	9	5*	15	12	5*	6	A
			Level of Service	A			A			B			C			
			V/C Ratio by Movement	0.01			0.01			0.08			0.09			
			Queue Length (in metres)	0			0			2			2			
44 Ave N / Access #3	Stop-Controlled on Access	AM	Volumes (vph)		426	4	6	227		11		16				A
			Level of Service		A		A			B						
			V/C Ratio by Movement		0.29		0.01			0.07						
			Queue Length (in metres)		0		0			2						
		PM	Volumes (vph)		274	13	19	440		7		11				A
			Level of Service		A		A			B						
			V/C Ratio by Movement		0.19		0.02			0.04						
			Queue Length (in metres)		0		0			1						
44 Ave N / Uplands Blvd N	Signalized	AM	Volumes (vph)	7	401	35	112	190	31	22	114	222	21	83	21	B
			Level of Service	B			B			B			B			
			V/C Ratio by Movement	0.63			0.64			0.71			0.29			
			Queue Length (in metres)	67			56			42			19			
		PM	Volumes (vph)	24	229	31	223	404	26	41	98	132	32	123	13	C
			Level of Service	A			C			D			C			
			V/C Ratio by Movement	0.33			0.90			0.79			0.56			
			Queue Length (in metres)	43			196			61			42			
	Signalized (Upgraded Configuration)	AM	Volumes (vph)	7	401	35	112	190	31	22	114	222	21	83	21	B
			Level of Service	B			B	A		B			B			
			V/C Ratio by Movement	0.64			0.35	0.32		0.71			0.29			
			Queue Length (in metres)	67			20	28		42			19			
		PM	Volumes (vph)	24	229	31	223	404	26	41	98	132	32	123	13	B
			Level of Service	B			B	B		C			B			
			V/C Ratio by Movement	0.42			0.52	0.59		0.65			0.41			
			Queue Length (in metres)	39			38	64		48			33			
	Roundabout	AM	Volumes (vph)	7	401	35	112	190	31	22	114	222	21	83	21	A
			Level of Service	A			A			A			A			
			V/C Ratio by Movement	0.54			0.38			0.57			0.17			
			Queue Length (in metres)	29			19			36			7			
		PM	Volumes (vph)	24	229	31	223	404	26	41	98	132	32	123	13	A
			Level of Service	A			A			A			B			
			V/C Ratio by Movement	0.43			0.72			0.37			0.38			
			Queue Length (in metres)	21			64			17			19			

Notes:
1. 95th percentile queues are based on Synchro results.
2. Manually added volumes: 5*

Table 4.3 - 2030 Post Development Operating Conditions Continued

Intersection	Intersection Control Device	Interval	Measure	Eastbound			Westbound			Northbound			Southbound			Overall Intersection LOS
				Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
Internal E-W / Internal N-S	Stop-Controlled on Internal N-S	AM	Volumes (vph)	7	32	39	24	12	10	15	6	9	4	12	3	A
			Level of Service		A			A			A			A		
			V/C Ratio by Movement		0.01			0.02			0.04			0.03		
			Queue Length (in metres)		0			0			1			1		
		PM	Volumes (vph)	5	21	26	15	35	7	43	13	27	11	8	8	A
			Level of Service		A			A			A			A		
			V/C Ratio by Movement		0.00			0.01			0.11			0.04		
			Queue Length (in metres)		0			0			3			1		
Internal E-W / Uplands Blvd N	Stop-Controlled on Internal E-W	AM	Volumes (vph)	33		37	13	326			217	12				A
			Level of Service		B		A				A					
			V/C Ratio by Movement		0.14		0.01				0.15					
			Queue Length (in metres)		4		0				0					
		PM	Volumes (vph)	22		24	41	250			342	36				A
			Level of Service		B		A				A					
			V/C Ratio by Movement		0.12		0.04				0.25					
			Queue Length (in metres)		3		1				0					
40 Ave N / Scenic Drive N	Signalized	AM	Volumes (vph)	22	5*	240	205	5*	18	79	447	156	20	498	7	C
			Level of Service		B		D	A		A	B	A		C		
			V/C Ratio by Movement		0.67		0.81	0.06		0.22	0.53	0.21		0.79		
			Queue Length (in metres)		22		42	5		14	85	9		167		
		PM	Volumes (vph)	15	5*	147	194	5*	24	237	580	225	23	548	21	B
			Level of Service		B		E	B		B	B	A		C		
			V/C Ratio by Movement		0.59		0.85	0.08		0.60	0.62	0.26		0.85		
			Queue Length (in metres)		21		54	7		38	125	10		194		
40 Ave N / Access #1	Stop-Controlled on Access	AM	Volumes (vph)	18	158			176	7	19		48				A
			Level of Service	A				A			B					
			V/C Ratio by Movement	0.02				0.12			0.10					
			Queue Length (in metres)	0				0			3					
		PM	Volumes (vph)	52	195			187	21	13		32				A
			Level of Service	A				A			B					
			V/C Ratio by Movement	0.04				0.14			0.08					
			Queue Length (in metres)	1				0			2					
40 Ave N / Internal N-S	Stop-Controlled on Side Streets	AM	Volumes (vph)	11	152	13	11	147	16	5	2	5	39	5	31	A
			Level of Service		A			A			B			B		
			V/C Ratio by Movement		0.01			0.01			0.02			0.14		
			Queue Length (in metres)		0			0			1			4		
		PM	Volumes (vph)	34	166	7	6	174	43	14	5	12	27	3	20	A
			Level of Service		A			A			B			B		
			V/C Ratio by Movement		0.03			0.00			0.07			0.11		
			Queue Length (in metres)		1			0			2			3		
40 Ave N / Access #3	Stop-Controlled on Access	AM	Volumes (vph)	6	190			158	6	16		17				A
			Level of Service	A				A			B					
			V/C Ratio by Movement	0.00				0.11			0.05					
			Queue Length (in metres)	0				0			1					
		PM	Volumes (vph)	19	186			213	19	11		11				A
			Level of Service	A				A			B					
			V/C Ratio by Movement	0.02				0.16			0.04					
			Queue Length (in metres)	0				0			1					
40 Ave N / Uplands Blvd N	Four-way Stop Conttrolled	AM	Volumes (vph)	106	32	69	55	47	35	37	199	26	17	157	80	B
			Level of Service		B			B			B			B		
			V/C Ratio by Movement		0.38			0.26			0.46			0.44		
			Queue Length (in metres)													
		PM	Volumes (vph)	93	52	52	33	28	21	88	177	53	34	216	116	B
			Level of Service		B			B			C			B		
			V/C Ratio by Movement		0.39			0.17			0.57			0.63		
			Queue Length (in metres)													

Notes:

1. 95th percentile queues are based on Synchro results.
2. Manually added volumes: 5*

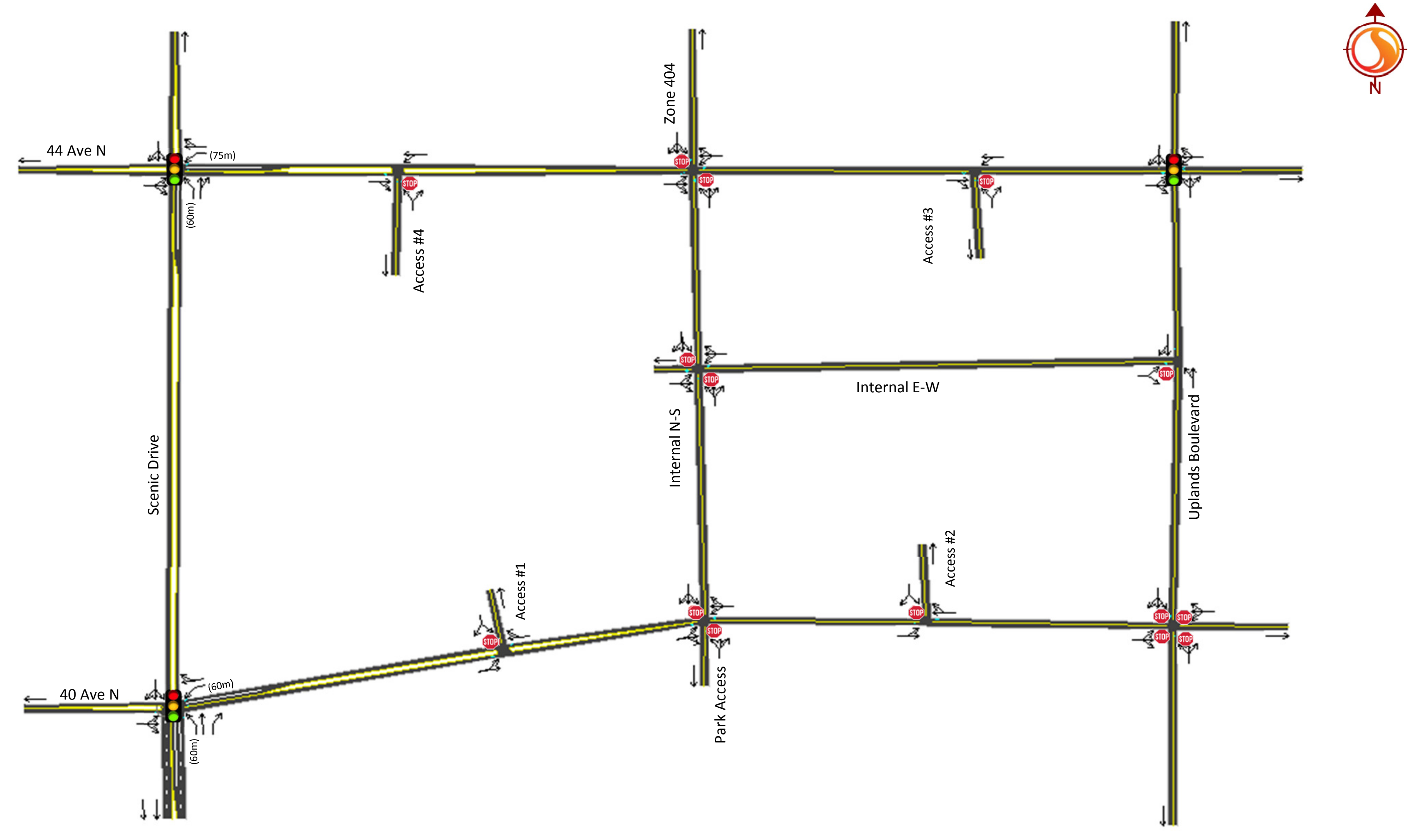
The results illustrated in Table 4.3 indicate the following:

- The Blackwolf Boulevard (40 Avenue) / Scenic Drive N intersection requires addition of a westbound left turn lane to accommodate the development of Blackwolf Stage 2. Based on this configuration, the intersection is anticipated to operate at acceptable levels of service during both the morning and afternoon peak hours. The following minimum storage lengths are recommended based on the analysis:
    - Northbound left turn lane – 60 meters
    - Westbound left turn lane – 60 meters
- The 44 Avenue / Scenic Drive N intersection will continue to operate at acceptable levels of service during both the morning and afternoon peak hours. The following minimum storage lengths are recommended based on the analysis:
    - Northbound left turn lane – 60 meters
    - Westbound left turn lane – 75 meters
- The 44 Avenue / Uplands intersection will continue to operate at acceptable levels of service during both the morning and afternoon peak hours. The analysis indicated that there will be notable westbound queuing (approaching 196m) during the afternoon peak hour. Based on this observation, the intersection was also analyzed using two additional configurations: first, with an added westbound left turn lane; second, with a single lane roundabout.

- Based on the results of the analysis for the two additional configurations, the intersection is anticipated to operate at an acceptable level of service during both the morning and afternoon peak hours. The following minimum storage length is recommended for the westbound left turn lane based on the analysis:
    - Westbound left turn lane – 60 meters
- The Blackwolf Boulevard / Uplands Boulevard intersection will continue to operate at acceptable levels of service during both the morning and afternoon peak hours.

- The internal intersections were analyzed assuming stop control on the minor/side-street approach (i.e. the approach onto either Blackwolf Boulevard, Uplands Boulevard, or 44 Avenue. The intersection in the middle of the development (identified as 'intersection 22' on the figures) was analyzed with stop control on the north and south legs of the intersection. Based on these configurations, all internal intersections are anticipated to operate at acceptable levels of service during both the morning and afternoon peak hours.

The recommended 2030 horizon post development lane configurations are shown in **Figure 4.1**.



Lethbridge Land

Blackwolf Stage 2

Transportation Impact Assessment

Legend

STOP **Stop Control** 🚦 **Traffic Signal**

(XXm) **Minimum Storage Length**

Figure 4.1

2030 Post Development Horizon

Recommended Lane Configurations

4.4 INTERNAL ROAD NETWORK CLASSIFICATION

The daily traffic volumes on the area road network were estimated by applying a factor of 10 to the PM peak hour volumes. Figure 4.2 illustrates the projected daily traffic volumes for the 2030 post development horizon.

The City of Lethbridge Design Guidelines classifies roadways into designations with the following daily vehicular traffic volumes:

- Arterial: > 15,000 vehicles per day (vpd)
- Super Collector: 2,000 – 15,000 vpd
- Community Entrance Road: 2,000 – 8,000 vpd
- Major Collector: 2,000 – 8,000 vpd
- Minor Collector Road: < 4,000 vpd
- Local Road: < 2,000 vpd

Based on the Outline Plan and the projected daily traffic volumes, the proposed roadway classifications are shown in **Figure 4.3**.

Scenic Drive N and 44 Avenue N fall within the recommended daily volume ranges for their classifications (Arterial and Super Collector, respectively). Uplands Boulevard and Blackwolf Boulevard fall within the range for a Major Collector roadway.

The section of Blackwolf Boulevard (40 Avenue) running through Blackwolf Stage 2 (at the north boundary of the regional park) could be considered for a potential community entrance road or custom standard if desired to enhance the atmosphere surrounding the park; however the road should be designed with characteristics/standards equivalent to a major collector, within a reasonable tolerance. The designated westbound left turn lane onto Scenic Drive should be maintained regardless of what standard is selected.

The internal roads within the development all fall within the recommended daily volume range for a local road. Consideration was made towards applying a minor collector standard in some locations, and ultimately was applied for the north/south road which connects Blackwolf Boulevard to 44 Avenue.

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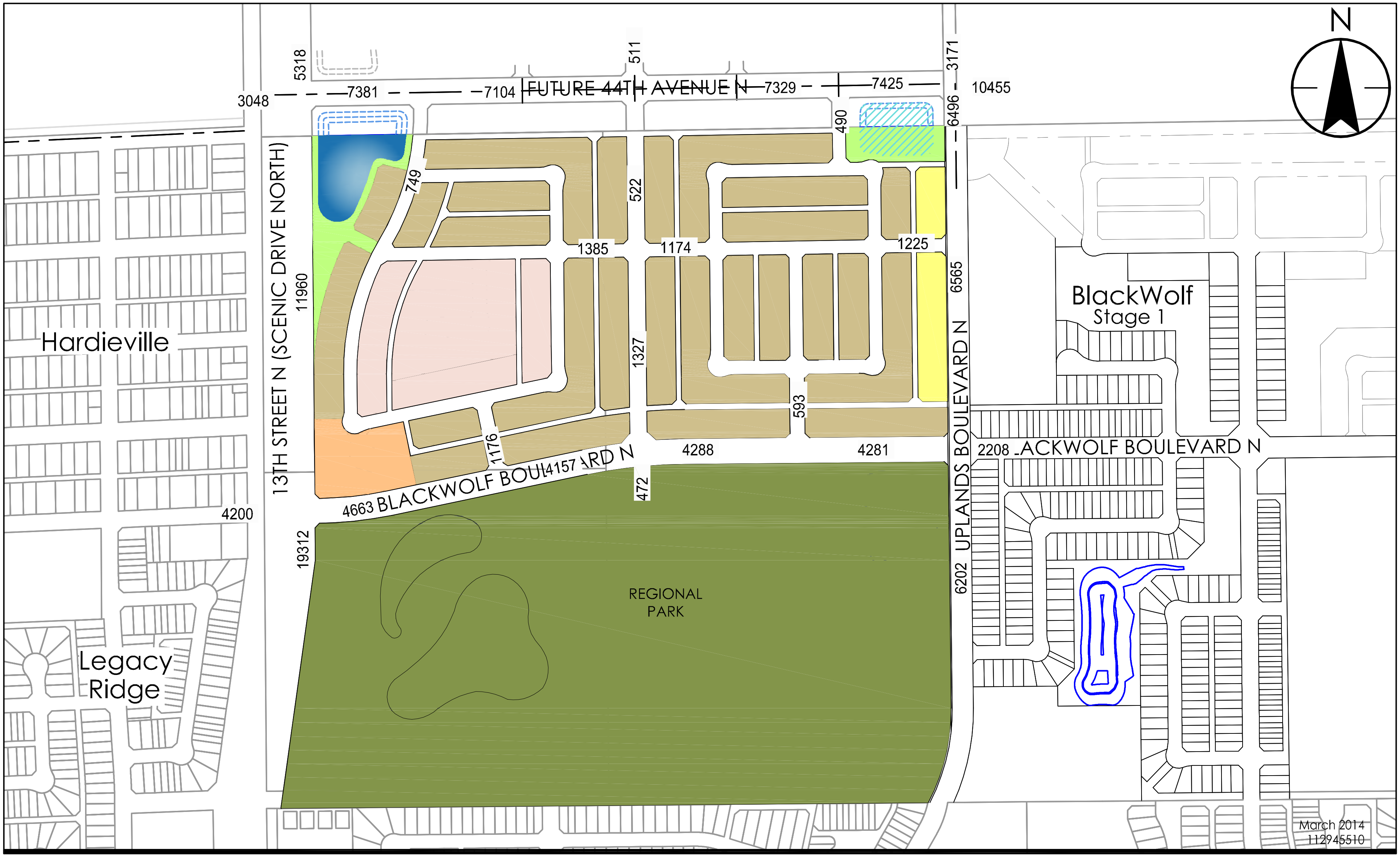
2014/03/18 5:12 PM By: Wang, Annie (Calgary)



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Fax. (403)-716-8129
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Legend:

internal Daily Two-way Traffic Volumes (vpd)

Client/Project

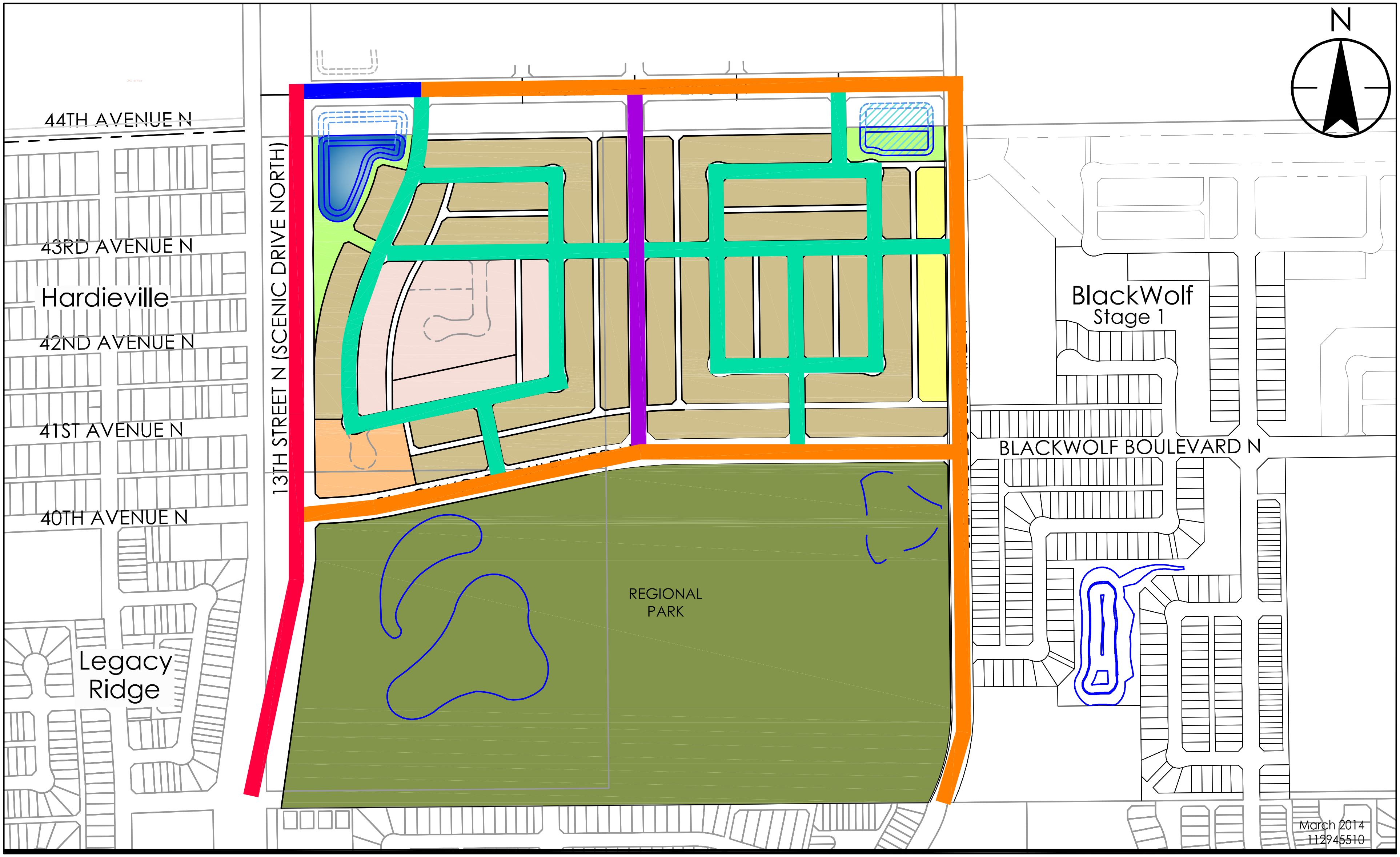
LETHBRIDGE LAND
BLACKWOLF STAGE 2
TRANSPORTATION IMPACT ASSESSMENT

Figure No.

4.2

Title

INTERNAL DAILY
TRAFFIC VOLUMES



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2014/04/15 3:11 PM By: Wang, Annie (Calgary)

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Legend:

- 🟩 Local Roadway
- 🟪 Minor Collector
- 🟧 Major Collector
- 🟦 Super Collector/ Community Entrance
- 🟥 Arterial Roadway

Client/Project

LETHBRIDGE LAND
BLACKWOLF STAGE 2
TRANSPORTATION IMPACT ASSESSMENT

Figure No.

4.3

Title

ROAD CLASSIFICATIONS

5.0 Transit and Active Modes

5.1 ACTIVE MODES CONSIDERATIONS

The proposed development is a greenfield site and will have pedestrian and cycling facilities implemented to facilitate active transportation in the area. At present 13 Street N (future Scenic Drive), the western border of the proposed development, has been constructed and is open to travelers.

Identifying destinations within a set walking or cycling distance allows for an assessment of the accessibility and potential for interaction within an area. Evaluating accessibility, as opposed to assessing mobility with transportation engineering measurements such as Level of Service and v/c ratios, enables a better understanding of the needs of active modes travelers (transit, cycle, walking) in the area.

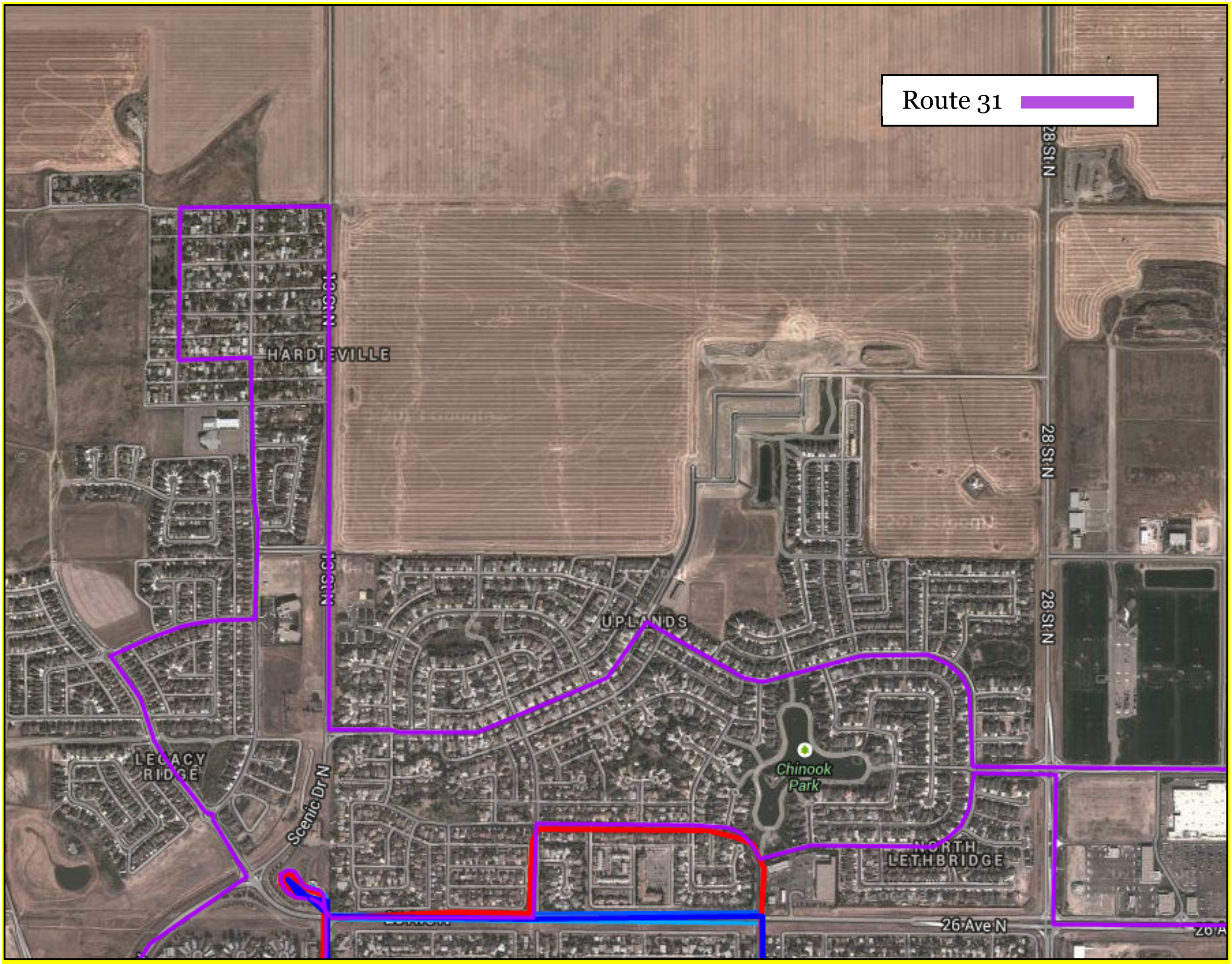
The Blackwolf Stage 2 proposed regional park is located on the south side of the outline plan area. The park is proposed to include a network of walking / cycling paths. The proposed network would include key connections across the boundary road network surrounding the park. A regional multi-use pathway is proposed along the northern and southern edges of the park. This will provide cycling and walking connectivity between Scenic Drive and Uplands Boulevard, also connecting the communities and amenities that serve them. A north-south multi-use pathway along Scenic Drive provides arterial cycling connectivity. **Outline Plan Figure 6.1** is included in Appendix E to illustrate the proposed Open Space Network.

Access to trails which run through the coulee adjacent the old man river exist within 1 km of the southwest boundary of the site. The access is located off Marie Van Haarlem Crescent in Legacy Ridge with potential existing accesses being implemented in Stage 3 of Legacy Ridge.

5.2 LOCAL TRANSIT SERVICE

The City of Lethbridge currently provides local transit service along Scenic Drive and the existing leg of Uplands Boulevard. Route 31 services lands adjacent to the proposed development. This route could be modified in a simple manner to serve the proposed community as well as those communities surrounding the proposed development. **Figure 5.1** highlights Route 31.

Figure 5.1 Existing Transit Network



6.0 Conclusions

The area road network was reviewed at the 2030 horizon based on the peak hour traffic volumes estimated using the methodologies described in the report. The following roads have been assumed to be constructed by the full-build horizon (2030):

- 44 Avenue from Scenic Drive to East of Uplands Boulevard (2-lane cross-section)
- 40 Avenue from Scenic Drive to Uplands Boulevard (2-lane cross-section)
- Uplands Boulevard from 40 Avenue to North of 44 Avenue (2-lane cross-section)

The results of the 2030 Horizon analysis suggested the following for each of the intersections reviewed:

- 40 Avenue (Blackwolf Boulevard)/Scenic Drive: the intersection is expected to operate at an acceptable level of service as a signalized intersection. A designated westbound left turn lane should be added to support development of Blackwolf Stage 2.
- 44 Avenue/Scenic Drive: the intersection is expected to operate at an acceptable level of service as a signalized intersection. Designated northbound and westbound left turn lanes should be considered to accommodate traffic demand for zones 301, 404, and 405.
- 44 Avenue/Uplands Boulevard: the intersection is expected to operate at an acceptable level of service as a signalized intersection. The analysis suggested there is potential for queuing on the westbound approach to the intersection. Consideration should be made towards implementing one of the alternatives suggested in the analysis (i.e. a single lane roundabout or addition of a designated westbound left turn lane) as a means of mitigating the potential for queuing.
- Blackwolf Boulevard/Uplands Boulevard: the intersection is expected to operate at an acceptable level of service as a four-way stop intersection.
- All Blackwolf Stage 2 internal area intersections were shown to operate within acceptable operational parameters as unsignalized intersections.

A review of the proposed road classifications was also undertaken. Scenic Drive N is classified as an arterial roadway. 44 Avenue is classified as a super collector. Uplands Boulevard and Blackwolf Boulevard (40 Avenue) are both classified as major collector roadways. Consideration may be given to implementing an “entrance road” standard or some type of custom standard to Blackwolf Boulevard within the outline plan boundary (running along the north side of the proposed regional park). These alternative classifications would be suitable, although the proposed road should be designed with equivalent standards to a major collector. Also, the ability to implement a designated westbound left turn lane onto Scenic Drive is recommended. The north/south road which connects Blackwolf Boulevard to 44 Avenue was recommended as a minor collector. All other internal roadways are recommended to local classification. Consideration for implementing minor collector standards to the internal roadways could be made, although standards above local are not warranted based on the analysis.

Appendix A Correspondence with City of Lethbridge

Wang, Annie (Calgary)

To: Wang, Annie (Calgary)
Subject: RE: Blackwolf Stage 2 TIA

From: Ahmed Ali [mailto:Ahmed.Ali@lethbridge.ca]
Sent: Tuesday, April 08, 2014 2:29 PM
To: Piechotta, Cole
Cc: Huber, Devin; Barry Peat; Joydip Majumder
Subject: RE: Blackwolf Stage 2 TIA

Cole,

We have reviewed the TIA and have a few minor comments:

- Section 4.3 including Table 4.3
    - Comment on long queue lengths i.e., 44 Ave N/Uplands Blvd W 196 m
    - The 60m left turn bay length recommended for the WB left turn at 44 Av N/Scenic Dr N is shorter than the post dev queue length of 74m in Table 4.3
- Show turn lane lengths in Figure 4.1
- Figure 4.3: Road classification
    - 44 Ave N to be Super Collector/Community Entrance up to the first connection east of Scenic Dr N with the remaining being shown as a major collector road
    - The N-S road in the center of the OP area shall be a minor collector road (will make good sense for a good network planning)

Please revise the report and send an electronic copy.
Thank you,
Ahmed

From: Piechotta, Cole [mailto:Cole.Piechotta@stantec.com]
Sent: March-21-14 6:17 PM
To: Ahmed Ali
Cc: Huber, Devin
Subject: Blackwolf Stage 2 TIA

Ahmed,

Please find attached the TIA for Blackwolf Stage 2, which Stantec/RELD have included as a component of the Gate 4 Submission for the Outline Plan.

We will be couriering hard copies to you next week.

If you have questions or comments, please don't hesitate to contact me.

Regards,

Cole

Cole Piechotta, P.Eng.
Transportation Engineer

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cole.piechotta@stantec.com

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From: Ahmed Ali <Ahmed.Ali@lethbridge.ca>
Sent: Thursday, February 13, 2014 10:01 AM
To: Piechotta, Cole
Cc: Huber, Devin; Schmidtke, Brad; Wang, Annie (Calgary)
Subject: RE: Blackwolf Stage 2 TIA Initial Sign-Off

Cole,

Here are a few comments on the scope and assumptions:

- 44 Ave N will be in place in the 10 year horizon
- Traffic to/from east of 26 Ave N will have multiple routes to use e.g., east to/from 44 Ave N, east to/from Blackwolf Blvd N and south to/from Uplands Blvd N. Please make appropriate changes to the trip distribution.

I am OK with other assumptions.

Thank you,
Ahmed

From: Piechotta, Cole [mailto:Cole.Piechotta@stantec.com]
Sent: January-31-14 11:42 AM
To: Ahmed Ali
Cc: Huber, Devin; Schmidtke, Brad; Wang, Annie (Calgary)
Subject: Blackwolf Stage 2 TIA Initial Sign-Off

Ahmed,

Please review the following proposed scope for the TIA for Blackwolf Stage 2. As discussed last week, we would appreciate a quick turnaround as we're trying to complete the study asap. If we can finalize this scope by next Friday (Feb. 7) I'd really appreciate it.

Items which may require a brief phone conversation to finalize include the following:

- Trip generation assumptions related to the regional park
- Staging of the development and timing for 44 Avenue
- Requirements for cycling and transit within the TIA

Proposed scope is as follows:

<u>Review Subject</u>

1. Site plan, development statistics:

   Characteristics of the development are as follows:

   - 345 low density units (R-L land use)
   - 33 medium density units (R-CM land use)

- 33 medium density units (R-37 land use)
- 166 mixed/medium density units (R-M) land use

- **345 low density units**
- **232 medium density units**

Attached for reference is **Figure 7.1 Proposed Land Use Designations** from the gate 3 submission**.**

2. Traffic impact study area:

   Location: north of Uplands Community, west of BlackWolf Stage 1, east of Scenic Drive North (current 13 Street North), south of future 44 Avenue North.

   The attached **Figure 2.2 Neighborhood Context Plan** from the gate 3 submission**,** illustrates the proposed site location within the context of North Lethbridge. The intersections we propose to review have been clouded. These include five intersections on Blackwolf Boulevard, five intersections on 44 Avenue, one intersection on Uplands Boulevard between Blackwolf Boulevard and 44 Avenue, and one intersection in the middle collector road between Blackwolf Boulevard and 44 Avenue.

3. Traffic analysis period(s):

   The weekday AM and PM peak hour period volumes will be analyzed. Daily Traffic Volumes will also be considered in order to confirm roadway classifications.

4. Planning horizons:

   A ten-year and a full-build horizon will be studied. Phasing details are to be confirmed in gate 4. Because timing for 44 Avenue may not be known at this time, we propose assumptions for the ten-year horizon includes developments of Blackwolf (City Zone 409) and Blackwolf 2 (Zone 408), with access primarily taken from Blackwold Boulevard and Uplands Boulevard. The full-build horizon in this case will include additional traffic related to zones 301, 404, 405 and a potential construction of 44 Avenue.

5. Trip generation factors: (review also pass-by, diverted and synergy trip rates):

   The following trip generation rates will be used:

Use	**AM Peak Hour**			**PM Peak Hour**		
		In	**Out**		**In**	**Out**
Low Density Residential	0.77 vph/unit	26%	74%	1.02 vph/unit	64%	36%
Medium Density Residential	0.75 vph/unit	29%	71%	0.92 vph/unit	61%	39%

*Assumptions related to the regional park to be confirmed.

Daily traffic volumes will be estimated by applying a factor of 10 to the PM peak hour volumes.

6. Basis for Trip Distribution:

   For the ten-year horizon:

   - 50% to/from east 26 Avenue (via 13 Street)
   - 40% to/from south Scenic Drive
   - 10% to/from north 13 Street

For the full-build horizon:

- 40% to/from east 26 Avenue (via 13 Street)
- 30% to/from south Scenic Drive
- 20% to/from east 44 Avenue
- 10% to/from north 13 Street

*some of the traffic to/from east 26 Avenue and south Scenic Drive will be assigned to the Uplands Boulevard entrance north of 26 Avenue

7. Source for Future Background Traffic:

   Similar to the 13 Street North/Hardieville Access Management Study:

   - Background traffic related to Legacy 1, Legacy 3, and Blackwolf will be based on previous TIAs
   - Background traffic related to additional developments north of 44 Avenue will be based on City population and employment forecasts

8. Assumed Road Improvements:

   Assumed the following road network at the ten-year horizon:

   - Scenic Drive North (13 Street) has a two-lane section
   - Blackwolf Boulevard connection to Scenic Drive North (north side of park) constructed (TIA to confirm requirements for this road)
   - Access to the development via Blackwolf Boulevard and Uplands Boulevard to/from the south is available

   Assumed the following additions to the road network at the full-build horizon:

   - Connections to/from 44 Avenue available

9. Traffic Analysis Software:

   Synchro 8 will be used to analyze signalized and unsignalized intersections; SIDRA Intersection 5.1 will be used to analyze roundabouts if required.

<u>Data Collection</u>

1. Existing Traffic Counts:

   The subdivision is located on an undeveloped parcel of land in North Lethbridge, and therefore it is not anticipated that additional counts of existing intersections will be required for analysis purposes.

2. Signal Timings:

   It is not anticipated that existing signal timings will be required for the study.

3. Bicycle Route Map:

   See attached "**Figure 6.1 Open Space Network**" from our gate 3 submission, which illustrates the local pathway system with connections to the regional system.

4. Bus Routes and Signs:

Transit routes are preferably placed on public collector roads. A route maybe placed on a local road either temporarily or permanently depending on the circumstance and at the discretion of the Transit Manager. Transit routes and stop locations will be determined as the neighbouhood develops and may be subject to change.

We would like to confirm TIA requirements for for cycling and transit: how much additional information should be included in the TIA? Can we reference the outline plan and the plans for the regional park or should we be including details within the TIA?

5. Local Parking Issues:

   Consideration of parking along major collector roadways to ensure access to higher standard adjacent roads (Arterial and Super Collectors) is compliant with City standards.

6. Local Traffic Issues:

   Review of site access road standards to ensure proper intersections and transitions are planned and to ensure that development roadways are engineered to function properly and as required.

Regards,

Cole

Cole Piechotta, P.Eng.
Transportation Engineer

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Appendix B Existing Traffic Count Information

INTERSECTION TRAFFIC FLOW ANALYSIS REPORT

ME2 TRANSPORTATION DATA CORP.

Location 12 Street & 40 Avenue

Date Wednesday 7 Mardh 2012

Observers MH

	FROM THE NORTH on						FROM THE SOUTH on						FROM THE EAST on						FROM THE WEST on					
time	12 Street						12 Street						40 Avenue						40 Avenue					
ending	LT	ST	RT	CV	PED	BIKE	LT	ST	RT	CV	PED	BIKE	LT	ST	RT	CV	PED	BIKE	LT	ST	RT	CV	PED	BIKE
7:15	0	1	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
7:30	0	0	0	0	0	0	1	0	1	1	0	0	1	0	0	1	0	0	0	1	1	0	2	0
7:45	1	0	0	0	0	0	1	1	1	2	0	0	1	0	0	0	0	0	0	2	0	0	0	0
8:00	0	1	0	0	0	0	1	0	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0
8:15	0	0	1	0	0	0	1	2	2	4	0	0	0	1	1	0	0	0	0	2	1	0	0	0
8:30	0	1	0	0	0	0	0	3	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
8:45	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0
9:00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0
2 hr total	1	3	1	0	0	0	4	8	7	11	0	0	5	2	1	1	0	0	0	9	2	0	3	0
		5		0%				19		58%				8		13%				11		0%		
peak hour	1	2	1				3	6	6				2	1	1				0	6	1			
		4						15						4						7				
4:15	0	1	0	0	0	0	2	1	1	3	0	0	1	0	1	0	0	0	0	2	1	0	0	0
4:30	0	2	0	0	0	0	3	1	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0
4:45	0	1	0	0	1	0	0	2	1	1	1	0	1	1	0	1	0	0	0	0	0	0	1	0
5:00	0	1	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30	2	2	0	0	0	0	2	1	1	0	0	0	0	4	1	0	1	0	0	1	1	0	0	0
5:45	2	0	0	0	0	0	0	2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
6:00	0	0	0	0	0	0	2	0	1	0	0	0	1	0	1	0	1	0	0	0	3	0	1	0
2 hr total	4	8	0	0	1	0	9	9	7	6	1	0	4	7	3	1	2	0	0	4	5	0	2	0
		12		0%				25		24%				14		7%				9		0%		
peak hour	4	3	0				4	4	3				2	4	2				0	1	4			
		7						11						8						5				
4 hour	5	11	1				13	17	14				9	9	4				0	13	7			
total		17						44						22						20				

INTERSECTION TRAFFIC FLOW ANALYSIS REPORT

ME2 TRANSPORTATION DATA CORP.

Location 13 Street & 41 Avenue
Date Wednesday 7 Mardh 2012
Observers LM

time	FROM THE NORTH on 13 Street						FROM THE SOUTH on 13 Street						FROM THE EAST on 41 Avenue						FROM THE WEST on 41 Avenue					
ending	LT	ST	RT	CV	PED	BIKE	LT	ST	RT	CV	PED	BIKE	LT	ST	RT	CV	PED	BIKE	LT	ST	RT	CV	PED	BIKE
7:15	0	5	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0
7:30	0	14	0	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0
7:45	0	21	0	4	0	0	2	6	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0
8:00	0	14	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0
8:15	0	19	0	3	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0
8:30	0	11	0	1	0	0	3	3	0	2	0	0	0	0	0	0	0	0	0	0	4	0	0	0
8:45	0	17	0	1	0	0	3	11	0	2	0	0	0	0	0	0	0	0	1	0	2	0	0	0
9:00	0	9	0	1	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
2 hr total	0	110	0	11	0	0	10	44	0	4	0	0	0	0	0	0	0	0	1	0	35	2	1	0
		110		10%				54		7%				0		#DIV/0!				36		6%		
peak hour	0	68	0				2	19	0				0	0	0				0	0	17			
		68						21						0						17				
4:15	0	17	0	3	0	0	7	25	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
4:30	0	11	0	0	0	0	2	13	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
4:45	0	10	1	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	4	0	2	0
5:00	0	12	1	2	0	0	5	19	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
5:15	0	17	0	1	0	0	6	26	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
5:30	0	11	0	0	0	0	1	34	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
5:45	0	12	0	1	0	0	5	16	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0
6:00	0	10	0	0	0	0	1	15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
2 hr total	0	100	2	7	0	0	27	166	0	1	0	0	0	0	0	0	0	0	0	0	14	1	3	0
		102		7%				193		1%				0		#DIV/0!				14		7%		
peak hour	0	52	1				17	95	0				0	0	0				0	0	7			
		53						112						0						7				
4 hour	0	210	2				37	210	0				0	0	0				1	0	49			
total		212						247						0						50				

INTERSECTION TRAFFIC FLOW ANALYSIS REPORT

ME2 TRANSPORTATION DATA CORP.

Location 13 Street & 42 Avenue Date Wednesday 7 Mardh 2012 Observers BP

time	FROM THE NORTH on 13 Street						FROM THE SOUTH on 13 Street						FROM THE EAST on 42 Avenue						FROM THE WEST on 42 Avenue					
ending	LT	ST	RT	CV	PED	BIKE	LT	ST	RT	CV	PED	BIKE	LT	ST	RT	CV	PED	BIKE	LT	ST	RT	CV	PED	BIKE
7:15	0	5	0	1	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
7:30	0	8	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	6	1	2	0
7:45	0	15	0	3	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0
8:00	0	7	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0
8:15	0	15	0	3	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	7	1	2	0
8:30	0	7	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
8:45	0	15	0	1	0	0	3	9	0	4	0	0	0	0	0	0	0	0	0	0	3	0	0	0
9:00	0	5	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	4	0	1	0
2 hr total	0	77	0	9	0	0	6	38	0	4	0	0	0	0	0	0	0	0	0	0	39	2	5	0
		77		12%				44		9%				0		#DIV/0!				39		5%		
peak hour	0	44	0				5	21	0				0	0	0				0	0	20			
		44						26						0						20				
4:15	0	16	0	3	0	0	5	19	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
4:30	0	11	0	0	0	0	1	13	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
4:45	0	11	0	0	0	0	3	15	0	0	1	0	0	0	0	0	0	0	0	0	2	0	1	0
5:00	0	9	0	2	1	0	8	11	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
5:15	0	15	0	1	0	0	6	18	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
5:30	0	9	0	0	0	0	5	25	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
5:45	0	8	0	1	0	0	2	15	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0
6:00	0	11	0	0	1	0	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 hr total	0	90	0	7	2	0	38	124	0	1	1	0	0	0	0	0	0	0	0	0	15	0	2	0
		90		8%				162		1%				0		#DIV/0!				15		0%		
peak hour	0	44	0				22	69	0				0	0	0				0	0	10			
		44						91						0						10				
4 hour	0	167	0				44	162	0				0	0	0				0	0	54			
total		167						206						0						54				

INTERSECTION TRAFFIC FLOW ANALYSIS REPORT

ME2 TRANSPORTATION DATA CORP.

Location 13 Street & 43 Avenue

Date Wednesday 7 Mardh 2012

Observers CB

time ending	FROM THE NORTH on 13 Street						FROM THE SOUTH on 13 Street						FROM THE EAST on 43 Avenue						FROM THE WEST on 43 Avenue					
	LT	ST	RT	CV	PED	BIKE	LT	ST	RT	CV	PED	BIKE	LT	ST	RT	CV	PED	BIKE	LT	ST	RT	CV	PED	BIKE
7:15	0	3	0	1	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	0	1	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
7:45	0	10	0	2	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0
8:00	0	5	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
8:15	0	10	1	1	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0
8:30	0	6	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
8:45	0	14	0	1	0	0	0	8	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	0	5	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2 hr total	0	54	1	6	0	0	7	28	0	4	0	0	0	0	0	0	0	1	0	0	18	2	0	0
		55		11%				35		11%				0		#DIV/0!				18		11%		
peak hour	0	35	1				3	17	0				0	0	0				0	0	9			
		36						20						0						9				
4:15	0	12	0	3	0	0	7	12	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
4:30	0	8	1	0	0	0	4	9	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
4:45	0	10	0	0	0	0	3	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00	0	8	0	3	0	0	3	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15	0	12	0	1	0	0	8	10	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
5:30	0	6	0	0	0	0	3	19	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
5:45	0	6	1	1	0	0	0	16	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0
6:00	0	9	0	0	0	0	2	7	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2 hr total	0	71	2	8	0	0	30	91	0	1	0	0	0	0	0	0	0	0	0	0	16	0	0	0
		73		11%				121		1%				0		#DIV/0!				16		0%		
peak hour	0	32	1				14	54	0				0	0	0				0	0	9			
		33						68						0						9				
4 hour	0	125	3				37	119	0				0	0	0				0	0	34			
total		128						156						0						34				

INTERSECTION TRAFFIC FLOW ANALYSIS REPORT

ME2 TRANSPORTATION DATA CORP.

Location 13 Street & 44 Avenue

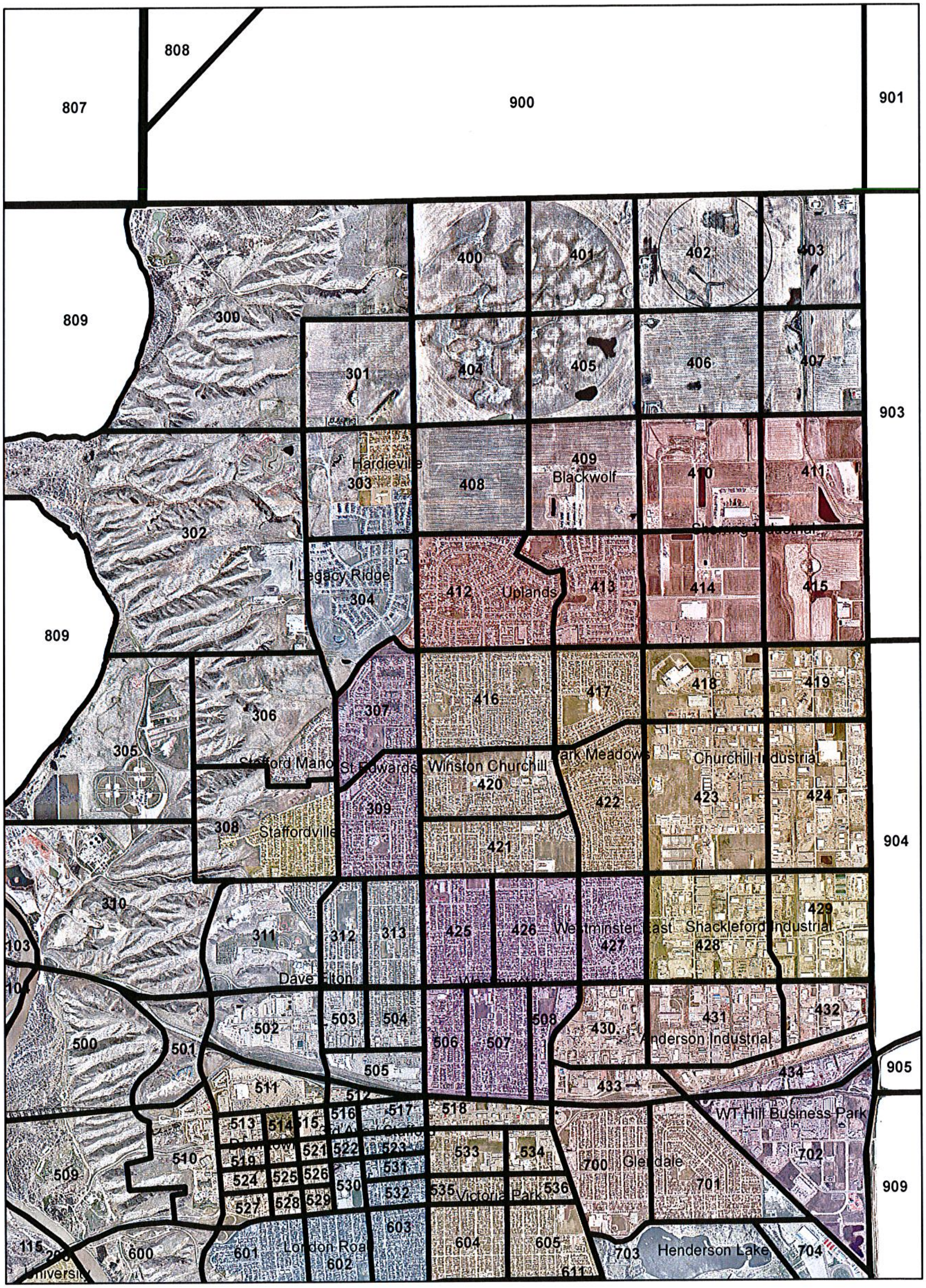
Date Wednesday 7 Mardh 2012

Observers DM

time	FROM THE NORTH on 13 Street						FROM THE SOUTH on 13 Street						FROM THE EAST on 44 Avenue						FROM THE WEST on 44 Avenue					
ending	LT	ST	RT	CV	PED	BIKE	LT	ST	RT	CV	PED	BIKE	LT	ST	RT	CV	PED	BIKE	LT	ST	RT	CV	PED	BIKE
7:15	0	2	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0
7:30	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
7:45	0	3	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	7	2	0	0
8:00	0	3	1	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
8:15	0	6	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0
8:30	0	6	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
8:45	0	8	0	0	0	0	2	7	0	4	0	0	0	0	0	0	0	0	0	0	5	1	0	0
9:00	0	4	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0
2 hr total	0	32	2	2	0	0	5	23	0	4	0	0	0	0	0	0	0	0	2	0	26	5	1	0
		34		6%				28		14%				0		#DIV/0!				28		18%		
peak hour	0	24	1				2	14	0				0	0	0				1	0	14			
		25						16						0						15				

4:15	0	5	0	2	0	0	4	7	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0
4:30	0	7	1	0	0	0	4	5	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
4:45	0	7	0	0	0	0	4	5	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
5:00	0	6	0	1	0	0	3	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0
5:15	0	8	0	0	0	0	3	7	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0
5:30	0	4	0	0	0	0	9	8	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
5:45	0	3	1	0	0	0	8	7	0	1	0	0	0	0	0	0	0	0	0	0	4	1	0	0
6:00	0	6	1	0	0	0	4	3	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
2 hr total	0	46	3	3	0	0	39	46	0	1	0	0	0	0	0	0	0	0	0	0	21	4	1	0
		49		6%				85		1%				0		#DIV/0!				21		19%		
peak hour	0	21	2				24	25	0				0	0	0				0	0	12			
		23						49						0						12				
4 hour	0	78	5				44	69	0				0	0	0				2	0	47			
total		83						113						0						49				

Appendix C City Transportation Zones and Population/Employment

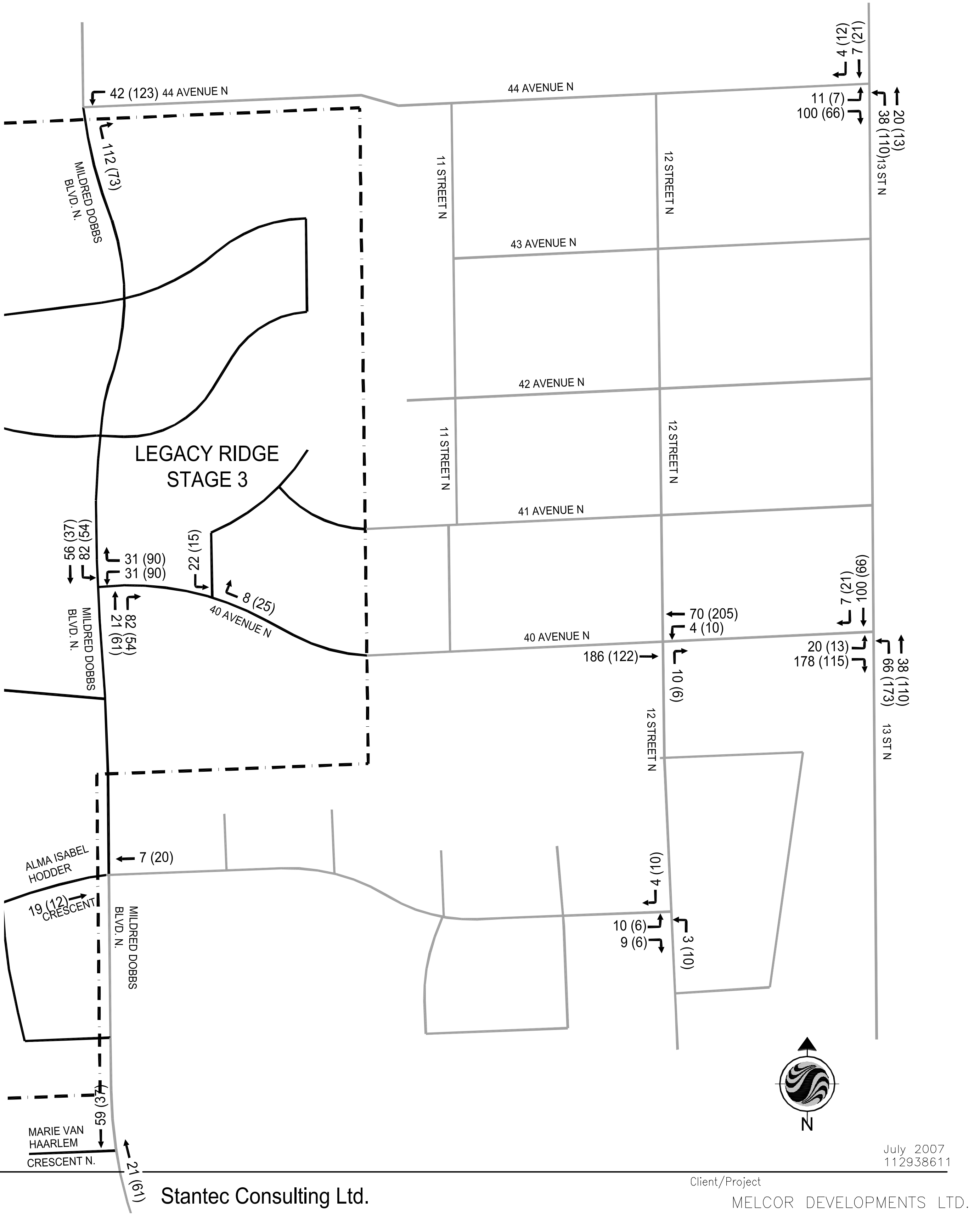


807
808
900
901
809
300
400
401
402
403
301
404
405
406
407
903
Hardieville
303
408
409
Blackwolf
410
411
302
Sherring Industrial
Legacy Ridge
304
412
Uplands
413
414
415
809
306
307
416
417
418
419
305
Stafford Manor
St Edwards
Winston Churchill
Park Meadows
Churchill Industrial
420
422
423
424
308
Staffordville
309
421
904
310
311
312
313
425
426
Westminster East
427
Shackleford Industrial
428
429
103
Dave Elton
104
502
503
504
506
507
508
430
431
Anderson Industrial
432
500
501
505
434
905
511
512
433
518
513
514
515
516
517
WT Hill Business Park
510
Downtown
521
522
523
533
534
702
509
519
531
700
Glendale
701
909
524
525
526
530
532
535
Victoria Park
536
527
528
529
603
601
London Road
602
604
605
703
Henderson Lake
704
115
University
600
611

TZone	Total Population 2012	Total Population 2020	Total Population 2040
300	0	0	0
301	0	49	1800
302	0	627	627
303	934	1867	1850
304	785	1246	1059
400		0	0
401		0	0
402		0	0
403		0	0
404		0	886
405		0	886
406		0	0
407		0	0
408		384	576
409		1348	2983
410		0	0
411		0	0
412		2322	2322
413		1524	1410
414		0	0
415		0	0

TZone	District	Total Employement 2020	Total Employement 2040
300	3 North West	0	0
301	3 North West	0	47
302	3 North West	17	17
303	3 North West	83	95
304	3 North West	190	184
400	4 North East	0	0
401	4 North East	0	0
402	4 North East	10	188
403	4 North East	145	333
404	4 North East	0	84
405	4 North East	0	24
406	4 North East	0	847
407	4 North East	0	847
408	4 North East	10	41
409	4 North East	36	81
410	4 North East	993	1224
411	4 North East	365	381
412	4 North East	34	34
413	4 North East	241	268
414	4 North East	930	1288
415	4 North East	426	641

Appendix D Adjacent Development Information



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2007-10-02 02:42PM By: bhay

July 2007
112938611

Stantec Consulting Ltd.

290, 220 – 4th Street S.
Lethbridge AB Canada
T1J 4J7
Tel. 403.329.3344
Fax. 403.328.0664
www.stantec.com

Client/Project

MELCOR DEVELOPMENTS LTD.
LEGACY RIDGE
TRAFFIC IMPACT ASSESSMENT

Figure No.

4.2

Title

2037 DEVELOPMENT TRAFFIC VOLUMES

6.2 Site Trip Generation

The Site trip generation for each zone was calculated based on the densities summarized in **Section 2.1.2** and is summarized in **Table 6-1**.

Table 6-1: Site Peak Hour Trip Generation

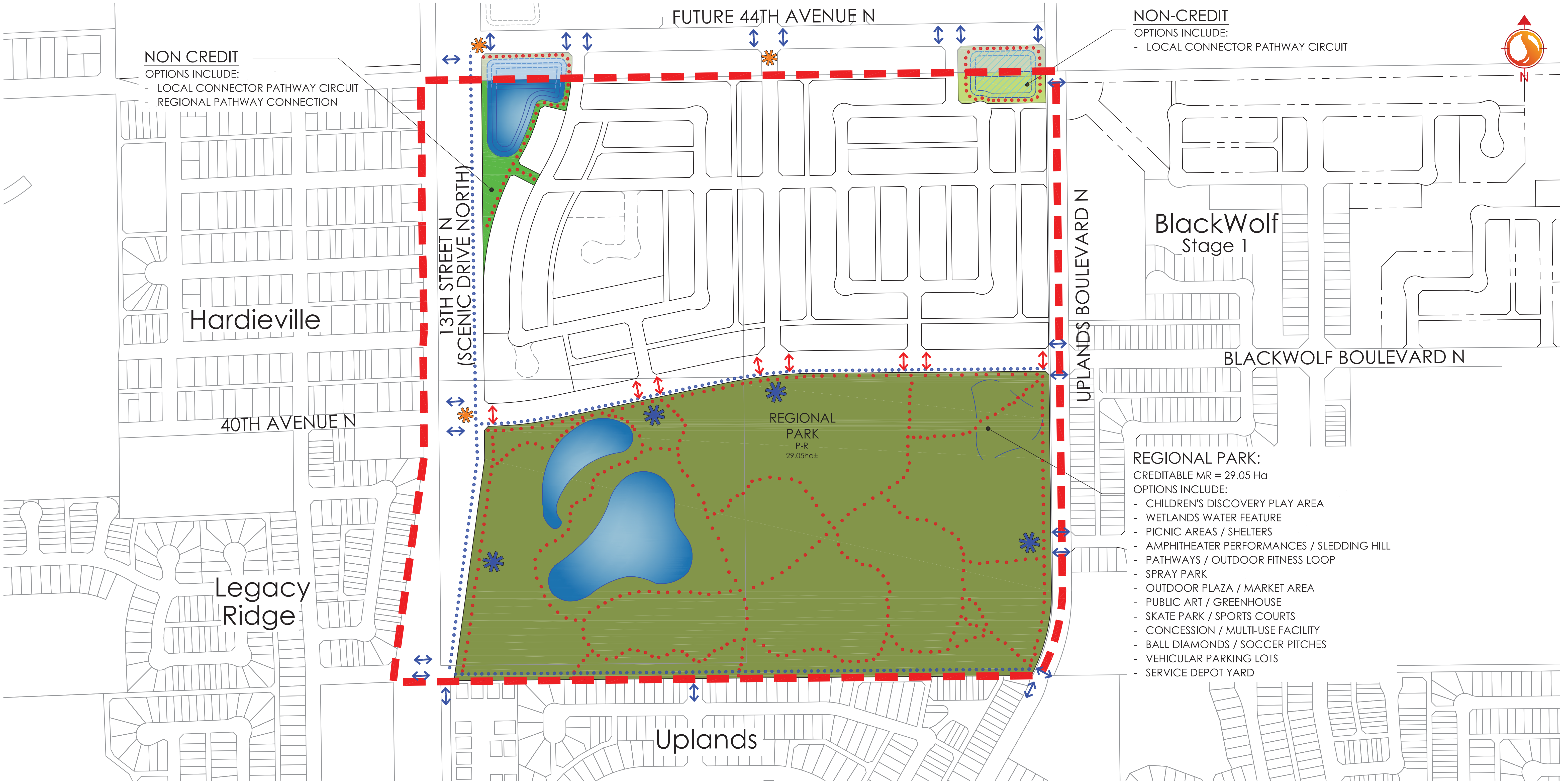
Land Use	Density (units)	a.m.						p.m.					
		Rate	Split (%)		Trips			Rate	Split (%)		Trips		
			in	out	in	out	total		in	out	in	out	total
Zone 1													
SF	141	0.77	26	74	28	81	109	1.02	64	36	92	52	144
MF	253	0.75	29	71	55	135	190	0.92	61	39	142	91	233
Total					83	216	299				234	143	377
Zone 2													
SF	301	0.77	26	74	60	172	232	1.02	64	36	196	111	307
Total					60	172	232				196	111	307
Zone 3													
SF	157	0.77	26	74	31	90	121	1.02	64	36	102	58	160
MF	18	0.75	29	71	4	10	14	0.92	61	39	10	7	17
School	400	0.42	55	45	92	76	168	0.07	20	80	6	22	28
Total					127	176	303				118	87	205
Site Total					270	564	834				548	341	889

SF – Single Family
MF – Multi Family

The trip generation rates for the single family and multi family land uses are taken from the City TIS guidelines. The trip generation rates for the other land uses are taken from the *Institute of Transportation Engineers (ITE) Trip Generation* informational report and the higher or the formula or rate was used. If the formula was used the rate was back calculated from the total trips.

Daily trip generation was also calculated using the ITE information report and the corresponding rates and trips are summarized in **Table 6-2**.

Appendix E   Outline Plan Information



NON CREDIT
OPTIONS INCLUDE:
- LOCAL CONNECTOR PATHWAY CIRCUIT
- REGIONAL PATHWAY CONNECTION

NON-CREDIT
OPTIONS INCLUDE:
- LOCAL CONNECTOR PATHWAY CIRCUIT

REGIONAL PARK:
CREDITABLE MR = 29.05 Ha
OPTIONS INCLUDE:
- CHILDREN'S DISCOVERY PLAY AREA
- WETLANDS WATER FEATURE
- PICNIC AREAS / SHELTERS
- AMPHITHEATER PERFORMANCES / SLEDDING HILL
- PATHWAYS / OUTDOOR FITNESS LOOP
- SPRAY PARK
- OUTDOOR PLAZA / MARKET AREA
- PUBLIC ART / GREENHOUSE
- SKATE PARK / SPORTS COURTS
- CONCESSION / MULTI-USE FACILITY
- BALL DIAMONDS / SOCCER PITCHES
- VEHICULAR PARKING LOTS
- SERVICE DEPOT YARD

NTS

Stantec
Design with community in mind

Lethbridge Land
Community focus. Built with integrity.

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December 23, 2013

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LEGEND

🟥 BlackWolf Stage 2 Boundary
🟩 Parks & Recreation (P-R)
🟩 Open Space Non-Credit (OS n/c)
🟦 Stormwater Management Facility (Wet Pond)
🟩 Stormwater Management Facility (Dry Pond)

• • • • • • Local Connector Pathways
• • • • • • Regional Multi-Use Pathway
↔ BlackWolf Boulevard Pedestrian Crosswalks
↔ Cross Neighborhood Pedestrian Connections

✱ Themed Gateway Entrance to Regional Park
✱ Community Entry and Theme Elements

BLACKWOLF STAGE 2 | FIGURE 6.1

Outline Plan

Open Space Network

PREPARED FOR: CITY OF LETHBRIDGE - RELD

🟨 Comprehensively Planned Medium Residential (R-CM)
🟫 Low Density Residential (R-L)
🟧 Medium Density Residential (R-37)
▨ Mixed Density Residential (R-M)
🟩 Parks and Recreation (P-R)
🟩 Open Space - Non Credit (OS n/c)
🟦 Storm Water Management (to HWL)

Gross Area	67.28 ha±
Environmental Reserve	0.00 ha±
Gross Developable Area (GDA)	67.28 ha±

Public Land Use	Area
Public Right of Ways (R/W)	17.66 ha±
Open Space (P-R)	29.05 ha±
O-S (non-credit) incl. SWMF to HWL	1.68 ha±
Public Sub Total	48.39 ha±
Net Developable Area (NDA)	18.89 ha±

Residential Land Use	Area	UPH	Total Units
Low Density (R-L)	13.8 ha±	25	345
Comprehensively Planned Medium Residential (R-CM)	0.88 ha±	37	33
Medium Density (R-37)	0.90 ha±	37	33
Mixed Density Residential (R-M)	3.31 ha±	50	166
Residential Sub Total	18.89 ha±		577
Total	67.28 ha±		

People/NDA = 76/ha
Dwelling Units/NDA = 30/ha

NTS

Stantec
Design with community in mind

Lethbridge Land
Community focus. Built with integrity.

112945510
December 23, 2013

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BLACKWOLF STAGE 2 | FIGURE 7.1

Outline Plan

Proposed Land Use Designations

PREPARED FOR: CITY OF LETHBRIDGE - RELD

Appendix F   Synchro and SIDRA Reports

14: 40 Ave N & Uplands Boulevard N

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	88	32	3	55	47	35	4	186	26	17	123	58
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	100	36	3	62	53	40	5	211	30	19	140	66

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	140	156	245	225
Volume Left (vph)	100	63	5	19
Volume Right (vph)	3	40	30	66
Hadj (s)	0.16	-0.04	-0.03	-0.12
Departure Headway (s)	5.5	5.3	5.0	5.0
Degree Utilization, x	0.21	0.23	0.34	0.31
Capacity (veh/h)	589	614	664	675
Control Delay (s)	10.0	9.9	10.6	10.2
Approach Delay (s)	10.0	9.9	10.6	10.2
Approach LOS	B	A	B	B

Intersection Summary			
Delay	10.2		
HCM Level of Service	B		
Intersection Capacity Utilization	40.9%	ICU Level of Service	A
Analysis Period (min)	15		

Blackwolf Stage 2 2030 Horizon Background Volumes AM Peak
10: 40 Ave N & Scenic Drive N 3/19/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑	↱		✥	
Volume (vph)	22	5	240	98	5	11	79	438	106	16	473	7
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	60.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	1		1	0		0
Taper Length (m)	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.97			0.99		1.00		0.97		1.00	
Frt		0.879			0.987				0.850		0.998	
Flt Protected		0.996			0.959		0.950				0.998	
Satd. Flow (prot)	0	1481	0	0	1633	0	1601	1685	1432	0	1678	0
Flt Permitted		0.965			0.418		0.350				0.980	
Satd. Flow (perm)	0	1434	0	0	709	0	588	1685	1391	0	1647	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		273			8				120		1	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		115.6			261.4			530.0			459.6	
Travel Time (s)		8.3			18.8			38.2			33.1	
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	5%	5%	5%	5%	5%	5%	5%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	25	6	273	111	6	12	90	498	120	18	538	8
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	304	0	0	129	0	90	498	120	0	564	0
Turn Type	Perm			Perm			pm+pt		Perm	Perm		
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		8	8		5	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	20.0	20.0	20.0	20.0	
Minimum Split (s)	25.5	25.5		25.5	25.5		12.0	25.0	25.0	25.0	25.0	
Total Split (s)	25.5	25.5	0.0	25.5	25.5	0.0	12.0	39.5	39.5	27.5	27.5	0.0
Total Split (%)	39.2%	39.2%	0.0%	39.2%	39.2%	0.0%	18.5%	60.8%	60.8%	42.3%	42.3%	0.0%
Maximum Green (s)	20.0	20.0		20.0	20.0		9.0	34.5	34.5	22.5	22.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.0	3.5	3.5	3.5	3.5	
All-Red Time (s)	2.0	2.0		2.0	2.0		0.0	1.5	1.5	1.5	1.5	
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)	5.5	5.5	4.0	5.5	5.5	4.0	3.0	5.0	5.0	5.0	5.0	4.0
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Recall Mode	None	None		None	None		None	C-Min	C-Min	C-Min	C-Min	
Walk Time (s)	8.0	8.0		8.0	8.0			8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0			10.0	10.0	10.0	10.0	
Pedestrian Calls (#/hr)	5	5		5	5			5	5	5	5	
Act Effct Green (s)		14.6			14.6		41.9	39.9	39.9		31.7	
Actuated g/C Ratio		0.22			0.22		0.64	0.61	0.61		0.49	
v/c Ratio		0.57			0.78		0.19	0.48	0.13		0.70	
Control Delay		8.4			51.7		6.5	9.9	2.1		21.7	
Queue Delay		0.0			0.0		0.0	0.0	0.0		0.0	
Total Delay		8.4			51.7		6.5	9.9	2.1		21.7	
LOS		A			D		A	A	A		C	
Approach Delay		8.4			51.7			8.2			21.7	
Approach LOS		A			D			A			C	
Queue Length 50th (m)		3.0			13.8		3.4	28.2	0.0		42.8	
Queue Length 95th (m)		17.2			#31.4		9.7	58.8	5.8		#116.8	
Internal Link Dist (m)		91.6			237.4			506.0			435.6	
Turn Bay Length (m)							60.0					
Base Capacity (vph)		630			224		519	1033	900		803	
Starvation Cap Reductn		0			0		0	0	0		0	
Spillback Cap Reductn		0			0		0	0	0		0	
Storage Cap Reductn		0			0		0	0	0		0	
Reduced v/c Ratio		0.48			0.58		0.17	0.48	0.13		0.70	

Intersection Summary

Area Type: Other

Cycle Length: 65

Actuated Cycle Length: 65

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green, Master Intersection

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.78

Intersection Signal Delay: 16.0 Intersection LOS: B

Intersection Capacity Utilization 89.2% ICU Level of Service E

Analysis Period (min) 15

\# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 10: 40 Ave N & Scenic Drive N

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥		↰	↱		↰	↱			✥	
Volume (vph)	12	10	143	175	3	35	50	92	328	49	176	6
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	60.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	0		0	1		0	1		0	0		0
Taper Length (m)	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.98		0.99	0.97		0.99	0.98			1.00	
Frt		0.883			0.860			0.883			0.996	
Flt Protected		0.996		0.950			0.950				0.989	
Satd. Flow (prot)	0	1489	0	1601	1412	0	1601	1455	0	0	1659	0
Flt Permitted		0.977		0.445			0.603				0.844	
Satd. Flow (perm)	0	1459	0	746	1412	0	1011	1455	0	0	1415	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		162			40			304			2	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		159.6			175.9			459.6			82.0	
Travel Time (s)		11.5			12.7			33.1			5.9	
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	14	11	162	199	3	40	57	105	373	56	200	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	187	0	199	43	0	57	478	0	0	263	0
Turn Type	Perm			pm+pt			Perm			Perm		
Protected Phases		4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		20.0	20.0		20.0	20.0	
Minimum Split (s)	25.0	25.0		12.0	25.0		25.0	25.0		25.0	25.0	
Total Split (s)	25.0	25.0	0.0	12.0	37.0	0.0	28.0	28.0	0.0	28.0	28.0	0.0
Total Split (%)	38.5%	38.5%	0.0%	18.5%	56.9%	0.0%	43.1%	43.1%	0.0%	43.1%	43.1%	0.0%
Maximum Green (s)	20.0	20.0		9.0	32.0		23.0	23.0		23.0	23.0	
Yellow Time (s)	3.5	3.5		3.0	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.5	1.5		0.0	1.5		1.5	1.5		1.5	1.5	
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)	5.0	5.0	4.0	3.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	None		None	None		C-Min	C-Min		C-Min	C-Min	
Walk Time (s)	8.0	8.0			8.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	12.0	12.0			12.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	5	5			5		5	5		5	5	
Act Effct Green (s)		12.0		26.5	24.5		30.5	30.5			30.5	
Actuated g/C Ratio		0.18		0.41	0.38		0.47	0.47			0.47	
v/c Ratio		0.47		0.46	0.08		0.12	0.57			0.40	
Control Delay		9.5		15.9	4.5		14.3	9.2			14.9	
Queue Delay		0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay		9.5		15.9	4.5		14.3	9.2			14.9	
LOS		A		B	A		B	A			B	
Approach Delay		9.5			13.8			9.7			14.9	
Approach LOS		A			B			A			B	
Queue Length 50th (m)		2.6		15.9	0.3		3.0	7.6			19.0	
Queue Length 95th (m)		13.8		21.7	4.1		m9.3	34.5			43.2	
Internal Link Dist (m)		135.6			151.9			435.6			58.0	
Turn Bay Length (m)				60.0			60.0					
Base Capacity (vph)		561		435	715		474	844			665	
Starvation Cap Reductn		0		0	0		0	0			0	
Spillback Cap Reductn		0		0	0		0	0			0	
Storage Cap Reductn		0		0	0		0	0			0	
Reduced v/c Ratio		0.33		0.46	0.06		0.12	0.57			0.40	

Intersection Summary

Area Type: Other

Cycle Length: 65

Actuated Cycle Length: 65

Offset: 10 (15%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 65

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.57

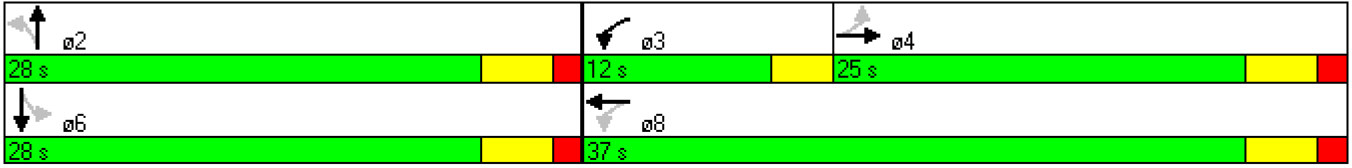
Intersection Signal Delay: 11.6 Intersection LOS: B

Intersection Capacity Utilization 84.6% ICU Level of Service E

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 30: 44 Ave N & Scenic Drive N



Blackwolf Stage 2 2030 Horizon Background Volumes
AM Peak

34: 44 Ave N & Uplands Boulevard N
3/19/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (vph)	7	375	20	94	177	31	12	114	182	21	83	21
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	60.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			1.00			0.98			0.99	
Frt		0.993			0.986			0.920			0.977	
Flt Protected		0.999			0.985			0.998			0.992	
Satd. Flow (prot)	0	1669	0	0	1632	0	0	1566	0	0	1673	0
Flt Permitted		0.993			0.786			0.985			0.920	
Satd. Flow (perm)	0	1659	0	0	1301	0	0	1546	0	0	1551	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			12			140			20	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		154.8			151.2			164.3			51.5	
Travel Time (s)		11.1			10.9			11.8			3.7	
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	8	426	23	107	201	35	14	130	207	24	94	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	457	0	0	343	0	0	351	0	0	142	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	20.0	20.0		20.0	20.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	25.0	25.0		25.0	25.0		23.0	23.0		23.0	23.0	
Total Split (s)	32.0	32.0	0.0	32.0	32.0	0.0	28.0	28.0	0.0	28.0	28.0	0.0
Total Split (%)	53.3%	53.3%	0.0%	53.3%	53.3%	0.0%	46.7%	46.7%	0.0%	46.7%	46.7%	0.0%
Maximum Green (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
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)	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	

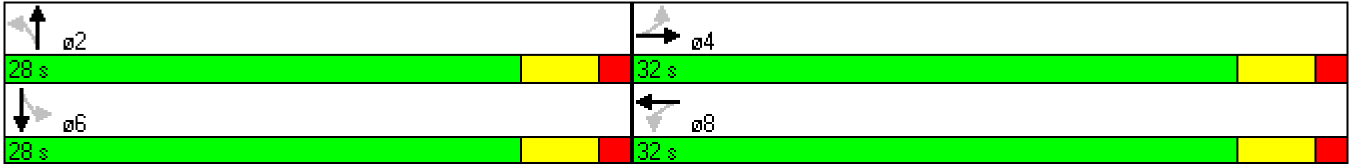
34: 44 Ave N & Uplands Boulevard N

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	8.0	8.0		8.0	8.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	5	5		5	5		5	5		5	5	
Act Effct Green (s)		21.5			21.5			12.9			12.9	
Actuated g/C Ratio		0.48			0.48			0.29			0.29	
v/c Ratio		0.57			0.54			0.64			0.31	
Control Delay		12.4			12.6			14.3			12.9	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		12.4			12.6			14.3			12.9	
LOS		B			B			B			B	
Approach Delay		12.4			12.6			14.3			12.9	
Approach LOS		B			B			B			B	
Queue Length 50th (m)		19.7			14.1			12.4			6.7	
Queue Length 95th (m)		54.7			43.0			35.3			18.7	
Internal Link Dist (m)		130.8			127.2			140.3			27.5	
Turn Bay Length (m)												
Base Capacity (vph)		1027			808			879			825	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.44			0.42			0.40			0.17	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 44.6
Natural Cycle: 50
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.64
Intersection Signal Delay: 13.0 Intersection LOS: B
Intersection Capacity Utilization 74.4% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 34: 44 Ave N & Uplands Boulevard N



14: 40 Ave N & Uplands Boulevard N

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	65	52	2	33	28	21	14	139	53	34	194	91
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	74	59	2	38	32	24	16	158	60	39	220	103

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	135	93	234	363
Volume Left (vph)	74	38	16	39
Volume Right (vph)	2	24	60	103
Hadj (s)	0.13	-0.04	-0.11	-0.12
Departure Headway (s)	5.7	5.6	4.9	4.8
Degree Utilization, x	0.21	0.14	0.32	0.48
Capacity (veh/h)	567	564	685	721
Control Delay (s)	10.2	9.5	10.3	12.1
Approach Delay (s)	10.2	9.5	10.3	12.1
Approach LOS	B	A	B	B

Intersection Summary			
Delay	11.0		
HCM Level of Service	B		
Intersection Capacity Utilization	46.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣		↰	↑	↱		✣	
Volume (vph)	15	5	147	115	5	19	237	552	104	15	532	21
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	60.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	1		1	0		0
Taper Length (m)	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.97			0.99				0.97		1.00	
Frt		0.881			0.981				0.850		0.995	
Flt Protected		0.996			0.960		0.950				0.999	
Satd. Flow (prot)	0	1479	0	0	1626	0	1601	1685	1432	0	1673	0
Flt Permitted		0.964			0.510		0.328				0.979	
Satd. Flow (perm)	0	1430	0	0	858	0	553	1685	1384	0	1639	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		167			8				118		3	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		115.6			261.4			530.0			459.6	
Travel Time (s)		8.3			18.8			38.2			33.1	
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	5%	5%	5%	5%	5%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	17	6	167	131	6	22	269	627	118	17	605	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	190	0	0	159	0	269	627	118	0	646	0
Turn Type	Perm			Perm			pm+pt		Perm	Perm		
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		8	8		5	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		12.0	20.0	20.0	20.0	20.0	
Minimum Split (s)	25.5	25.5		25.5	25.5		15.0	25.0	25.0	25.0	25.0	
Total Split (s)	35.0	35.0	0.0	35.0	35.0	0.0	15.0	65.0	65.0	50.0	50.0	0.0
Total Split (%)	35.0%	35.0%	0.0%	35.0%	35.0%	0.0%	15.0%	65.0%	65.0%	50.0%	50.0%	0.0%
Maximum Green (s)	29.5	29.5		29.5	29.5		12.0	60.0	60.0	45.0	45.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.0	3.5	3.5	3.5	3.5	
All-Red Time (s)	2.0	2.0		2.0	2.0		0.0	1.5	1.5	1.5	1.5	
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)	5.5	5.5	4.0	5.5	5.5	4.0	3.0	5.0	5.0	5.0	5.0	4.0
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Recall Mode	None	None		None	None		None	C-Min	C-Min	C-Min	C-Min	
Walk Time (s)	8.0	8.0		8.0	8.0			8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	12.0	12.0		12.0	12.0			10.0	10.0	10.0	10.0	
Pedestrian Calls (#/hr)	5	5		5	5			5	5	5	5	
Act Effct Green (s)		20.4			20.4		71.1	69.1	69.1		53.7	
Actuated g/C Ratio		0.20			0.20		0.71	0.69	0.69		0.54	
v/c Ratio		0.45			0.87		0.52	0.54	0.12		0.73	
Control Delay		10.0			75.7		9.9	11.2	1.8		19.7	
Queue Delay		0.0			0.0		0.0	0.0	0.0		0.0	
Total Delay		10.0			75.7		9.9	11.2	1.8		19.7	
LOS		A			E		A	B	A		B	
Approach Delay		10.0			75.7			9.8			19.7	
Approach LOS		A			E			A			B	
Queue Length 50th (m)		3.6			28.6		15.8	53.2	0.0		43.4	
Queue Length 95th (m)		17.9			46.1		33.6	101.5	6.1		#164.4	
Internal Link Dist (m)		91.6			237.4			506.0			435.6	
Turn Bay Length (m)							60.0					
Base Capacity (vph)		540			259		522	1164	992		882	
Starvation Cap Reductn		0			0		0	0	0		0	
Spillback Cap Reductn		0			0		0	0	0		0	
Storage Cap Reductn		0			0		0	0	0		0	
Reduced v/c Ratio		0.35			0.61		0.52	0.54	0.12		0.73	

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green, Master Intersection
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 18.2 Intersection LOS: B
Intersection Capacity Utilization 103.8% ICU Level of Service G
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 10: 40 Ave N & Scenic Drive N

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥		↰	↱		↰	↱			✥	
Volume (vph)	7	6	97	328	11	57	167	205	198	46	139	16
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	60.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	0		0	1		0	1		0	0		0
Taper Length (m)	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.97		0.99	0.97		0.99	0.98			1.00	
Frt		0.881			0.873			0.926			0.989	
Flt Protected		0.997		0.950			0.950				0.989	
Satd. Flow (prot)	0	1480	0	1601	1431	0	1601	1535	0	0	1644	0
Flt Permitted		0.979		0.414			0.610				0.837	
Satd. Flow (perm)	0	1453	0	692	1431	0	1019	1535	0	0	1390	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		110			65			61			5	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		159.6			175.9			459.6			82.0	
Travel Time (s)		11.5			12.7			33.1			5.9	
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	8	7	110	373	12	65	190	233	225	52	158	18
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	125	0	373	77	0	190	458	0	0	228	0
Turn Type	Perm			pm+pt			Perm			Perm		
Protected Phases		4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		20.0	20.0		20.0	20.0	
Minimum Split (s)	25.0	25.0		12.0	25.0		25.0	25.0		25.0	25.0	
Total Split (s)	25.0	25.0	0.0	27.0	52.0	0.0	48.0	48.0	0.0	48.0	48.0	0.0
Total Split (%)	25.0%	25.0%	0.0%	27.0%	52.0%	0.0%	48.0%	48.0%	0.0%	48.0%	48.0%	0.0%
Maximum Green (s)	20.0	20.0		24.0	47.0		43.0	43.0		43.0	43.0	
Yellow Time (s)	3.5	3.5		3.0	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.5	1.5		0.0	1.5		1.5	1.5		1.5	1.5	
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)	5.0	5.0	4.0	3.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	None		None	None		C-Min	C-Min		C-Min	C-Min	
Walk Time (s)	8.0	8.0			8.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	12.0	12.0			12.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	5	5			5		5	5		5	5	
Act Effct Green (s)		12.0		40.0	38.0		52.0	52.0			52.0	
Actuated g/C Ratio		0.12		0.40	0.38		0.52	0.52			0.52	
v/c Ratio		0.46		0.77	0.13		0.36	0.55			0.31	
Control Delay		15.5		34.0	6.1		11.0	11.5			16.4	
Queue Delay		0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay		15.5		34.0	6.1		11.0	11.5			16.4	
LOS		B		C	A		B	B			B	
Approach Delay		15.5			29.3			11.3			16.4	
Approach LOS		B			C			B			B	
Queue Length 50th (m)		2.7		56.3	1.5		9.3	24.6			23.1	
Queue Length 95th (m)		16.3		68.3	8.3		0.0	101.5			46.2	
Internal Link Dist (m)		135.6			151.9			435.6			58.0	
Turn Bay Length (m)				60.0			60.0					
Base Capacity (vph)		379		500	707		530	828			726	
Starvation Cap Reductn		0		0	0		0	0			0	
Spillback Cap Reductn		0		0	0		0	0			0	
Storage Cap Reductn		0		0	0		0	0			0	
Reduced v/c Ratio		0.33		0.75	0.11		0.36	0.55			0.31	

Intersection Summary

Area Type: Other

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 40 (40%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 65

Control Type: Actuated-Coordinated

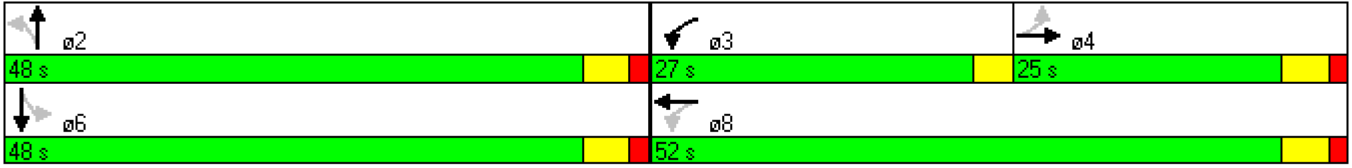
Maximum v/c Ratio: 0.77

Intersection Signal Delay: 18.0 Intersection LOS: B

Intersection Capacity Utilization 80.7% ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 30: 44 Ave N & Scenic Drive N



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (vph)	24	209	17	178	374	26	24	98	103	32	123	13
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	60.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			1.00			0.99			1.00	
Frt		0.991			0.994			0.938			0.989	
Flt Protected		0.995			0.985			0.995			0.991	
Satd. Flow (prot)	0	1658	0	0	1648	0	0	1597	0	0	1696	0
Flt Permitted		0.925			0.804			0.952			0.903	
Satd. Flow (perm)	0	1541	0	0	1342	0	0	1527	0	0	1544	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			6			54			5	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		154.8			151.2			164.3			62.5	
Travel Time (s)		11.1			10.9			11.8			4.5	
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	27	238	19	202	425	30	27	111	117	36	140	15
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	284	0	0	657	0	0	255	0	0	191	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	20.0	20.0		20.0	20.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	25.0	25.0		25.0	25.0		23.0	23.0		23.0	23.0	
Total Split (s)	52.0	52.0	0.0	52.0	52.0	0.0	23.0	23.0	0.0	23.0	23.0	0.0
Total Split (%)	69.3%	69.3%	0.0%	69.3%	69.3%	0.0%	30.7%	30.7%	0.0%	30.7%	30.7%	0.0%
Maximum Green (s)	47.0	47.0		47.0	47.0		18.0	18.0		18.0	18.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
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)	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	

34: 44 Ave N & Uplands Boulevard N

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	8.0	8.0		8.0	8.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	5	5		5	5		5	5		5	5	
Act Effct Green (s)		32.8			32.8			13.6			13.6	
Actuated g/C Ratio		0.57			0.57			0.24			0.24	
v/c Ratio		0.32			0.85			0.63			0.51	
Control Delay		7.1			22.4			25.3			26.8	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		7.1			22.4			25.3			26.8	
LOS		A			C			C			C	
Approach Delay		7.1			22.4			25.3			26.8	
Approach LOS		A			C			C			C	
Queue Length 50th (m)		11.9			45.1			17.7			16.2	
Queue Length 95th (m)		26.1			101.8			46.8			40.5	
Internal Link Dist (m)		130.8			127.2			140.3			38.5	
Turn Bay Length (m)												
Base Capacity (vph)		1275			1110			549			522	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.22			0.59			0.46			0.37	

Intersection Summary

Area Type: Other
Cycle Length: 75
Actuated Cycle Length: 57.1
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 20.4 Intersection LOS: C
Intersection Capacity Utilization 79.4% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 34: 44 Ave N & Uplands Boulevard N

11: 40 Ave N & Access #1

3/19/2014

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	18	158	176	7	19	48
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	20	180	200	8	22	55
Pedestrians		5	5		5	
Lane Width (m)		3.7	3.7		3.7	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		261				
pX, platoon unblocked						
vC, conflicting volume	213				434	214
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	213				434	214
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				96	93
cM capacity (veh/h)	1351				565	819

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	200	208	76
Volume Left	20	0	22
Volume Right	0	8	55
cSH	1351	1700	726
Volume to Capacity	0.02	0.12	0.10
Queue Length 95th (m)	0.4	0.0	2.7
Control Delay (s)	0.9	0.0	10.5
Lane LOS	A		B
Approach Delay (s)	0.9	0.0	10.5
Approach LOS			B

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	37.1%	ICU Level of Service	A
Analysis Period (min)	15		

12: 40 Ave N & Internal N-S

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (veh/h)	11	152	13	11	147	16	5	2	5	39	5	31
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	12	173	15	12	167	18	6	2	6	44	6	35
Pedestrians		5			5			5			5	
Lane Width (m)		3.7			3.7			3.7			3.7	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	190			192			454	425	190	423	424	186
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	190			192			454	425	190	423	424	186
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			99	100	99	91	99	96
cM capacity (veh/h)	1378			1375			476	507	844	520	508	849

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	200	198	14	85
Volume Left	12	12	6	44
Volume Right	15	18	6	35
cSH	1378	1375	589	618
Volume to Capacity	0.01	0.01	0.02	0.14
Queue Length 95th (m)	0.2	0.2	0.5	3.6
Control Delay (s)	0.6	0.6	11.3	11.8
Lane LOS	A	A	B	B
Approach Delay (s)	0.6	0.6	11.3	11.8
Approach LOS			B	B

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	27.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		Y	
Volume (veh/h)	6	190	158	6	16	17
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	7	216	180	7	18	19
Pedestrians		5	5		5	
Lane Width (m)		3.7	3.7		3.7	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	191				422	193
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	191				422	193
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				97	98
cM capacity (veh/h)	1376				580	841

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	223	186	38
Volume Left	7	0	18
Volume Right	0	7	19
cSH	1376	1700	691
Volume to Capacity	0.00	0.11	0.05
Queue Length 95th (m)	0.1	0.0	1.3
Control Delay (s)	0.3	0.0	10.5
Lane LOS	A		B
Approach Delay (s)	0.3	0.0	10.5
Approach LOS			B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	27.6%	ICU Level of Service	A
Analysis Period (min)	15		

14: 40 Ave N & Uplands Boulevard N

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	106	32	69	55	47	35	37	199	26	17	157	80
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	120	36	78	62	53	40	42	226	30	19	178	91

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	235	156	298	289
Volume Left (vph)	120	63	42	19
Volume Right (vph)	78	40	30	91
Hadj (s)	-0.06	-0.04	0.00	-0.14
Departure Headway (s)	5.8	6.0	5.6	5.5
Degree Utilization, x	0.38	0.26	0.46	0.44
Capacity (veh/h)	561	525	597	611
Control Delay (s)	12.3	11.1	13.3	12.6
Approach Delay (s)	12.3	11.1	13.3	12.6
Approach LOS	B	B	B	B

Intersection Summary			
Delay	12.5		
HCM Level of Service	B		
Intersection Capacity Utilization	50.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (veh/h)	7	32	39	24	12	10	15	6	9	4	12	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	8	36	44	27	14	11	17	7	10	5	14	3
Pedestrians		5			5			5			5	
Lane Width (m)		3.7			3.7			3.7			3.7	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	30			86			169	164	69	172	180	29
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	30			86			169	164	69	172	180	29
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			98			98	99	99	99	98	100
cM capacity (veh/h)	1576			1504			756	706	986	752	691	1036

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	89	52	34	22
Volume Left	8	27	17	5
Volume Right	44	11	10	3
cSH	1576	1504	800	743
Volume to Capacity	0.01	0.02	0.04	0.03
Queue Length 95th (m)	0.1	0.4	1.0	0.7
Control Delay (s)	0.7	3.9	9.7	10.0
Lane LOS	A	A	A	A
Approach Delay (s)	0.7	3.9	9.7	10.0
Approach LOS			A	A

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	22.2%	ICU Level of Service	A
Analysis Period (min)	15		

24: Internal E-W & Uplands Boulevard N

3/19/2014

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰↱			↰	↱	
Volume (veh/h)	33	37	13	326	217	12
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	38	42	15	370	247	14
Pedestrians	5			5	5	
Lane Width (m)	3.7			3.7	3.7	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)					164	
pX, platoon unblocked						
vC, conflicting volume	663	263	265			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	663	263	265			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	91	95	99			
cM capacity (veh/h)	418	769	1293			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	80	385	260
Volume Left	38	15	0
Volume Right	42	0	14
cSH	550	1293	1700
Volume to Capacity	0.14	0.01	0.15
Queue Length 95th (m)	3.8	0.3	0.0
Control Delay (s)	12.6	0.4	0.0
Lane LOS	B	A	
Approach Delay (s)	12.6	0.4	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	42.8%	ICU Level of Service	A
Analysis Period (min)	15		

Blackwolf Stage 2 2030 Horizon Post Development Volumes

AM Peak

31: 44 Ave N & Access #4

3/19/2014

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	↰↱	
Volume (veh/h)	397	11	5	236	29	13
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	451	12	6	268	33	15
Pedestrians	5			5	5	
Lane Width (m)	3.7			3.7	3.7	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	176					
pX, platoon unblocked						
vC, conflicting volume			469		747	467
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			469		747	467
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		91	97
cM capacity (veh/h)			1088		375	590

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	464	274	48
Volume Left	0	6	33
Volume Right	12	0	15
cSH	1700	1088	423
Volume to Capacity	0.27	0.01	0.11
Queue Length 95th (m)	0.0	0.1	2.9
Control Delay (s)	0.0	0.2	14.6
Lane LOS		A	B
Approach Delay (s)	0.0	0.2	14.6
Approach LOS			B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Volume (veh/h)	3	401	6	12	219	7	12	5	11	19	5	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	3	456	7	14	249	8	14	6	12	22	6	11
Pedestrians		5			5			5			5	
Lane Width (m)		3.7			3.7			3.7			3.7	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)					377							
pX, platoon unblocked												
vC, conflicting volume	262			468			770	760	469	771	759	263
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	262			468			770	760	469	771	759	263
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			95	98	98	93	98	99
cM capacity (veh/h)	1297			1089			301	328	589	298	328	769

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	466	270	32	39
Volume Left	3	14	14	22
Volume Right	7	8	12	11
cSH	1297	1089	379	370
Volume to Capacity	0.00	0.01	0.08	0.10
Queue Length 95th (m)	0.1	0.3	2.1	2.6
Control Delay (s)	0.1	0.5	15.4	15.9
Lane LOS	A	A	C	C
Approach Delay (s)	0.1	0.5	15.4	15.9
Approach LOS			C	C

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	35.9%	ICU Level of Service	A
Analysis Period (min)	15		

	→	↘	↙	←	↖	↗
Movement	**EBT**	**EBR**	**WBL**	**WBT**	**NBL**	**NBR**
Lane Configurations	↱			↰	↰↱	
Volume (veh/h)	426	4	6	227	11	16
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	484	5	7	258	12	18
Pedestrians	5			5	5	
Lane Width (m)	3.7			3.7	3.7	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				155		
pX, platoon unblocked						
vC, conflicting volume			494		768	496
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			494		768	496
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		97	97
cM capacity (veh/h)			1065		364	569

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	489	265	31
Volume Left	0	7	12
Volume Right	5	0	18
cSH	1700	1065	463
Volume to Capacity	0.29	0.01	0.07
Queue Length 95th (m)	0.0	0.1	1.6
Control Delay (s)	0.0	0.3	13.3
Lane LOS		A	B
Approach Delay (s)	0.0	0.3	13.3
Approach LOS			B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	36.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥		↰	↱		↰	↑	↱		✥	
Volume (vph)	22	5	240	205	5	18	79	447	156	20	498	7
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	60.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	0		0	1		0	1		1	0		0
Taper Length (m)	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.98		1.00	0.98				0.97		1.00	
Frt		0.879			0.885				0.850		0.998	
Flt Protected		0.996		0.950			0.950				0.998	
Satd. Flow (prot)	0	1494	0	1648	1500	0	1601	1685	1432	0	1678	0
Flt Permitted		0.971		0.261			0.310				0.972	
Satd. Flow (perm)	0	1456	0	452	1500	0	522	1685	1388	0	1634	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		273			20				177		1	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		115.6			261.4			530.0			459.6	
Travel Time (s)		8.3			18.8			38.2			33.1	
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	5%	5%	5%	5%	5%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	25	6	273	233	6	20	90	508	177	23	566	8
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	304	0	233	26	0	90	508	177	0	597	0
Turn Type	Perm			pm+pt			pm+pt		Perm	Perm		
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		3	8		5	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		5.0	20.0	20.0	20.0	20.0	
Minimum Split (s)	25.5	25.5		12.0	25.5		12.0	25.0	25.0	25.0	25.0	
Total Split (s)	25.5	25.5	0.0	12.0	37.5	0.0	12.0	42.5	42.5	30.5	30.5	0.0
Total Split (%)	31.9%	31.9%	0.0%	15.0%	46.9%	0.0%	15.0%	53.1%	53.1%	38.1%	38.1%	0.0%
Maximum Green (s)	20.0	20.0		9.0	32.0		9.0	37.5	37.5	25.5	25.5	
Yellow Time (s)	3.5	3.5		3.0	3.5		3.0	3.5	3.5	3.5	3.5	
All-Red Time (s)	2.0	2.0		0.0	2.0		0.0	1.5	1.5	1.5	1.5	
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)	5.5	5.5	4.0	3.0	5.5	4.0	3.0	5.0	5.0	5.0	5.0	4.0
Lead/Lag	Lag	Lag		Lead			Lead			Lag	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Recall Mode	None	None		None	None		None	C-Min	C-Min	C-Min	C-Min	
Walk Time (s)	8.0	8.0			8.0			8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	12.0	12.0			12.0			10.0	10.0	10.0	10.0	
Pedestrian Calls (#/hr)	5	5			5			5	5	5	5	
Act Effct Green (s)		12.3		26.8	24.3		47.2	45.2	45.2		36.8	
Actuated g/C Ratio		0.15		0.34	0.30		0.59	0.56	0.56		0.46	
v/c Ratio		0.67		0.81	0.06		0.22	0.53	0.21		0.79	
Control Delay		13.4		44.3	9.4		9.6	14.4	2.5		34.2	
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0		0.0	
Total Delay		13.4		44.3	9.4		9.6	14.4	2.5		34.2	
LOS		B		D	A		A	B	A		C	
Approach Delay		13.4			40.8			11.1			34.2	
Approach LOS		B			D			B			C	
Queue Length 50th (m)		4.3		28.4	0.7		4.9	40.8	0.0		73.5	
Queue Length 95th (m)		21.6		#41.9	4.8		14.0	84.9	9.0		#166.8	
Internal Link Dist (m)		91.6			237.4			506.0			435.6	
Turn Bay Length (m)				60.0			60.0					
Base Capacity (vph)		569		286	612		429	953	862		752	
Starvation Cap Reductn		0		0	0		0	0	0		0	
Spillback Cap Reductn		0		0	0		0	0	0		0	
Storage Cap Reductn		0		0	0		0	0	0		0	
Reduced v/c Ratio		0.53		0.81	0.04		0.21	0.53	0.21		0.79	

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green, Master Intersection

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.81

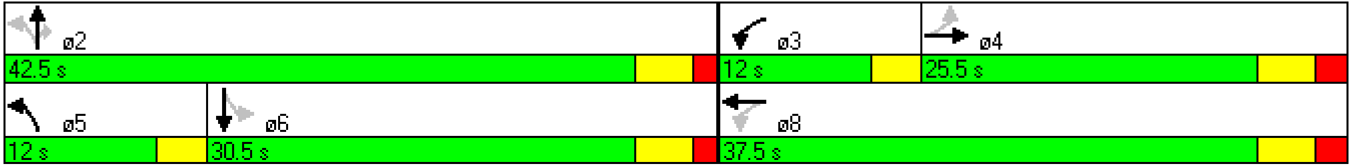
Intersection Signal Delay: 22.6 Intersection LOS: C

Intersection Capacity Utilization 91.1% 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: 10: 40 Ave N & Scenic Drive N



30: 44 Ave N & Scenic Drive N

3/19/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥		↰	↱		↰	↱			✥	
Volume (vph)	12	10	143	201	3	61	50	98	338	60	180	6
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	60.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	0		0	1		0	1		0	0		0
Taper Length (m)	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.97		0.99	0.97		0.99	0.98			1.00	
Frt		0.883			0.856			0.884			0.997	
Flt Protected		0.996		0.950			0.950				0.988	
Satd. Flow (prot)	0	1486	0	1601	1401	0	1601	1454	0	0	1659	0
Flt Permitted		0.974		0.494			0.598				0.815	
Satd. Flow (perm)	0	1452	0	827	1401	0	1002	1454	0	0	1367	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		162			69			259			2	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		159.6			175.9			459.6			82.0	
Travel Time (s)		11.5			12.7			33.1			5.9	
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	14	11	162	228	3	69	57	111	384	68	205	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	187	0	228	72	0	57	495	0	0	280	0
Turn Type	Perm			pm+pt			Perm			Perm		
Protected Phases		4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		20.0	20.0		20.0	20.0	
Minimum Split (s)	25.0	25.0		12.0	25.0		25.0	25.0		25.0	25.0	
Total Split (s)	29.0	29.0	0.0	14.0	43.0	0.0	37.0	37.0	0.0	37.0	37.0	0.0
Total Split (%)	36.3%	36.3%	0.0%	17.5%	53.8%	0.0%	46.3%	46.3%	0.0%	46.3%	46.3%	0.0%
Maximum Green (s)	24.0	24.0		11.0	38.0		32.0	32.0		32.0	32.0	
Yellow Time (s)	3.5	3.5		3.0	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.5	1.5		0.0	1.5		1.5	1.5		1.5	1.5	
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)	5.0	5.0	4.0	3.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Lead/Lag	Lead	Lead		Lag								
Lead-Lag Optimize?	Yes	Yes		Yes								
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	None		None	None		C-Min	C-Min		C-Min	C-Min	
Walk Time (s)	8.0	8.0			8.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	12.0	12.0			12.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	5	5			5		5	5		5	5	
Act Effct Green (s)		12.0		25.0	23.0		47.0	47.0			47.0	
Actuated g/C Ratio		0.15		0.31	0.29		0.59	0.59			0.59	
v/c Ratio		0.53		0.68	0.16		0.10	0.52			0.35	
Control Delay		12.7		36.3	6.1		2.4	5.0			11.2	
Queue Delay		0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay		12.7		36.3	6.1		2.4	5.0			11.2	
LOS		B		D	A		A	A			B	
Approach Delay		12.7			29.1			4.8			11.2	
Approach LOS		B			C			A			B	
Queue Length 50th (m)		3.4		28.3	0.3		0.3	0.0			18.8	
Queue Length 95th (m)		17.0		39.9	7.7		m3.9	94.4			41.1	
Internal Link Dist (m)		135.6			151.9			435.6			58.0	
Turn Bay Length (m)				60.0			60.0					
Base Capacity (vph)		549		409	702		589	961			805	
Starvation Cap Reductn		0		0	0		0	0			0	
Spillback Cap Reductn		0		0	0		0	0			0	
Storage Cap Reductn		0		0	0		0	0			0	
Reduced v/c Ratio		0.34		0.56	0.10		0.10	0.52			0.35	

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 40 (50%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 65

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.68

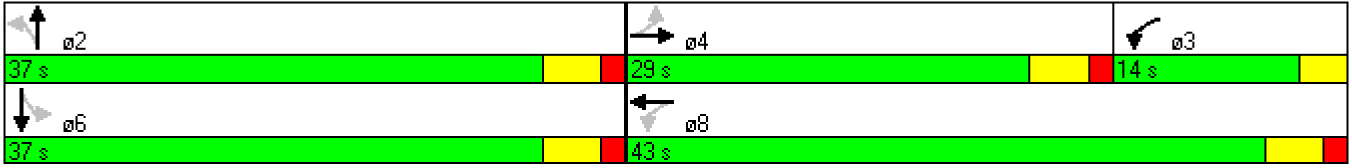
Intersection Signal Delay: 12.8 Intersection LOS: B

Intersection Capacity Utilization 86.9% ICU Level of Service E

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 30: 44 Ave N & Scenic Drive N



	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (vph)	7	401	35	112	190	31	22	114	222	21	83	21
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	60.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			1.00			0.98			0.99	
Frt		0.989			0.988			0.916			0.977	
Flt Protected		0.999			0.983			0.997			0.992	
Satd. Flow (prot)	0	1661	0	0	1632	0	0	1557	0	0	1673	0
Flt Permitted		0.993			0.739			0.975			0.913	
Satd. Flow (perm)	0	1651	0	0	1226	0	0	1522	0	0	1539	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			11			158			20	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		154.8			151.2			164.3			51.5	
Travel Time (s)		11.1			10.9			11.8			3.7	
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	8	456	40	127	216	35	25	130	252	24	94	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	504	0	0	378	0	0	407	0	0	142	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	20.0	20.0		20.0	20.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	25.0	25.0		25.0	25.0		23.0	23.0		23.0	23.0	
Total Split (s)	32.0	32.0	0.0	32.0	32.0	0.0	28.0	28.0	0.0	28.0	28.0	0.0
Total Split (%)	53.3%	53.3%	0.0%	53.3%	53.3%	0.0%	46.7%	46.7%	0.0%	46.7%	46.7%	0.0%
Maximum Green (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
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)	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	

34: 44 Ave N & Uplands Boulevard N

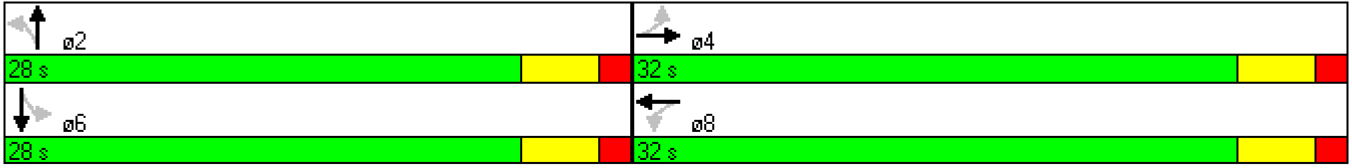
3/19/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	8.0	8.0		8.0	8.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	5	5		5	5		5	5		5	5	
Act Effct Green (s)		22.8			22.8			14.4			14.4	
Actuated g/C Ratio		0.48			0.48			0.30			0.30	
v/c Ratio		0.63			0.64			0.71			0.29	
Control Delay		14.6			16.4			16.5			13.0	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		14.6			16.4			16.5			13.0	
LOS		B			B			B			B	
Approach Delay		14.6			16.4			16.5			13.0	
Approach LOS		B			B			B			B	
Queue Length 50th (m)		25.8			19.1			15.1			6.8	
Queue Length 95th (m)		67.4			55.7			42.1			18.6	
Internal Link Dist (m)		130.8			127.2			140.3			27.5	
Turn Bay Length (m)												
Base Capacity (vph)		969			721			837			777	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.52			0.52			0.49			0.18	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 47.5
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.71
Intersection Signal Delay: 15.4 Intersection LOS: B
Intersection Capacity Utilization 83.2% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 34: 44 Ave N & Uplands Boulevard N



Blackwolf Stage 2 2030 Horizon Post Development Volumes
AM Peak
34: 44 Ave N & Uplands Boulevard N - UPGRADED
4/25/2014

	⤴	→	⤵	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣		↰	↱			✣			✣	
Volume (vph)	7	401	35	112	190	31	22	114	222	21	83	21
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	60.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	1		0	0		0	0		0
Taper Length (m)	2.5		2.5	30.0		2.5	2.5		2.5	2.5		2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		1.00	1.00			0.98			0.99	
Frt		0.989			0.979			0.916			0.977	
Flt Protected		0.999		0.950				0.997			0.992	
Satd. Flow (prot)	0	1661	0	1601	1643	0	0	1557	0	0	1673	0
Flt Permitted		0.995		0.455				0.975			0.914	
Satd. Flow (perm)	0	1654	0	764	1643	0	0	1522	0	0	1541	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			18			158			20	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		154.8			151.2			164.3			51.5	
Travel Time (s)		11.1			10.9			11.8			3.7	
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	8	456	40	127	216	35	25	130	252	24	94	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	504	0	127	251	0	0	407	0	0	142	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	20.0	20.0		20.0	20.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	25.0	25.0		25.0	25.0		23.0	23.0		23.0	23.0	
Total Split (s)	32.0	32.0	0.0	32.0	32.0	0.0	28.0	28.0	0.0	28.0	28.0	0.0
Total Split (%)	53.3%	53.3%	0.0%	53.3%	53.3%	0.0%	46.7%	46.7%	0.0%	46.7%	46.7%	0.0%
Maximum Green (s)	27.0	27.0		27.0	27.0		23.0	23.0		23.0	23.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
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)	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	

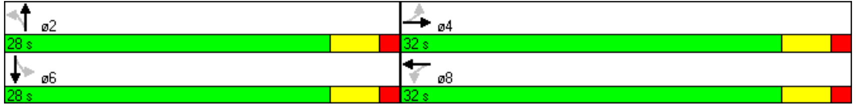
Blackwolf Stage 2 2030 Horizon Post Development Volumes
AM Peak
34: 44 Ave N & Uplands Boulevard N - UPGRADED
4/25/2014

	⤴	→	⤵	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	8.0	8.0		8.0	8.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	5	5		5	5		5	5		5	5	
Act Effct Green (s)		22.0		22.0	22.0			14.2			14.2	
Actuated g/C Ratio		0.47		0.47	0.47			0.31			0.31	
v/c Ratio		0.64		0.35	0.32			0.71			0.29	
Control Delay		14.8		12.7	9.4			16.0			12.5	
Queue Delay		0.0		0.0	0.0			0.0			0.0	
Total Delay		14.8		12.7	9.4			16.0			12.5	
LOS		B		B	A			B			B	
Approach Delay		14.8			10.5			16.0			12.5	
Approach LOS		B			B			B			B	
Queue Length 50th (m)		24.9		5.4	9.5			15.1			6.8	
Queue Length 95th (m)		67.4		19.7	28.4			42.1			18.5	
Internal Link Dist (m)		130.8			127.2			140.3			27.5	
Turn Bay Length (m)				60.0								
Base Capacity (vph)		990		456	987			851			793	
Starvation Cap Reductn		0		0	0			0			0	
Spillback Cap Reductn		0		0	0			0			0	
Storage Cap Reductn		0		0	0			0			0	
Reduced v/c Ratio		0.51		0.28	0.25			0.48			0.18	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 46.4
Natural Cycle: 50
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.71
Intersection Signal Delay: 13.8 Intersection LOS: B
Intersection Capacity Utilization 80.2% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 34: 44 Ave N & Uplands Boulevard N



MOVEMENT SUMMARY

Site: 44 Ave & Uplands Blvd 2030
PD am

44 Ave N / Uplands Boulevard N Intersection
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
							Vehicles veh	Distance m			
South: Uplands Boulevard N											
3	L	25	2.0	0.568	14.9	LOS B	4.6	35.7	0.80	1.02	29.7
8	T	130	2.0	0.568	8.2	LOS A	4.6	35.7	0.80	0.88	32.2
18	R	252	2.0	0.568	9.7	LOS A	4.6	35.7	0.80	0.92	31.8
Approach		407	2.0	0.568	9.5	LOS A	4.6	35.7	0.80	0.91	31.7
East: 44 Ave N											
1	L	127	5.0	0.380	10.1	LOS B	2.4	19.4	0.46	0.78	34.0
6	T	216	5.0	0.380	3.4	LOS A	2.4	19.4	0.46	0.39	37.0
16	R	35	5.0	0.380	4.9	LOS A	2.4	19.4	0.46	0.52	36.3
Approach		378	5.0	0.380	5.8	LOS A	2.4	19.4	0.46	0.53	35.8
North: Uplands Boulevard N											
7	L	24	2.0	0.174	11.2	LOS B	0.9	6.8	0.53	0.87	33.1
4	T	94	2.0	0.174	4.5	LOS A	0.9	6.8	0.53	0.51	36.5
14	R	24	2.0	0.174	6.0	LOS A	0.9	6.8	0.53	0.61	36.0
Approach		142	2.0	0.174	5.9	LOS A	0.9	6.8	0.53	0.59	35.7
West: 44 Ave N											
5	L	8	5.0	0.539	11.2	LOS B	3.7	29.4	0.60	0.90	33.7
2	T	456	5.0	0.539	4.5	LOS A	3.7	29.4	0.60	0.51	36.3
12	R	40	5.0	0.539	6.1	LOS A	3.7	29.4	0.60	0.64	36.0
Approach		503	5.0	0.539	4.7	LOS A	3.7	29.4	0.60	0.53	36.2
All Vehicles		1431	3.8	0.568	6.5	LOS A	4.6	35.7	0.61	0.64	34.7

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

Processed: Friday, April 25, 2014 9:49:35 AM
SIDRA INTERSECTION 5.1.5.2006
Project: Not Saved
8001103, STANTEC CONSULTING LTD., SINGLE

11: 40 Ave N & Access #1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰↑	↑↱		↰↱	
Volume (veh/h)	52	195	187	21	13	32
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	59	222	212	24	15	36
Pedestrians		5	5		5	
Lane Width (m)		3.7	3.7		3.7	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		261				
pX, platoon unblocked						
vC, conflicting volume	241				574	234
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	241				574	234
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				97	95
cM capacity (veh/h)	1319				455	798

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	281	236	51
Volume Left	59	0	15
Volume Right	0	24	36
cSH	1319	1700	655
Volume to Capacity	0.04	0.14	0.08
Queue Length 95th (m)	1.1	0.0	1.9
Control Delay (s)	2.0	0.0	11.0
Lane LOS	A		B
Approach Delay (s)	2.0	0.0	11.0
Approach LOS			B

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	41.4%	ICU Level of Service	A
Analysis Period (min)	15		

12: 40 Ave N & Internal N-S

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (veh/h)	34	166	7	6	174	43	14	5	12	27	3	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	39	189	8	7	198	49	16	6	14	31	3	23
Pedestrians		5			5			5			5	
Lane Width (m)		3.7			3.7			3.7			3.7	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	252			202			540	540	203	532	520	232
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	252			202			540	540	203	532	520	232
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			100			96	99	98	93	99	97
cM capacity (veh/h)	1308			1364			419	429	831	428	441	800

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	235	253	35	57
Volume Left	39	7	16	31
Volume Right	8	49	14	23
cSH	1308	1364	521	527
Volume to Capacity	0.03	0.00	0.07	0.11
Queue Length 95th (m)	0.7	0.1	1.6	2.7
Control Delay (s)	1.5	0.2	12.4	12.7
Lane LOS	A	A	B	B
Approach Delay (s)	1.5	0.2	12.4	12.7
Approach LOS			B	B

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	41.2%	ICU Level of Service	A
Analysis Period (min)	15		

13: 40 Ave N & Access #2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		Y	
Volume (veh/h)	19	186	213	19	11	11
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	22	211	242	22	12	12
Pedestrians		5	5		5	
Lane Width (m)		3.7	3.7		3.7	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	269				517	263
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	269				517	263
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				98	98
cM capacity (veh/h)	1289				505	769

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	233	264	25
Volume Left	22	0	12
Volume Right	0	22	12
cSH	1289	1700	610
Volume to Capacity	0.02	0.16	0.04
Queue Length 95th (m)	0.4	0.0	1.0
Control Delay (s)	0.9	0.0	11.2
Lane LOS	A		B
Approach Delay (s)	0.9	0.0	11.2
Approach LOS			B

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	39.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	93	52	52	33	28	21	88	177	53	34	216	116
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	106	59	59	38	32	24	100	201	60	39	245	132

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	224	93	361	416
Volume Left (vph)	106	38	100	39
Volume Right (vph)	59	24	60	132
Hadj (s)	-0.03	-0.04	-0.01	-0.14
Departure Headway (s)	6.2	6.6	5.6	5.4
Degree Utilization, x	0.39	0.17	0.57	0.63
Capacity (veh/h)	512	445	604	635
Control Delay (s)	13.1	10.9	15.7	17.1
Approach Delay (s)	13.1	10.9	15.7	17.1
Approach LOS	B	B	C	C

Intersection Summary			
Delay	15.3		
HCM Level of Service	C		
Intersection Capacity Utilization	64.0%	ICU Level of Service	C
Analysis Period (min)	15		

22: Internal E-W & Internal N-S

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (veh/h)	5	21	26	15	35	7	43	13	27	11	8	8
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	6	24	30	17	40	8	49	15	31	12	9	9
Pedestrians		5			5			5			5	
Lane Width (m)		3.7			3.7			3.7			3.7	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	53			58			151	142	49	176	153	54
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	53			58			151	142	49	176	153	54
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			94	98	97	98	99	99
cM capacity (veh/h)	1546			1539			780	732	1011	731	722	1005

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	59	65	94	31
Volume Left	6	17	49	12
Volume Right	30	8	31	9
cSH	1546	1539	833	792
Volume to Capacity	0.00	0.01	0.11	0.04
Queue Length 95th (m)	0.1	0.3	2.9	0.9
Control Delay (s)	0.7	2.0	9.9	9.7
Lane LOS	A	A	A	A
Approach Delay (s)	0.7	2.0	9.9	9.7
Approach LOS			A	A

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	23.0%	ICU Level of Service	A
Analysis Period (min)	15		

	↗	↘	↖	↑	↓	↙
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↰	↱	
Volume (veh/h)	22	24	41	250	342	36
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	25	27	47	284	389	41
Pedestrians	5			5	5	
Lane Width (m)	3.7			3.7	3.7	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)					164	
pX, platoon unblocked	1.00	1.00	1.00			
vC, conflicting volume	796	419	435			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	795	416	432			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	93	96	96			
cM capacity (veh/h)	338	629	1120			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	52	331	430
Volume Left	25	47	0
Volume Right	27	0	41
cSH	446	1120	1700
Volume to Capacity	0.12	0.04	0.25
Queue Length 95th (m)	3.0	1.0	0.0
Control Delay (s)	14.1	1.5	0.0
Lane LOS	B	A	
Approach Delay (s)	14.1	1.5	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	Y	
Volume (veh/h)	275	32	15	412	19	9
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	312	36	17	468	22	10
Pedestrians	5			5	5	
Lane Width (m)	3.7			3.7	3.7	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	176					
pX, platoon unblocked						
vC, conflicting volume			354		843	341
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			354		843	341
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		93	99
cM capacity (veh/h)			1200		326	696

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	349	485	32
Volume Left	0	17	22
Volume Right	36	0	10
cSH	1700	1200	394
Volume to Capacity	0.21	0.01	0.08
Queue Length 95th (m)	0.0	0.3	2.0
Control Delay (s)	0.0	0.4	14.9
Lane LOS		A	B
Approach Delay (s)	0.0	0.4	14.9
Approach LOS			B

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	48.3%	ICU Level of Service	A
Analysis Period (min)	15		

32: 44 Ave N & Zone 404 Access

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (veh/h)	11	259	14	14	411	22	9	5	15	12	5	6
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	12	294	16	16	467	25	10	6	17	14	6	7
Pedestrians		5			5			5			5	
Lane Width (m)		3.7			3.7			3.7			3.7	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)					377							
pX, platoon unblocked												
vC, conflicting volume	497			315			858	861	312	869	857	490
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	497			315			858	861	312	869	857	490
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			96	98	98	95	98	99
cM capacity (veh/h)	1062			1240			260	284	722	253	285	574

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	323	508	33	26
Volume Left	12	16	10	14
Volume Right	16	25	17	7
cSH	1062	1240	397	305
Volume to Capacity	0.01	0.01	0.08	0.09
Queue Length 95th (m)	0.3	0.3	2.0	2.1
Control Delay (s)	0.4	0.4	14.9	17.9
Lane LOS	A	A	B	C
Approach Delay (s)	0.4	0.4	14.9	17.9
Approach LOS			B	C

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	42.3%	ICU Level of Service	A
Analysis Period (min)	15		

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	Y	
Volume (veh/h)	274	13	19	440	7	11
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	311	15	22	500	8	12
Pedestrians	5			5	5	
Lane Width (m)	3.7			3.7	3.7	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				155		
pX, platoon unblocked					0.92	
vC, conflicting volume			331		872	329
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			331		820	329
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		97	98
cM capacity (veh/h)			1223		310	707

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	326	522	20
Volume Left	0	22	8
Volume Right	15	0	12
cSH	1700	1223	472
Volume to Capacity	0.19	0.02	0.04
Queue Length 95th (m)	0.0	0.4	1.0
Control Delay (s)	0.0	0.5	13.0
Lane LOS		A	B
Approach Delay (s)	0.0	0.5	13.0
Approach LOS			B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥		↰	↱		↰	↑	↱		✥	
Volume (vph)	15	5	147	194	5	24	237	580	225	23	548	21
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	60.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	0		0	1		0	1		1	0		0
Taper Length (m)	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.98		1.00	0.97				0.97		1.00	
Frt		0.881			0.877				0.850		0.995	
Flt Protected		0.996		0.950			0.950				0.998	
Satd. Flow (prot)	0	1496	0	1648	1481	0	1601	1685	1432	0	1671	0
Flt Permitted		0.968		0.267			0.294				0.963	
Satd. Flow (perm)	0	1453	0	461	1481	0	495	1685	1384	0	1612	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		167			27				256		2	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		115.6			261.4			530.0			459.6	
Travel Time (s)		8.3			18.8			38.2			33.1	
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	5%	5%	5%	5%	5%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	17	6	167	220	6	27	269	659	256	26	623	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	190	0	220	33	0	269	659	256	0	673	0
Turn Type	Perm			pm+pt			pm+pt		Perm	Perm		
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		3	8		5	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		5.0	20.0	20.0	20.0	20.0	
Minimum Split (s)	25.5	25.5		12.0	25.5		12.0	25.0	25.0	25.0	25.0	
Total Split (s)	25.5	25.5	0.0	14.0	39.5	0.0	15.0	60.5	60.5	45.5	45.5	0.0
Total Split (%)	25.5%	25.5%	0.0%	14.0%	39.5%	0.0%	15.0%	60.5%	60.5%	45.5%	45.5%	0.0%
Maximum Green (s)	20.0	20.0		11.0	34.0		12.0	55.5	55.5	40.5	40.5	
Yellow Time (s)	3.5	3.5		3.0	3.5		3.0	3.5	3.5	3.5	3.5	
All-Red Time (s)	2.0	2.0		0.0	2.0		0.0	1.5	1.5	1.5	1.5	
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)	5.5	5.5	4.0	3.0	5.5	4.0	3.0	5.0	5.0	5.0	5.0	4.0
Lead/Lag	Lag	Lag		Lead			Lead			Lag	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	

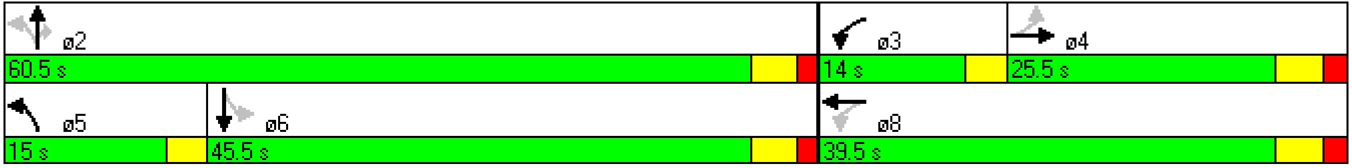
Blackwolf Stage 2 2030 Horizon Post Development Volumes PM Peak
10: 40 Ave N & Scenic Drive N 3/19/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Recall Mode	None	None		None	None		None	C-Min	C-Min	C-Min	C-Min	
Walk Time (s)	8.0	8.0			8.0			8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	12.0	12.0			12.0			10.0	10.0	10.0	10.0	
Pedestrian Calls (#/hr)	5	5			5			5	5	5	5	
Act Effct Green (s)		12.0		28.4	25.9		65.6	63.6	63.6		49.0	
Actuated g/C Ratio		0.12		0.28	0.26		0.66	0.64	0.64		0.49	
v/c Ratio		0.59		0.85	0.08		0.60	0.62	0.26		0.85	
Control Delay		16.5		58.2	11.8		13.8	14.9	2.0		27.2	
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0		0.0	
Total Delay		16.5		58.2	11.8		13.8	14.9	2.0		27.2	
LOS		B		E	B		B	B	A		C	
Approach Delay		16.5			52.1			11.9			27.2	
Approach LOS		B			D			B			C	
Queue Length 50th (m)		4.1		36.2	0.9		18.1	65.2	0.0		114.8	
Queue Length 95th (m)		20.8		#54.1	6.8		38.3	124.9	9.6		#194.2	
Internal Link Dist (m)		91.6			237.4			506.0			435.6	
Turn Bay Length (m)				60.0			60.0					
Base Capacity (vph)		424		262	521		462	1071	973		791	
Starvation Cap Reductn		0		0	0		0	0	0		0	
Spillback Cap Reductn		0		0	0		0	0	0		0	
Storage Cap Reductn		0		0	0		0	0	0		0	
Reduced v/c Ratio		0.45		0.84	0.06		0.58	0.62	0.26		0.85	

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green, Master Intersection
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 21.2 Intersection LOS: C
Intersection Capacity Utilization 109.5% ICU Level of Service H
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 10: 40 Ave N & Scenic Drive N



30: 44 Ave N & Scenic Drive N

3/19/2014

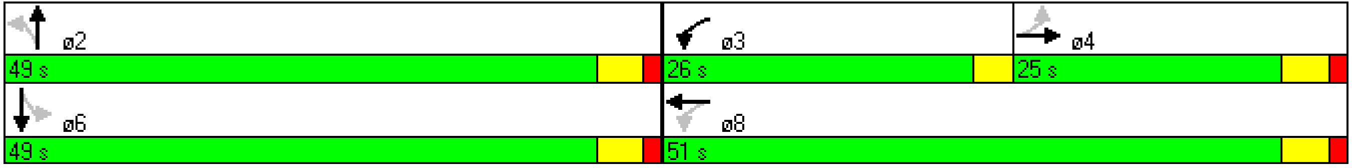
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥		↰	↱		↰	↱			✥	
Volume (vph)	7	6	97	344	11	76	167	211	225	75	147	16
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	60.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	0		0	1		0	1		0	0		0
Taper Length (m)	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.97		0.99	0.97		0.99	0.98			1.00	
Frt		0.881			0.868			0.923			0.991	
Flt Protected		0.997		0.950			0.950				0.985	
Satd. Flow (prot)	0	1480	0	1601	1421	0	1601	1528	0	0	1641	0
Flt Permitted		0.977		0.414			0.581				0.659	
Satd. Flow (perm)	0	1450	0	692	1421	0	972	1528	0	0	1097	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		110			86			69			5	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		159.6			175.9			459.6			82.0	
Travel Time (s)		11.5			12.7			33.1			5.9	
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	8	7	110	391	12	86	190	240	256	85	167	18
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	125	0	391	98	0	190	496	0	0	270	0
Turn Type	Perm			pm+pt			Perm			Perm		
Protected Phases		4		3	8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		20.0	20.0		20.0	20.0	
Minimum Split (s)	25.0	25.0		12.0	25.0		25.0	25.0		25.0	25.0	
Total Split (s)	25.0	25.0	0.0	26.0	51.0	0.0	49.0	49.0	0.0	49.0	49.0	0.0
Total Split (%)	25.0%	25.0%	0.0%	26.0%	51.0%	0.0%	49.0%	49.0%	0.0%	49.0%	49.0%	0.0%
Maximum Green (s)	20.0	20.0		23.0	46.0		44.0	44.0		44.0	44.0	
Yellow Time (s)	3.5	3.5		3.0	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.5	1.5		0.0	1.5		1.5	1.5		1.5	1.5	
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)	5.0	5.0	4.0	3.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	None		None	None		C-Min	C-Min		C-Min	C-Min	
Walk Time (s)	8.0	8.0			8.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	12.0	12.0			12.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	5	5			5		5	5		5	5	
Act Effct Green (s)		12.0		40.3	38.3		51.7	51.7			51.7	
Actuated g/C Ratio		0.12		0.40	0.38		0.52	0.52			0.52	
v/c Ratio		0.46		0.80	0.16		0.38	0.60			0.47	
Control Delay		15.5		35.9	5.5		9.6	9.7			20.2	
Queue Delay		0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay		15.5		35.9	5.5		9.6	9.7			20.2	
LOS		B		D	A		A	A			C	
Approach Delay		15.5			29.8			9.7			20.2	
Approach LOS		B			C			A			C	
Queue Length 50th (m)		2.7		59.0	1.4		10.2	21.2			31.1	
Queue Length 95th (m)		16.3		74.0	9.3		17.3	39.1			60.5	
Internal Link Dist (m)		135.6			151.9			435.6			58.0	
Turn Bay Length (m)				60.0			60.0					
Base Capacity (vph)		378		500	700		502	823			569	
Starvation Cap Reductn		0		0	0		0	0			0	
Spillback Cap Reductn		0		0	0		0	0			0	
Storage Cap Reductn		0		0	0		0	0			0	
Reduced v/c Ratio		0.33		0.78	0.14		0.38	0.60			0.47	

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 100
Offset: 27 (27%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 18.2 Intersection LOS: B
Intersection Capacity Utilization 83.8% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 30: 44 Ave N & Scenic Drive N



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (vph)	24	229	31	223	404	26	41	98	132	32	123	13
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	60.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	2.5		2.5	2.5		2.5	2.5		2.5	2.5		2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			1.00			0.98			1.00	
Frt		0.985			0.995			0.934			0.989	
Flt Protected		0.996			0.983			0.992			0.991	
Satd. Flow (prot)	0	1647	0	0	1646	0	0	1582	0	0	1696	0
Flt Permitted		0.922			0.768			0.922			0.840	
Satd. Flow (perm)	0	1525	0	0	1283	0	0	1469	0	0	1436	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		11			4			56			5	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		154.8			151.2			164.3			51.5	
Travel Time (s)		11.1			10.9			11.8			3.7	
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	27	260	35	253	459	30	47	111	150	36	140	15
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	322	0	0	742	0	0	308	0	0	191	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	20.0	20.0		20.0	20.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	25.0	25.0		25.0	25.0		24.0	24.0		23.0	23.0	
Total Split (s)	56.0	56.0	0.0	56.0	56.0	0.0	34.0	34.0	0.0	34.0	34.0	0.0
Total Split (%)	62.2%	62.2%	0.0%	62.2%	62.2%	0.0%	37.8%	37.8%	0.0%	37.8%	37.8%	0.0%
Maximum Green (s)	51.0	51.0		51.0	51.0		29.0	29.0		29.0	29.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
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)	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	

34: 44 Ave N & Uplands Boulevard N

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	8.0	8.0		8.0	8.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	5	5		5	5		5	5		5	5	
Act Effct Green (s)		51.3			51.3			19.0			19.0	
Actuated g/C Ratio		0.64			0.64			0.24			0.24	
v/c Ratio		0.33			0.90			0.79			0.56	
Control Delay		8.8			31.9			38.1			32.2	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		8.8			31.9			38.1			32.2	
LOS		A			C			D			C	
Approach Delay		8.8			31.9			38.1			32.2	
Approach LOS		A			C			D			C	
Queue Length 50th (m)		19.0			85.1			36.1			24.9	
Queue Length 95th (m)		42.9			#196.4			60.9			42.4	
Internal Link Dist (m)		130.8			127.2			140.3			27.5	
Turn Bay Length (m)												
Base Capacity (vph)		977			821			569			525	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.33			0.90			0.54			0.36	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 80.4

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.90

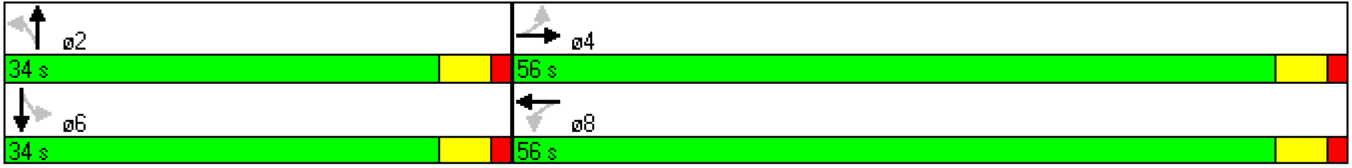
Intersection Signal Delay: 28.4 Intersection LOS: C

Intersection Capacity Utilization 88.8% ICU Level of Service E

Analysis Period (min) 15

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 34: 44 Ave N & Uplands Boulevard N



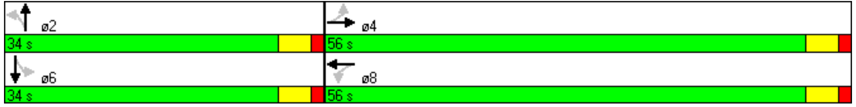
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥		↰	↱			✥			✥	
Volume (vph)	24	229	31	223	404	26	41	98	132	32	123	13
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	60.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	1		0	0		0	0		0
Taper Length (m)	2.5		2.5	30.0		2.5	2.5		2.5	2.5		2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		0.99	1.00			0.98			1.00	
Frt		0.985			0.991			0.934			0.989	
Flt Protected		0.996		0.950				0.992			0.991	
Satd. Flow (prot)	0	1647	0	1601	1667	0	0	1582	0	0	1696	0
Flt Permitted		0.945		0.595				0.922			0.909	
Satd. Flow (perm)	0	1563	0	996	1667	0	0	1469	0	0	1554	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		11			6			56			5	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		154.8			151.2			164.3			51.5	
Travel Time (s)		11.1			10.9			11.8			3.7	
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	27	260	35	253	459	30	47	111	150	36	140	15
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	322	0	253	489	0	0	308	0	0	191	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	20.0	20.0		20.0	20.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	25.0	25.0		25.0	25.0		24.0	24.0		23.0	23.0	
Total Split (s)	56.0	56.0	0.0	56.0	56.0	0.0	34.0	34.0	0.0	34.0	34.0	0.0
Total Split (%)	62.2%	62.2%	0.0%	62.2%	62.2%	0.0%	37.8%	37.8%	0.0%	37.8%	37.8%	0.0%
Maximum Green (s)	51.0	51.0		51.0	51.0		29.0	29.0		29.0	29.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
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)	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Walk Time (s)	8.0	8.0		8.0	8.0		8.0	8.0		8.0	8.0	
Flash Dont Walk (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	5	5		5	5		5	5		5	5	
Act Effct Green (s)		24.0		24.0	24.0			14.4			14.4	
Actuated g/C Ratio		0.49		0.49	0.49			0.29			0.29	
v/c Ratio		0.42		0.52	0.59			0.65			0.41	
Control Delay		10.3		14.0	13.1			20.1			17.3	
Queue Delay		0.0		0.0	0.0			0.0			0.0	
Total Delay		10.3		14.0	13.1			20.1			17.3	
LOS		B		B	B			C			B	
Approach Delay		10.3			13.4			20.1			17.3	
Approach LOS		B			B			C			B	
Queue Length 50th (m)		14.0		12.2	24.4			15.5			10.7	
Queue Length 95th (m)		38.7		37.5	63.9			47.9			32.6	
Internal Link Dist (m)		130.8			127.2			140.3			27.5	
Turn Bay Length (m)				60.0								
Base Capacity (vph)		1477		941	1575			933			966	
Starvation Cap Reductn		0		0	0			0			0	
Spillback Cap Reductn		0		0	0			0			0	
Storage Cap Reductn		0		0	0			0			0	
Reduced v/c Ratio		0.22		0.27	0.31			0.33			0.20	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 48.9
Natural Cycle: 50
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.65
Intersection Signal Delay: 14.6 Intersection LOS: B
Intersection Capacity Utilization 75.4% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 34: 44 Ave N & Uplands Boulevard N



MOVEMENT SUMMARY

Site: 44 Ave & Uplands Blvd 2030 PD pm

44 Ave N / Uplands Boulevard N Intersection
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
							Vehicles veh	Distance m			
South: Uplands Boulevard N											
3	L	47	2.0	0.368	11.3	LOS B	2.2	17.0	0.60	0.85	32.9
8	T	111	2.0	0.368	4.6	LOS A	2.2	17.0	0.60	0.53	35.3
18	R	150	2.0	0.368	6.1	LOS A	2.2	17.0	0.60	0.65	35.1
Approach		308	2.0	0.368	6.4	LOS A	2.2	17.0	0.60	0.63	34.8
East: 44 Ave N											
1	L	253	5.0	0.723	12.0	LOS B	8.1	63.8	0.72	0.81	32.5
6	T	459	5.0	0.723	5.3	LOS A	8.1	63.8	0.72	0.62	33.9
16	R	30	5.0	0.723	6.8	LOS A	8.1	63.8	0.72	0.67	34.1
Approach		742	5.0	0.723	7.6	LOS A	8.1	63.8	0.72	0.68	33.4
North: Uplands Boulevard N											
7	L	36	2.0	0.377	15.7	LOS B	2.4	18.7	0.85	1.01	29.4
4	T	140	2.0	0.377	9.0	LOS A	2.4	18.7	0.85	0.90	31.6
14	R	15	2.0	0.377	10.5	LOS B	2.4	18.7	0.85	0.93	31.2
Approach		191	2.0	0.377	10.4	LOS B	2.4	18.7	0.85	0.92	31.0
West: 44 Ave N											
5	L	27	5.0	0.433	12.7	LOS B	2.7	21.1	0.68	0.95	32.2
2	T	260	5.0	0.433	5.9	LOS A	2.7	21.1	0.68	0.68	35.1
12	R	35	5.0	0.433	7.5	LOS A	2.7	21.1	0.68	0.76	35.2
Approach		323	5.0	0.433	6.7	LOS A	2.7	21.1	0.68	0.71	34.8
All Vehicles		1564	4.0	0.723	7.5	LOS A	8.1	63.8	0.70	0.71	33.6

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

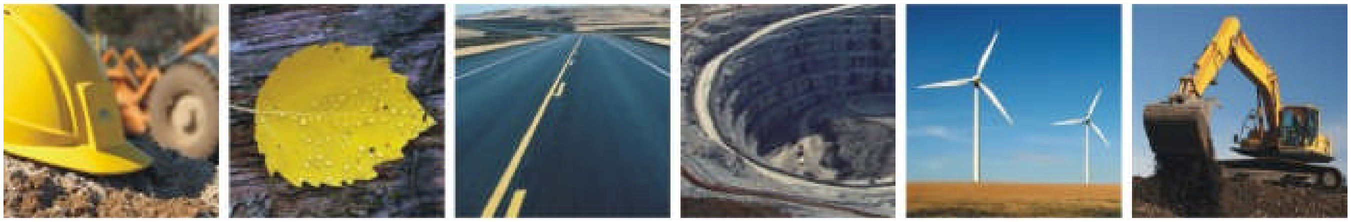
C

APPENDIX C

Geotechnical Evaluation

STANTEC CONSULTING LTD.

GEOTECHNICAL EVALUATION LANDS NORTH OF UPLANDS OUTLINE PLAN LETHBRIDGE, ALBERTA



REPORT

JANUARY 2012
ISSUED FOR USE
EBA FILE: L12101928

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FIGURES

APPENDICES

1.0 INTRODUCTION

This report presents the results of a geotechnical evaluation, conducted by EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company (EBA), for the proposed Lands North of Uplands Subdivision, to be located in North Lethbridge, Alberta. The legal description of the property is NW ¼ 17-9-21 W4M.

The scope of work for the geotechnical evaluation was described in a proposal issued to Mr. Trent Purvis, P.Eng., of Stantec Consulting Ltd. (Stantec), on January 10, 2011. The objective of this evaluation was to determine the general subsurface conditions in the area of the proposed development and to provide general recommendations for the geotechnical aspects of design and construction for a residential subdivision development. This work is in support of the Outline Plan submission to the City of Lethbridge.

This work is supplemented by a review of previous EBA geotechnical reports in this area, as well as a Phase I environmental site assessment (ESA) for the development by EBA (reported under separate cover).

Authorization to proceed with the evaluation was provided by Stantec.

2.0 PROJECT DETAILS AND SCOPE OF WORK

The subject property is located within north Lethbridge, Alberta, as shown on Figure 1, including approximately 158 acres (64 hectares). It is understood that the development will include commercial and residential lots, utility and street infrastructure, as well as stormwater management facilities. The foundation system for the housing will likely choose shallow spread footings with a grade supported lower level floor slab, typical of residential developments in the Lethbridge area. Foundation recommendations for larger structures, such as commercial developments or other facilities, are provided in this report.

It is understood that the proposed street structures will be designed and constructed to City of Lethbridge Infrastructure Services Engineering Standards. The majority of the roadways may comprise designated 'local' pavement structures, with some arterial or collector pavement structures in heavier traffic areas.

The scope of work included twenty-five (25) geotechnical boreholes (for the land development, street, and stormwater developments). A laboratory program was completed to assist in classifying the subsurface soils. This report provides the following general design and construction recommendations:

- Recommended design parameters for footings and pile foundations.
- Recommendations for lot grading, backfill materials, and compaction.
- Recommendations for utility installation, trench excavation, backfill, and compaction standards.
- Recommendations for stormwater management facility design and construction considerations.
- Recommendations for subgrade preparation for street pavements.
- Recommendations for dewatering during construction.
- Recommended design and construction provisions for control of groundwater.
- Recommendations for concrete type.

3.0 GEOTECHNICAL FIELD AND LABORATORY WORK

The fieldwork for this evaluation was carried out on November 28 and 31, 2011. A truck-mounted drill rig was contracted from Chilako Drilling Services Ltd. of Coaldale, Alberta. The rig was equipped with 150 mm diameter solid stem continuous flight augers. EBA's field representative was Mr. Jackson Meadows, C.E.T. The location of buried utilities was carried out through Alberta One-Call.

Twenty-five (25) boreholes (11BH001 through 11BH025) were drilled across the property to depths of 6.6 m and 9.6 m below ground surface. The borehole locations are depicted on Figure 1. The borehole elevations and locations were surveyed and provided by Stantec.

In all boreholes, disturbed grab samples were obtained at depth intervals of 600 mm. The Standard Penetration Test (SPT) was completed at intervals of 1.5 m. All soil samples were visually classified in the field, and the individual soil strata and the interfaces between them were noted. The borehole logs are presented in Appendix B. An explanation of the terms and symbols used on the borehole logs is also included in Appendix B.

Slotted 25 mm diameter polyvinyl chloride (PVC) standpipes were installed in each of the boreholes in order to monitor the groundwater levels. Auger cuttings were used to backfill around the standpipes and they were sealed at the ground surface with bentonite chips.

Classification tests, including natural moisture content, Atterberg Limits, and soluble sulphate content were subsequently performed in the laboratory on samples collected from the boreholes to aid in the determination of engineering properties. The results of the laboratory tests are presented on the borehole logs in Appendix B. In addition, bulk samples were also tested for Standard Proctor moisture density (SPD), as well as remoulded hydraulic conductivity. These results are presented in Appendix D.

4.0 SITE CONDITIONS

4.1 Surface Features

The proposed property is an undeveloped farmland, bounded on the east by the future Uplands Boulevard North right-of-way; on the west by 13 Street North and by Hardieville; to the north by other farmlands; and to the south by the Uplands Subdivision.

The ground surface was noted to be relatively flat, with a slight slope west to the Oldman River valley. The apparent site drainage pattern noted is generally towards the low-lying areas, with marginal off-site drainage noted, resulting in seasonal surface water ponding in some areas.

4.2 Historical Aerial Photographic Review

Based on EBA's understanding of the property's history, including an aerial photograph review from the 1950s to the present day, the land has been used for agricultural purposes.

As part of the aerial photograph review, an earth pile was noted at the centre of the property in a 1999 aerial photograph but was not visible in any other year's photographs. It could be related with the construction activity of the Uplands Subdivision development to the south at that time. No other ground disturbances are noted.

4.3 Mining Activity

Research was conducted on the possible existence of mine workings within the boundary of the site, including publications by Energy and Utilities Board (EUB) and various documents contained in EBA's library regarding the coal mining industry in the Lethbridge area. The literature indicates the presence of one mine working within a portion of the subject site (Figure 1).

Mine 0003/1 (commonly referred to as Galt No. 6) operated between 1909 and 1935. This was an underground coal mine, operated by Lethbridge Colleries Limited, a subsidiary of the Canadian Pacific Railway Company (from 1912). The depth of mine workings in this area was approximately 130 m (approximate Geodetic Elevation of 774 m). The mine used a room and pillar mining arrangement. It is understood that the majority of the coal pillars were removed from the mine in the area underlying the project site during mine working, prior to mine closure in 1935. This was an extensive mine, underlying the western third of the site and within adjacent lands west, north, and south of the site.

During a previous geotechnical evaluation for the northern portion of Legacy Ridge Subdivision, located just west of Hardieville (for Melcor Development Ltd., in January 2001, EBA File 0404-00-42652), EBA completed an aerial photograph review for this area, as well as field reconnaissance to assess potential coal mine subsidence. With the exception of localized subsidence around the two mine shafts, no significant evidence of subsidence within the project limits has been recorded. This review is supplemented by a detailed mine subsidence study completed by EBA for the lands south of Hardieville, in 1984.

Based on research conducted by others in similar geologic profiles to this site (England, Sladen and Joshi) and from EBA's research noted above, the literature indicates that generally, subsidence at ground surface due to collapse of mine workings (rooms and mine access roadways) occurs within 5 years following closure of the workings, with negligible long term consolidation thereafter. Given the depth of the coal mine workings of 130 m, it is not considered that the proposed development area would be adversely affected by the presence of the underground mine workings.

No mine shafts were noted within the proposed site on the No. 6 Galt Mine map (Section 18-9-21 W4M). The nearest shafts are located approximately 450 m to the west of the site limits. For preliminary consideration, it is EBA's understanding that the setback distance from mine shafts is typically determined by projecting a line up from the base of the mine shaft at an angle of approximately 80 degrees from the horizontal. In this case, with a mine shaft base depth of 130 m, the minimum setback distance would be a minimum circular radius of 23 m around each mine shaft. Therefore, the site is well beyond the setback distance from the shafts and influence by mine shafts need not be considered for this development.

Based on EBA's experience, a number of points should be considered for all such developments where underground mine workings are known to exist. Due to coal mine subsidence, there may be localized tension cracks (referenced as linear features) across this property which may require special attention if encountered below the bearing surfaces. This typically does not affect the foundation load capacity of the site soils. It is recommended that any cracks encountered should be overexcavated to remove any softened infill soil materials and backfilled with compacted general engineered fill (cohesive soils).

Therefore, considering this issue, all footing excavations should be observed by experienced personnel. In addition, in the event of residual mine subsidence, there is a possibility of small amounts of ground surface strain that could theoretically be experienced in a worst-case scenario, should an old mine section collapse in the future. Closer engineering examination by a structural engineer and more detailed geotechnical review is recommended for any building higher than two storeys in height or greater than about 30 m length in plan. The review should be intended to verify that type of structures proposed can structurally accommodate these ranges of strain.

4.4 Soil Stratigraphy

It should be noted that geological conditions are innately variable. At the time of preparation of this report, information on the subsurface stratigraphy was available only at discrete borehole locations. In order to develop recommendations from this information, it is necessary to make some assumptions concerning conditions other than at the borehole locations. Adequate field reviews should be provided during construction to check that these assumptions are reasonable.

The following subsections provide a summary of the stratigraphic units encountered at the project site at the specific borehole locations. A more detailed description is provided on the borehole logs provided in Appendix B.

4.4.1 Topsoil

A surficial layer of topsoil was encountered at the borehole locations with varying thicknesses ranging between 100 mm and 200 mm. The topsoil was generally described as clay, silty, sandy, damp, dark brown with roots and organics. The thickness of topsoil should be expected to vary across the lands for the agricultural using purpose.

4.4.2 Clay

A clay layer was encountered below the topsoil at the borehole locations, extending to depths ranging between 0.5 m and 2.2 m. The clay was described as silty, some sand, damp to very moist, medium to high plastic, and stiff in consistency. Moisture contents of clay samples ranged between 11% and 22%. Atterberg Limits testing indicated Liquid Limits of 49% and 40%; and Plastic Limits of 15% and 19%; indicative of medium plasticity. The clay soils are considered to have a medium to high swelling potential. SPT “N” values within this layer ranged from 10 to 15 blows per 300 mm penetration, indicative of stiff consistency.

4.4.3 Clay Till

Clay till was encountered beneath the clay and extended to the borehole termination depths. The clay till was generally described as silty, some sand to sandy, trace gravel, damp to moist, medium to high plastic, stiff to very stiff, and light brown with dark brown mottling. Occasional sand lenses and pockets, coal inclusions, oxide staining, gravel inclusions, and high plastic clay inclusions were also encountered at the borehole locations. Moisture contents of clay till samples ranged between 9% and 31%. Atterberg Limits testing indicated Liquid Limits ranging from 31% to 38%; and Plastic Limits ranging from 11% to 14%; indicative of medium plasticity, with high plastic inclusions.

SPT "N" values within this layer ranged from 8 to 44 blows per 300 mm penetration, indicative of stiff to hard consistency.

The results of SPD testing of the clay till indicate a maximum dry density of 1860 kg/m^3 at an optimum moisture content (OMC) of 13.5%.

A more complete description of the subsurface conditions encountered at the borehole locations is provided on the borehole logs presented in Appendix B.

4.5 Groundwater Conditions

The groundwater level was measured on November 21, 2011. The following table summarizes the groundwater monitoring data.

Table 4.5: Groundwater Monitoring Data

Borehole Number	Depth of Standpipe (m)	Geodetic Elevation of Borehole (m)	Groundwater Monitoring Data November 21, 2011	
			Depth to Groundwater (m)	Elevation of Groundwater (m)
BH001	9.6	912.84	4.95	907.89
BH002	9.6	912.59	7.20	905.39
BH003	9.6	912.39	DRY	-
BH004	9.6	914.16	DRY	-
BH005	9.6	914.64	DRY	-
BH006	9.6	914.66	DRY	-
BH007	9.6	913.58	DRY	-
BH008	9.6	911.14	1.98	909.16
BH009	9.6	916.44	8.20	908.24
BH010	9.6	915.82	4.95	910.87
BH011	9.6	916.65	8.80	907.85
BH012	9.6	915.16	DRY	-
BH013	6.6	913.06	1.49	911.57
BH014	6.6	913.45	6.20	907.25
BH015	6.6	911.02	DRY	-
BH016	6.6	913.75	6.60	907.15
BH017	6.6	913.60	4.83	908.77
BH018	6.6	915.29	DRY	-
BH019	6.6	915.75	DRY	-
BH020	6.6	911.92	DRY	-
BH021	6.6	914.25	DRY	-
BH022	6.6	915.79	DRY	-
BH023	6.6	916.76	6.55	910.21
BH024	6.6	916.37	5.41	910.96
BH025	6.6	916.60	4.47	912.13

It is noted that groundwater levels will fluctuate seasonally in response to climatic conditions, and may be at a different depth when construction commences. Groundwater levels should be monitored prior to development. The intent is to provide an early indication of dewatering requirements during excavation for foundations or utility trenches. Further comments regarding groundwater issues are provided in subsequent sections.

5.0 GEOTECHNICAL RECOMMENDATIONS

5.1 General

The recommendations that follow offer varying options intended to aid in the development of the project concepts and specifications. The recommendations are provided on the understanding and condition that EBA will be retained to review the relevant aspects of the final design (drawings and specifications), and will be retained to conduct such field reviews as are necessary to ensure compliance with geotechnical aspects of the Building Code, this report, and the final plans and specifications. EBA accepts no liability for any use of this report in the event that EBA is not retained to provide these review services.

Recommendations are provided for shallow footings, cast-in-place (CIP) concrete piles, grade supported floor slabs, below grade construction, general site development and lot grading, trench excavation and backfill, stormwater retention ponds, groundwater issues, backfill materials and compaction, roadway subgrade preparation, pavements, and concrete type.

A groundwater study has not been requested as part of this evaluation. It is recommended that weeping tiles for the residences include tie-ins to the storm sewer utility, as per City of Lethbridge Design Standards.

The initial topsoil stripping depth is of particular importance. A topsoil survey is recommended on a phase by phase basis to confirm stripping requirements. Following removal of the surficial organic topsoil, the majority of any underlying B Horizon layer (organic stained, but essentially inorganic clay) can likely remain in place during site stripping and be incorporated into the fill mass during general site grading. Full-time monitoring by experienced personnel is recommended in order to avoid over-stripping and to ensure appropriate material mixing and placement.

Subgrade preparation is required in all lots as well as all paved areas, to City of Lethbridge Standards. This includes stripping of topsoil and deleterious fill materials, scarification, moisture conditioning, and compaction. The native clay soils should be acceptable for site grading purposes. The clay soils appear to be both below and above OMC and as such, moisture conditioning (wetting, mixing, and drying as necessary) will be required to reduce the swelling potential of this soil and to achieve the compaction standards recommended. Proof-rolling within roadways to detect soft areas is also recommended. The contractor should expect soil moisture variability across the site.

All existing utilities and pipelines (whether operational or abandoned) must be located. Existing utility or pipeline trenches pose a particular risk due to settlement of backfill material. Care should be taken to ensure that all existing trenches are excavated to remove the utility/pipeline and backfilled with general engineered fill. Alternatively, the development should be planned to avoid such features. All other existing or historical ground disturbances, if encountered, should be removed and backfilled with general engineered fill.

Shallow footings are generally feasible for residential developments in all areas of the subdivision, most likely in conjunction with full or partial basements. Further recommendations are provided in Section 5.10. However, because footings may be placed within areas of general engineered fill, full-time quality assurance monitoring by geotechnical personnel is required during fill placement. It is noted that placement of foundations on engineered cohesive fill thicknesses greater than 1.5 m require special consideration regarding long-term consolidation of the fill and subsequent performance issues with the foundations/floor slabs-on-grade. Following finalization of the surface grades for the subdivision, this aspect should be addressed, as per City of Lethbridge Design Standards.

CIP concrete piles are a feasible alternative for other developments, such as schools or commercial buildings. However, for drilled pile foundations, the sand lenses and inclusions within the clay till may necessitate the use of casing to prevent sloughing of the pile bores. This may make this foundation alternative less economic in consideration of a shallow foundation system. Recommendations for both of these foundation systems are provided in the following subsections.

Slabs-on-grade for this project must consider the precautions recommended for slabs-on-grade, including the subgrade preparation measures intended to improve slab performance.

All foundation recommendations presented in this report are based on the assumption that an adequate level of monitoring will be provided during construction and that all construction will be carried out by suitably qualified contractors, experienced in foundation and earthworks construction. An adequate level of monitoring is considered to be:

- For shallow foundations and slabs; inspection of bearing surfaces prior to placement of concrete or mudslab, and design review during construction.
- For pile foundations; full time monitoring and design review during construction.
- For earthworks; full-time monitoring and compaction testing.

All such monitoring should be carried out by suitably qualified persons, independent of the contractor. One of the purposes of providing an adequate level of monitoring is to check that recommendations, based on data obtained at discrete borehole locations, are relevant to other areas of the site.

5.2 Lot Grading

The lot grading should be designed and carried out to the current City of Lethbridge Infrastructure Services Engineering Standards, with particulars discussed as follows.

All lots should be graded for drainage at a minimum gradient of 2.0%. The existing surficial site soils, comprising medium to high plastic clay and clay till, are suitable for use as landscape fill materials or for use as general engineered fill materials for lot grading, as defined in Appendix C. The moisture content of the site soil materials at surface generally appears to be both above and below the anticipated OMC for these soils in most areas. It is anticipated therefore, that moisture conditioning consisting of both wetting and drying will be required at the site for proper compaction. Although soil moisture variability should be expected, the earthwork contractor should assess the requirements and should consider such factors as weather and construction procedures.

General engineered fill materials for lot grading should be moisture conditioned to within a range of -1% to +2% of the OMC prior to compaction, and compacted to a minimum of 98% of SPD.

Further recommendations regarding backfill materials and compaction are in Appendix C.

5.3 Construction Excavations

Excavations should be carried out in accordance with the Alberta Occupational Health and Safety (OH&S) Regulations. For this project, the depth for the majority of the excavations is assumed to be less than 3.0 m below existing ground surface. Excavations to deeper depths require special considerations. The following recommendations notwithstanding, the responsibility of trench and all excavation cutslopes resides with the Contractor and should take into consideration site-specific conditions concerning soil stratigraphy and groundwater. All excavations should be reviewed by a geotechnical engineer prior to personnel working within the base of the excavation.

Temporary excavations within stiff clay soils which are to be deeper than 1.5 m should have the sides shored and braced or the slopes should be cut back no steeper than 1.0 horizontal to 1.0 vertical (1H:1V).

Flatter sideslopes may be required in some areas where groundwater is encountered within sand/silt layers interbedded within the clay layers, which may cause local sloughing and instability of the excavation sidewalls. In these instances, the excavation configuration design should be reviewed by experienced personnel, prior to allowing personnel to enter the base of the excavation. Vertical trench cuts using trench box wall support are not recommended for this project due to the inherent difficulty in compacting the backfill materials to an engineered standard, as well as the potential of cave-ins of the excavation sidewalls against the utility box.

Any encountered groundwater seepage should be directed towards sumps for removal. Conventional construction sump pumps should be capable of groundwater control.

The composition and consistencies of the soils encountered along the utility alignments are such that conventional hydraulic excavators should be able to remove these materials.

Temporary surcharge loads, such as spill piles, should not be allowed within a distance equal to the depth of the excavation from an unsupported excavation face or 3.0 m, whichever is greater, while mobile equipment should be kept back at least 3.0 m. All excavation sidewall slopes should be checked regularly for signs of sloughing, especially after rainfall periods. Small earth falls from the sideslopes are a potential source of danger to workmen and must be guarded against.

General recommendations regarding construction excavations are included in Appendix C.

5.4 Trench Backfill

The moisture content of the clay soils encountered across the site generally varies below and above the estimated OMC for the materials. It is expected that such soils would be satisfactory as trench backfill material; however, may require moisture conditioning prior to reworking. It is anticipated; therefore, that moisture conditioning consisting of both wetting and drying or mixing will be required for proper compaction. The earthwork contractor should however, make his own estimate of the requirements and should consider such factors as weather and construction procedures.

Trenches must be backfilled in such a way as to minimize the potential differential settlement and/or frost heave movements. A minimum density of 98% of SPD is recommended for all trench backfill, at a moisture content of between –1% and +2% of optimum. The compacted thickness of each lift of backfill shall not exceed 150 mm. The upper 1.5 m of service trenches should be cut back at a maximum slope of 1H:1V to avoid an abrupt transition between backfill and in situ soil.

It should be noted that the ultimate performance of the trench backfill is directly related to the uniformity of the backfill compaction. In order to achieve this uniformity, the lift thickness and compaction criteria must be strictly enforced.

For frost protection, pipes buried with less than 2.0 m of soil cover (above top of pipe) should be protected with insulation to avoid frost damage or breakage of the pipes. Rigid insulation placed under areas subject to vehicular wheel loadings should be provided with a minimum thickness of 600 mm of compacted granular base.

General recommendations regarding construction excavation, backfill materials and compaction are contained in Appendix C.

5.5 Backfill Materials and Compaction

The existing site soils comprising the predominantly medium plastic clay and clay till are adequate for use as both landscape fill and general engineered fill materials, as defined in Appendix C. Any soil containing deleterious materials should be removed from site. The final decision on approved backfill materials should be made during site construction.

The moisture content of the site soil materials is expected to be variable with respect to the OMC. It is anticipated, therefore, that moisture conditioning will be required at the site for proper backfill placement. The earthwork contractor should make their own estimate of the requirements for moisture conditioning to the recommended standards, and should consider such factors as weather and construction procedures. A contingency for importation of general engineered clay fill is recommended, in the event that the site soils can not be moisture conditioned.

General engineered fill materials in all building areas and for trenches should be moisture conditioned to within a range of -1% to +2% of the OMC prior to compaction, and compacted to a minimum of 98% SPD.

Further recommendations for backfill materials and compaction are in Appendix C.

5.6 Street Subgrade Preparation

Within all paved areas, the upper 300 mm of native clay soils or prepared general engineered fill subgrade should be scarified and uniformly moisture conditioned to between -1% of optimum and 2% over OMC. The subgrade should then be uniformly compacted to a minimum of 98% of SPD.

Based on EBA's local experience, the contractor should be made aware that subgrade difficulties often arise at moisture contents of 3% over optimum, as noted in the current City of Lethbridge Standards, where siltier soils are encountered. Therefore, in practice, the moisture content within proposed paved areas should be limited to no more than 2% over optimum for acceptable subgrade support conditions.

Backfill to raise these areas to subgrade level should be general engineered cohesive fill materials, as defined in the report text or Appendix C, moisture conditioned and compacted as noted previously. The subgrade should be prepared and graded to allow drainage into catchbasins. Proof-rolling of the prepared surface is recommended to identify localized soft areas and for an indication of overall subgrade support characteristics.

It is imperative that positive surface drainage be provided to prevent ponding of water within the roadway structure and subsequent softening and loss of strength of the subgrade materials. Surrounding landscaping should be such that runoff water is prevented from ponding beside paved areas in order to avoid softening and premature failure of the pavement surface.

The soil moisture regime should be considered in achieving the above recommended standards for construction of the subgrades. If localized areas of soft subgrade soils are encountered, provisions may be required to subcut each area and replace with cohesive engineered fill, or alternatively, with granular (pit-run) fill with the use of a geotextile grid or geotextile fabric to strengthen the subgrade support characteristics. Further design information can be provided following initial proof-rolling of the subgrade soils.

5.7 Pavement Design and Construction

For the purposes of this report, two design sections are provided. One, if the roadway design classification is as a 'local' roadway and one where the classification is as a 'collector' roadway.

Table 5.7: Pavement Structures

Design Pavement Section		
Material Type	**Local Urban (mm)**	**Collector (mm)**
Surface Course Asphalt Concrete (Type III)*	75	50
Base Course Asphalt Concrete (Type II)*	-	60
Granular Base Course*	200	300

* Current City of Lethbridge Transportation Detailed Engineering Standards

A detailed review of the general paving plan has not been completed. The above recommended pavement layer thicknesses generally refer to average values and recognize typical construction variability. As constructed layer thicknesses should satisfy the thickness tolerances identified in the City of Lethbridge Engineering Standards for granular materials and asphalt concrete (or equivalent).

All asphalt paving lifts should be compacted to a minimum of Marshall Design density, as per current City of Lethbridge Transportation Detailed Engineering Standards. Additional recommended guidelines for design and construction of pavement structure are presented in Appendix C of this report.

The pavement design should include provisions for subsurface drainage of the pavement granular layers. For urban sections, one option is to provide subsurface drainage in the form of longitudinal subdrains along the edge of the pavement structure, where viable. Subdrains will provide a means of removing water that infiltrates the pavement structure, either through cracks and vertical details (e.g., face of gutter), or from peripheral surface runoff. The subdrain should consist of a perforated flexible plastic drainpipe (100 mm diameter), complete with filter sock. The drain should be placed along the edge of the pavement section in a recessed area of the prepared subgrade. Positive outfall of the drains should be provided at catchbasin locations or other stormwater outfalls.

5.8 Concrete Issues

5.8.1 Concrete Type

The water-soluble sulphate content of four representative soil samples recovered from the site (determined in a laboratory) varied between 0.2% and 4.9%. The properties of concrete for foundations in contact with soil or groundwater shall meet the requirements of Canadian Standards Association (CSA) A23.1-09, Table 3 Class S-2 exposure, i.e., water/cementing materials (w/cm) ratio of 0.45, air-entrainment of 4% to 7% (for 14 mm to 20 mm nominal maximum aggregate size), and a minimum specified 56-day compressive strength of 32 MPa.

For this exposure classification, alternatives include the usage of Type HS (sulphate-resistant) Portland cement or blends of cement and supplementary cementing materials conforming to Type MSb and/or Type HSb cements.

Stricter recommendations may be required due to structural or other exposure considerations (A23.1-09, Table 1). Air entrainment should be increased to 5% to 7% for exterior flatwork.

5.8.2 Concrete Surface Works

With respect to surface works concrete (i.e., specifically concrete curbs and sidewalks), the recommendations provided in this report for subgrade preparation, including moisture conditioning and compaction, are intended to provide relative uniformity in the subgrade. The intention of uniformity, with respect to material type and moisture content, is to reduce the risk of differential concrete movements due to soil volume changes as a result of fluctuating moisture content. A gradual increase in soil moisture content over time is likely to occur (due to precipitation, reduced evaporation, and irrigation), and some differential movement and subsequent cracking of concrete surface works should be anticipated, typical for the Lethbridge area.

With respect to providing a layer of granular material beneath surface works concrete, there are both positive and negative consequences. In the positive sense, it must be assumed that the subgrade will be uniformly graded properly such that any moisture gaining access beneath the concrete within the granular layer would be drained away quickly to an area designed to accommodate excess moisture (i.e., roadway weeping tile tied into the storm system). If well drained, the provision of granular material also serves to reduce some differential distortions, when washed materials are used, and has been documented as helping to reduce longitudinal cracking.

On the negative side, if free drainage of the granular layer is not designed, constructed, and maintained, granular materials provide easy access for excess moisture to pond below the concrete, causing swelling of the medium to high plastic subgrade soils and/or consolidation of fill soils. There is also a risk of softening of the adjacent roadway pavement edges.

The risk of differential movement of the subgrade soils and the economic consequence for either option should be given due consideration by the municipal engineer.

5.9 Limit States Design

The design parameters provided in the following sections may be used to calculate the ultimate foundation capacity in each case. For the Limit States Design (LSD) methodology, in order to calculate the factored load capacity, the appropriate soil resistance factors must be applied to each loading condition, as follows.

Factored Capacity = Ultimate Capacity x (Soil Resistance Factors)

The following soil resistance factors must be incorporated into the foundation design. These factors are considered to be in accordance with the 2006 Canadian Foundation Engineering Manual (CFEM), as well as the 2005 National Building Code of Canada.

Table 5.9: Soil Resistance Factors

Item	Soil Resistance Factor
Shallow Foundations	
Bearing resistance	0.5
Passive resistance	0.5
Horizontal resistance (sliding)	0.8
Deep Foundations	
Axial load - From semi-empirical analysis	0.4
Axial load - From static loading test results	0.6
Axial load - From dynamic monitoring results [i.e., pile driving analyzer (PDA) testing]	0.5
Uplift - From semi-empirical analysis	0.3
Uplift - From loading test results	0.4
Horizontal passive resistance	0.5

Under LSD methodology, foundations should be designed on the basis of factored Ultimate Limit State (ULS) parameters. In order to determine the applicable working capacity, Serviceability Limit States (SLS) must also be considered. The lower of the factored ULS resistance or the unfactored SLS resistance should be used as the working capacity for foundation design purposes

Further comments are provided in the following sections. Deep foundations refer to drilled CIP concrete piles.

5.10 Shallow Foundations

Shallow foundations, if considered, should be constructed a minimum of 1.4 m below the final design exterior ground surface (frost protection requirement).

At the time of preparation of this report, information about the presence of fill soils on site was only available at the specific borehole locations. For this reason, the final subgrade elevation for footings should be determined in the field by qualified geotechnical personnel. All fill and debris materials (where encountered) must be removed from the building footprint areas to expose native clay subgrade.

The ultimate static bearing pressure for the design of strip and spread footings at these depths may be taken as 250 kPa for native clay and clay till soils, subject to other recommendations in this report. The ultimate static bearing pressure is based on correlation between SPT "N" values. Factoring should be considered as noted in Section 5.9. Footing dimensions should be in accordance with the minimum requirements of the Building Code.

Bearing certification by a geotechnical engineer is recommended to ensure that the shallow foundations are placed on competent native soils. If softer native soils or residual fill soils are encountered at footing level, recommendations may be provided to lower the footing elevations to materials satisfying the design bearing capacity or to widen the footings within softer clay areas. This should be a field determination at the time of bearing observation.

It is recommended that a smooth-edge trimming bucket or grade-all be used for final excavation to the foundation subgrade elevation to minimize disturbance of the founding soils. A 50 mm concrete mudslab should be placed immediately following excavation to protect the bearing surface from weathering.

The anticipated foundation soils are of medium plasticity, and as such, are prone to volume changes (both heave and settlement) with varying moisture content. Therefore, a permanent weeping tile system is also recommended around the outside perimeter of any structures at the foundation elevation to maintain a consistent moisture profile of the founding soils. This will reduce the potential of differential movement (heave or settlement) of the foundations.

Settlement of footings designed and constructed in accordance with the above recommendations should be well within the normally tolerated values of 25 mm total and 15 mm differential at factored loading. If this range of settlement is not tolerable, then a pile foundation system may be considered for the building.

Recommendations for minimum depth of cover for footings are presented in Section 5.16. Further recommendations regarding shallow foundations are given in Appendix C.

5.11 Bored Cast-in-Place Concrete Piles

Bored CIP concrete piles, if considered, should be founded in native clay till and may be designed to resist axial compressive loads on the basis of the ultimate skin friction and end-bearing parameters given below. End-bearing should not be used for small diameter (less than 760 mm base diameter) piles because of the difficulties associated with ensuring a clean base. End-bearing may only be considered in the design of under-reamed or belled piles if facilities are available for adequate cleaning of the pile base.

Straight shaft bored piles should have a minimum diameter of 400 mm plus a minimum length of 6.0 m. The piling designer and/or contractor should take the soil conditions into account during pile design consideration. Under-reaming to form belled piles may be considered for piles with shaft diameters of 400 mm or greater, and where formation of the bell is within competent clay till soils to prevent sloughing of the under-ream.

Static ultimate design parameters for skin friction and end-bearing are as follows:

Table 5.11: Static Ultimate Design Parameters for Skin Friction and End-bearing

Depth below Final Grade (m)	Ultimate Skin Friction (kPa)	Ultimate End-bearing (kPa)
0 – 1.5	0	N/A
1.5 – 6.0	40	N/A
Below 6.0	50	650

A minimum ratio of depth of cover versus the base or bell diameter (D/B) of 2.5 has been assumed to determine the above end-bearing pressure. Should less cover be provided, the bearing pressure would have to be reduced. Minimum bell diameters should be twice the shaft diameter.

The pile design for belled piles may consider end-bearing in addition to shaft friction, as noted above, in order to determine the total ultimate pile capacity. However, the shaft friction should be neglected for a distance of one shaft diameter above the top of the bell, and within the portion of the pile shafts within fill soils.

Casing should be on hand before drilling starts and used, if necessary, to seal off water and/or prevent sloughing of the hole. In the present site conditions, it is anticipated that casing use may be required due to the presence of groundwater. The piling contractor should make his own estimate of casing requirements considering such factors as soil types, construction procedures, and bore diameter.

Additional recommendations are provided in Appendix C.

5.12 Floor Slabs-on-Grade

Construction of floor slabs-on-grade for this project (outside of basements) must consider the surficial clay soils noted within the development area as well as the general engineered fill layers placed during site grading. Construction should consider that the following precautions and construction recommendations are followed.

In native soils areas, following removal of topsoil, the subgrade should be scarified to a minimum depth of 300 mm, and moisture conditioned to a range of optimum to 2% over OMC. Within areas of fill, the exposed subgrade should be scarified for a minimum depth of 600 mm, considering the clay fill soils (not containing deleterious materials) and moisture conditioned as noted above. The minimum compaction in each case should be 98% of SPD. The prepared subgrade should be proof-rolled and any soft or loose pockets detected should be reconditioned as recommended above or over-excavated and replaced with general engineered fill.

A levelling course of clean well-graded crushed gravel, at least 150 mm in compacted thickness, is recommended directly beneath the slabs-on-grade, unless a thicker course is required for structural purposes. The subgrade beneath slabs-on-grade should be protected at all times from moisture or exposure which may cause softening or disturbance of the subgrade soils. This applies during and after the construction period (and before and after replacement of the required general engineered fill). Should the exposed surface become saturated or disturbed, it should be reworked to achieve the above standards.

If the subgrade is properly prepared as noted above, floor slab movements should be limited to less than, approximately, 25 mm. Slabs-on-grade should be separated from bearing members to allow some differential movement. If this range of differential movement is unacceptable, the owner should consider a structurally supported floor.

Recommended procedures for proof-rolling and backfill materials and further recommendations for slabs-on-grade construction are included in Appendix C.

5.13 Structural Slabs

A structurally supported floor slab with a crawl space beneath may be used if differential movements from a slabs-on-grade system are not tolerable. The crawl space floor should be graded toward a sump to collect water that may enter. The crawl space floor should also be covered with a vapour barrier and concrete. If a concrete floor is selected for the crawl space, bond breaks should be provided at the foundation walls and columns to allow it to move independently of the structure.

It is important that the crawl space be properly insulated and vented according to applicable building codes, as it has been EBA’s experience that in some cases, crawl spaces may develop a moisture/humidity problem. The use of a crawl space with any other covering is not recommended for this development.

Alternatively, the slab may be totally structurally supported with no crawl space. However, with this type of structurally supported floor slab system, there is a risk of ground movement relative to the slab. This relative movement can lead to problems if piping and other utilities that are connected to the slab are embedded within the ground beneath the slab. Utilities beneath the structurally supported floor slabs should be protected from differential movement by placing utilities within boxes suspended from the structural slab. In addition, a void form is recommended below the floor slab in order to prevent transfer of uplift pressures due to swelling clay soil.

5.14 Basement Construction

5.14.1 Basement Floor Slabs

Slabs-on-grade construction for basements is considered feasible providing certain precautions are undertaken. All excavations should be carried out remotely using a smooth-mouth bucket or Grade-All at final grade in order to minimize disturbance of the base. Basement floor slabs should be supported by a minimum of 150 mm compacted, clean, free-draining granular material.

In areas where floor slabs bear on a clay subgrade, the clay at this site may swell following completion of the floor slabs. Therefore, some movement should be anticipated. Any light columns in the basement designed to support the main floor should be of the adjustable "telepost" type. If partitions are constructed in the basement, provision must be made so that, if the basement floor slab heaves, the partitions do not raise the main floor. A minimum allowance of 25 mm should be left between the top plates of basement partitions and the floor above them to accommodate heaving of the floor slab. This heaving allowance is less applicable for interior columns founded on spread footings.

The slab subgrade should be sloped to provide positive drainage to the edge of the slab (where the native soils are cohesive). A minimum drainage gradient of 0.5% is recommended.

Slabs-on-grade should be separated from bearing members to allow some differential movement. If differential movement is unacceptable, a structurally supported floor system or crawl space may be considered.

General recommendations regarding floor slab construction are presented in Appendix C.

5.14.2 Below-Grade Walls

All below-grade walls should be designed to resist lateral earth pressures in an "at-rest" condition. This condition assumes a triangular pressure distribution and may be calculated using the following expression:

$$P_o = K_o\,(\gamma H+Q)$$

Where: P_o = Lateral earth pressure "at-rest" condition (no wall movement occurs at a given depth).

K_o = Coefficient of earth pressure "at-rest" condition (use 0.5 for cohesive backfill and 0.45 for sand and gravel backfill).

γ = Bulk unit weight of backfill soil (use 19 or 21 kN/m^3 for cohesive or granular backfill, respectively).

H = Depth below final grade (m).

Q = Surcharge pressure at ground level (kPa).

It is assumed that drainage is provided for all below-grade walls through the installation of the weeping tile, and hydrostatic pressures will not be a factor in design. An acceptable weeping tile system should consist of a perforated weeping tile wrapped in a geosock or geotextile fabric, in turn surrounded with a minimum of 150 mm thick blanket of washed rock (maximum size 20 mm). The weeping tile should have a minimum 0.5% slope leading to a sump. The preferred method would be to have provision to tie the sump into the storm sewer utility or the property's on site drainage system.

Backfill around concrete walls should not commence before the concrete has reached a minimum two-thirds of its design strength and first floor framing is in place or the walls are laterally braced. Only hand-operated compaction equipment should be employed within 600 mm of the concrete walls. Caution should be used when compacting backfill to avoid high lateral loads caused by excessive compactive effort. A compaction standard of 95% of SPD is recommended. To avoid differential wall pressures, the backfill should be brought up evenly around the walls. A minimum 600 mm thick clay cap should be placed at the ground surface to reduce the infiltration of surface water.

5.15 Foundation Perimeter Drainage Requirements

It is recommended that a weeping tile and sump system be constructed around the outside perimeter of the buildings (at the base of the footings, if selected) to maintain a relatively consistent moisture profile of the subgrade soils. The weeping tile system should comprise a perforated weeping tile, in turn surrounded with a minimum of 150 mm thick blanket of washed rock (maximum size 20 mm) with the granular layer wrapped in non-woven geotextile. The weeping tile should have a minimum 0.5% slope leading to a sump.

5.16 Frost Protection

For protection against frost-action, perimeter footings in heated structures should be extended to such depths as to provide a minimum soil cover of 1.4 m. Isolated or exterior footings in unheated structures should have a minimum soil cover of 2.1 m unless provided with equivalent insulation.

For a deep foundation system, all piles in unheated areas should have full depth steel reinforcement and should be drilled to a minimum depth of 6.0 m. Grade beams spanning concrete piles should have a minimum 100 mm void space on the underside of the grade beam and around the pile caps to reduce the risk of interaction with the underlying soil associated with frost heaving and/or swelling soils.

Pipes buried with less than 2.0 m of soil cover should be protected with insulation to avoid frost effects that might cause damage to or breakage of the pipes. Rigid insulation placed under areas subject to vehicular wheel loadings should be provided with a minimum thickness of 600 mm of compacted granular base.

5.17 Seismic Design

The Site Classification recommended for Seismic Site Response is Classification D, as noted in Table 4.1.8.4.a of NBCC.

6.0 STORMWATER POND DEVELOPMENT

6.1 General

The locations of the stormwater management facilities proposed have not been finalized at the time of preparation of this report.

Based on EBA's understanding of a typical stormwater management facility design, a dry pond typically has a base elevation of approximately 2 m to 3 m below final ground surface. A typical wet pond might have a base elevation ranging between 3 m and 5 m below final ground surface. Such facilities are normally constructed as an excavation below ground surface, while above ground berms are generally not common. The facility will provide overland stormwater storage for the area in accordance with municipal regulations.

Once the operational water level elevation of the wet pond is designed, it is recommended that the proposed sideslopes for the pond below normal operating level be no steeper than 3H:1V. Above the normal water level, the sideslopes are recommended to be no steeper than 5H:1V.

In the preparation of the recommendations provided in this report for the geotechnical aspects of design and construction of the facility, EBA reviewed pertinent sections of the "Stormwater Management Guidelines for the Province of Alberta", dated January 1999 and prepared by the Municipal Program Development Branch of Alberta Environmental Protection [known now as Alberta Environment (AENV)]. Detailed recommendations for the design and construction of this facility are provided in subsequent sections.

6.2 Facility Design

As discussed in the previous sections, the subsurface stratigraphy of the site comprises lacustrine clay overlying glacial clay till. Within the stormwater facility footprint, all organic soils must be removed to ensure the pond subgrades bear on the site's clay soils.

It is considered that the clay till soils will most likely comprise the majority of the clay liner and are found naturally below the proposed pond invert. Literature references (geology) for the clay till (Buffalo Lake Till Sheet) confirm that the till is vertically fractured (due to over consolidation during periods of glaciation). The till is also referenced (as confirmed by the site specific drilling program) to contain sand and/or silt lenses or pockets throughout its matrix. These preferential paths for groundwater seepage may or may not be horizontally continuous and it is not possible to quantify potential seepage losses. However, the literature does present a range of permeability (k) for this till sheet between 10E-05 cm/sec and 10E-06 cm/sec. When compared to the field permeability of a reworked clay liner (recommended k=10E-07 cm/sec), the difference in potential water loss may be in the order of one to two magnitudes (10 to 100 times less for a remoulded clay liner).

It should be recognized that, following construction of the wet pond component (within 3 to 5 years), siltation of the pond floor, swelling of the medium plastic clays, and the development of a groundwater mound will greatly affect the estimated annual water losses. Quantifying this loss to a greater extent than that predicted here would require groundwater modeling which was not included in the current project scope.

In consideration of the above-noted factors, the use of the clay till soils in their native state is not recommended because of the potential loss of containment through the fissured till structure and possible silty or sandy pockets within the clay till, which may provide preferential seepage paths. For this development, it is recommended that the native, cohesive clay till soils be reworked into a low permeable, compacted clay liner to provide the required containment (for wet ponds). With this option, some loss of containment is still possible (as with any earth retention structure). However, the recommendations presented herein are intended to limit seepage losses to an acceptable level, consistent with current industry standards.

Alternate liner types, such as synthetics, are not addressed in this evaluation. They may provide additional protection against leakage but are substantially more expensive.

The use of the native clay till materials encountered on this site for construction of a remoulded clay liner for the pond is considered feasible, provided certain precautions are undertaken, as recommended in the following sections. The results from the field program indicate that perched groundwater levels may be within the proposed wet pond invert, within relatively thin or small saturated sand/silt seams. The use of native lacustrine clay soils for construction of remoulded clay liners should be limited to areas above the high water level (HWL).

It is assumed that above the normal water level, the sideslopes are to be 5H:1V. Below the normal water level, the sideslopes are assumed to be at approximately 3H:1V. Assuming the embankment between the normal water level and HWL is constructed with an engineered clay liner (as recommended in this report), the potential for erosion from wave action should be considered. Slope protection comprising rip-rap designed for potential wave erosion or other means should be given consideration. The use of a filter fabric median between the native soils and rip-rap is also recommended. Design recommendations for this type of protection are beyond the scope of this report.

For the assessment of clay liner suitability, one laboratory constant head permeability test was conducted on a remoulded sample of the native clay soils. The laboratory test was conducted on composite clay till samples retrieved from between 1.5 m to 3.0 m below ground level (to model that excavated from within the pond footprint and proposed for use as a clay liner). The sample was compacted to approximately 98% of SPD at approximately the OMC for the soil sample (Appendix D). The measured steady state permeability (k) was 1.29E-09 cm/sec. Therefore, the design field liner permeability assumed for the remoulded clay till soil is 1.29E-08 cm/sec. (one order of magnitude larger than the laboratory k). Prior to final design and construction of the proposed facility, additional permeability testing on site soil samples taken from the proposed excavation of the facility or borrow source should be conducted to verify the site specific permeability coefficient.

Based upon the site soil conditions and the above-noted permeability value, it is recommended that a preliminary thickness for the remoulded clay liner be 0.6 m along the base of the wet pond and 1.0 m along the sidewalls up to design operation water elevation (minimum recommended).

A liner thickness of 0.3 m may be given consideration for base liners in other areas of the proposed developed (dry pond), which will only occasionally be below water. This thickness accounts for the potential of desiccation of the upper 0.2 m during the initial periods when the dry pond is empty. It also accounts for potential disturbance during storm events and to facilitate access during periods of maintenance. Thirdly, it is intended as an additional level of protection, to reduce the long term infiltration of groundwater and soil saturation below the dry pond, as a means of maintaining long-term stability of the adjacent slopes.

The following discussions and recommendations pertain to the pond construction, including the construction of a low permeability compacted clay liner.

6.3 Pond Construction

6.3.1 General Base Preparation

Following stripping of any organic materials within the development area, the containment basin area should be over-excavated beneath the proposed invert elevation in order to allow sufficient thickness of compacted clay base liner. The clay till soil within the base of the excavation should then be scarified to a minimum depth of 300 mm, moisture conditioned to between –1% and +2% of OMC, and recompacted to a minimum of 98% of SPD. The prepared subgrade thickness may be taken into account in the design liner thickness.

The basin sidewalls in the cut areas (up to HWL) should also be over-excavated a sufficient amount to allow the construction of a compacted clay liner with the exposed subgrade scarified, moisture conditioned, and compacted as noted above.

Monitoring of excavated soils within the pond footprint is recommended so that unsuitable materials, such as low plastic silts or cohesionless sands, are incorporated only in general landscape areas (above HWL) where low permeability is not a requirement.

The composition and consistencies of the soils encountered on the property are such that conventional hydraulic excavators should be able to remove these materials. Cobbles and boulders may be present within the clay till matrix, albeit infrequently. General recommendations regarding backfill materials and compaction as well as construction excavations are given in Appendix C.

Full-time monitoring is recommended by suitably qualified persons, independent of the Contractor. One of the purposes of providing an adequate level of monitoring is to check that recommendations, based on data obtained at discrete borehole locations, are relevant to other areas of the site.

6.3.2 Remoulded Clay Liner

The following recommendations for the construction of remoulded clay liners are based on compliance with AENV's publication, "Stormwater Management Guidelines for the Province of Alberta", dated January 1999. This publication does not specifically provide permeability recommendations for wet ponds; however, it does provide a guideline in Figure 6.10, Wet Detention Pond Plan Sections, for suitable subgrade to prevent infiltration below permanent depth (Max = 1.2 m/Min = 0.6 m).

Recommendations for the pond base and sidewall preparation have been provided in the previous section. The plan dimensions of the excavation should exceed the final "toe-to-toe" interior basin dimensions to provide an overlap between the pond floor liner, and berm or sideslope liner. The subgrade should be relatively level and proof-rolled to provide a good base for compacting the first liner lift to the specified density. Soft pockets that would prevent sufficient compaction of the liner must be over-excavated and replaced with compacted cohesive clay fill materials. In lieu of satisfying the compaction requirements, a geotextile fabric (such as Armtec 200) may be required on or about the elevation of any encountered soft subgrade, although this is not anticipated for the current site conditions.

Careful site observation and testing will be required to avoid incorporating low or non-plastic materials into the liner. It is recommended that materials with a Liquid Limit of less than 30% not be incorporated into the liner. However, low plastic clays, silt or sands not meeting liner requirements, may be used in the top areas of the embankments above HWL or outside the liner zones.

Based on the results of the field program, moisture conditioning of the clay liner materials will be required during liner construction. Appropriate methods of moisture conditioning should be reviewed with qualified construction personnel prior to final design of the liner.

Subsequent to the preparation of the pond floor, the excavated clay soils (liner borrow material) should be moisture conditioned to between –1% and +2% of OMC. Each lift should then be compacted to a minimum of 98% of SPD in lifts of maximum 150 mm compacted thickness to a total placed liner thickness of 0.6 m for the base, as recommended above.

A maximum "clod" size of 100 mm during moisture conditioning (prior to compaction) will produce relatively uniform moisture content throughout the soil matrix and a relatively homogenous compacted soil structure. The size of the "clods" can be controlled with agricultural equipment such as a disk. As far as practical, the liner should be built up in a uniform fashion over the containment basin area, in order to avoid sections of "butted fill" where seepage paths may develop. Compaction should be carried out utilizing "kneading" type compaction equipment such as vibratory padfoot or sheepsfoot type compactors. Completed liner areas should have the surface smoothed by a vibratory smooth drum roller.

Sideslope liners in "cut" areas should have a minimum thickness (perpendicular to the slope face) of 1.0 m, as noted. The cohesive materials for the sideslope liners should be moisture conditioned and compacted as indicated above for the pond bottom.

If a lift of liner soil is allowed to become dry and desiccated prior to the placement of the next lift, the exposed surface should be scarified, remoisture conditioned, and recompacted. Prior to pond filling and during maintenance periods when the pond is empty, the pond bottom should be prevented from drying out beyond 0.2 m as accounted for in the design liner thickness.

7.0 DESIGN AND CONSTRUCTION GUIDELINES

Recommended general design and construction guidelines are provided in Appendix C, under the following headings:

- Shallow Foundations
- Floor Slabs-on-Grade
- Construction Excavations
- Backfill Materials and Compaction
- Bored Cast-in-Place Concrete Piles
- Proof-rolling

These guidelines are intended to present standards of good practice. Although supplemental to the main text of this report, they should be interpreted as part of the report. Design recommendations presented herein are based on the premise that these guidelines will be followed. The design and construction guidelines are not intended to represent detailed specifications for the works although they may prove useful in the preparation of such specifications. In the event of any discrepancy between the main text of this report and Appendix C, the main text should govern.

8.0 REVIEW OF DESIGN AND CONSTRUCTION

EBA should be given the opportunity to review details of the design and specifications, related to geotechnical aspects of this project, prior to construction.

Bearing surfaces, foundation installation, and deep excavations should be monitored by qualified geotechnical personnel during construction. EBA should be retained to provide these services. A detailed, site specific geotechnical evaluation is recommended for large structures (e.g., multi-family residences, institutional, and commercial developments).

9.0 LIMITATIONS

Recommendations presented herein are based on a geotechnical evaluation of the findings in twenty-five geotechnical boreholes and a review of historical aerial photographs, mine records, and other existing information. The conditions encountered during the fieldwork are considered to be reasonably representative of the site. If, however, conditions other than those reported are noted during subsequent phases of the project, EBA should be notified and given the opportunity to review our current recommendations in light of new findings. Recommendations presented herein may not be valid if an adequate level of monitoring is not provided during construction.

10.0 CLOSURE

We trust this report satisfies your present requirements. We would be pleased to provide further information that may be needed during the design and to advise on the geotechnical aspects of specifications for inclusion in contract documents. Should you require additional information or monitoring services, please contact the undersigned at your convenience.

Sincerely,
EBA Engineering Consultants Ltd.

JAMES A. RYAN

Jan 18/12

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PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.
Signature
Date January 18, 2012
PERMIT NUMBER: P245
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

FIGURES

C:\Users\leanne.hughes\Documents\L12101928\L12101928_FIG1_R0.dwg [FIGURE 1] January 16, 2012 - 9:10:57 am (BY: HUGHES, LEANNE)

LEGEND

⊕ - BOREHOLE

▨ - MINING AREA

0 200 500m

SCALE 1:12 500

NOTES
BASED ON IMAGE PROVIDED BY GOOGLE EARTH PRO.

CLIENT

Stantec

A TETRA TECH COMPANY

NORTH UPLANDS SUBDIVISION

BOREHOLE LOCATION PLAN

PROJECT NO.	DWN	CKD	REV	
L12101927	LCH	JZ	0	**Figure 1**
OFFICE	DATE			
EBA-Lethbridge	January 2012			

APPENDIX A

APPENDIX A GEOTECHNICAL REPORT – GENERAL CONDITIONS

GENERAL CONDITIONS

GEOTECHNICAL REPORT

This report incorporates and is subject to these "General Conditions".

1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of EBA's Client. EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA's Client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. EBA's instruments of professional service will be used only and exactly as submitted by EBA.

Electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, EBA has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

5.0 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

7.0 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

9.0 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

10.0 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

11.0 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

12.0 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

13.0 SAMPLES

EBA will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client’s expense upon written request, otherwise samples will be discarded.

14.0 INFORMATION PROVIDED TO EBA BY OTHERS

During the performance of the work and the preparation of the report, EBA may rely on information provided by persons other than the Client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

APPENDIX B

APPENDIX B BOREHOLE LOGS

TERMS USED ON BOREHOLE LOGS

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on 0.075mm sieve): Includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as inferred from laboratory or in situ tests.

DESCRIPTIVE TERM	RELATIVE DENSITY	N (blows per 0.3m)
Very Loose	0 TO 20%	0 to 4
Loose	20 TO 40%	4 to 10
Compact	40 TO 75%	10 to 30
Dense	75 TO 90%	30 to 50
Very Dense	90 TO 100%	greater than 50

The number of blows, N, on a 51mm O.D. split spoon sampler of a 63.5kg weight falling 0.76m, required to drive the sampler a distance of 0.3m from 0.15m to 0.45m.

FINE GRAINED SOILS (major portion passing 0.075mm sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as estimated from laboratory or in situ tests.

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH (KPA)
Very Soft	Less than 25
Soft	25 to 50
Firm	50 to 100
Stiff	100 to 200
Very Stiff	200 to 400
Hard	Greater than 400

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil.

GENERAL DESCRIPTIVE TERMS

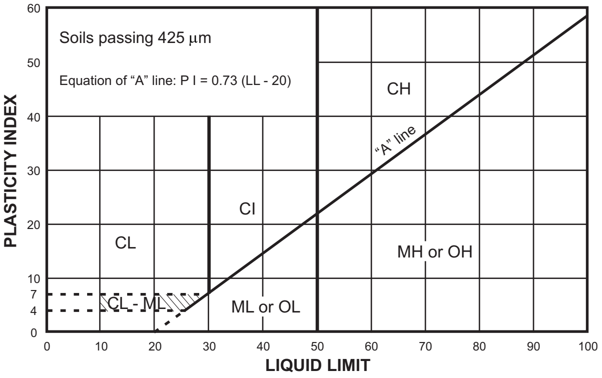
Slickensided - having inclined planes of weakness that are slick and glossy in appearance.
Fissured - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
Laminated - composed of thin layers of varying colour and texture.
Interbedded - composed of alternate layers of different soil types.
Calcareous - containing appreciable quantities of calcium carbonate.;
Well graded - having wide range in grain sizes and substantial amounts of intermediate particle sizes.
Poorly graded - predominantly of one grain size, or having a range of sizes with some intermediate size missing.

MODIFIED UNIFIED SOIL CLASSIFICATION

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA		
COARSE-GRAINED SOILS More than 50% retained on 75 µm sieve*	**GRAVELS** 50% or more of coarse fraction retained on 4.75 mm sieve	**CLEAN GRAVELS**	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines Less than 5% Pass 75 µm sieve More than 12% Pass 75 µm sieve 5% to 12% Pass 75 µm sieve GW, GP, SW, SP GM, GC, SM, SC Borderline Classification requiring use of dual symbols	$C_U = D_{60}/D_{10}$ $C_C = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$	Greater than 4 Between 1 and 3
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW	
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits plot above "A" line or plasticity index greater than 7	
	SANDS More than 50% of coarse fraction passes 4.75 mm sieve	**CLEAN SANDS**	SW	Well-graded sands and gravelly sands, little or no fines		$C_U = D_{60}/D_{10}$ $C_C = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$	Greater than 6 Between 1 and 3
			SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW	
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits plot above "A" line or plasticity index greater than 7	
FINE-GRAINED SOILS (by behavior) 50% or more passes 75 µm sieve*	**SILTS**	Liquid limit <50	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands of slight plasticity			
		Liquid limit >50	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts			
	CLAYS Above "A" line on plasticity chart negligible organic content	Liquid limit <30	CL	Inorganic clays of low plasticity, gravelly clays, sandy clays, silty clays, lean clays			
		Liquid limit 30-50	CI	Inorganic clays of medium plasticity, silty clays			
		Liquid limit >50	CH	Inorganic clays of high plasticity, fat clays			
	ORGANIC SILTS AND CLAYS	Liquid limit <50	OL	Organic silts and organic silty clays of low plasticity			
		Liquid limit >50	OH	Organic clays of medium to high plasticity			
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils			

For classification of fine-grained soils and fine fraction of coarse-grained soils.

PLASTICITY CHART



*Based on the material passing the 75 mm sieve
Reference: ASTM Designation D2487, for identification procedure see D2488. USC as modified by PFRA

SOIL COMPONENTS

FRACTION	SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY MASS OF MINOR COMPONENTS	
	PASSING	RETAINED	PERCENTAGE	DESCRIPTOR
GRAVEL				
coarse	75 mm	19 mm	>35 %	"and"
fine	19 mm	4.75 mm	21 to 35 %	"y-adjective"
SAND				
coarse	4.75 mm	2.00 mm	10 to 20 %	"some"
medium	2.00 mm	425 µm	>0 to 10 %	"trace"
fine	425 µm	75 µm		
SILT (non plastic) or CLAY (plastic)	75 µm		**as above but by behavior**	

OVERSIZE MATERIAL

Rounded or subrounded	
COBBLES	75 mm to 300 mm
BOULDERS	> 300 mm
Not rounded	
ROCK FRAGMENTS	>75 mm
ROCKS	> 0.76 cubic metre in volume

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2046-11.cdr

ROCK DESCRIPTION TERMS USED ON BOREHOLE LOGS

MECHANICAL STRENGTH CALCULATIONS

TERM	UCS* (MPa)	GRADE	FIELD IDENTIFICATION**
Extremely Strong	> 250	R6	Specimen can only be chipped with geological hammer
Very Strong	100 - 250	R5	Specimen requires many blows of geological hammer to fracture
Strong	50 - 100	R4	Specimen requires more than one blow of geological hammer to fracture
Medium Strong	25 - 50	R3	Cannot be scraped or peeled with pocket knife; can be fractured with single firm blow of geologic hammer
Weak	5 - 25	R2	Can be peeled by pocket knife with difficulty; shallow indentation made by firm blow with geological hammer
Very Weak	1 - 5	R1	Crumbles under firm blow with point of geological hammer; can be peeled by a pocket knife
Extremely Weak	0.25 - 1	R0	Indented by thumbnail

*UCS - unconfined compressive strength; **Correlations determined by Field Identification are approximate.

GRAIN SIZE

NON-CARBONATE DETRITAL SEDIMENTARY ROCKS		OTHER ROCKS	GRAIN SIZE
Conglomerate or Breccia		Very Coarse Grained	More than 80 mm
Conglomerate or Breccia		Coarse Grained	4 to 80 mm
Sandstone [1]		Medium Grained	80 µm to 4 mm
FISSILE	NON-FISSILE		
Silt Shale	Siltstone	Fine Grained	> 2/3 silt-sized (2 to 80 µm)
Mud Shale	Mudstone	Fine Grained	Silt and clay-sized (<80 µm)
Clay Shale	Claystone	Very Fine Grained	> 2/3 clay-sized (<2 µm)

[1] Sandstone further subdivided where appropriate into fine, medium, coarse

DISCONTINUITY SPACING

BEDDING	OTHER DISCONTINUITY	SPACING
Very Thickly Bedded	Very Widely Spaced	More than 2 m
Thickly Bedded	Widely Spaced	600 mm to 2 m
Medium Bedded	Moderately Widely Spaced	200 to 600 mm
Thinly Bedded	Closely Spaced	60 to 200 mm
Very Thinly Bedded	Very Closely Spaced	20 to 60 mm
Laminated	Extremely Closely Spaced	6 to 20 mm
Thinly Laminated	Extremely Closely Spaced	2 to 6 mm
Fissile	Extremely Closely Spaced	Less than 2 mm

ROCK QUALITY

TERM	RQD
Very Poor Quality	0 to 25
Poor Quality	25 to 50
Fair Quality	50 to 75
Good Quality	75 to 90
Excellent Quality	90 to 100

WEATHERED STATE

TERM	DEGREE
Fresh	No visible signs of weathering
Slightly Weathered	Weathering only on open discontinuity surfaces
Moderately Weathered	Rock mass weathered but not friable
Highly Weathered	Rock mass weathered and partly friable
Completely Weathered	Wholly decomposed but texture and structure preserved
Residual Soil	Original rock texture and structure destroyed

CORE RECOVERY

TERM	DESCRIPTION
Total Core Recovery	Total recovery expressed as a percentage of run length
Solid Recovery	Solid recovery expressed as a percentage of run length
Rock Quality Designation (RQD)	Sum of lengths of solid core more than 100 mm long expressed as a percentage of run length
Fracture Frequency (FF)	The number of fractures per metre of core (FF’s in excess of 30 denoted at 30+)

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH001
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 912.84m

SAMPLE TYPE ▨ DISTURBED ◿ NO RECOVERY ☒ SPT ☰ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ▨ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁘ SAND

SOIL DESCRIPTION

TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics

CLAY - silty, some sand, moist, stiff, medium plastic, brown grey brown, white precipitates
... soluble sulphate content = 0.2% @ 0.6m

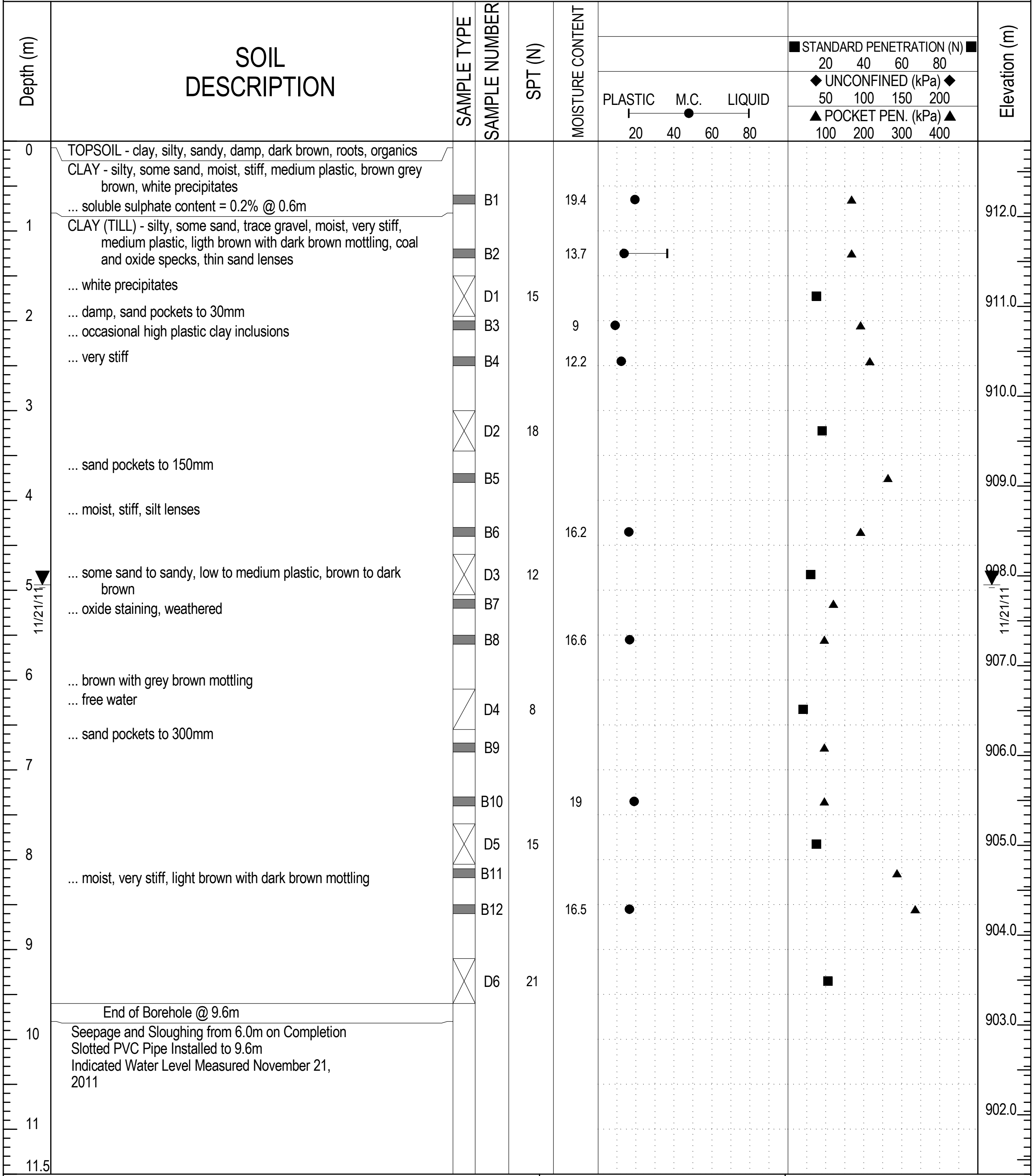
CLAY (TILL) - silty, some sand, trace gravel, moist, very stiff, medium plastic, ligth brown with dark brown mottling, coal and oxide specks, thin sand lenses
... white precipitates
... damp, sand pockets to 30mm
... occasional high plastic clay inclusions
... very stiff
... sand pockets to 150mm
... moist, stiff, silt lenses
... some sand to sandy, low to medium plastic, brown to dark brown
... oxide staining, weathered
... brown with grey brown mottling
... free water
... sand pockets to 300mm
... moist, very stiff, light brown with dark brown mottling

End of Borehole @ 9.6m

Seepage and Sloughing from 6.0m on Completion
Slotted PVC Pipe Installed to 9.6m
Indicated Water Level Measured November 21, 2011

▼ 11/21/11

SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
▨	B1		19.4
▨	B2		13.7
☒	D1	15	
▨	B3		9
▨	B4		12.2
☒	D2	18	
▨	B5		
▨	B6		16.2
☒	D3	12	
▨	B7		
▨	B8		16.6
◿	D4	8	
▨	B9		
▨	B10		19
☒	D5	15	
▨	B11		
▨	B12		16.5
☒	D6	21	



LOGGED BY: JKM	COMPLETION DEPTH: 9.6m
REVIEWED BY: TC	COMPLETE: 10/28/2011
DRAWING NO: B1	Page 1 of 1

EBA Engineering Consultants Ltd.

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH002
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 912.59m

SAMPLE TYPE	■ DISTURBED	◿ NO RECOVERY	☒ SPT	☰ A-CASING	▥ SHELBY TUBE	▌ CORE
BACKFILL TYPE	■ BENTONITE	⁘ PEA GRAVEL	▥ SLOUGH	⁘ GROUT	▧ DRILL CUTTINGS	⁙ SAND

SOIL DESCRIPTION

TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics

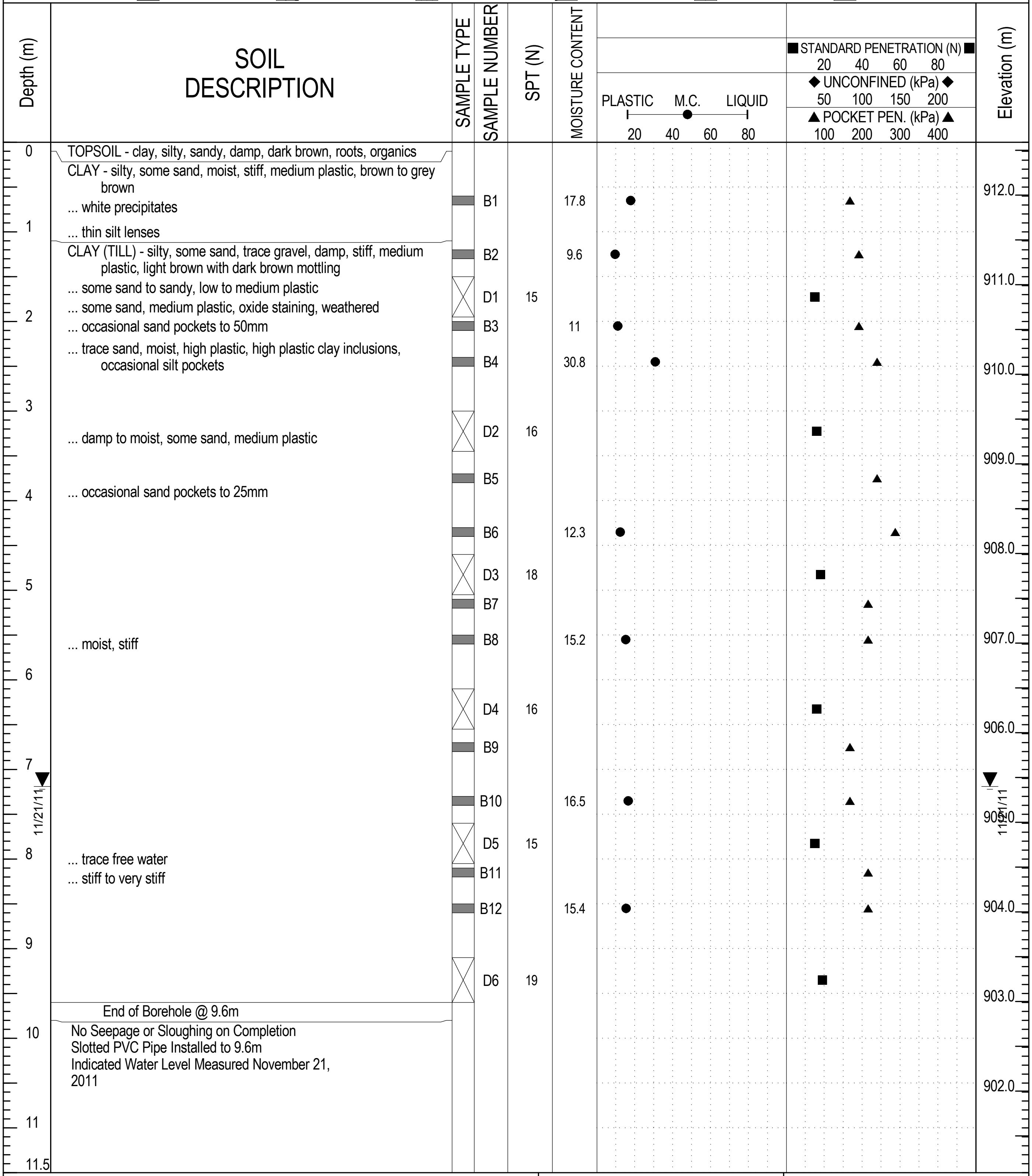
CLAY - silty, some sand, moist, stiff, medium plastic, brown to grey brown
... white precipitates
... thin silt lenses

CLAY (TILL) - silty, some sand, trace gravel, damp, stiff, medium plastic, light brown with dark brown mottling
... some sand to sandy, low to medium plastic
... some sand, medium plastic, oxide staining, weathered
... occasional sand pockets to 50mm
... trace sand, moist, high plastic, high plastic clay inclusions, occasional silt pockets
... damp to moist, some sand, medium plastic
... occasional sand pockets to 25mm
... moist, stiff
... trace free water
... stiff to very stiff

End of Borehole @ 9.6m

No Seepage or Sloughing on Completion
Slotted PVC Pipe Installed to 9.6m
Indicated Water Level Measured November 21, 2011

SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
■	B1		17.8
■	B2		9.6
☒	D1	15	
■	B3		11
■	B4		30.8
☒	D2	16	
■	B5		
■	B6		12.3
☒	D3	18	
■	B7		
■	B8		15.2
☒	D4	16	
■	B9		
■	B10		16.5
☒	D5	15	
■	B11		
■	B12		15.4
☒	D6	19	



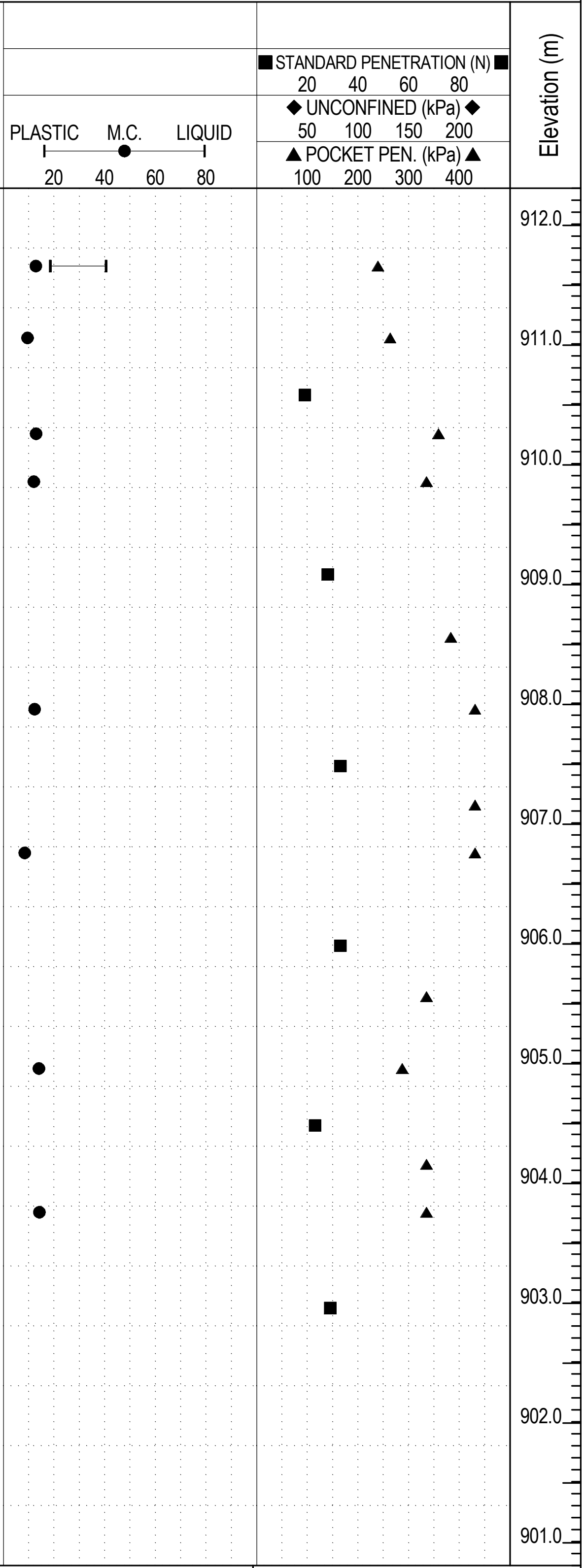
EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 9.6m
	REVIEWED BY: TC	COMPLETE: 10/28/2011
	DRAWING NO: B2	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH003
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 912.31m

SAMPLE TYPE ▨ DISTURBED ◿ NO RECOVERY ☒ SPT ▤ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ▨ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁘ SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
0	TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics				
	CLAY - silty, trace to some sand, damp to moist, very stiff, medium to high plastic, light brown with dark brown mottling, white precipitates	▨	B1		12.8
1	CLAY (TILL) - silty, some sand, trace gravel, damp to moist, very stiff, medium plastic, light brown with dark brown mottling, coal and oxide specks, thin sand lenses	▨	B2		9.5
	... soluble sulphate content = 0.2% @ 1.2m				
	... heavy white precipitates	☒	D1	19	
2	... some sand to sandy, low to medium plastic, oxide staining, weathered	▨	B3		12.9
		▨	B4		12
3	... some sand, medium plastic	☒	D2	28	
	... damp to moist, hard, sand pockets to 50mm	▨	B5		
4	... brown to grey brown	▨	B6		12.3
		☒	D3	33	
5	... moist	▨	B7		
	... light brown with dark brown mottling				
	... some sand to sandy, low to medium plastic	▨	B8		8.4
	... 200mm gravel pocket @ 5.5m				
6	... some sand, medium plastic	☒	D4	33	
	... very stiff	▨	B9		
7		▨	B10		14
		☒	D5	23	
8		▨	B11		
		▨	B12		14.2
9		☒	D6	29	
	End of Borehole @ 9.6m				
10	No Seepage or Sloughing on Completion Slotted PVC Pipe Installed to 9.6m Borehole Measured Dry November 21, 2011				
11					
11.5					



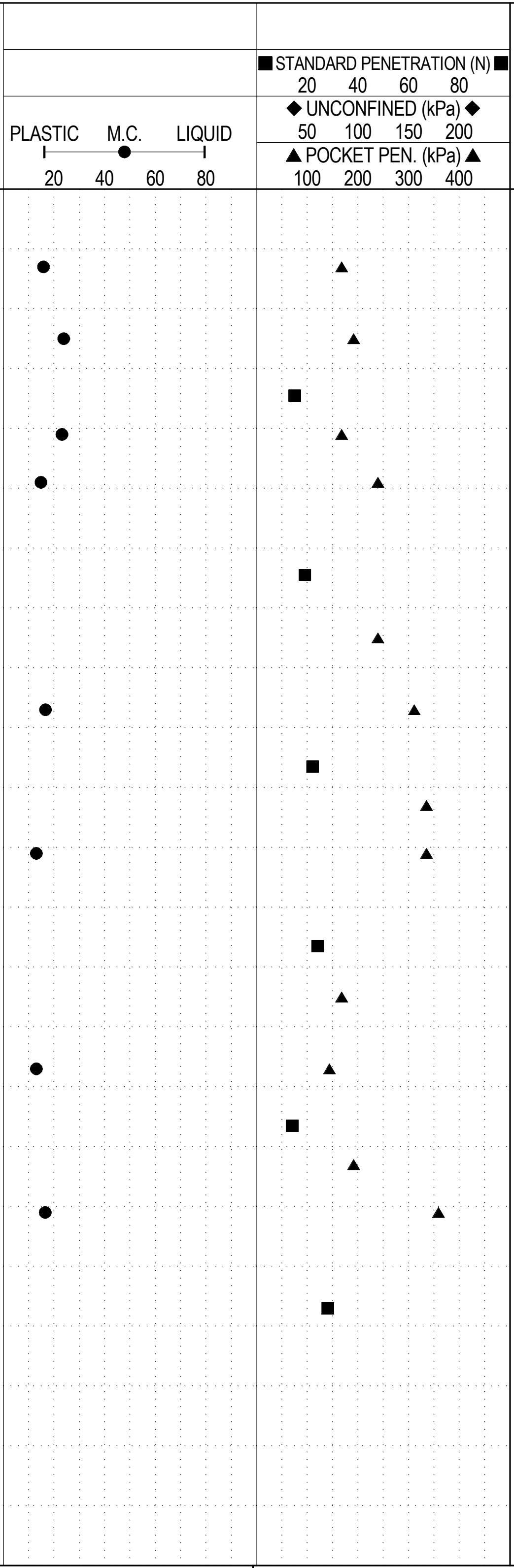
EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 9.6m
	REVIEWED BY: TC	COMPLETE: 10/28/2011
	DRAWING NO: B3	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH004
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 914.16m

SAMPLE TYPE ▨ DISTURBED ◿ NO RECOVERY ☒ SPT ☰ A-CASING ||| SHELBY TUBE ▮ CORE

BACKFILL TYPE ▨ BENTONITE ⁘ PEA GRAVEL ||| SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁘ SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT	Elevation (m)
0	TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics					914.0
	CLAY - silty, some sand, moist, stiff, medium plastic, light brown with dark brown mottling, white precipitates					
		▨	B1		15.8	
1						913.0
		▨	B2		23.8	
	... trace to some sandy, medium to high plastic					
		☒	D1	15		
2		▨	B3		23.1	912.0
	CLAY (TILL) - silty, some sand, trace gravel, moist, very stiff, medium plastic, light brown with dark brown mottling, coal and oxide specks, high plastic clay inclusions	▨	B4		14.8	
3	... trace to some sand, medium to high plastic					911.0
		☒	D2	19		
		▨	B5			
4						910.0
		▨	B6		16.6	
		☒	D3	22		
5	... some sand, medium plastic, thin sand lenses, oxide staining, weathered	▨	B7			909.0
		▨	B8		13	
6						908.0
		☒	D4	24		
	... stiff					
		▨	B9			
7						907.0
		▨	B10		13	
		☒	D5	14		
8	... trace to some sand, medium to high plastic, thin silt lenses					906.0
		▨	B11			
	... very stiff	▨	B12		16.5	
9						905.0
		☒	D6	28		
	End of Borehole @ 9.6m					
10	No Seepage or Sloughing on Completion Slotted PVC Pipe Installed to 9.6m Borehole Measured Dry November 21, 2011					904.0
11						903.0
11.5						



EBA Engineering Consultants Ltd.

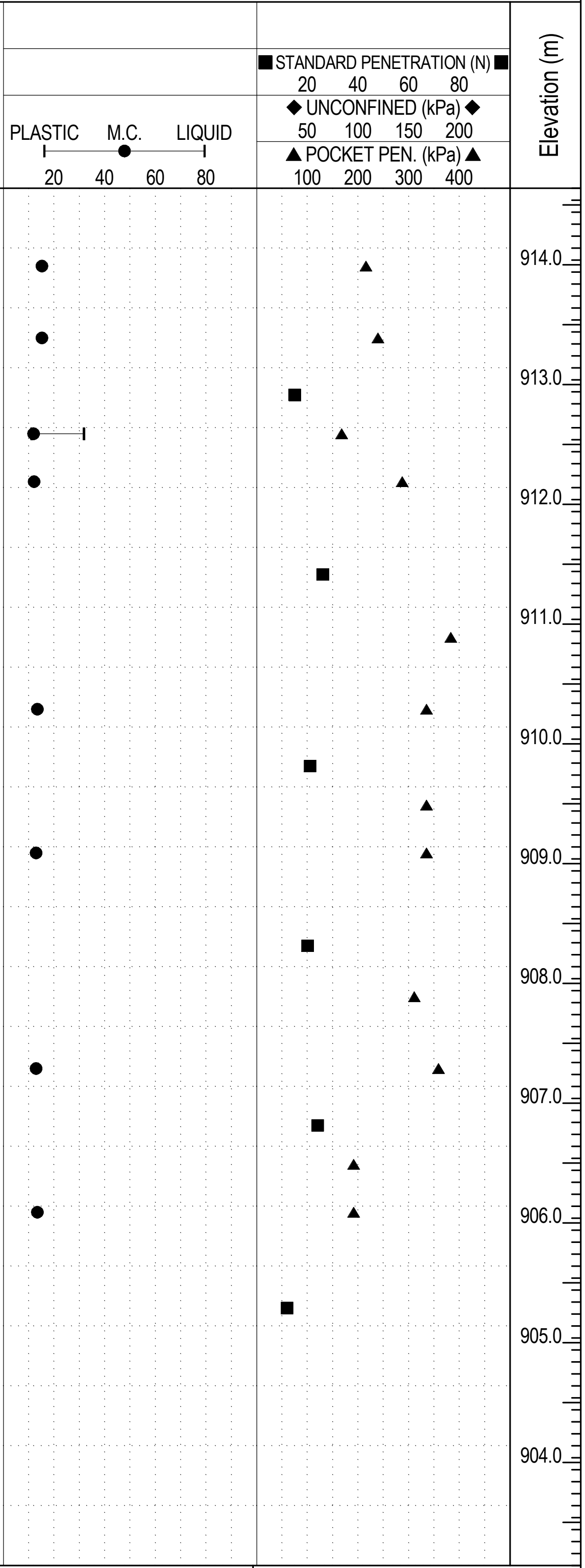
LOGGED BY: JKM	COMPLETION DEPTH: 9.6m
REVIEWED BY: TC	COMPLETE: 10/28/2011
DRAWING NO: B4	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH005
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 914.64m

SAMPLE TYPE: ▨ DISTURBED ◺ NO RECOVERY ☒ SPT ☰ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE: ▨ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁙ SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
0	TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics				
	CLAY - silty, trace sand, damp to moist, very stiff, medium plastic, grey brown, thinly laminated				
		▨	B1		15.2
1					
	... white precipitates				
	... soluble sulphate content = 4.91% @ 1.2m	▨	B2		15.2
	CLAY (TILL) - silty, some sand, trace gravel, damp to moist, stiff, medium plastic, light brown with dark brown mottling, coal and oxide specks, thin sand lenses	☒	D1	15	
2					
		▨	B3		11.9
		▨	B4		12.1
	... very stiff, oxide staining, weathered				
3					
		☒	D2	26	
	... occasional coal inclusions				
		▨	B5		
4					
		▨	B6		13.4
	... occasional sand pockets to 20mm	☒	D3	21	
5					
		▨	B7		
		▨	B8		12.9
6					
		☒	D4	20	
	... sand pockets to 75mm	▨	B9		
7					
		▨	B10		12.9
	... trace to some sand, medium to high plastic				
		☒	D5	24	
8					
	... some sand, stiff, medium plastic, thin sand lenses	▨	B11		
		▨	B12		13.4
9					
		☒	D6	12	
	End of Borehole @ 9.6m				
10	No Seepage or Sloughing on Completion Slotted PVC Pipe Installed to 9.6m Borehole Measured Dry November 21, 2011				
11					
11.5					



EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 9.6m
	REVIEWED BY: TC	COMPLETE: 10/28/2011
	DRAWING NO: B5	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH006
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 914.66m

SAMPLE TYPE ▆ DISTURBED ◺ NO RECOVERY ☒ SPT ☰ A-CASING ▥ SHELBY TUBE ▌ CORE

BACKFILL TYPE ▆ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁘ SAND

SOIL DESCRIPTION

TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics

CLAY - silty, trace to some sand, damp to moist, very stiff, medium to high plastic, light brown, white precipitates

... occasional high plastic clay inclusions

... thin sand lenses

CLAY (TILL) - silty, some sand, trace gravel, moist, very stiff, medium plastic, light brown to brown, coal and oxide specks, thin sand lenses, occasional high plastic clay inclusions

... some sand to sandy, low to medium plastic

... sand pockets to 75mm, oxide staining, highly weathered

... stiff

... very stiff, brown

... light brown with dark brown mottling

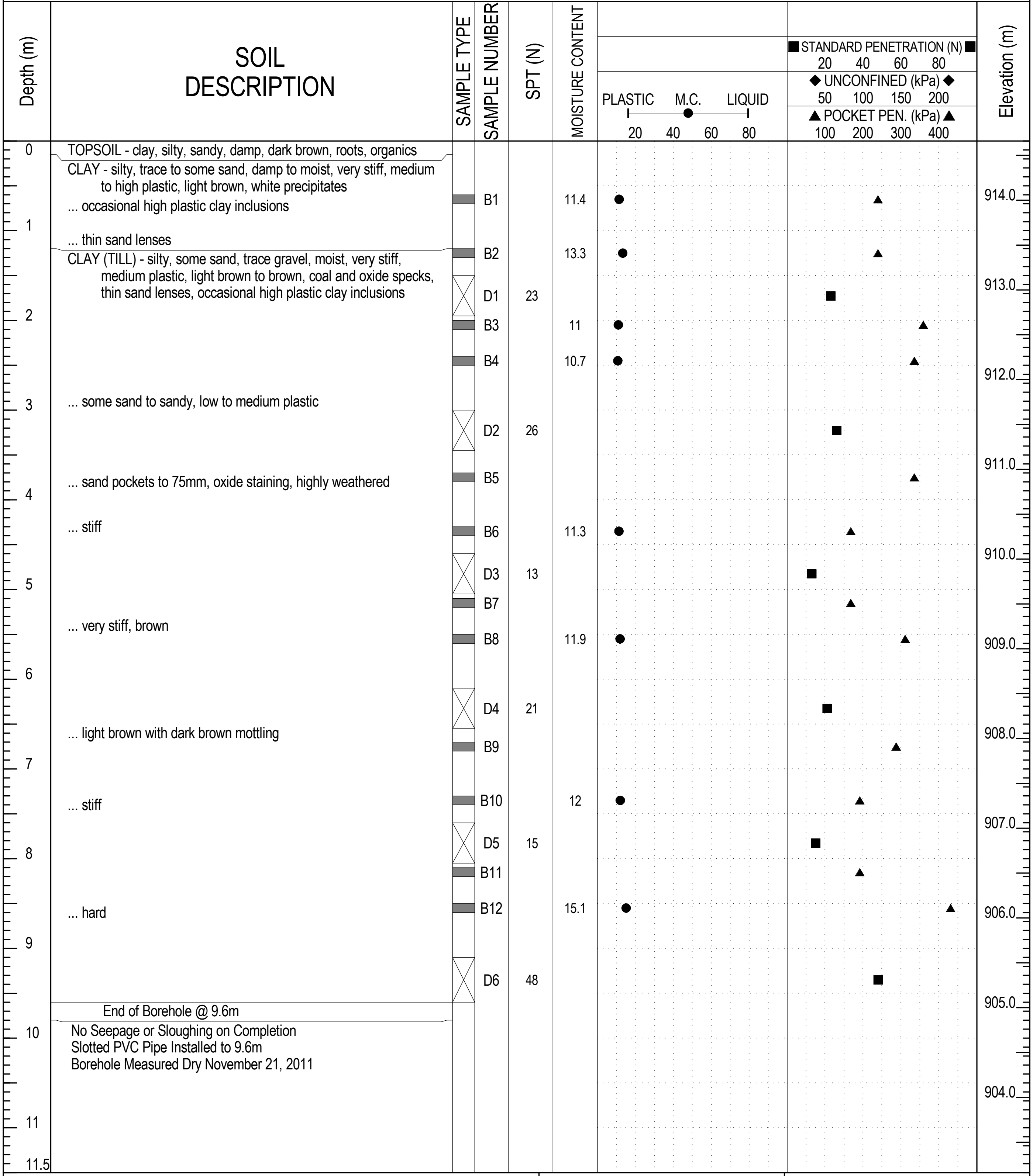
... stiff

... hard

End of Borehole @ 9.6m

No Seepage or Sloughing on Completion
Slotted PVC Pipe Installed to 9.6m
Borehole Measured Dry November 21, 2011

SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
▆	B1		11.4
▆	B2		13.3
☒	D1	23	
▆	B3		11
▆	B4		10.7
☒	D2	26	
▆	B5		
▆	B6		11.3
☒	D3	13	
▆	B7		
▆	B8		11.9
☒	D4	21	
▆	B9		
▆	B10		12
☒	D5	15	
▆	B11		
▆	B12		15.1
☒	D6	48	



LOGGED BY: JKM	COMPLETION DEPTH: 9.6m
REVIEWED BY: TC	COMPLETE: 10/28/2011
DRAWING NO: B6	Page 1 of 1

EBA Engineering Consultants Ltd.

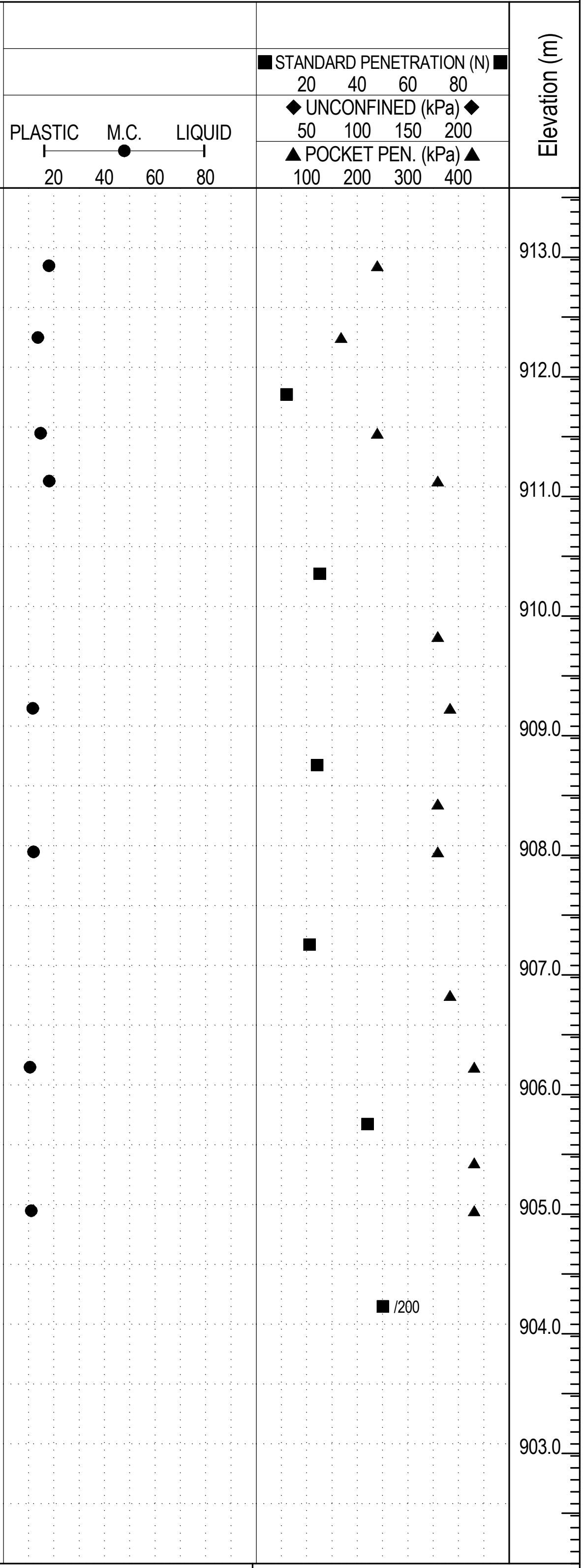
PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH007
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 913.58m

SAMPLE TYPE ▆ DISTURBED ▨ NO RECOVERY ☒ SPT ☰ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ▆ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▨ DRILL CUTTINGS ⁘ SAND

Depth (m)	SOIL DESCRIPTION
0	TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics
	CLAY - silty, trace to some sand, moist, very stiff, medium to high plastic, brown to grey brown
1	CLAY (TILL) - silty, some sand, trace gravel, moist, stiff, medium plastic, light brown with dark brown mottling, coal and oxide specks, thin sand lenses
	... white precipitates
	... high plastic clay inclusions
2	... very stiff
3	
	... damp to moist, oxide staining, highly weathered
4	
	... occasional coal inclusions
5	
6	... occasional sand pockets
7	... hard
8	
9	
	End of Borehole @ 9.6m
10	No Seepage or Sloughing on Completion Slotted PVC Pipe Installed to 9.6m Borehole Measured Dry November 21, 2011
11	
11.5	

SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
▆	B1		18
▆	B2		13.6
☒	D1	12	
▆	B3		14.7
▆	B4		18.1
☒	D2	25	
▆	B5		
▆	B6		11.6
☒	D3	24	
▆	B7		
▆	B8		11.9
☒	D4	21	
▆	B9		
▆	B10		10.5
☒	D5	44	
▆	B11		
▆	B12		11
☒	D6	50/200mm	



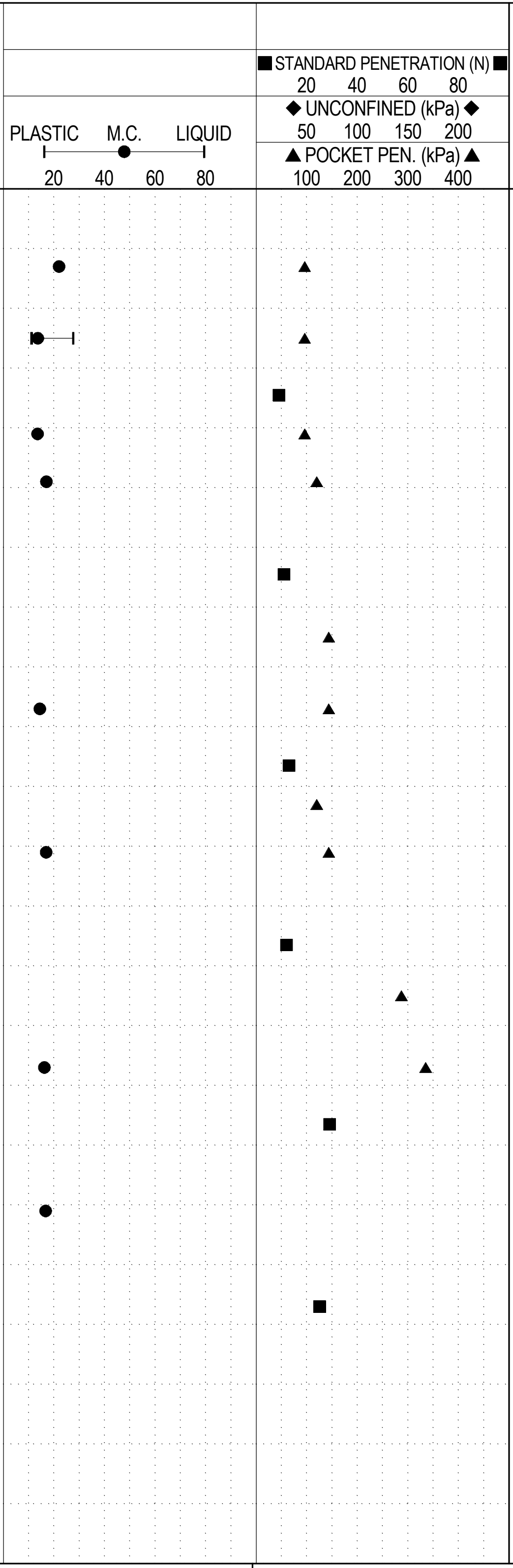
EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 9.6m
	REVIEWED BY: TC	COMPLETE: 10/28/2011
	DRAWING NO: B7	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH008
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 911.14m

SAMPLE TYPE ▨ DISTURBED ◺ NO RECOVERY ☒ SPT ☰ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ▨ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁘ SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT	Elevation (m)
0	TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics					911.0
	CLAY - silty, trace to some sand, moist to very moist, stiff, medium to high plastic, light brown with dark brown mottling, white precipitates	▨	B1		22	
	... soluble sulphate content = 0.5% @ 0.6m					
1	CLAY (TILL) - silty, sandy, trace gravel, moist, stiff, low plastic, light brown with dark brown mottling, coal and oxide specks, thin sand lenses, high plastic clay inclusions, white precipitates	▨	B2		13.6	910.0
		☒	D1	9		
2 ▼ 11/21/11		▨	B3		13.5	909.0 ▼ 11/21/11
		▨	B4		17	
3						908.0
	... gypsum crystals	☒	D2	11		
	... oxide staining, highly weathered	▨	B5			
4	... trace free water					907.0
	... occasional sand pockets to 25mm	▨	B6		14.4	
		☒	D3	13		
5		▨	B7			906.0
		▨	B8		16.9	
6						905.0
		☒	D4	12		
	... trace to some sand, moist, very stiff, medium to high plastic, brown to grey brown	▨	B9			
7						904.0
		▨	B10		16.2	
	SAND - silty, trace clay, poorly graded, medium grained, wet, compact, brown	☒	D5	29		
8	... occasional high plastic clay inclusions	▨	B11			903.0
		▨	B12		16.7	
	CLAY (TILL) - silty, trace to some sand, trace gravel, moist, very stiff, medium to high plastic, brown with dark brown mottling, coal and oxide specks, thin sand lenses, high plastic clay inclusions					
9						902.0
		☒	D6	25		
	End of Borehole @ 9.6m					
10	No Seepage or Sloughing on Completion Slotted PVC Pipe Installed to 9.6m Indicated Water Level Measured November 21, 2011					901.0
11						900.0
11.5						



EBA Engineering Consultants Ltd.

LOGGED BY: JKM	COMPLETION DEPTH: 9.6m
REVIEWED BY: TC	COMPLETE: 10/28/2011
DRAWING NO: B8	Page 1 of 1

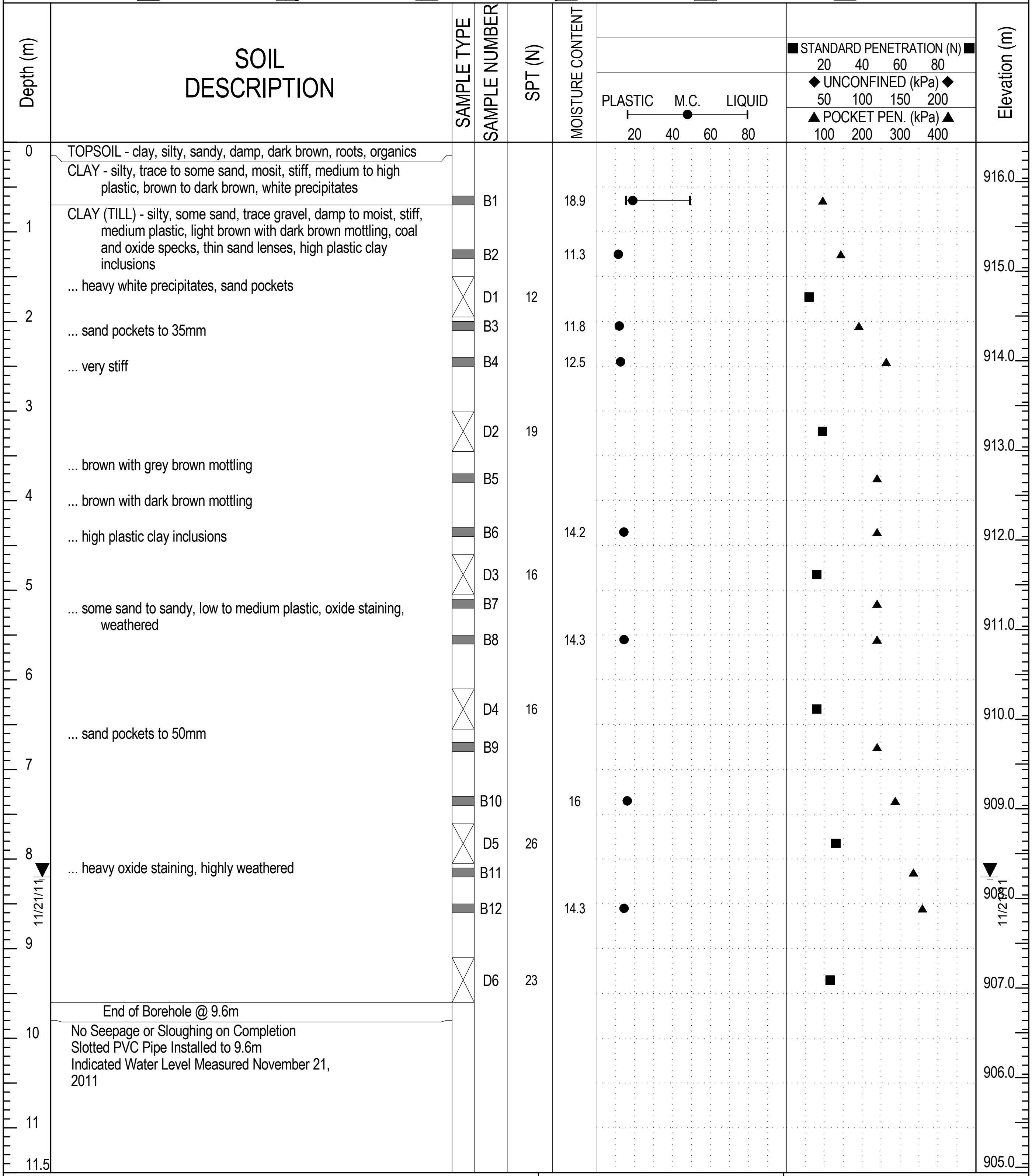
PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH009
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 916.44m

SAMPLE TYPE ▒ DISTURBED ⧄ NO RECOVERY ☒ SPT ▤ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ▒ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁙ SAND

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics				
CLAY - silty, trace to some sand, mosit, stiff, medium to high plastic, brown to dark brown, white precipitates				
	▒	B1		18.9
CLAY (TILL) - silty, some sand, trace gravel, damp to moist, stiff, medium plastic, light brown with dark brown mottling, coal and oxide specks, thin sand lenses, high plastic clay inclusions				
	▒	B2		11.3
... heavy white precipitates, sand pockets				
	☒	D1	12	
... sand pockets to 35mm	▒	B3		11.8
... very stiff	▒	B4		12.5
	☒	D2	19	
... brown with grey brown mottling				
	▒	B5		
... brown with dark brown mottling				
... high plastic clay inclusions	▒	B6		14.2
	☒	D3	16	
... some sand to sandy, low to medium plastic, oxide staining, weathered	▒	B7		
	▒	B8		14.3
	☒	D4	16	
... sand pockets to 50mm				
	▒	B9		
	▒	B10		16
	☒	D5	26	
... heavy oxide staining, highly weathered	▒	B11		
	▒	B12		14.3
	☒	D6	23	
End of Borehole @ 9.6m				

No Seepage or Sloughing on Completion
Slotted PVC Pipe Installed to 9.6m
Indicated Water Level Measured November 21, 2011



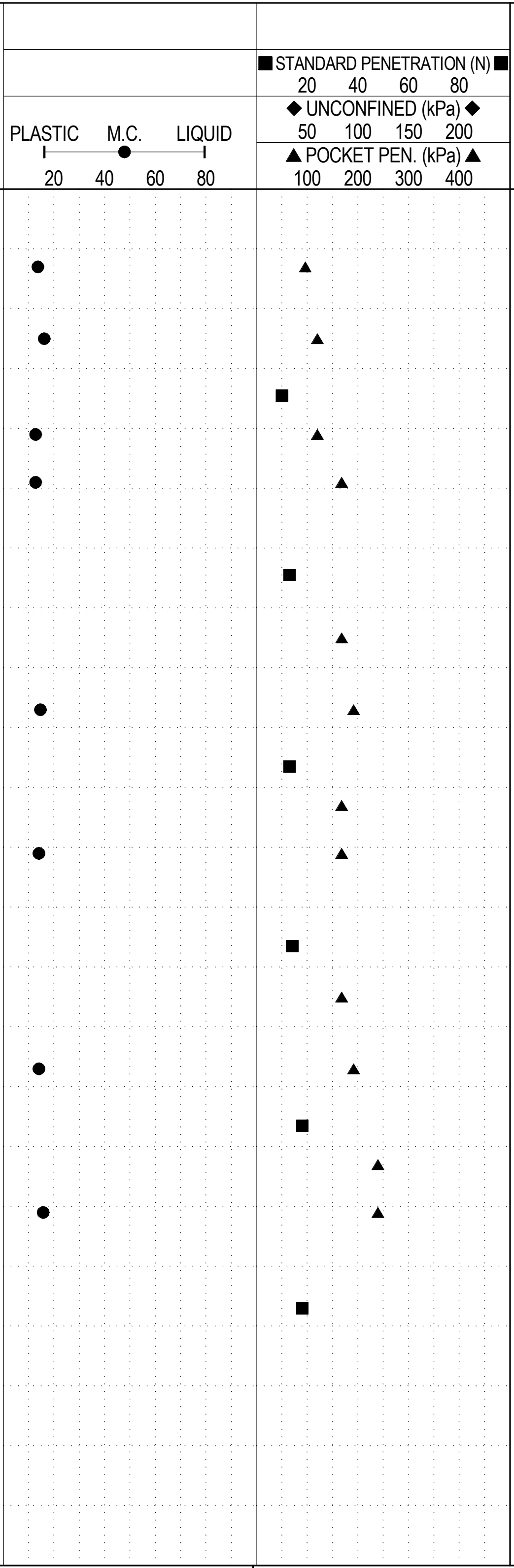
EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 9.6m
	REVIEWED BY: TC	COMPLETE: 10/28/2011
	DRAWING NO: B9	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH010
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 915.82m

SAMPLE TYPE ▬ DISTURBED ◸ NO RECOVERY ☒ SPT ☰ A-CASING ▥ SHELBY TUBE ▌ CORE

BACKFILL TYPE ▬ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▨ DRILL CUTTINGS ⁘ SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT	Elevation (m)
0	TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics					
	CLAY - silty, trace to some sand, moist, stiff, medium to high plastic, brown to dark brown, white precipitates					
		▬	B1		13.6	915.0
1						
		▬	B2		16.1	
		☒	D1	10		914.0
2	CLAY (TILL) - silty, some sand, trace gravel, moist, stiff, medium plastic, brown with dark brown mottling, coal and oxide specks, sand lenses	▬	B3		12.7	
	... brown	▬	B4		12.7	
3						913.0
	... oxide stianing, highly weathered	☒	D2	13		
	... occasional coal inclusions	▬	B5			912.0
4	... occasional sand pockets to 25mm					
		▬	B6		14.6	
5 ▼ 11/21/11		☒	D3	13		911.0 ▼ 11/21/11
		▬	B7			
		▬	B8		14	910.0
6	... trace free water	☒	D4	14		
		▬	B9			909.0
7	... light brown with dark brown mottling					
	... occasional claystone fragments	▬	B10		14	
	... very stiff, brown with grey mottling, occasional sand pockets	☒	D5	18		908.0
8		▬	B11			
		▬	B12		15.7	907.0
9		◸	D6	18		
	End of Borehole @ 9.6m					906.0
10	No Seepage or Sloughing on Completion Slotted PVC Pipe Installed to 9.6m Indicated Water Level Measured November 21, 2011					
11						905.0
11.5						



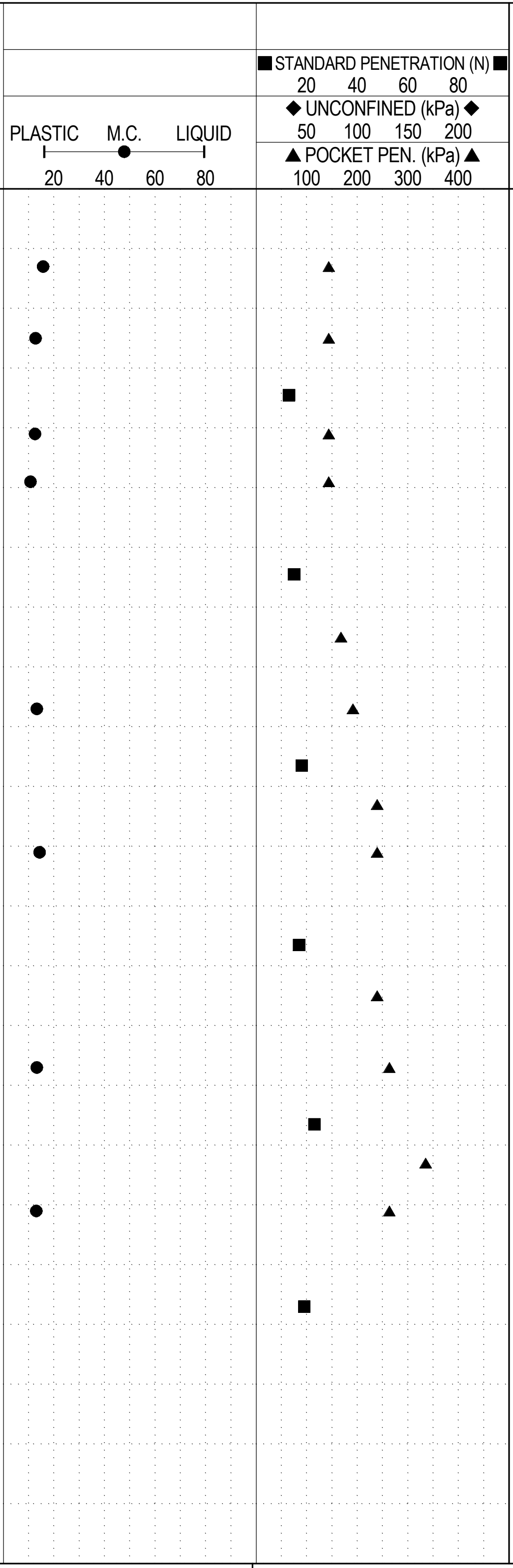
EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 9.6m
	REVIEWED BY: TC	COMPLETE: 10/28/2011
	DRAWING NO: B10	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH011
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 916.65m

SAMPLE TYPE ▨ DISTURBED ◸ NO RECOVERY ☒ SPT ▤ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ▨ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁘ SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT	Elevation (m)
0	TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics					
	CLAY - silty, trace to some sand, moist, stiff, medium to high plasitc, brown to grey brown, white precipitates					
		▨	B1		15.7	916.0
1	CLAY (TILL) - silty, some sand, trace gravel, moist, stiff, medium plastic, brown with dark brown mottling, coal and oxide specks, sand lenses					
		▨	B2		12.7	
	... white precipitates					915.0
		☒	D1	13		
2						
	... oxide staining, highly weathered	▨	B3		12.5	
		▨	B4		10.7	914.0
3						
	... brown, sand pockets to 50mm					
		☒	D2	15		
						913.0
		▨	B5			
4						
	... trace free water					
	... light brown with dark brown mottling	▨	B6		13.2	
	... moist, very stiff, brown with dark brown mottling					912.0
		☒	D3	18		
5						
		▨	B7			
		▨	B8		14.3	911.0
6						
		☒	D4	17		
	... light brown with dark brown mottling, occasional high plastic clay inclusions					910.0
		▨	B9			
7						
		▨	B10		13.2	
						909.0
		☒	D5	23		
8						
		▨	B11			
		▨	B12		13	908.0
▼ 11/21/11						▼ 11/21/11
9						
		☒	D6	19		
						907.0
	End of Borehole @ 9.6m					
10	No Seepage or Sloughing on Completion Slotted PVC Pipe Installed to 9.6m Indicated Water Level Measured November 21, 2011					
						906.0
11						
11.5						



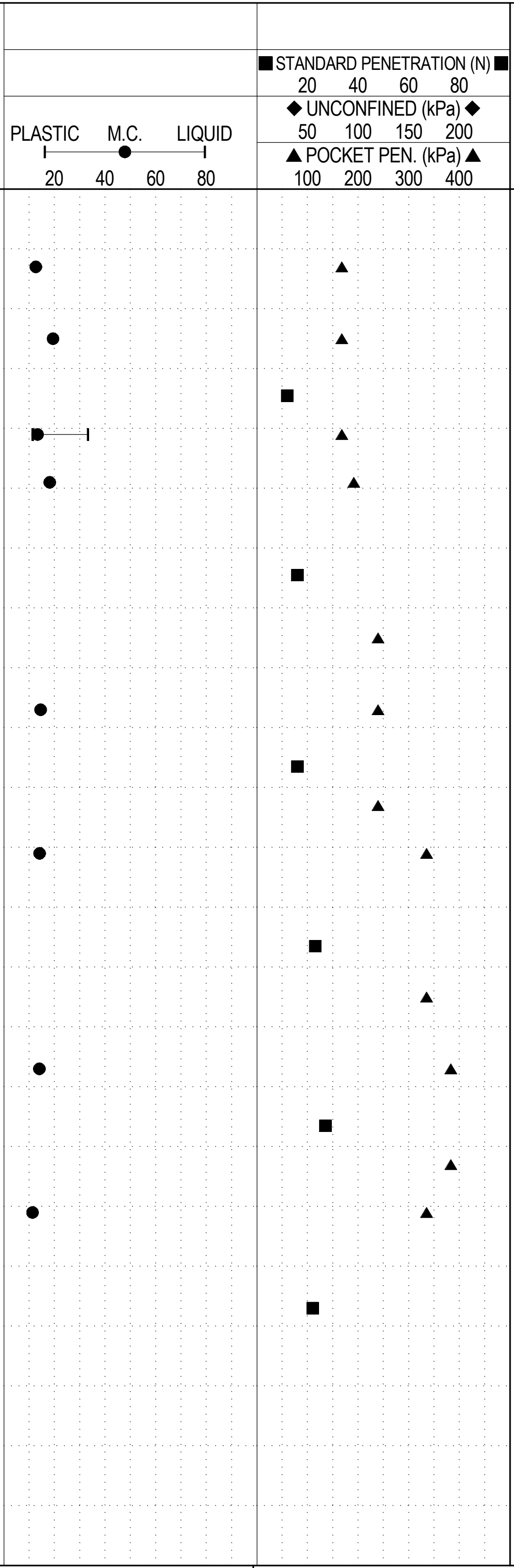
EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 9.6m
	REVIEWED BY: TC	COMPLETE: 10/28/2011
	DRAWING NO: B11	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH012
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 915.16m

SAMPLE TYPE ▨ DISTURBED ▱ NO RECOVERY ☒ SPT ☰ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ▨ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁘ SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT	Elevation (m)
0	TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics					915.0
	CLAY - silty, trace to some sand, moist, stiff, medium to high plastic, brown to dark brown					
		▨	B1		12.6	
1						914.0
	... heavy white precipitates	▨	B2		19.4	
	CLAY (TILL) - silty, some sand, trace gravel, moist, stiff, medium plastic, brown with dark brown mottling, coal and oxide specks, thin sand lenses, occasional high plastic clay inclusions	☒	D1	12		
2		▨	B3		13.3	913.0
	... trace to some sand, medium to high plastic, light brown with dark brown mottling	▨	B4		18.1	
3	... oxide stianing, weathered					
	... very stiff, brown with dark brown mottling					912.0
		☒	D2	16		
		▨	B5			
4						911.0
		▨	B6		14.5	
		☒	D3	16		
5		▨	B7			910.0
	... brown to grey brown, heavy oxide staining, highly weathered	▨	B8		14.1	
6						909.0
		☒	D4	23		
		▨	B9			
7						908.0
		▨	B10		14	
	... sand pockets to 25mm					
	... brown with dark brown mottling	☒	D5	27		
8	... sand pockets to 50mm	▨	B11			907.0
		▨	B12		11.3	
9						906.0
		☒	D6	22		
	End of Borehole @ 9.6m					
10	No Seepage or Sloughing on Completion Slotted PVC Pipe Installed to 9.6m Borehole Measured Dry November 21, 2011					905.0
11						904.0
11.5						



EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 9.6m
	REVIEWED BY: TC	COMPLETE: 10/28/2011
	DRAWING NO: B12	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH013
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 913.06m

SAMPLE TYPE ▨ DISTURBED ◺ NO RECOVERY ☒ SPT ▤ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ▨ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁘ SAND

SOIL DESCRIPTION

Depth (m)

0 TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics

CLAY - silty, trace sand, moist, stiff, high plastic, brown to dark brown, white precipitates

... light brown with dark brown mottling, thin sand lenses

1

▼ 11/21/11

2

CLAY (TILL) - silty, trace to some sand, trace gravel, moist, stiff, medium to high plastic, light brown with dark brown mottling, coal and oxide specks, sand lenses

... moist to very moist

3

... some sand, meidum plastic, occasional high plastic clay inclusions, occasional sand pockets to 25mm

4

... trace to some sand, medium to high plastic

5

... moist, very stiff

6

End of Borehole @ 6.6m

7

No Seepage or Sloughing on Completion
Slotted PVC Pipe Installed to 6.6m
Indicated Water Level Measured November 21, 2011

8

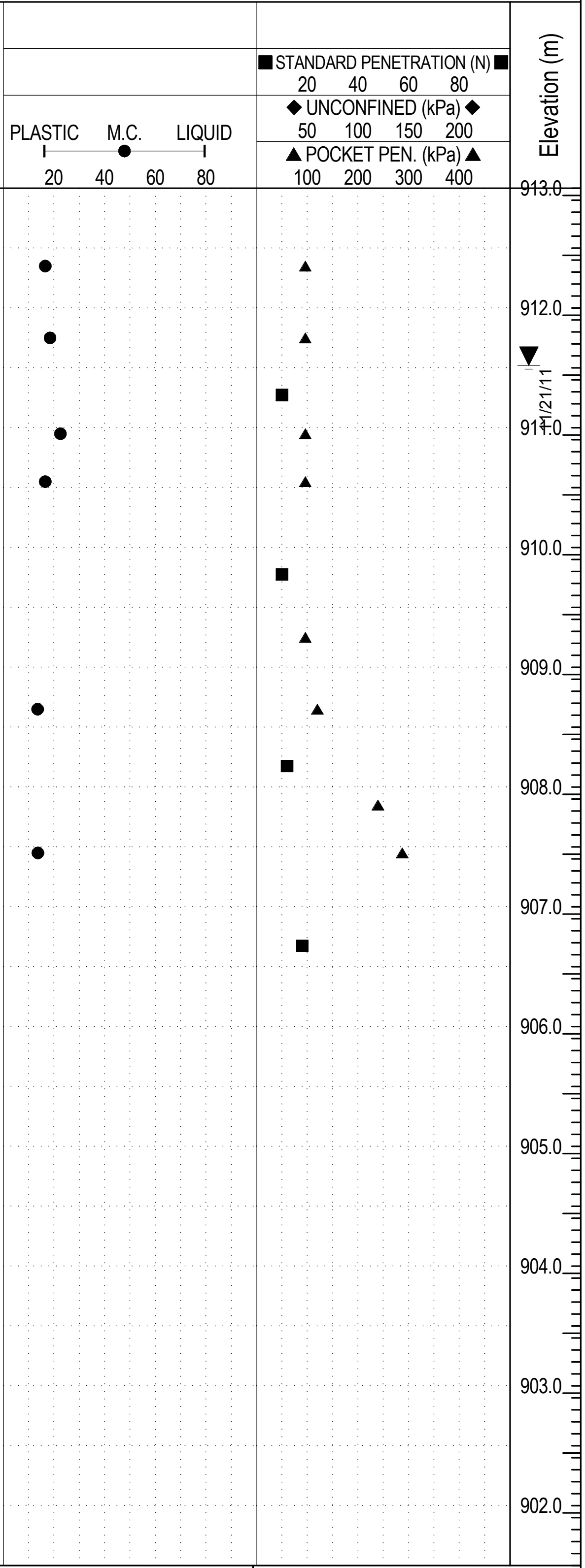
9

10

11

11.5

SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
▨	B1		16.5
▨	B2		18.4
☒	D1	10	
▨	B3		22.5
▨	B4		16.5
☒	D2	10	
▨	B5		
▨	B6		13.5
☒	D3	12	
▨	B7		
▨	B8		13.6
☒	D4	18	



EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 6.6m
	REVIEWED BY: TC	COMPLETE: 10/31/2011
	DRAWING NO: B13	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH014
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 913.45m

SAMPLE TYPE ▇ DISTURBED ◺ NO RECOVERY ☒ SPT ☰ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ▇ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁙ SAND

Depth (m)

SOIL DESCRIPTION

0 TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics

CLAY - silty, trace to some sand, moist, stiff, meidum to high plastic, brown to dark brown, white precipitates

1 CLAY (TILL) - silty, some sand, trace gravel, moist, very stiff, medium plastic, light brown with dark brown mottling, coal and oxide specks, high plastic clay inclusions

... dark brown, heavy white precipitates

2 ... trace to some sand, medium to high plastic, brown with dark brown mottling, thinly laminated

... some sand to sandy, damp to moist, low to medium plastic, light brown with dark brown mottling, sand pockets to 50mm

3 ... some sand, medium plastic, brown to dark brown, sand pockets to 30mm

... damp to moist

4

... oxide staining, weathered, occasional coal inclusions

5

6 ▼ 11/21/11

End of Borehole @ 6.6m

7 No Seepage or Sloughing on Completion
Slotted PVC Pipe Installed to 6.6m
Indicated Water Level Measured November 21, 2011

8

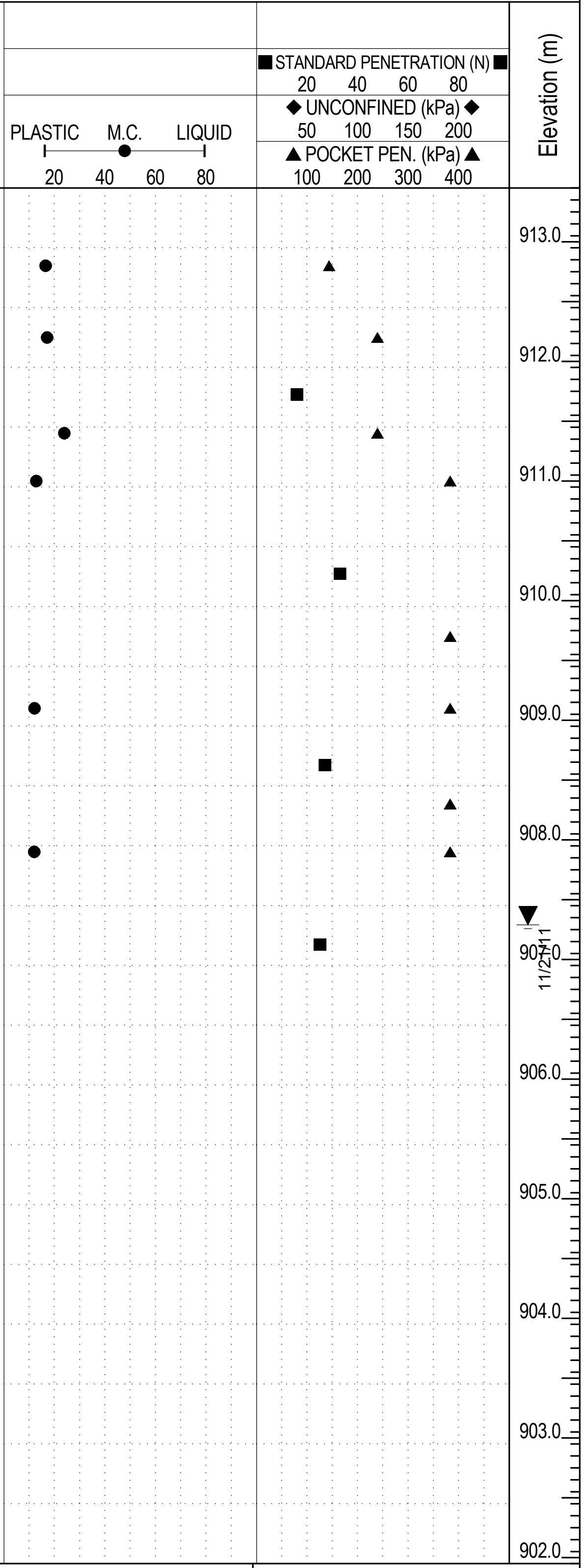
9

10

11

11.5

SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
▇	B1		16.5
▇	B2		17.1
☒	D1	16	
▇	B3		23.9
▇	B4		12.8
☒	D2	33	
▇	B5		
▇	B6		12.1
☒	D3	27	
▇	B7		
▇	B8		12
☒	D4	25	

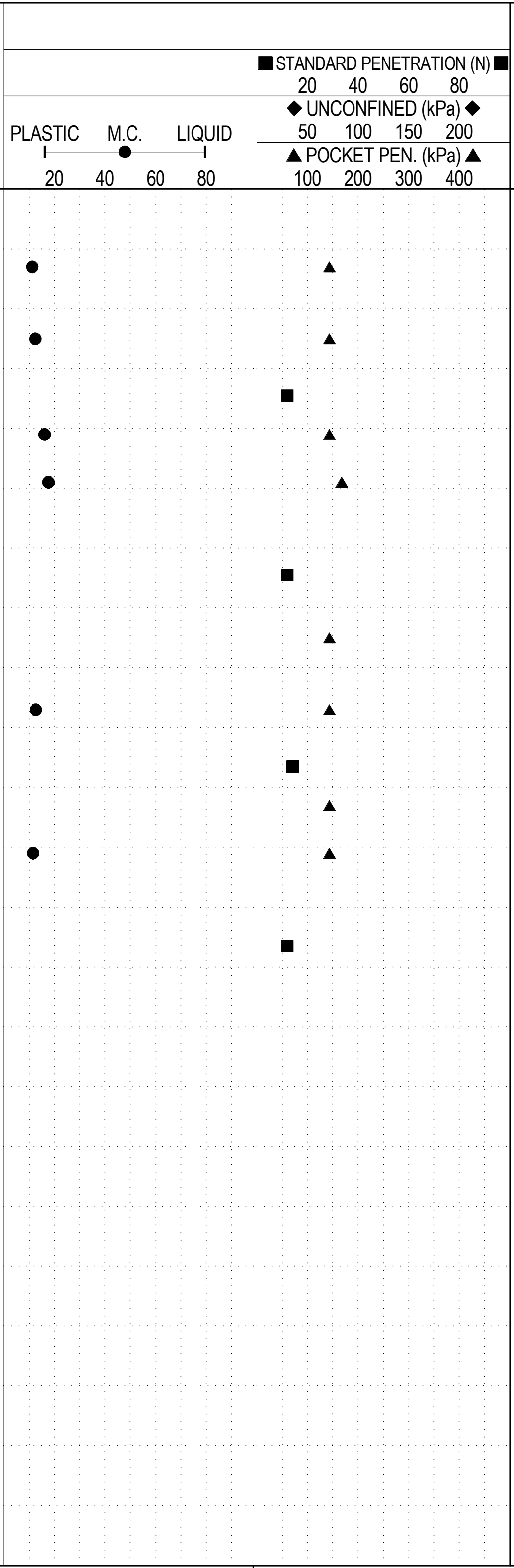


EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 6.6m
	REVIEWED BY: TC	COMPLETE: 10/31/2011
	DRAWING NO: B14	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH015
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 911.02m

SAMPLE TYPE	▨ DISTURBED	◿ NO RECOVERY	☒ SPT	☰ A-CASING	▥ SHELBY TUBE	▮ CORE
BACKFILL TYPE	▨ BENTONITE	⁘ PEA GRAVEL	▥ SLOUGH	⁘ GROUT	▧ DRILL CUTTINGS	⁘ SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT	Elevation (m)
0	TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics					911.0
	CLAY - silty, trace to some sand, moist, stiff, medium to high plastic, brown to dark brown ... white precipitates	▨	B1		11.2	
1	CLAY (TILL) - silty, some sand, trace gravel, moist, stiff, medium plastic, light brown with dark brown mottling, coal and oxide specks, sand pockets to 30mm, occasional high plastic clay inclusions, white precipitates					910.0
		▨	B2		12.4	
	... some sand to sandy, low to medium plastic	☒	D1	12		
2						909.0
		▨	B3		16.1	
	... some sand, medium plastic	▨	B4		17.6	
3						908.0
	... oxide staining, weathered ... silt pockets	☒	D2	12		
	... trace to some sand, medium to high plastic, brown with dark brown mottling	▨	B5			
4						907.0
	... damp tpo moist, occasional gravel pockets to 50mm	▨	B6		12.6	
		☒	D3	14		
5	... some sand, medium plastic, thin sand lenses	▨	B7			906.0
	... sandy, low plastic, occasional sand pockets to 100mm	▨	B8		11.5	
6						905.0
	... some sand to sandy, low to medium plastic	☒	D4	12		
	End of Borehole @ 6.6m					
7	No Seepage or Sloughing on Completion Slotted PVC Pipe Installed to 6.6m Borehole Measured Dry November 21, 2011					904.0
8						903.0
9						902.0
10						901.0
11						900.0
11.5						



EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 6.6m
	REVIEWED BY: TC	COMPLETE: 10/31/2011
	DRAWING NO: B15	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH016
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 913.75m

SAMPLE TYPE ■ DISTURBED ◿ NO RECOVERY ☒ SPT ☰ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ■ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁖ GROUT ▧ DRILL CUTTINGS ⁙ SAND

Depth (m): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 11.5

SOIL DESCRIPTION

TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics

CLAY - silty, trace to some sand, moist, stiff, medium to high plastic, grey brown
... silt pockets, high plastic clay inclusions, light brown with dark brown mottling
... trace sand, high plastic

CLAY (TILL) - silty, trace to some sand, trace gravel, moist, stiff, medium to high plastic, light brown with dark brown mottling, coal and oxide specks, thin sand lenses, high plastic clay inclusions
... damp to moist, sandy, low plastic, sand pockets to 50mm
... oxide staining, weathered, very stiff

SAND - silty, trace to some clay, poorly graded, medium grained, moist, compact, brown, coal staining, weathered, occasional high plastic clay inclusions

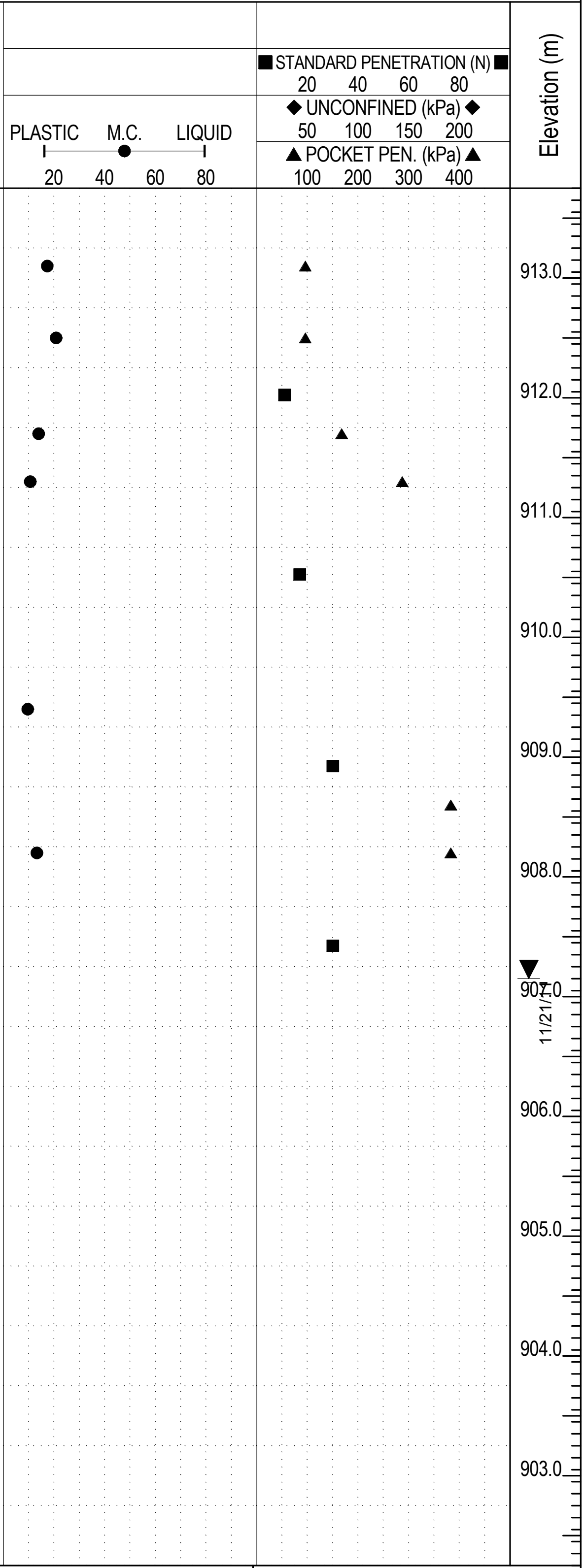
CLAY (TILL) - silty, some sand to sandy, trace gravel, moist, very stiff, low to medium plastic, brown to grey brown, coal and oxide staining, weathered
... some sand, medium plastic, light brown with dark brown mottling

End of Borehole @ 6.6m

No Seepage or Sloughing on Completion
Slotted PVC Pipe Installed to 6.6m
Indicated Water Level Measured November 21, 2011

11/21/11

SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
■	B1		17.3
■	B2		20.8
☒	D1	11	
■	B3		13.9
■	B4		10.6
☒	D2	17	
■	B5		
■	B6		9.6
☒	D3	30	
■	B7		
■	B8		13.2
☒	D4	30	



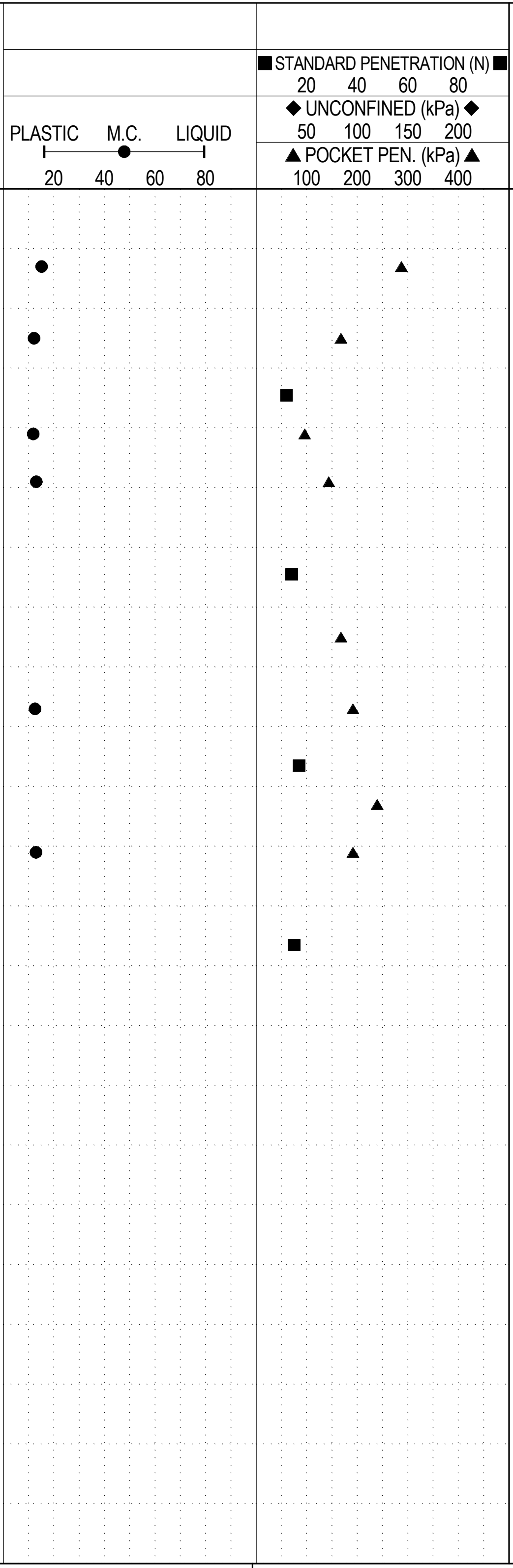
EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 6.6m
	REVIEWED BY: TC	COMPLETE: 10/31/2011
	DRAWING NO: B16	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH017
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 913.6m

SAMPLE TYPE ▨ DISTURBED ╱ NO RECOVERY ☒ SPT ☰ A-CASING ▥ SHELBY TUBE ▌ CORE

BACKFILL TYPE ▨ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁛ GROUT ▧ DRILL CUTTINGS ⁚ SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT	Elevation (m)
0	TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics					
	CLAY - silty, trace to some sand, damp to moist, very stiff, medium to high plastic, brown, white precipitates, occasional silt pockets	▨	B1		15.1	913.0
1	CLAY (TILL) - silty, some sand, trace gravel, damp to moist, stiff, medium plastic, brown to grey brown, coal and oxide specks, thin sand lenses					
		▨	B2		12.1	
		☒	D1	12		912.0
2		▨	B3		11.8	
	... light brown with dark brown mottling, sand pockets to 50mm	▨	B4		13	911.0
3						
		☒	D2	14		910.0
4		▨	B5			
	...300mm sand pocket	▨	B6		12.5	909.0
	... very stiff, brown to grey brown	☒	D3	17		
5	... some sand to sandy, low to medium plastic, oxide staining, weathered	▨	B7			
	... stiff	▨	B8		12.9	908.0
6						
		☒	D4	15		907.0
	End of Borehole @ 6.6m					
7	No Seepage or Sloughing on Completion Slotted PVC Pipe Installed to 6.6m Borehole Measured Dry November 21, 2011					906.0
8						905.0
9						904.0
10						903.0
11						
11.5						



EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 6.6m
	REVIEWED BY: TC	COMPLETE: 10/31/2011
	DRAWING NO: B17	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH018
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 915.29m

SAMPLE TYPE ▨ DISTURBED ▨ NO RECOVERY ☒ SPT ▤ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ▨ BENTONITE ▨ PEA GRAVEL ▥ SLOUGH ▨ GROUT ▧ DRILL CUTTINGS ▨ SAND

SOIL DESCRIPTION

TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics

CLAY - silty, trace to some sand, damp, very stiff, medium to high plastic, light brown to brown, white precipitates, silt pockets

... moist, brown

... trace sand, high plastic, heavy white precipitates

CLAY (TILL) - silty, trace to some sand, trace gravel, moist, stiff, medium to high plastic, light brown with dark brown mottling, coal and oxide specks, thin sand lenses

... some sand to sandy, low to medium plastic, sand pockets to 50mm

... sandy, low plastic

... some sand, low plastic, brown with dark brown mottling, oxide staining, weathered

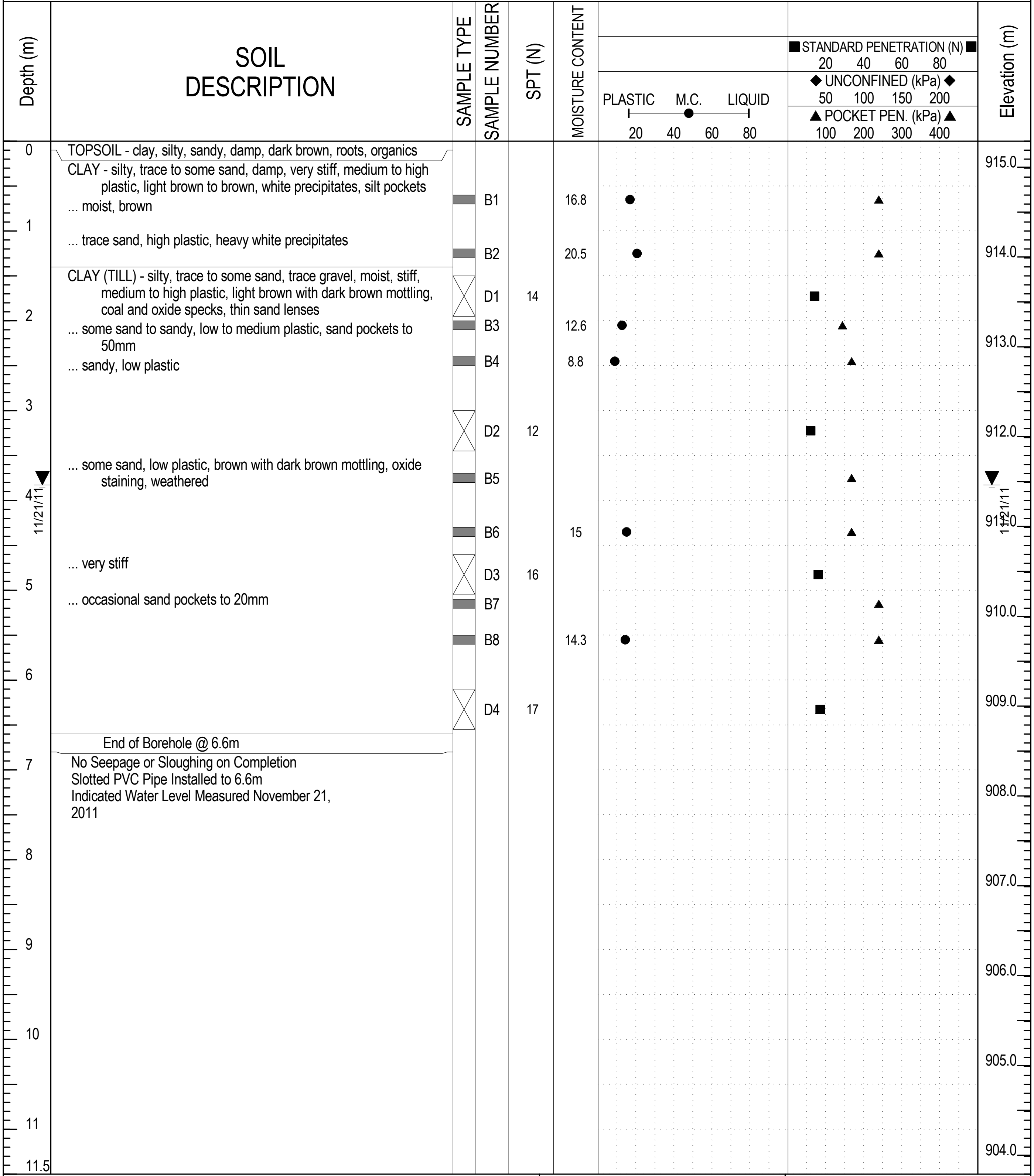
... very stiff

... occasional sand pockets to 20mm

End of Borehole @ 6.6m

No Seepage or Sloughing on Completion
Slotted PVC Pipe Installed to 6.6m
Indicated Water Level Measured November 21, 2011

SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
DISTURBED	B1		16.8
DISTURBED	B2		20.5
SPT	D1	14	
DISTURBED	B3		12.6
DISTURBED	B4		8.8
SPT	D2	12	
DISTURBED	B5		
DISTURBED	B6		15
SPT	D3	16	
DISTURBED	B7		
DISTURBED	B8		14.3
SPT	D4	17	



EBA Engineering Consultants Ltd.

LOGGED BY: JKM	COMPLETION DEPTH: 6.6m
REVIEWED BY: TC	COMPLETE: 10/31/2011
DRAWING NO: B18	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH019
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 915.75m

SAMPLE TYPE ▨ DISTURBED ◿ NO RECOVERY ☒ SPT ☰ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ▨ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁖ GROUT ▧ DRILL CUTTINGS ⁙ SAND

Depth (m) 0 – 11.5

SOIL DESCRIPTION

TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics

CLAY - silty, some sand, damp to moist, very stiff, medium plastic, light brown to brown, white precipitates

... trace to some sand, moist, medium to high plastic, light brown with dark brown mottling, high plastic clay inclusions, thinly laminated, heavy white precipitates

... moist, stiff

CLAY (TILL) - silty, some sand, trace gravel, moist, stiff, medium plastic, light brown with dark brown mottling, coal and oxide specks, thin sand lenses, white precipitates

... very stiff

... sand pockets to 50mm

... some sand to sandy, low to medium plastic

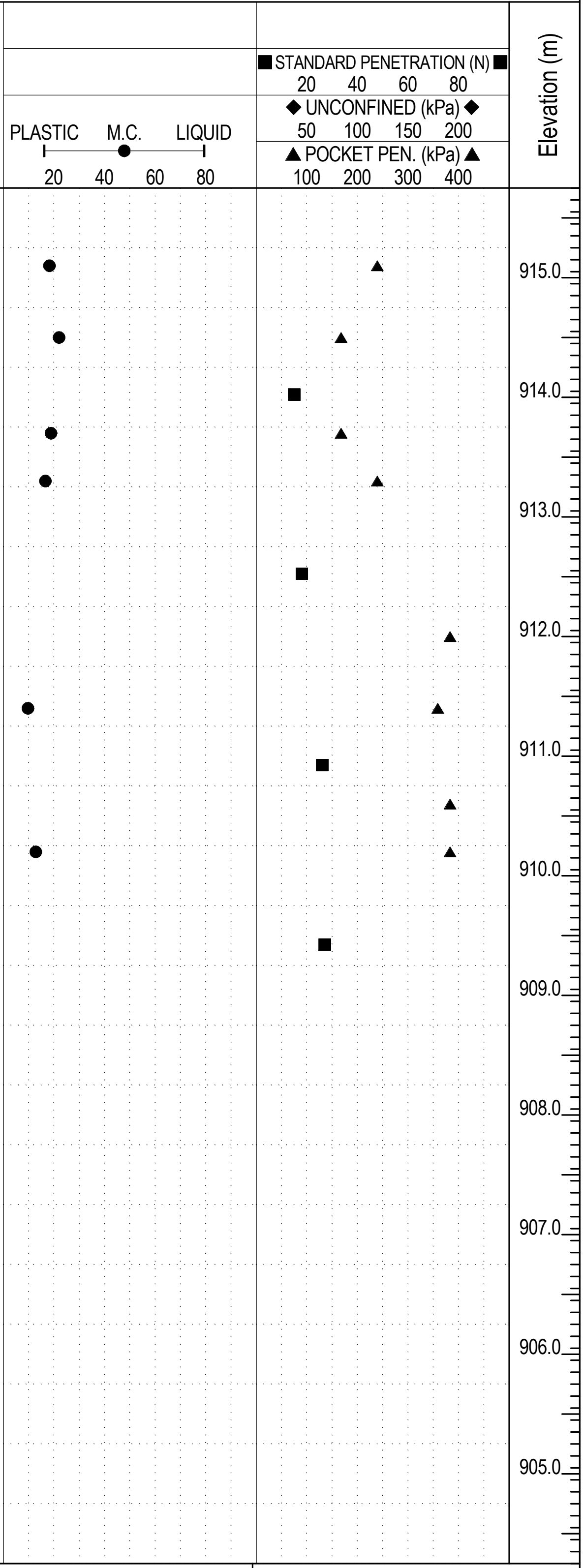
... sandy, damp, low plastic, oxide staining, weathered

... some sand, moist, medium plastic, brown to grey brown

End of Borehole @ 6.6m

No Seepage or Sloughing on Completion
Slotted PVC Pipe Installed to 6.6m
Borehole Measured Dry November 21, 2011

SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
▨	B1		18.2
▨	B2		22
☒	D1	15	
▨	B3		18.8
▨	B4		16.6
☒	D2	18	
▨	B5		
▨	B6		9.7
☒	D3	26	
▨	B7		
▨	B8		12.8
☒	D4	27	



EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 6.6m
	REVIEWED BY: TC	COMPLETE: 10/31/2011
	DRAWING NO: B19	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH020
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 911.92m

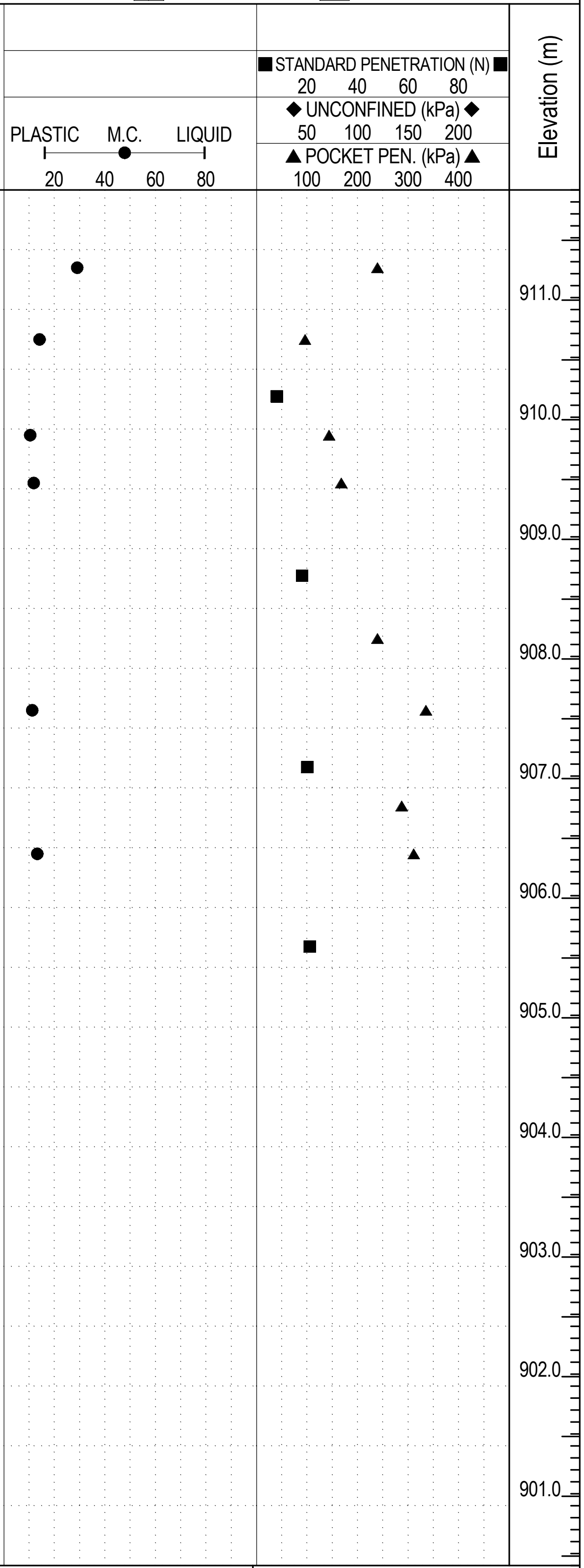
SAMPLE TYPE: ▨ DISTURBED, ◸ NO RECOVERY, ☒ SPT, ☰ A-CASING, ▥ SHELBY TUBE, ▮ CORE

BACKFILL TYPE: ▨ BENTONITE, ⁘ PEA GRAVEL, ▥ SLOUGH, ⁘ GROUT, ▧ DRILL CUTTINGS, ⁙ SAND

Depth (m)	SOIL DESCRIPTION
0	TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics
	CLAY - silty, trace sand, moist, very stiff, high plastic, brown to grey brown
1	CLAY (TILL) - silty, some sand, trace gravel, moist, stiff, brown, coal and oxide specks, sand pockets
	... sand pockets to 30mm
2	... some sand to sandy, damp to moist, low to medium plastic
3	... very stiff
	... oxide staining, weathered
4	... some sand, medium plastic, brown with dark brown mottling, occasional high plastic clay inclusions, thin sand lenses
6.6	End of Borehole @ 6.6m
7	No Seepage or Sloughing on Completion Slotted PVC Pipe Installed to 6.6m Borehole Measured Dry November 21, 2011

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 11.5

SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
▨	B1		29
▨	B2		14.1
☒	D1	8	
▨	B3		10.4
▨	B4		11.8
☒	D2	18	
▨	B5		
▨	B6		11.2
☒	D3	20	
▨	B7		
▨	B8		13.2
☒	D4	21	



EBA Engineering Consultants Ltd.

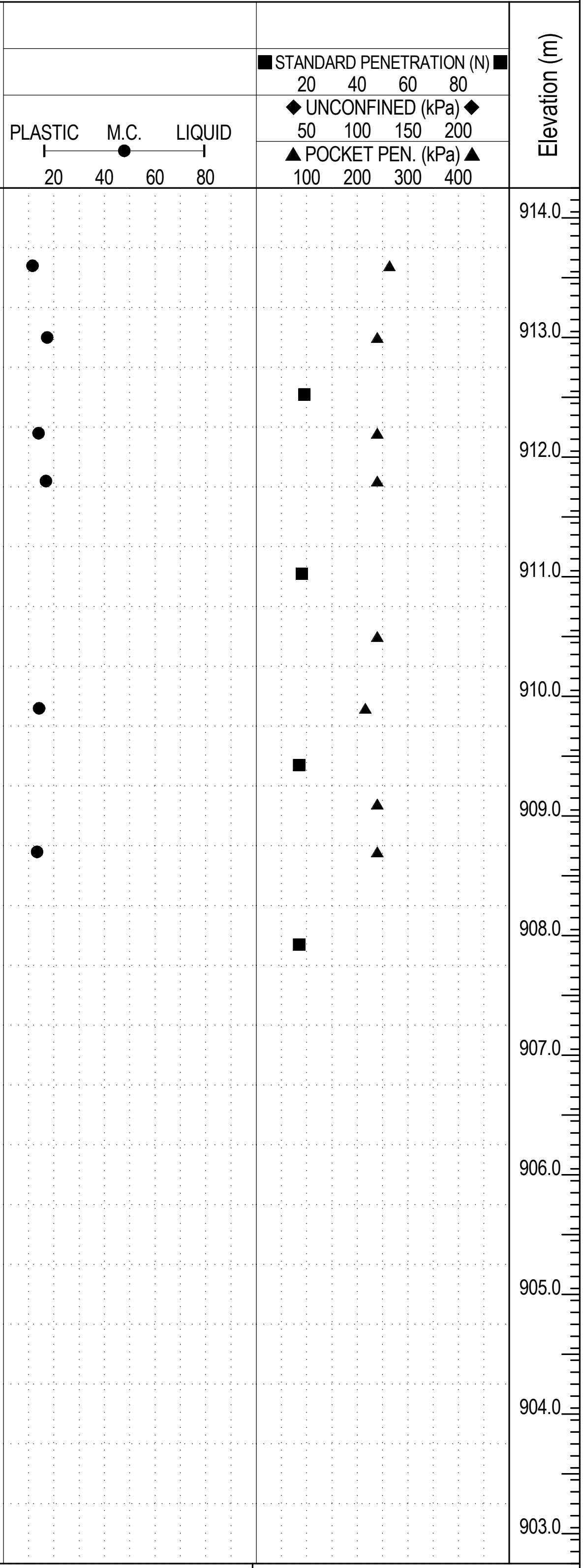
LOGGED BY: JKM	COMPLETION DEPTH: 6.6m
REVIEWED BY: TC	COMPLETE: 10/31/2011
DRAWING NO: B20	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH021
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 914.25m

SAMPLE TYPE ▨ DISTURBED ◺ NO RECOVERY ☒ SPT ☰ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ▨ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁙ SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
0	TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics				
	CLAY - silty, some sand, damp, very stiff, medium plastic, light brown, white precipiates, occasional silt pockets				
		▨	B1		11.5
1	... trace to some sand, moist, medium to high plastic, brown to dark brown	▨	B2		17.3
	CLAY (TILL) - silty, some sand, trace gravel, moist, stiff, medium plastic, brown with dark brown mottling, coal and oxide specks, thin sand lenses, high plastic clay inclusions	☒	D1	19	
2		▨	B3		13.9
		▨	B4		16.8
3	... some sand to sandy, low to medium plastic	☒	D2	18	
	... some sand, medium plastic				
		▨	B5		
4	... sand pockets to 30mm				
	... oxide staining, weathered	▨	B6		14.1
5		☒	D3	17	
		▨	B7		
		▨	B8		13.3
6		☒	D4	17	
	End of Borehole @ 6.6m				
7	No Seepage or Sloughing on Completion Slotted PVC Pipe Installed to 6.6m Borehole Measured Dry November 21, 2011				
8					
9					
10					
11					
11.5					



EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 6.6m
	REVIEWED BY: TC	COMPLETE: 10/31/2011
	DRAWING NO: B21	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH022
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 915.79m

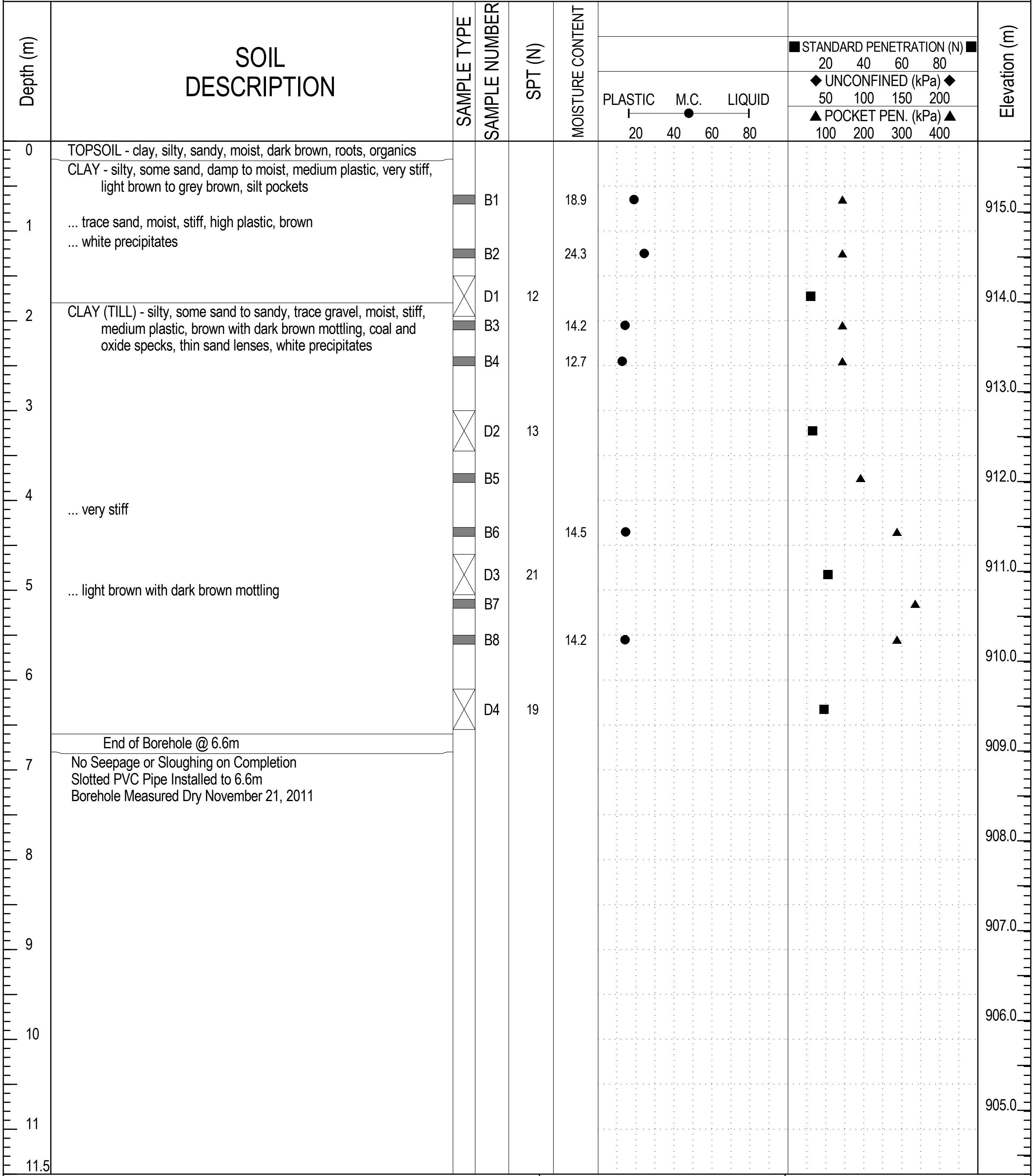
SAMPLE TYPE: ▇ DISTURBED ◸ NO RECOVERY ☒ SPT ▤ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE: ▇ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁘ SAND

Depth (m)	SOIL DESCRIPTION
0	TOPSOIL - clay, silty, sandy, moist, dark brown, roots, organics
	CLAY - silty, some sand, damp to moist, medium plastic, very stiff, light brown to grey brown, silt pockets
1	... trace sand, moist, stiff, high plastic, brown ... white precipitates
2	CLAY (TILL) - silty, some sand to sandy, trace gravel, moist, stiff, medium plastic, brown with dark brown mottling, coal and oxide specks, thin sand lenses, white precipitates
4	... very stiff
5	... light brown with dark brown mottling
6.6	End of Borehole @ 6.6m

No Seepage or Sloughing on Completion
Slotted PVC Pipe Installed to 6.6m
Borehole Measured Dry November 21, 2011

SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
DISTURBED	B1		18.9
DISTURBED	B2		24.3
SPT	D1	12	
DISTURBED	B3		14.2
DISTURBED	B4		12.7
SPT	D2	13	
DISTURBED	B5		
DISTURBED	B6		14.5
SPT	D3	21	
DISTURBED	B7		
DISTURBED	B8		14.2
SPT	D4	19	

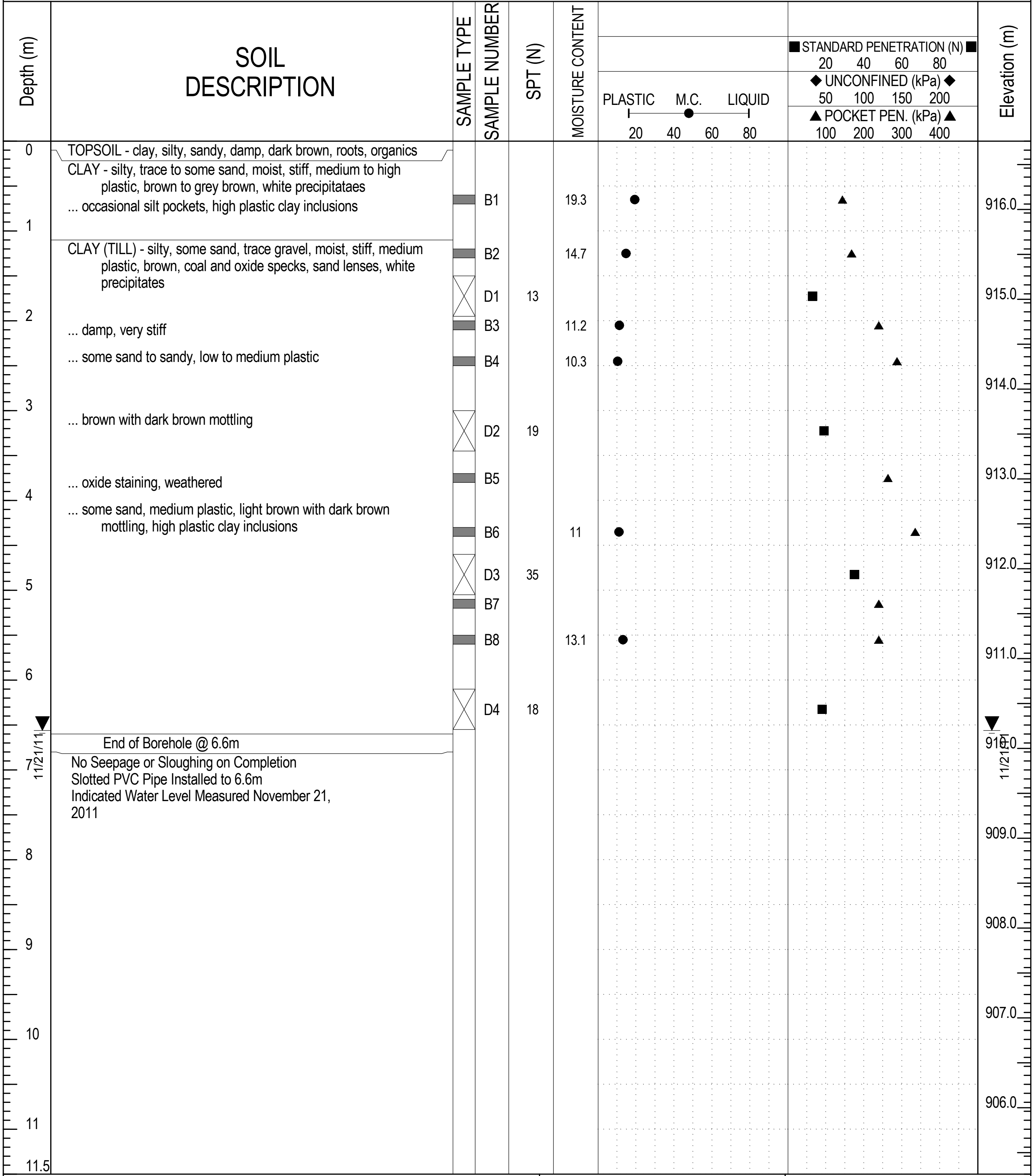


EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 6.6m
	REVIEWED BY: TC	COMPLETE: 10/31/2011
	DRAWING NO: B22	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH023
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 916.76m

SAMPLE TYPE ▆ DISTURBED ◿ NO RECOVERY ☒ SPT ▤ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ▆ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁘ SAND



SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics				
CLAY - silty, trace to some sand, moist, stiff, medium to high plastic, brown to grey brown, white precipitataes				
... occasional silt pockets, high plastic clay inclusions	▆	B1		19.3
CLAY (TILL) - silty, some sand, trace gravel, moist, stiff, medium plastic, brown, coal and oxide specks, sand lenses, white precipitates	▆	B2		14.7
	☒	D1	13	
... damp, very stiff	▆	B3		11.2
... some sand to sandy, low to medium plastic	▆	B4		10.3
... brown with dark brown mottling	☒	D2	19	
... oxide staining, weathered	▆	B5		
... some sand, medium plastic, light brown with dark brown mottling, high plastic clay inclusions	▆	B6		11
	☒	D3	35	
	▆	B7		
	▆	B8		13.1
	☒	D4	18	
End of Borehole @ 6.6m				

No Seepage or Sloughing on Completion
Slotted PVC Pipe Installed to 6.6m
Indicated Water Level Measured November 21, 2011

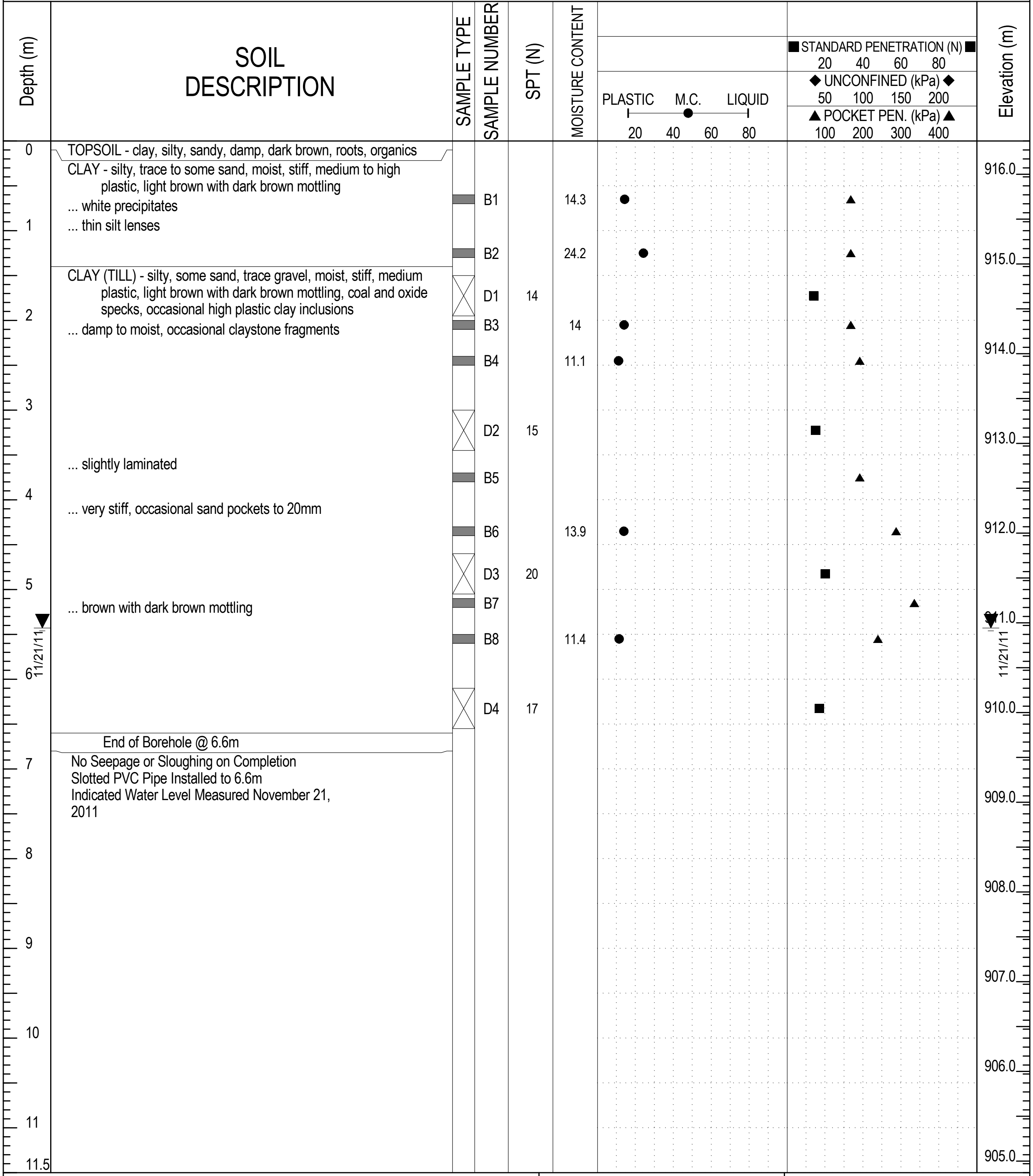
EBA Engineering Consultants Ltd.

LOGGED BY: JKM	COMPLETION DEPTH: 6.6m
REVIEWED BY: TC	COMPLETE: 10/31/2011
DRAWING NO: B23	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH024
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 916.37m

SAMPLE TYPE ▨ DISTURBED ◿ NO RECOVERY ☒ SPT ☰ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ▨ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁘ SAND



TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics

CLAY - silty, trace to some sand, moist, stiff, medium to high plastic, light brown with dark brown mottling

... white precipitates

... thin silt lenses

CLAY (TILL) - silty, some sand, trace gravel, moist, stiff, medium plastic, light brown with dark brown mottling, coal and oxide specks, occasional high plastic clay inclusions

... damp to moist, occasional claystone fragments

... slightly laminated

... very stiff, occasional sand pockets to 20mm

... brown with dark brown mottling

End of Borehole @ 6.6m

No Seepage or Sloughing on Completion
Slotted PVC Pipe Installed to 6.6m
Indicated Water Level Measured November 21, 2011

SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
▨	B1		14.3
▨	B2		24.2
☒	D1	14	
▨	B3		14
▨	B4		11.1
☒	D2	15	
▨	B5		
▨	B6		13.9
☒	D3	20	
▨	B7		
▨	B8		11.4
☒	D4	17	

EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 6.6m
	REVIEWED BY: TC	COMPLETE: 10/31/2011
	DRAWING NO: B24	Page 1 of 1

PROJECT: LANDS NORTH OF UPLANDS	CLIENT: STANTEC CONSULTING LTD.	PROJECT NO. - BOREHOLE NO.
LOCATION: NW 1/4 SEC 17-9-21 W4M	DRILL METHOD: 150mm SOLID STEM AUGER	L12101928 - 11BH025
CITY: LETHBRIDGE, AB	PROJECT ENGINEER: JIEJUN ZHAO	ELEVATION: 913.6m

SAMPLE TYPE ▆ DISTURBED ╱ NO RECOVERY ☒ SPT ☰ A-CASING ▥ SHELBY TUBE ▮ CORE

BACKFILL TYPE ▆ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▧ DRILL CUTTINGS ⁘ SAND

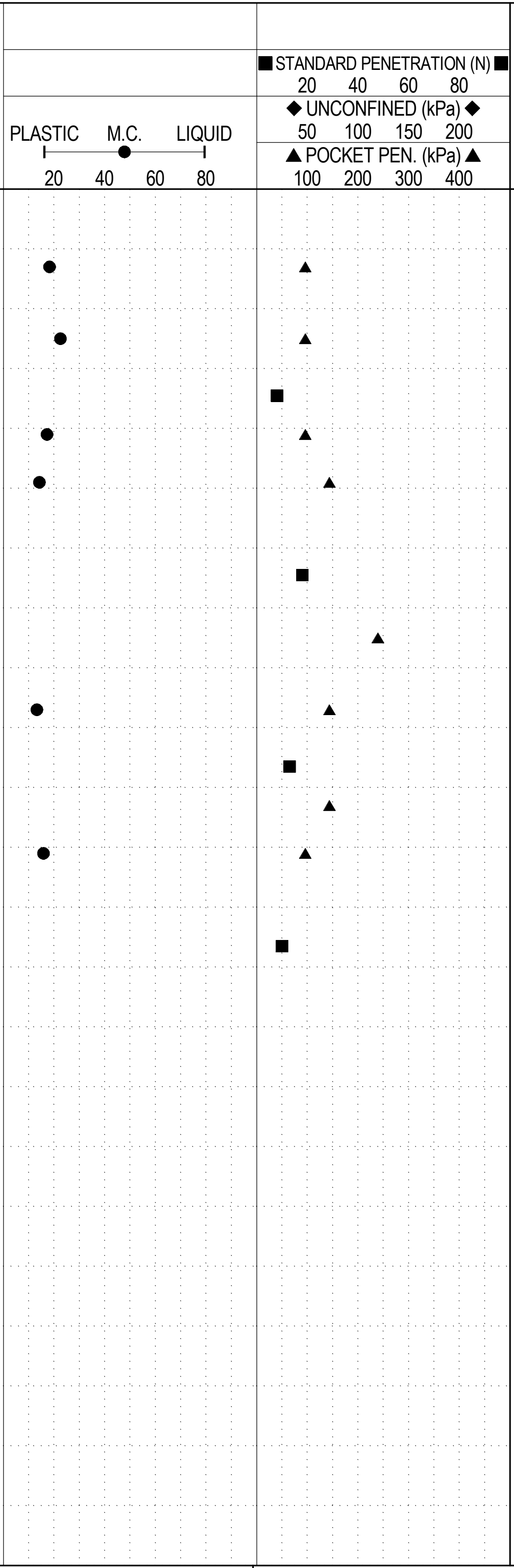
SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	MOISTURE CONTENT
TOPSOIL - clay, silty, sandy, damp, dark brown, roots, organics				
CLAY - silty, trace to some sand, moist, stiff, medium to high plastic, brown, white precipitates, occasional silt lenses, high plastic clay inclusions	▆	B1		18.2
... some sand to sandy, low to medium plastic, brown to dark brown	▆	B2		22.5
	☒	D1	8	
CLAY (TILL) - silty, trace to some sand, trace gravel, moist, stiff, medium to high plastic, light brown with dark brown mottling, coal and oxide specks, thin sand lenses, high plastic clay inclusions	▆	B3		17.2
	▆	B4		14.2
... oxide staining, weathered				
... some sand, very stiff, medium plastic	☒	D2	18	
	▆	B5		
... stiff	▆	B6		13.2
	☒	D3	13	
... brown	▆	B7		
... occasional sand pockets	▆	B8		15.8
... trace free water	☒	D4	10	
End of Borehole @ 6.6m				

Seepage and Sloughing from 6.0m on Completion
Slotted PVC Pipe Installed to 6.6m
Indicated Water Level Measured November 21, 2011

Depth (m): 0 1 2 3 4 5 6 7 8 9 10 11 11.5

▼ 11/21/11

Elevation (m): 913.0 912.0 911.0 910.0 909.0 908.0 907.0 906.0 905.0 904.0 903.0



EBA Engineering Consultants Ltd.	LOGGED BY: JKM	COMPLETION DEPTH: 6.6m
	REVIEWED BY: TC	COMPLETE: 10/31/2011
	DRAWING NO: B25	Page 1 of 1

APPENDIX C

APPENDIX C RECOMMENDED GENERAL DESIGN AND CONSTRUCTION GUIDELINES

CONSTRUCTION GUIDELINE

SHALLOW FOUNDATIONS

Design and construction of shallow foundations should comply with relevant Building Code requirements.

The term ‘shallow foundations’ includes strip and spread footings, mat slab and raft foundations.

Minimum footing dimensions in plan should be 0.45 m and 0.9 m for strip and square footings respectively.

No loose, disturbed or sloughed material should be allowed to remain in open foundation excavations. Hand cleaning should be undertaken to prepare an acceptable bearing surface. Recompaction of disturbed or loosened bearing surface may be required.

Foundation excavations and bearing surfaces should be protected from rain, snow, freezing temperatures, excessive drying and the ingress of free water before, during and after footing construction.

Footing excavations should be carried down into the designated bearing stratum.

After the bearing surface is approved, a mud slab should be poured to protect the soil and provide a working surface for construction, should immediate foundation construction not be intended.

All constructed foundations should be placed on unfrozen soils, which should be at all times protected from frost penetration.

All foundation excavations and bearing surfaces should be inspected by a qualified geotechnical engineer to check that the recommendations contained in this report have been followed.

Where over-excavation has been carried out through a weak or unsuitable stratum to reach into a suitable bearing stratum or where a foundation pad is to be placed above stripped natural ground surface such over-excavation may be backfilled to subgrade elevation utilizing either structural fill or lean-mix concrete. These materials are defined under the separate heading ‘Backfill Materials and Compaction’.

FLOOR SLABS-ON-GRADE

All soft, loose or organic material should be removed from beneath slab areas. If any local 'hard spots' such as old basement walls are revealed beneath the slab area, these should be over-excavated and removed to not less than 0.9 m below underside of slab level. The exposed soil should be proof-rolled and the final grade restored by general engineered fill placement. If proof-rolling reveals any soft or loose spots, these should be excavated and the desired grade restored by general engineered fill placement. Proof-rolling should be carried out in accordance with the recommendations given elsewhere in this Appendix. The subgrade should be compacted to a depth of not less than 0.3 m to a density of not less than 98 percent Standard Proctor Maximum Dry Density (ASTM Test Method D698).

If, for economic reasons, it is considered desirable to leave low quality material in-place beneath a slab-on-grade, special ground treatment procedures may be considered, EBA could provide additional advice on this aspect if required.

A levelling course of 20 mm crushed gravel at least 150 mm in compacted thickness, is recommended directly beneath all slabs-on-grade. Alternatively a minimum thickness of 150 mm of pit-run gravel overlain by a minimum thickness of 50 mm of 20 mm crushed gravel may be used. Very coarse material (larger than 25 mm diameter) should be avoided directly beneath the slab-on-grade to limit potential stress concentrations within the slab. All levelling courses directly under floor slabs should be compacted to 100 percent of Standard Proctor maximum dry density.

General engineered fill, pit-run gravel and crushed gravel are defined under the heading 'Backfill Materials and Compaction' elsewhere in this Appendix.

The slab should be structurally independent from walls and columns supported on foundations. This is to reduce any structural distress that may occur as a result of differential soil movements. If it is intended to place any internal non-load bearing partition walls directly on a slab-on-grade, such walls should also be structurally independent from other elements of the building founded on a conventional foundation system so that some relative vertical movement of the walls can occur freely.

The excavated subgrade beneath slabs-on-grade should be protected at all times from rain, snow, freezing temperatures, excessive drying and the ingress of free water. This applies during and after the construction period.

A minimum slab concrete thickness of 100 mm is recommended. Control joints should be provided in all slabs. Typically for a 125 mm slab thickness; control joints should be placed on a 3 m square grid, should be sawn to a depth of one-quarter the slab thickness and have a width of approximately 3 mm.

Wire mesh reinforcement, 150 mm square grid, should be provided to reduce the possibility of uncontrolled slab cracking. The mesh should be adequately supported and should be located at mid-height of the slab with adequate cover.

CONSTRUCTION EXCAVATIONS

Construction should be in accordance with good practice and comply with the requirements of the responsible regulatory agencies.

All excavations greater than 1.5 m deep should be sloped or shored for worker protection.

Shallow excavations up to about 3 m depth may use temporary sideslopes of 1H:1V. A flatter slope of 2H:1V should be used if groundwater is encountered. Localized sloughing can be expected from these slopes.

Deep excavations or trenches may require temporary support if space limitations or economic considerations preclude the use of sloped excavations.

For excavations greater than 3 m depth, temporary support should be designed by a qualified geotechnical engineer. The design and proposed installation and construction procedures should be submitted to EBA for review.

The construction of a temporary support system should be monitored. Detailed records should be taken of installation methods, materials, in situ conditions and the movement of the system. If anchors are used, they should be load tested. EBA can provide further information on monitoring and testing procedures if required.

Attention should be paid to structures or buried service lines close to the excavation. For structures, a general guideline is that if a line projected down, at 45 degrees from the horizontal from the base of foundations of adjacent structures intersects the extent of the proposed excavation, these structures may require underpinning or special shoring techniques to avoid damaging earth movements. The need for any underpinning or special shoring techniques and the scope of monitoring required can be determined when details of the service ducts and vaults, foundation configuration of existing buildings and final design excavation levels are known.

No surface surcharges should be placed closer to the edge of the excavation than a distance equal to the depth of the excavation, unless the excavation support system has been designed to accommodate such surcharge.

BACKFILL MATERIALS AND COMPACTION

Maximum density as used in this section means Standard Proctor Maximum Dry Density (ASTM Test Method D698) unless specifically noted otherwise. Optimum moisture content is as defined in this test.

"Landscape fill" material may comprise soils without regard to engineering quality. Such soils should be placed in compacted lifts not exceeding 300 mm and compacted to a density of not less than 90 percent of maximum density.

"General engineered fill" materials should comprise clean, inorganic granular or clay soils. "Select engineered fill" materials should comprise clean, well-graded granular soils or inorganic low plastic clay soils. Engineered fill materials should be placed in layers of 150 mm compacted thickness and should be compacted to 98 percent of maximum density.

Granular soils used for select engineered fills should consist of relatively clean, well graded, sand or mixture of sand and gravel (maximum size 75 mm).

Low to medium plastic clay with the following range of Atterberg limits is generally considered suitable for use as select engineered fill.

Liquid Limit = 20 to 40%

Plastic Limit = 10 to 20%

Plasticity Index = 10 to 30%

Clay fill materials should be compacted at or slightly above the optimum moisture content.

"Structural fill" materials should comprise clean, well-graded inorganic granular soils. Such fill should be placed in compacted lifts not exceeding 150 mm and compacted to not less than 100 percent of maximum density.

Backfill adjacent to and above footings, abutment walls, basement walls, grade beams and pile caps or below highway, street or parking lot pavement sections and base courses should comprise "general engineered fill" materials as defined above.

Backfill below slabs-on-grade or where increased volumetric stability is desired should comprise "select engineered fill" materials as defined above.

Backfill supporting structural loads should comprise "structural fill" materials as defined above.

Exterior backfill adjacent to footings, foundation walls, grade beams and pile caps and within 300 mm of final grade should comprise inorganic clay "general engineered" fill as defined above. Such backfill should provide a relatively impervious surface layer to reduce seepage into the subsoil.

Backfill should not be placed against a foundation structure until the structure has sufficient strength to withstand the earth pressures resulting from placement and compaction. During compaction, careful observation of the foundation wall for deflection should be carried out continuously. Where deflections are apparent, the compactive effort should be reduced accordingly.

In order to reduce potential compaction induced stresses, only hand held compaction equipment should be used in the compaction of fill within 500 mm of retaining walls or basement walls.

Backfill materials should not be placed in a frozen state, or placed on a frozen subgrade. All lumps of materials should be broken down during placement.

Where the maximum-sized particles in any backfill material exceed 50 percent of the minimum dimension of the cross-section to be backfilled, such particles should be removed and placed at other more suitable locations on-site or screened off prior to delivery to site.

Bonding should be provided between backfill lifts, if the previous lift has become desiccated. For fine-grained materials the previous lift should be scarified to the base of the desiccated layer, properly moisture-conditioned and recompacted and bonded thoroughly to the succeeding lift. For granular materials, the surface of the previous lift should be scarified to about a 75 mm depth followed by proper moisture-conditioning and recompaction.

Suggested specifications for various backfill types are presented below.

"Pit-Run gravel" and fill sand shall be reasonably well graded and should conform to the following gradings:

PERCENT PASSING BY WEIGHT		
SIEVE SIZE	**PIT RUN GRAVEL (A.T. D6-C80)**	**FILL SAND**
80.0 mm	100	--
50 mm	55-100	--
25 mm	38 – 100	100
16 mm	32 – 85	--
5.0 mm	20 – 65	75 – 100
630 µm	--	45 – 80
315 µm	6 – 30	--
80 µm	2 – 10	2 - 10

The Pit-Run gravel should be free of any form of coating and any gravel or sand containing clay, loam or other deleterious materials should be rejected. No oversize material should be tolerated. The percent of material passing the 80 µm sieve should not exceed 2/3 of the material passing the 315 µm sieve.

20 mm and 40 mm crushed gravel should be hard, clean, well graded, crushed aggregate, free of organics, coal, clay lumps, coatings of clay, silt and other deleterious materials. The aggregates should conform to the following Alberta Transportation gradation requirements when tested in accordance with ASTM C136:

PERCENT PASSING BY WEIGHT		
SIEVE SIZE	**20 mm CRUSH (A.T. D2-C20)**	**40 mm CRUSH (A.T. D2-C40)**
40 mm	--	100
25 mm	--	70 – 94
20 mm	100	--
16 mm	84 – 94	55 – 85
10 mm	63 – 86	44 – 74
5.0 mm	40 – 67	32 – 62
1.25 mm	20 – 43	17 – 43
630 µm	14 – 34	12 – 34
315 µm	9 – 26	8 – 26
160 µm	5 – 18	5 – 18
80 µm	2 – 10	2 – 10

A minimum of 60 percent of the material retained on the 5 mm sieve for the 20 mm crushed gravel should have at least two freshly crushed faces. Not less than 50 percent of the material retained on the 5 mm sieve for the 40 mm crushed gravel should have at least two freshly crushed faces.

The 20 mm granular course should be compacted in lifts not exceeding 150 mm to 100 percent of Standard Proctor maximum dry density.

"Coarse gravel" for bedding and drainage should conform to the following grading:

PERCENT PASSING BY WEIGHT		
SIEVE SIZE	**28 mm GRAVEL**	**20 mm GRAVEL**
40 mm	100	--
28 mm	95 - 100	100
20 mm	--	85 – 100
14 mm	25 - 60	60 – 90
10 mm	--	25 – 60
5 mm	0 - 10	0 – 10
2.5 mm	0 - 5	0 - 5

"Coarse sand" for bedding and drainage should conform to the following grading:

SIEVE SIZE (Square Openings)	**PERCENT PASSING (By Weight)**
10 mm	100
5 mm	95 - 100
2.5 mm	80 - 100
1.25 mm	50 - 90
630 µm	25 - 65
315 µm	10 - 35
160 µm	2 - 10
80 µm	0 - 4

"Lean-mix concrete" should be low strength concrete having a minimum 28-day compressive strength of 3.5 MPa.

CONSTRUCTION GUIDELINE

BORED CAST-IN-PLACE CONCRETE PILES

Design and construction of piles should comply with relevant Building Code requirements.

Piles should be installed under full-time inspection of geotechnical personnel. Pile design parameters should be reviewed in light of the findings of the initial bored shafts drilled on a site. Further design review may be necessary if conditions observed during site construction do not conform to design assumptions.

Where fill material or lenses or strata of sand, silt or gravel are present within the designed pile depth, these may be incompetent and/or water bearing and may cause sloughing. Casing should be on hand before drilling starts and be used, if necessary, to seal off water and/or prevent sloughing of the hole.

If piles are to be underreamed (belled), the underreams should be formed entirely in self supporting soil and entirely within the competent bearing stratum. Where caving occurs at design elevation it may be necessary to extend the base of the pile bell to a greater depth. Piles may be constructed with bells having outside diameters up to approximately three times the diameters of their shafts. Piles with shaft diameters of less than 400 mm should not be underreamed due to difficulties associated with ensuring a clean base.

Prior to pouring concrete, bottoms of pile bells or of straight-shaft end-bearing piles should be cleaned of all disturbed material.

Pile excavations should be visually inspected after completion to ensure that disturbed materials and/or water are not present on the base so that recommended allowable bearing and skin friction parameters may apply.

Visual inspection may be accomplished by the inspector descending into the pile shaft (shaft diameter of 760 mm (30 inch) or greater). A protective cage and other safety equipment required by government regulations should be provided by the contractor to facilitate downhole inspection.

Other procedures to inspect the pile shafts may be used where shaft diameters of less than 760 mm (30 inch) are constructed, such as, inspection with a light.

For safety reasons, where hand cleaning and/or 'down shaft' inspection by personnel are required, the pile shaft must be cased full-length prior to personnel entering the shaft.

Reinforcing steel should be on hand and should be placed as soon as the bore has been completed and approved.

Longitudinal reinforcing steel is recommended to counteract the possible tensile stresses induced by frost action and should extend to a minimum depth of 3.5 m. A minimum steel of 0.5 percent of the gross shaft area is recommended.

Where a limited quantity of water is present on the pile base, when permitted or directed by a geotechnical engineer, it should be either removed or absorbed by the addition of dry cement, which should then be thoroughly mixed as an in situ slurry by means of the belling tool, using reverse rotation of the tool. Where significant quantities of water are present and it is impracticable to exclude water from the pile bore, concrete should be placed by tremie techniques or concrete pump.

A "dry" pile should be poured by "free fall" of concrete only where impact of the concrete against the reinforcing cage, which can cause segregation of the concrete, will not occur. A hopper should be used to direct concrete down the centre of the pile base and to prevent impact of concrete against reinforcing steel.

Concrete used for "dry" uncased piles should be self compacting and should have a target slump of 125 mm. Where casing is required to prevent sloughing or seepage, the slump should be increased to 150 mm. In order to comply with maximum water:cement ratios for the concrete, the use of chemicals (or superplasticizers) to temporarily increase the slump may be required. Concrete for each pile should be poured in one continuous operation and should be placed immediately after excavation and inspection of piles, to reduce the opportunity for the ingress of free water or deterioration of the exposed soil or rock.

If piles cannot be formed in dry conditions then the concrete should be placed by tremie tube or concrete pump. Concrete placed by tremie should have a slump of not less than 150 mm. A ball or float should be used in the tremie tube to separate the initial charge of concrete from the water in the pile hole. The outlet of the tremie tube should be maintained at all times 1.0 m to 2.0 m below the surface of the concrete. The diameter of the tremie tube should be at least 200 mm. The tube should be water tight and not be made of aluminum. Smaller diameter pipes may be used with a concrete pump. The surface of the concrete should be allowed to rise above the cut off level of the pile, so that when the temporary casing is withdrawn and the surface level of the concrete adjusts to the new volume, the top of the uncontaminated concrete is at or above the cut off level. The concrete should be placed in one continuous smooth operation without any halts or delays. Placing the lower portion of the pile by tremie tube and placing the upper portion of the pile by "free fall" should not be permitted, to ensure that defects in the pile shaft at the top of the tremie concrete do not occur. As the surface of the concrete rises in the pile bore the water in the pile bore will be displaced upwards and out of the top of the pile casing. It may be necessary to pump off this water to a container or temporary ditch drain to prevent the formation of ice or flooding conditions, and possibly damage to existing structures.

When concreting piles by tremie techniques allowance should be made for the removal of contaminated or otherwise defective concrete at the tops of the piles.

The casing should be filled with concrete and then the casing should be withdrawn smoothly and continuously. Sufficient concrete should be placed to allow for the additional volume of the casing and reduction in level of the concrete as the casing is withdrawn. Concrete should not be poured on top of previously poured concrete, after the casing is withdrawn.

An accurate record of the volume of concrete placed should be maintained as a check that a continuous pile had been formed.

Concrete should not be placed if its temperature is less than 5°C or exceeds 30°C, or if it is more than 2.0 hours old.

Where tension, horizontal or bending moment loading on the pile is foreseen, steel reinforcing should be extended and tied into the grade beam or pile cap. The steel should be designed to transfer loads to the required depth in the pile and to resist resultant bending moments and shear forces.

Void formers should be placed beneath all grade beams to reduce the risk of damage due to frost effects or soil moisture changes.

Where the drilling operation might affect the concrete in an adjacent pile (i.e.; where pile spacing is less than about three diameters) drilling should not be carried out before the previously poured pile concrete has set for at least 24 hours.

Where a group of four or more piles are used the allowable working load on the piles may need to be modified to allow for group effects.

Piles should be spaced no closer than 2.5 times the pile shaft diameter, measured centre-to-centre. Strict control of pile location and verticality should be exercised to provide accurate locations and spacings of piles. In general, piles should be constructed within a tolerance of 75 mm plan distance in any direction and within a verticality of 1 in 75.

A detailed record should be kept of pile construction; the following information should be included, pile number, shaft/base diameter, date and time bored, date and time concreted, elevation of piling platform, depths (from piling platform level) to pile base and to concrete cut-off level, length of casing used, details of reinforcement, details of any obstructions, details of any groundwater inflows, brief description of soils encountered in the bore and details of any unusual occurrences during construction.

If a large number of piles are to be installed, it may be possible to optimize the design on the basis of pile load tests.

CONSTRUCTION GUIDELINE

PROOF-ROLLING

Proof-rolling is a method of detecting soft areas in an 'as-excavated' subgrade for fill, pavement, floor or foundations or detecting non-uniformity of compacted embankment. The intent is to detect soft areas or areas of low shear strength not otherwise revealed by means of testholes, density testing, or visual examination of the site surface and to check that any fill placed or subgrade meets the necessary design strength requirements.

Proof-rolling should be observed by qualified geotechnical personnel.

Proof-rolling is generally accomplished by the use of a heavy (15 to 60 tonne) rubber-tired roller having 4 wheels abreast on independent axles with high contact wheel pressures (inflation pressures ranging from 550 kPa (80 psi) up to 1030 kPa (150 psi).

A heavily loaded tandem axle gravel truck may be used in lieu of the equipment described in the paragraph above. The truck should be loaded to approximately 10 tonnes per axle and a minimum tire pressure of 550 kPa (80 psi).

Ground speed - maximum 8 km/hr recommended 4 km/hr.

The recommended procedure is two complete coverages with the proof-rolling equipment in one direction and a second series of two coverages made at right angles to the first series; one 'coverage' means that every point of the proof-rolled surface has been subjected to the tire pressure of a loaded wheel. Less rigorous procedures may be acceptable under certain conditions subject to the approval of an engineer.

Any areas of soft, rutted, or displaced materials detected should be either recompacted with additional fill or the existing material removed and replaced with general engineered fill, or properly moisture conditioned as necessary.

The surface of the grade under the action of the proof-roller should be observed, noting; visible deflection and rebound of the surface, formation of a crack pattern in the compacted surface or shear failure in the surface of granular soils as ridging between wheel tracks.

If any part of an area indicates significantly more distress than other parts, the cause should be investigated, by, for example, shallow auger holes.

In the case of granular subgrades, distress will generally consist of either compression due to insufficient compaction or shearing under the tires. In the first case, rolling should be continued until no further compression occurs. In the second case, the tire pressure should be reduced to a point where the subgrade can carry the load without significant deflection and subsequently gradually increased to its specified pressure as the subgrade increases in shear strength under this compaction.

APPENDIX D

APPENDIX D LABORATORY TEST RESULTS

CONSTANT HEAD PERMEABILITY TEST REPORT

ASTM D5084

Project: North Uplands Subdivision
Project No.: L12101928
Client: Stantec Consulting
Attention: Trent Purvis

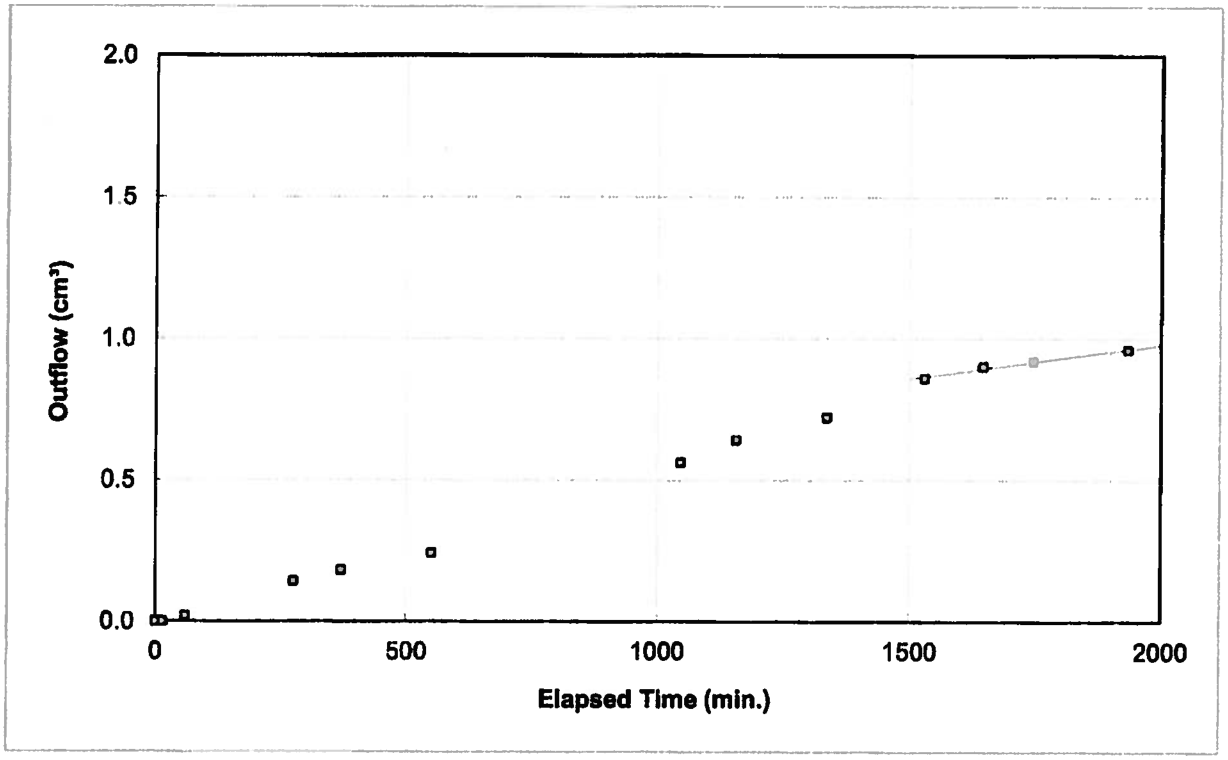
Test No.: Bulk
Borehole No.: Bulk
Sample Depth: 3.0 - 4.5 m
Date Tested: December 13, 2011
Tested By: MS

Soil Description: CLAY. silty, trace sand

	Initial	Final
Moisture Content (%)	12.8	16.6
Dry Density (kg/m^3)	1818	1787

k_{20} = 1.29E-09 cm/sec

Height = 5.003 cm
Diameter = 7.275 cm
Head Diff. = 35 kPa
Q = 4.12E-06 cm^3/sec
i = 71.38
A = 41.57 cm^2



Remarks:

Reviewed By: P.Eng

A TETRA TECH COMPANY

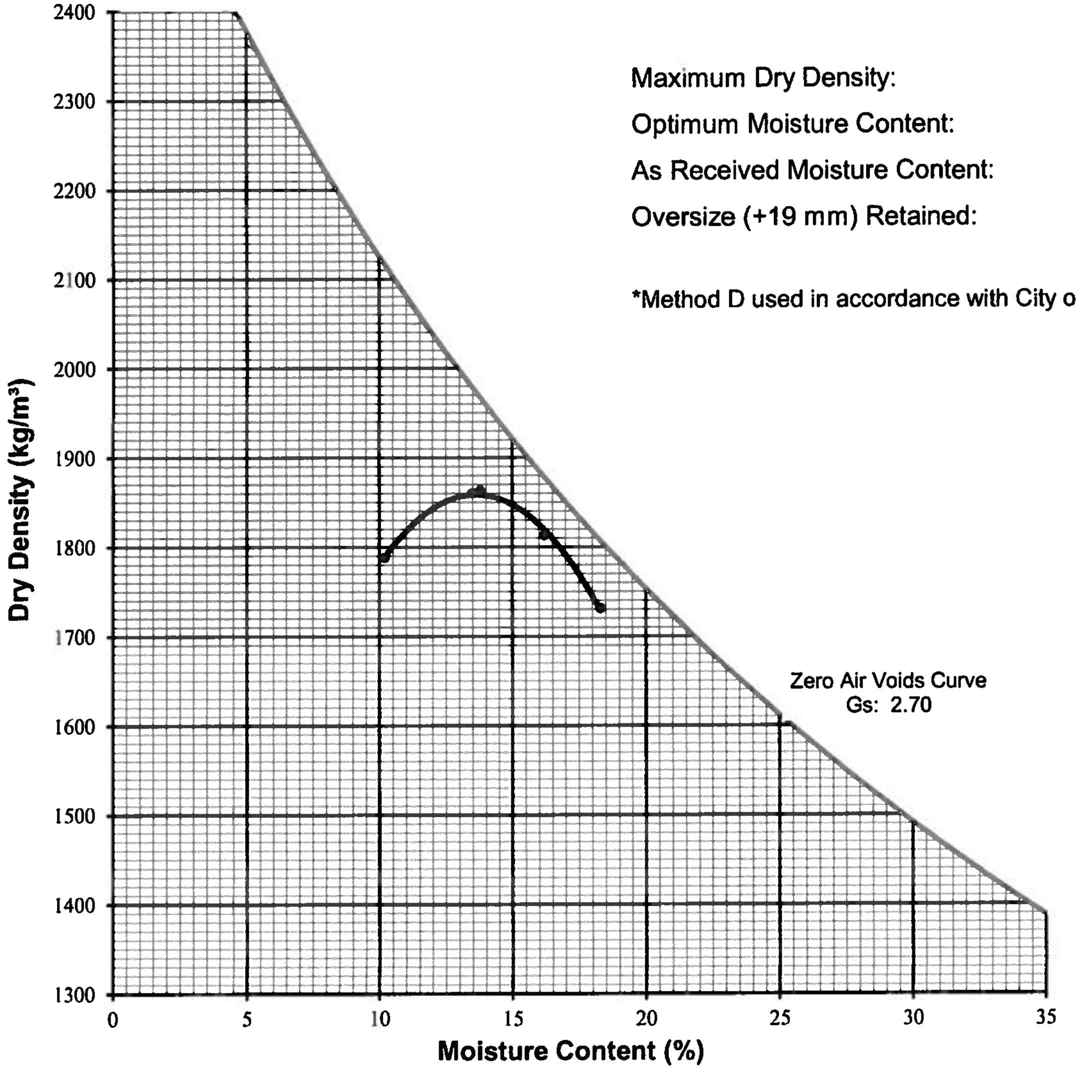
MOISTURE-DENSITY RELATIONSHIP (Proctor) REPORT

ASTM D698 (Standard Proctor)

Project:	North Uplands Subdivision	Sample No.:	
Project No.:	L12101928	Sampled By:	EBA
Client:	Stantec Consulting Ltd.	Date Received:	1-Nov-11
Attention:	Mr. Trent Purvis	Test Date:	8-Nov-11
E-mail:	tpurvis@stantec.com	Test Method:	Method D*
Source:		Compaction:	Manual

Sample Location: Bulk Sample @ 3.0 - 4.5m

Sample Description: Clay, silty, trace sand



Maximum Dry Density:	**1860**	kg/m³
Optimum Moisture Content:	**13.5**	%
As Received Moisture Content:	10.7	%
Oversize (+19 mm) Retained:	0.0	%

*Method D used in accordance with City of Edmonton practice

Remarks: Atterberg Limit = plastic limit - 13, liquid limit - 33, plastic index - 20

Reviewed By:__________________________ C.E.T.

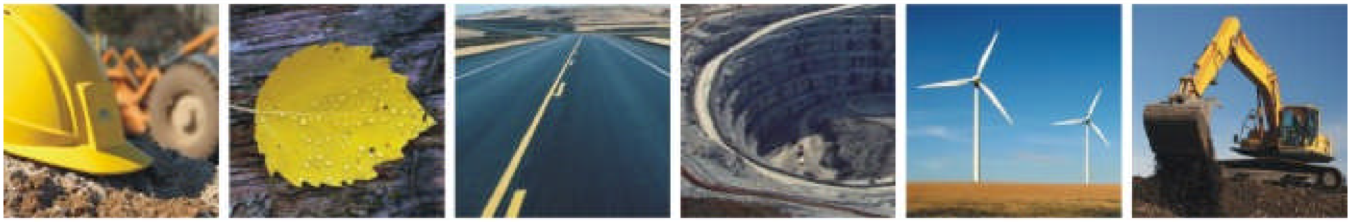
D

APPENDIX D

Environmental Site Assessment

STANTEC CONSULTING LTD.

PHASE I ENVIRONMENTAL SITE ASSESSMENT
LANDS NORTH OF UPLANDS
3625 & 4205 – 13 STREET NORTH AND
2200 – 44 AVENUE NORTH
LETHBRIDGE, ALBERTA



REPORT

MARCH 2012
ISSUED FOR USE
EBA FILE: L12101928.001

creating & delivering | BETTER SOLUTIONS

eba
A TETRA TECH COMPANY

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Stantec Consulting Ltd. and their agents. EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company (EBA), does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than the Stantec Consulting Ltd., or for any project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in EBA's Services Agreement. EBA's General Conditions are provided in Appendix A of this report.

EXECUTIVE SUMMARY

Foreword

Stantec Consulting Ltd. (Stantec), retained EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company (EBA), to conduct a Phase I environmental site assessment (ESA) of the proposed Lands North of Uplands residential subdivision, located in North Lethbridge, Alberta. The municipal addresses for the site are 3625 & 4205 – 13 Street North and 2200 – 44 Avenue North. The legal description of the property is NW ¼ 17-9-21 W4M. Collectively, this area will hereinafter be referred to as the site.

The objective of the Phase I ESA was to provide comment on whether any past or present land use, either on site or off site, may have a potential to cause environmental impairment to the site. EBA understands that Stantec requires the Phase I ESA for potential development purposes. The Phase I ESA was conducted in general accordance with the Canadian Standards Association (CSA) Phase I ESA Standard Z768-01 (2006).

A geotechnical investigation was conducted by EBA (EBA File No. L12101928) which will be issued under separate cover.

Findings and Conclusions

The site is currently cultivated, agricultural land with an ephemeral wetland on the north boundary and one on the west side of the site. No buildings are located on the site. One associated natural gas pipeline belonging to ATCO is located within NW 17-9-21 W4M along the west property line. Another ATCO owned pipeline is present further west of the site and extends parallel to the pipeline on the site. A pad mounted transformer is located on the northwest side of the site.

The site is bound to the north by agricultural cropland. The site is bound by 13 Street North to the west followed by Hardieville on the northern half and the Legacy Ridge residential subdivision on the southern half. A former service station was historically located at 1236/1240 – 41 Avenue North, adjacent to the site to the west within Hardieville. The Oldman River is located approximately 2.5 km further west. The site is bound to the south by the Uplands residential subdivision. The site is bound to the east by agricultural cropland and the Blackwolf residential subdivision approximately 200 m further east.

In general terms, there are two distinct types of potential environmental risk to any property. The first type of risk is from potential contamination from on-site land use. This would include potential accidental spills or site practices that may contaminate the property directly. The second type of risk is from contamination caused by adjacent property owners, which might then be transported through the subsurface soils by groundwater, or in overland runoff onto the site.

There was one source of potential environmental impairment from current or historical on-site land uses identified during this study. The following table identifies this source.

Potential On-site Source of Environmental Impairment

Source of Potential Impairment	Source of Information	EBA Evaluation
Ephemeral wetlands on the site.	Site reconnaissance, aerial photograph review.	Ephemeral wetlands were located on the north side and west sides of the site which may have the potential for methane generation.

There was one source of potential environmental impairment from current or historical off-site land uses identified during this study. The following table outlines this source.

Potential Off-site Source of Environmental Impairment

Source of Potential Impairment	Source of Information	EBA Evaluation
Former gas station located at 1236/1240 – 41 Avenue North	Henderson Business Directories, personnel interviews.	Information from the site interview suggests that the former gas station was present at this location from the early 1950s to the early 1970s. The former tanks were located on the north side of this property, which is approximately 30 m from the site. There is potential for soil and groundwater impact to the site from historical off-site activities.

Based on the present study, further intrusive environmental investigation would be required to assess the soil and groundwater quality on the west side of the site in the general vicinity of the former gas station.

EBA also suggests taking the following into consideration:

- An ephemeral wetland was observed on the north side of the site during the site reconnaissance and an additional ephemeral wetland was noted on the west side of the site in the aerial photograph review. Future development in these areas would require an approval under the Alberta Water Act. There is potential for methane generation from the buried organic material which is commonly found in wetland areas. Buried organic soils should be removed in the areas of future building development.

- The site is underlain by a coal mine that was mined to approximately 100 m below the surface of the site. Based on the review of the ERCB coal mine atlas and the aerial photograph review, there is no evidence of mining activities on the surface of the site. Should evidence of coal slag be encountered on the site during site redevelopment, an environmental professional should be consulted and further investigation may be warranted.

- A natural gas pipeline is located on the west side of the site and one further west of the site. There may be potential for impacts to the soil from pipeline construction activities. If evidence of petroleum hydrocarbon staining or odours are encountered during site redevelopment, an environmental professional should be consulted and further investigation may be warranted.

- According to the AEW water well database, a water well is located within the site boundary; however, the exact location of the well cannot be accurately determined. If the well is encountered during construction activities, it will need to be decommissioned in accordance with current regulations.

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FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 General

Stantec Consulting Ltd. (Stantec), retained EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company (EBA), to conduct a Phase I environmental site assessment (ESA) of the proposed Lands North of Uplands residential subdivision, located in North Lethbridge, Alberta. The municipal addresses for the site are 3625 & 4205 – 13 Street North and 2200 – 44 Avenue North. The legal description of the property is NW ¼ 17-9-21 W4M. Collectively, this area will hereinafter be referred to as the site.

The objective of the Phase I ESA was to provide comment on whether any past or present land use, either on site or off site, may have a potential to cause environmental impairment to the site. EBA understands that Stantec requires the Phase I ESA for potential development purposes. The Phase I ESA was conducted in general accordance with the Canadian Standards Association (CSA) Phase I ESA Standard Z768-01 (2006).

A geotechnical investigation was conducted by EBA (EBA File No. L12101928) which will be issued under separate cover.

1.2 Authorization

Mr. Trent Purvis, P.Eng., on behalf of Stantec, provided written authorization to proceed with the present Phase I ESA on January 28, 2011.

1.3 Scope of Work

EBA conducted the following scope of work for the Phase I ESA:

- Conducted a records review for the site and surrounding properties:
  - Reviewed current and historical information searches of provincial regulatory information including:
    - Alberta Registries’ current and historical land titles.
    - The Petroleum Tank Management Association of Alberta (PTMAA).
    - The Energy Resources Conservation Board (ERCB) information provided by the Abacus Datagraphics (AbaData) database.
    - Alberta Environment’s (AENV’s) database: ESA Repository (ESAR), Online Water Well Database, Approval Viewer, and Spatial Information System (SPIN II).
  - Reviewed available regional and municipal information including:
    - Aerial photographs.
    - The City of Lethbridge.

  - The County of Lethbridge.
  - Geologic and hydrogeologic information including published topographic, geologic, soils, and groundwater maps.
- Conducted a site reconnaissance to evaluate the extent and manner that past, present, and surrounding activities may have upon the site and the environment. Intrusive sampling was not conducted as part of the Phase I ESA.
- Prepared this report discussing the site history and identified the potential for environmental concerns caused by past or present land use on site and in the surrounding area.

1.4 Qualifications of Assessors

Ms. Michele Crawford, B.Sc., CIE, assisted with the historical records review and prepared this report. Ms. Crawford is an environmental scientist for EBA's Edmonton environment practice and has over 4 years of experience in the environmental industry.

Ms. Mireille Rigaux, B.Sc., acted as the Project Manager, conducted the site visit and the peer review of the report. Ms. Rigaux is an environmental scientist for EBA's Lethbridge environment practice and has over five years of experience in the environmental industry.

Ms. Mandi Parker, P.Ag., assisted with the interpretation of the findings and conducted the senior review of the report. Ms. Parker is a Project Director for EBA's Lethbridge environment practice and has over 11 years of experience in the environment industry.

1.5 General Site Details

The square site is located north of the Uplands residential subdivision on the north side of Lethbridge, Alberta. The site is currently cultivated, agricultural land with one ephemeral wetland on the north property boundary and one on the west side of the site. No buildings were located on the site. One associated natural gas pipeline belonging to ATCO is located within NW 17-9-21 W4M along the west property line. Another ATCO owned pipeline is present further west of the site and runs parallel to the pipeline on the site. A pad mounted transformer is located on the northwest side of the site.

The site is bound to the north by agricultural cropland. The site is bound by 13 Street North to the west followed by Hardieville on the northern half and the Legacy Ridge residential subdivision on the southern half. A former service station was historically located at 1236/1240 – 41 Avenue North, adjacent to the site to the west, within Hardieville. The Oldman River is located approximately 2.5 km further west. The site is bound to the south by the Uplands residential subdivision. The site is bound to the east by agricultural cropland and the Blackwolf residential subdivision approximately 200 m further east.

Figure 1 shows the site location plan and Figure 2 shows the site plan showing surrounding land use. Photographs (Photos) of the site are provided in Appendix B.

2.0 RECORDS REVIEW

The results of regulatory searches are provided in Appendix C.

2.1 Municipal Addresses, Legal Land Descriptions, Land Use, and Ownership

The site is located within the City of Lethbridge. The legal land descriptions, land use, and ownership are summarized in Table A.

Table A: Municipal Addresses, Legal Land Descriptions, Land Use, and Ownership

Municipal Address	Legal Land Description	Zoning	Owner(s)
3625 – 13 St N, Lethbridge AB	12-17-9-21 W4M	Future Urban Development (FUD)	The City of Lethbridge
4205 – 13 St N, Lethbridge AB	LSD 13 NW 17-9-21 W4M	FUD	
2200 – 44 Ave N, Lethbridge AB	LSD 11 and 14-17-9-21 W4M	Valley (V)	

2.2 Historical Records Review

A historical records review was undertaken for this site and surrounding properties. Sections 2.2.1 through Section 2.7 discuss the findings of this review.

2.2.1 Historical Land Title Records

The results of the land title searches for the site are summarized in the following tables (Tables B through Table D).

Table B: Land Titles Summary 12-17-9-21 W4M

Year(s) of Ownership	Owner(s)	EBA Evaluation
1982 - Present	The City of Lethbridge	Utility Right-of-Way – Canadian Natural Gas Company Ltd. (1960)
1982 - 1982	Olshaski Farms Ltd.	
1979 - 1982	Baldio Land Developments Ltd.	
1978 - 1979	Olshaski Farms Ltd.	
1945 - 1978	Steven Robert Olshaski of the City of Lethbridge in the Province of Alberta (Farmer)	
1945 - 1945	May V. Krapfel	
1910 - 1945	Albert Frank Krapfel	

Notes: Land titles were obtained from Alberta Registries land title office in Calgary, Alberta.

Table C: Land Titles Summary LSD 13 NW 17-9-21 W4M

Year(s) of Ownership	Owner(s)	EBA Evaluation
1982- Present	The City of Lethbridge	Utility Right-of-Way – Canadian Natural Gas Company Ltd. (1960) present since the 1960s. No obvious environmental concern.
1982 - 1982	Olshaski Farms Ltd.	
1979- 1982	Baldio Land Developments Ltd.	
1978-1979	Olshaski Farms Ltd.	
1945 - 1978	Steven Robert Olshaski of the City of Lethbridge in the Province of Alberta (Farmer)	
1921 - 1945	His Majesty King George V in the right of the Province of Alberta	
1915 - 1921	Roman Catholic Bishop of the Diocese of Calgary	

Notes: Land titles were obtained from Alberta Registries land title office in Calgary, Alberta.

Table D: Land Titles Summary LSD 11 and 1417-9-21 W4M

Year(s) of Ownership	Owner(s)	EBA Evaluation
1982 - present	The City of Lethbridge	No obvious environmental concern.
1982 - 1982	Olshaski Farms Ltd.	
1979 - 1982	Baldio Land Developments Ltd.	
1978 - 1979	Olshaski Farms Ltd.	
1947 - 1978	Steven Robert Olshaski of the City of Lethbridge in the Province of Alberta (Farmer)	
1944 - 1947	Mary Elizabeth Atkinson of the City of Lethridge	
1907 - 1944	Canadian Pacific Railway Company	Based on the name, there may have been rail lines associated with the site or the mine site to the west of Hardieville. There may be potential for environmental impacts to the site from former rail lines operating in the area.

Notes: Land titles were obtained from Alberta Registries land title office in Calgary, Alberta

2.2.2 Aerial Photographs

Aerial photographs provide visual evidence of site occupancy, operational activities, and general site details. Aerial photographs capture a view of the site and the surrounding areas at a given time. Table E provides a detailed historical review of the aerial photographs.

Table E: Historical Aerial Photograph Summary

Year	Scale	Observations
1950	1:40,000	On-site: Cultivated agricultural cropland. Dirt trails are visible extending from the southwest to the northeast side of the site. The outline of an ephemeral wetland is visible on the northern boundary of the site although it appears to be cultivated.
		Off-site: Cultivated agricultural cropland surrounding the site. Thirteenth Street North is present adjacent to the site to the west. Hardieville is visible to the west of the site and the land west of Hardieville appears to be disturbed (likely mining operations). A rectangular building is present to the southwest of the site (old Hardieville school). A small rectangular building is present to the west of the site on the south side.
1961	1:31,680	On-site: Similar to the 1950 aerial photograph.
		Off-site: Hardieville has been expanded to the west of the site. A yard with trees and shrubs now surrounds the small rectangular building to the west of the site on the south side. Two round structures are visible on the east side of the Hardieville school property.
1970	1:31,680	On-site: The ephemeral wetland on the north side of the site appears darker and cultivation extends around it rather than through it.
		Off-site: Additional development has been constructed within Hardieville including a large irregular-shaped building on the south side of town (currently the Trinity Reformed Church).
1979	1:25,000	On-site: The ephemeral wetland appears to contain water. The remaining of the surrounding land is similar to the 1970 aerial photograph.
		Off-site: Debris is visible on the Hardieville school property to the south of the site. Low lying wetlands in the surrounding area appear to contain water.
1988	1:30,000	On-site: A linear area on the west side of the site, extending from the Hardieville school to the northern boundary, appears to be stripped (likely the ATCO gas pipeline). The ephemeral wetland is smaller and does not appear to contain water.
		Off-site: Much of the debris has been removed from the Hardieville school property to the south of the site. Construction of the Uplands residential subdivision is underway to the south of the site, approximately 500 m to 800 m from the site boundary. An irrigation pivot has been added to the land north of the site.
1999	1:20,000	On-site: An oblong feature, possibly a soil pile or haystack is visible on the southeast side of the site. A linear area on the southwest side of the site appears to have been stripped (possibly an additional natural gas pipeline). A low area (ephemeral wetland) is visible on the west side of the site which does not appear to contain water.
		Off-site: Development in the Uplands residential subdivision has extended further north and is now visible along the southern boundary of the site.
2005	Unknown	On-site: A small rectangular object is visible on the northwest side of the site (possibly the changing station). A powerline has been constructed along the north boundary of the site.
		Off-site: The Uplands subdivision has been fully constructed along the southern boundary of the site.
2011	Unknown	On-site: The oblong feature is no longer present on the southeast side of the site and the low area on the west side of the site has been cultivated over.
		Off-site: The Hardieville school is no longer present to the south of the site. The acreage to the west of the site has been removed and the Legacy Ridge residential subdivision has been developed west of the site. Several fill piles are visible on the land to the east of the site, likely associated with the development of the Blackwolf residential subdivision approximately 200 m further east.

Notes:

To be read in conjunction with the accompanying report.

The aerial photographs are enlarged (where possible) for the review.

Aerial photographs were obtained from Alberta Sustainable Resource Development (ASRD).

*2005 and 2011 imagery taken from the City of Lethbridge Interactive Webmap aerial photograph.

The site has remained agricultural throughout the timeline of the aerial photograph review. The surrounding land to the north has also remained agricultural throughout the timeline of the aerial photograph review. Land to the south remained agricultural until development of the Uplands residential subdivision occurred between 1979 and 2005. The land to the west shows the development of the Hamlet of Hardieville prior to 1950 and development of the Legacy Ridge subdivision between 2005 and 2011. The land further east remained agricultural until the development of the Blackwolf subdivision between 2005 and 2011.

2.2.3 Museum Archives

EBA searched the City of Lethbridge Galt Museum archives and maps for indications of historical land use at the site. The museum had maps for the mine which underlays the majority of the site; the coal slag piles, mine shafts, and buildings were located west of Hardieville, at least 800 m from the site. There are no shafts observed on the site itself.

2.2.4 Business Directories

EBA reviewed Henderson Business Directories (HBDs) approximately every five years from 1914 to 2000. The business directories were no longer published after 2000. There were no listings for the site itself; however, listings exist for the land to the west (Hardieville) and for the Hardieville School south of the site. Table F summarizes the findings of this review.

Table F: Business Directory Summary

Location	Historical Occupant(s)	Dates Listed	Direction and Distance from Site	EBA Evaluation
3225 – 13 Street North	Hardieville School	1917 - 1985	Adjacent to the site to the southwest.	No obvious environmental concern.
421 – 13 Street North (currently 1236 and 1240 – 41 Avenue North in Hardieville)	Husky Service Station	1956	Across 13 Street North to the west, approximately 30 m from the site.	Potential for storage and handling of petroleum hydrocarbons (PHC).

2.2.5 Fire Insurance Plans

EBA reviewed the Canadian Underwriters Association Fire Insurance Map for Lethbridge from 1955 (partially revised 1964); however, the map did not provide coverage for the site or the immediate surrounding area.

2.2.6 Other Archival Records

Anecdotal information suggested that a former service station was present at 1236/1240 – 41 Avenue North in Hardieville from the early 1950s to the early 1970s. Personnel involved with the property indicated that there were two underground storage tanks (USTs) present on the north side of the property approximately 30 m from the site. Personnel indicated that the tanks were removed in approximately 1973. No other details pertaining to the service station were available. Personnel interviews (Section 4.0) summarize the information pertaining to the service station.

2.3 Provincial Regulatory Information

This section describes the results of provincial regulatory searches. Copies of the search results and correspondence are provided in Appendix C.

2.3.1 Petroleum Tank Management Association of Alberta [PTMAA]

EBA contacted the PTMAA regarding the potential for registered petroleum storage tanks (PSTs) at the site and surrounding properties, including the address of the former service station. The PTMAA indicated that no PSTs were registered at the site (3625 & 4205 – 13 Street North and 2200 – 44 Avenue North) or in the immediate surrounding area, including the location of the former service station located at 1236/1240 – 41 Avenue North.

The PTMAA requires that all USTs be registered; however, only above-ground storage tanks (ASTs) with a capacity greater than 2,500 litres are required to be registered. The database is based on a limited survey conducted in 1992 and voluntary information submitted thereafter; therefore, it is not considered to be a comprehensive inventory of all tanks in Alberta.

2.3.2 Energy Resources Conservation Board [ERCB]

EBA acquires ERCB database information through AbaData. The AbaData database was searched to determine if oil/gas wells and/or pipelines exist or have existed at the site. AbaData indicated that one pipeline is present on the west side of the site and one is west of the site, across 13 Street North. One spill incident was also reported on the site. Additional information acquired from the ERCB on the pipelines and spill can be viewed in Appendix C. Table G outlines the details of the spill.

Table G: Spill Incident

Name	Spill
Incident Number	19972884
ERCB Notified	August 11, 1997
Company	ATCO Gas and Pipelines Ltd. (South)
Licence Number	2150-10 (Pipeline License)
Source	Natural Gas Pipeline
Pipeline Damage	Leak
Failure Type	Gird Weld Failure
Spill Offsite?	No
Public/Wildlife/Area Affected	Conversion from Env System
Substance Spilled	1 (1,000 m^3) Gas Production (Raw) (0(1,000 m^3) Recovered)
Clean up Date	August 11, 1997

Table H outlines the details of the associated pipelines.

Table H: Pipeline Information

Number	2150-8	2150-12
Location	Extending north through the site on the west side.	Extending north through the adjacent site to the west (18-9-21 W4M).
Permit Date	January 9, 2003	October 30, 2007
Company	ATCO Gas and Pipelines Ltd. (South)	
From	14-29-009-21 W4M	16-19-009-21 W4M
To	12-17-009-21 W4M	01-18-009-21 W4M
Length	3.88 km	3.12 km
Substance	Natural gas	Natural gas
H2S	0 mol/kmol	0 mol/kmol

The natural gas pipelines information provided by AbaData is current to January 31, 2012.

The ERCB Coal Mine Atlas was reviewed and it was determined that a coal mine is located underground of the majority of the subject site. The information from the ERCB Coal Mine Atlas indicated that the Galt Mine No. 6 (Mine number 0003/1) was previously located in 19-009-21 W4M. The mine belonged to the Canadian Pacific Railway and was operational from 1909 to 1935. Approximately 4,589.1 kilotonnes of coal was removed from the mine and the mine was abandoned in 1935.

This mine is not considered to be a concern to the site as the mine working area, including the tipple, office buildings, rail line, mine shaft, coal slag piles, and the active mining area were located approximately 800 m west of the site. The mine was underground and coal was removed from approximately 100 m below grade.

2.3.3 Alberta Environment and Water [AEW]

The AEW Online Environmental Site Repository (ESAR) is a searchable database that provides scientific and technical information about assessed sites throughout Alberta. The ESAR was searched for ESAs on the site. The ESAR search indicated that no records were available for NW 17-9-21 W4M.

The AEW Online Approval Viewer allows the public to view approvals, licenses, registrations, and permits issued under the Water Act and Environmental Protection and Enhancement Act (EPEA). No approvals, licenses, registrations, or permits were available for the site (NW 17-9-21 W4M).

The AEW Water Well Database has record of one water well within the site boundary; however, the exact location of the well cannot accurately be determined.

Table I summarizes the water well information.

Table I: Water Well Information

Section Location	Water Well ID	Owner	Year Drilled	Location on Site	Depth (m)
NW 17-9-21 W4M	106315	#6 Galt Mine	1908	Centre of the site	114.9

If the water well is encountered during site construction activities, it will need to be appropriately decommissioned in accordance with current regulations.

The Alberta Government SPIN Website provides information pertaining to legal land locations, ownership, and transportation and utility right-of-way (ROW). SPIN shows the same pipeline ROWs on the west side of the site as identified through AbaData.

2.4 Regional and Municipal Regulatory Information

This section describes the result of municipal regulatory searches. Copies of the search results and correspondence are provided in Appendix C.

2.4.1 City of Lethbridge Development Services

EBA requested a site inquiry with the City of Lethbridge for available information regarding environmental information at or near the site. They mentioned that Hardieville and east was annexed by the City in 1978 and the land to the north of the site was annexed in 1984. The land has been agricultural for the entire period that the City has had control over it.

2.4.2 County of Lethbridge

EBA requested a site inquiry with the County of Lethbridge. Personnel from the County indicated that the land was annexed by the City in 1978 (along with Hardieville).

2.5 Landforms and Geology

2.5.1 Topography

Surface topography can influence the direction of migration of contaminants at the soil surface. The local topography is the topography at the site, whereas regional topography is the overall expression of the soil surface in a given region. The surface topography of the site is gently undulating and slopes slightly (< 2 degrees) to the southwest. Regional topography in the area is generally undulating, and slopes west towards the Oldman River

2.5.2 Geology

The surficial geology in the area is characterized by moraine clay till deposits with sporadic lenses of gravel, sand, and silt.

The stratigraphy of the Lethbridge area is generally comprised of 65 m to 70 m of surficial deposits overlying bedrock. Bedrock in the Lethbridge area consists of strata from the upper Oldman Formation and the lower Bearspaw Formation, both of the late Cretaceous age. The bedrock has a relatively flat surface dipping slightly to the northwest and is locally encountered at about geodetic elevation 843 m. The bedrock strata consist of thin beds of predominantly weak mudstones, siltstones, and sandstones with occasional bentonite and coal seams.

2.5.3 Hydrology and Hydrogeology

Groundwater is of significance as a potential means of contaminant transport. Regional groundwater flow is the overall direction of groundwater flow in a given region. There may be local groundwater flow within a region that is in a different direction from the regional flow and that is controlled by topography and/or subsurface soil conditions.

The nearest surface waterbody is a stormwater retention pond (Chinook Lake) located approximately 500 m to the southeast in the Uplands residential subdivision. Drainage of surface water is expected to be west towards the Legacy Ridge subdivision. It is anticipated that shallow and regional groundwater flow would be west towards the Oldman River which is located approximately 2.0 km to the west of the site. Perched groundwater tables have been encountered in many areas of Lethbridge. The depth to these perched tables can vary from approximately 2 m below ground level to considerable depths within gravel, sand, and/or silt seams. The flow of these perched tables can also vary in any direction or be still, dependent on the horizontal and vertical dip and the extent of the sand and/or silt seams.

It should be noted that topography, geologic materials, land development, and soil disturbances influence localized variances in groundwater movement and pattern. In addition, groundwater levels will fluctuate seasonally and in response to climatic conditions.

2.6 Previous Reports

No previous reports were available for review at the site.

2.7 Other Information Sources

There were no other information sources available for review for this assessment.

3.0 SITE RECONNAISSANCE

Ms. Mireille Rigaux, of EBA, visited the site on February 7, 2012. The reconnaissance included a visual inspection of the site and observations of adjacent properties to identify evidence of impairment, or potential sources of impairment, which may adversely affect the site. The site was dry, fully accessible, and was vegetated with stubble at the time of the site reconnaissance.

3.1 Building Details

There were no buildings on site at the time of the site reconnaissance.

3.2 Site Servicing

No known municipal water was supplied to the site at the time of the site reconnaissance. In addition, no water wells were observed on the site at the time of the site reconnaissance. See Section 2.3.3 for water well details. A storm sewer was observed on the northwest side of the site. A distribution powerline was present on the west side of the site extending north and south, and on the north side extending east and west.

3.3 Special Attention Items

There were no buildings located on the site at the time of the site reconnaissance; however, other special attention items may be present at the site. Table J summarizes these special attention items. Further background information on these materials is provided in Appendix D.

Table J: Special Attention Items

Item	Presence/ Potential	Comments
Asbestos	Low	No buildings were present at the site during the site reconnaissance.
Lead		
Mould		
Ozone-depleting Substances (ODS)		
Urea Formaldehyde Foam Insulation (UFFI)		
Polychlorinated Biphenyls (PCBs)	Moderate	A pad mounted transformer was present on the north side of the site and an additional pad mounted transformer was observed adjacent to the site to the south in the Uplands subdivision. It is unknown whether the transformers contained PCBs.
Radon	Low	There was no radon gas testing reported for the site; however, natural radon concentrations are low in Alberta and radon gas concentrations are usually well below target limits set for Canada. There were no anthropogenic sources of radon gas identified.
Methane	High	There was no methane gas testing reported for the site. Based upon information collected during this investigation (i.e., aerial photograph review, site reconnaissance), there is evidence of deposits of buried organics at the site that could produce methane. Suspected areas of methane generation include the ephemeral wetland located on the site (north side of the site and west side of the site). Refer to Section 3.4.6 regarding potential fill areas.
Electromagnetic (EM)	Low	A distribution power line was observed parallel to the north boundary of the site which could be a source of EM fields. No EM assessment was completed for the site.
Noise and Vibration	Low	There were no major sources of noise and vibration at the site during the site reconnaissance.

The above is based on observations made during the site reconnaissance.

3.4 Site Observations

This section describes observations made of the site during the site reconnaissance.

3.4.1 Surficial Stains

There were no surficial stains observed during the site reconnaissance.

3.4.2 Lead-based Paints

There was no suspected lead-based paint observed on the site.

3.4.3 Vegetation

The majority of the vegetation on the site consisted of cereal stubble. No areas of stressed vegetation were observed on site during the site reconnaissance; however, vegetation was in a dormant state at the time of the site visit.

3.4.4 Ponding of Water

An ephemeral wetland was observed on the north side of the site at the time of the site reconnaissance which did not contain water. An additional ephemeral wetland was noted in the 1999 aerial photograph, but was not observed during the site reconnaissance. Future development in these areas would require an approval under the Alberta Water Act. Under the Alberta Water Act, a "waterbody" refers to "any location where water flows or is present, whether or not the flow or the presence of water is continuous, intermittent or occurs only during a flood, and includes but is not limited to wetlands…" (Water Act, revised Statutes of Alberta 2000, Chapter W-3, Section 1). A wetland identified on the property would be considered a "waterbody" under the Alberta Water Act and should therefore be included in the wetland compensation plan.

AENV's Provincial Restoration and Compensation Guide (February 2007) defines a wetland as "land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation, and various kinds of biological activity which are adapted to a wet environment".

3.4.5 Washouts and Erosion

There was no evidence of washouts or erosion observed during the site reconnaissance.

3.4.6 Fill Areas and Soil Conditions

No fill was observed at the site during the site reconnaissance; however, the ephemeral wetlands on the site had been cultivated over and there may be evidence of buried organics from the wetlands.

Soil stockpiles were observed during the site visit to the east of the site adjacent to the Blackwolf residential subdivision, approximately 200 m east of the site.

It should be noted that determining depths and exact locations of potential fill material are not within the scope of a Phase I ESA; however, a geotechnical evaluation was completed concurrently by EBA in January 2012 (EBA File No. L12101928) and is issued under separate cover.

3.4.7 Oil/Gas Wells and Pipelines

A high pressure ATCO gas pipeline was observed extending north to south on the western boundary of the site. There were no oil/gas wells observed at the site during the site reconnaissance. See Section 2.3.2 (AbaData) for well and pipeline details.

3.4.8 Waste Storage

There was no waste storage observed at the site during the site reconnaissance.

3.4.9 Sumps and Drains

There were no sumps observed at the site during the site reconnaissance.

3.4.10 Chemical Storage

There was no chemical storage observed at the site during the site reconnaissance.

3.4.11 Hazardous Materials

There were no hazardous materials observed at the site during the site reconnaissance.

3.4.12 Storage Containers

There were no storage containers observed at the site during the site reconnaissance.

3.4.13 Transformers

A pad mounted transformer was observed on the northwest corner of the site. The model number of the transformer was PMH-9 and the date was October 1986. There may be potential for the transformer to contain PCBs. A pad mounted transformer was also observed to the south of the site within the Uplands residential subdivision. No leaks or spills were observed in the area of the transformers.

3.4.14 Hydraulic Elevators and Hoists

There were no hydraulic elevators or hoists observed during the site visit.

3.4.15 Vent Pipes and Underground Storage Tanks [USTs]

No vent pipes or USTs were observed at the site during the site visit. Please refer to Section 2.3.1 and Section 2.6 for information about USTs on site or in the surrounding area.

3.4.16 Above-ground Storage Tanks [ASTs] and Drum Storage

No ASTs or drums were observed on the site during the site reconnaissance. Please refer to Section 2.3.1 and Section 2.6 for information about ASTs on site or in the surrounding area.

3.4.17 General Housekeeping

The general housekeeping of the site was good and no obvious signs of negligent acts or illegal dumping were observed during the site visit.

3.5 Off-site Observations

Table K summarizes the surrounding land use.

Table K: Surrounding Land Use

Direction	Land Use	EBA Evaluation
North	Agricultural cropland.	No obvious potential for environmental concerns.
East	Agricultural cropland followed by the Blackwolf residential subdivision 200 m further east.	
South	Uplands residential subdivision.	
West	Legacy Ridge residential subdivision and Hardieville.	There may be potential for soil and groundwater impacts to the site from historical property activities from the former service station located at 1236/1240 – 41 Avenue North (across 13 Street North within Hardieville).

4.0 PERSONNEL INTERVIEWS

EBA interviewed the following personnel during the Phase I ESA. The findings of the personnel interviews, which have been incorporated into this report, are in general agreement with the records review conducted for the site. Table L summarizes the interviews.

Table L: Interview Summary

Item	Description
Interviewee	Employee with the City of Lethbridge Planning Department.
Information Provided	Provided information about the current and historical land use at the site. The City Planning Department confirmed that Hardieville and the land east of the site was annexed by the City in 1978 and that the land to the north of the site was annexed in 1984. The site land has been agricultural for the entire time the City has had control over it.
Interviewee	Owner of the former service station located at 1236/1240 – 41 Avenue North to the west of the site (Hardieville) who wishes to remain anonymous.
Information Provided	Provided information about the current and historical land use at the property including tank locations and approximate years of operation.

5.0 DISCUSSION AND CONCLUSIONS

5.1 General

The site is currently cultivated, agricultural land with an ephemeral wetland on the north boundary and one on the west side of the site. No buildings are located on the site. One associated natural gas pipeline belonging to ATCO is located within NW 17-9-21 W4M along the west property line. Another ATCO owned pipeline is present further west of the site and extends parallel to the pipeline on the site. A pad mounted transformer is located on the northwest side of the site.

The site is bound to the north by agricultural cropland. The site is bound by 13 Street North to the west followed by Hardieville on the northern half and the Legacy Ridge residential subdivision on the southern half. A former service station was historically located at 1236/1240 – 41 Avenue North, adjacent to the site to the west within Hardieville. The Oldman River is located approximately 2.5 km further west. The site is bound to the south by the Uplands residential subdivision. The site is bound to the east by agricultural cropland and the Blackwolf residential subdivision approximately 200 m further east.

In general terms, there are two distinct types of potential environmental risk to any property. The first type of risk is from potential contamination from on-site land use. This would include potential accidental spills or site practices that may contaminate the property directly. The second type of risk is from contamination caused by adjacent property owners, which might then be transported through the subsurface soils by groundwater, or in overland runoff onto the site.

5.2 Potential for Impairment from On-site Source(s)

There was one source of potential environmental impairment from current or historical on-site land uses identified during this study. Table M identifies this source.

Table M: Potential On-site Source of Environmental Impairment

Source of Potential Impairment	Source of Information	EBA Evaluation
Ephemeral wetlands on the site.	Site reconnaissance, aerial photograph review.	Ephemeral wetlands were located on the north side and west sides of the site which may have the potential for methane generation.

5.3 Potential for Impairment from Off-site Source(s)

There was one source of potential environmental impairment from current or historical off-site land uses identified during this study. Table N outlines this source.

Table N: Potential Off-site Source of Environmental Impairment

Source of Potential Impairment	Source of Information	EBA Evaluation
Former gas station located at 1236/1240 – 41 Avenue North	Henderson Business Directories, personnel interviews.	Information from the site interview suggests that the former gas station was present at this location from the early 1950s to the early 1970s. The former tanks were located on the north side of this property which is approximately 30 m from the site. There is potential for soil and groundwater impact to the site from historical off-site activities.

6.0 FURTHER ACTION/RENDERING AN OPINION

Based on the present study, further intrusive environmental investigation would be required to assess the soil and groundwater quality on the west side of the site in the general vicinity of the former gas station.

EBA also suggests taking the following into consideration:

- An ephemeral wetland was observed on the north side of the site during the site reconnaissance and an additional ephemeral wetland was noted on the west side of the site in the aerial photograph review. Future development in these areas would require an approval under the Alberta Water Act. There is potential for methane generation from the buried organic material which is commonly found in wetland areas. Buried organic soils should be removed in the areas of future building development.

- The site is underlain by a coal mine that was mined to approximately 100 m below the surface of the site. Based on the review of the ERCB coal mine atlas and the aerial photograph review, there is no evidence of mining activities on the surface of the site. Should evidence of coal slag be encountered on the site during site redevelopment, an environmental professional should be consulted and further investigation may be warranted.
- A natural gas pipeline is located on the west side of the site and one further west of the site. There may be potential for impacts to the soil from pipeline construction activities. If evidence of petroleum hydrocarbon staining or odours are encountered during site redevelopment, an environmental professional should be consulted and further investigation may be warranted.
- According to the AEW water well database, a water well is located within the site boundary; however, the exact location of the well cannot be accurately determined. If the well is encountered during construction activities, it will need to be decommissioned in accordance with current regulations.

7.0 CLOSURE

We trust this report meets your present requirements. Should you have any questions or comments, please contact the undersigned.

Sincerely,
EBA Engineering Consultants Ltd.

ALBERTA INSTITUTE OF AGROLOGISTS
MANDI PARKER, P.Ag.
2005
MEMBER

March 6/12

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references

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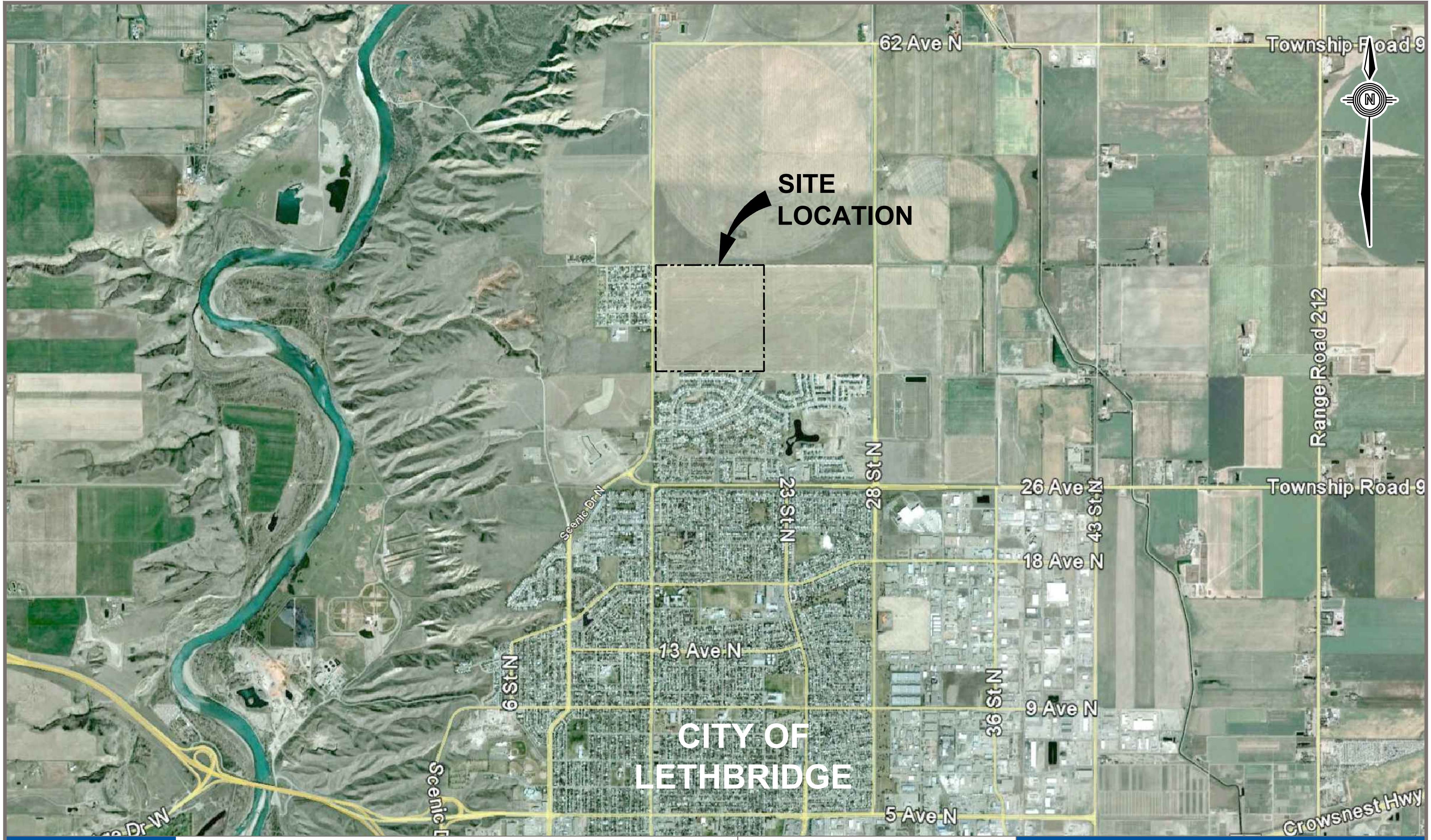
FIGURES

C:\Users\leanne.hughes\Documents\L12101928\L12101928-001_FIG1,2_R0.dwg [FIGURE 1] February 29, 2012 - 1:31:54 pm (BY: HUGHES, LEANNE)



LEGEND

0 0.4 1 2 km

SCALE 1:40 000

NOTES

BASED ON IMAGE PROVIDED BY GOOGLE EARTH PRO.

CLIENT

Stantec Consulting Ltd.

eba

A TETRA TECH COMPANY

PHASE I ENVIRONMENTAL SITE ASSESSMENT NORTH UPLANDS SUBDIVISION

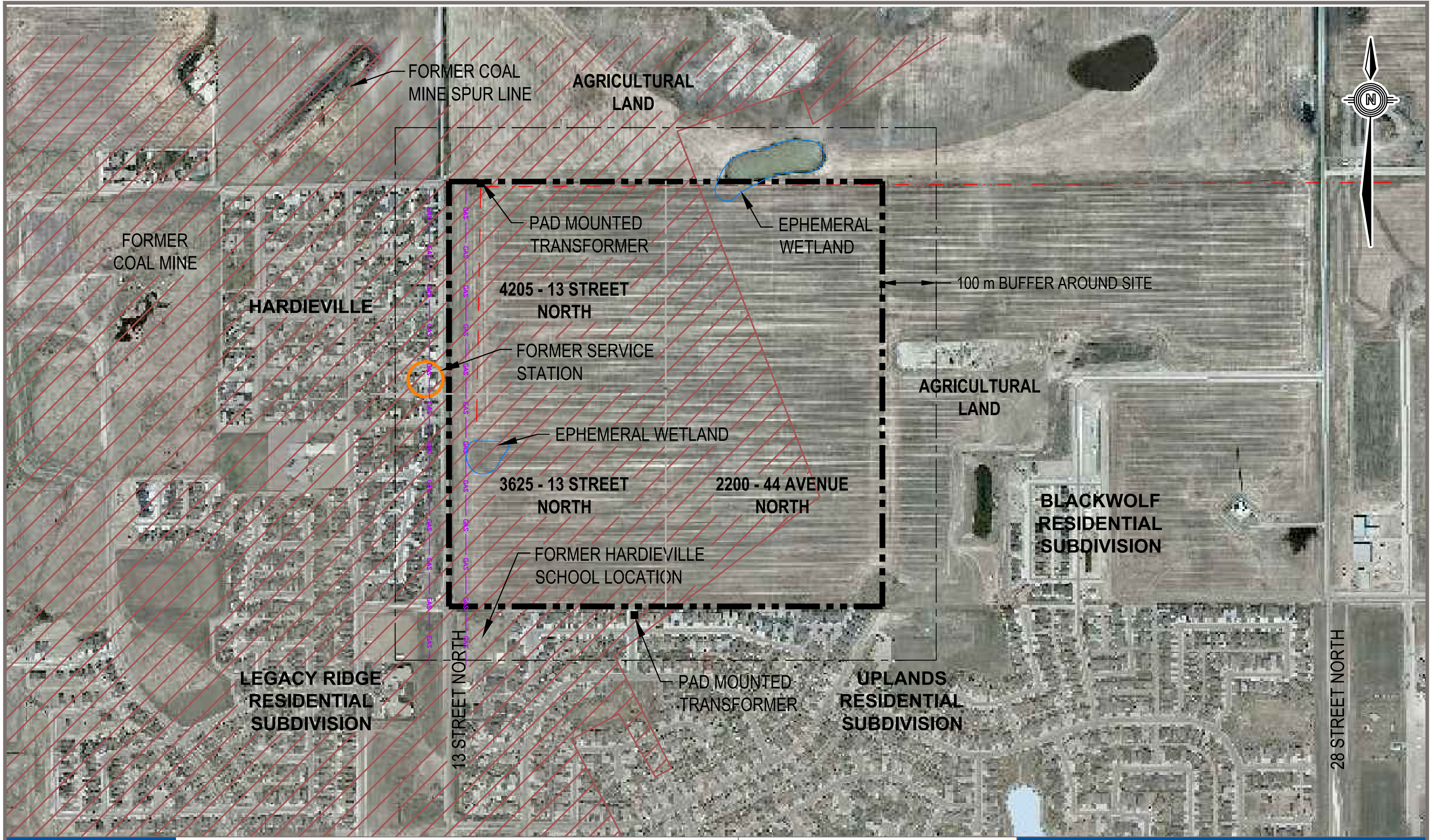
SITE LOCATION PLAN

PROJECT NO.	DWN	CKD	REV
L12101928.001	LCH	JZ	0

OFFICE	DATE
EBA-Lethbridge	February 2012

Figure 1

C:\Users\leanne.hughes\Documents\L12101928\L12101928-001_FIG1,2_R0.dwg [FIGURE 2] February 29, 2012 - 1:30:59 pm (BY: HUGHES, LEANNE)



LEGEND

- SITE BOUNDARY
- POWER LINE
- ATCO HIGH PRESSURE GAS LINES
- BOREHOLE
- AREA OF POTENTIAL ENVIRONMENTAL CONCERN
- MINING AREA

0 200 500m

SCALE 1:12 500

NOTES

BASED ON IMAGE PROVIDED BY THE CITY OF LETHBRIDGE WEBMAP.

CLIENT

Stantec Consulting Ltd.

eba

A TETRA TECH COMPANY

PHASE I ENVIRONMENTAL SITE ASSESSMENT NORTH UPLANDS SUBDIVISION

DETAILED SITE PLAN

PROJECT NO.	DWN	CKD	REV
L12101928.001	LCH	MR	0

OFFICE	DATE
EBA-Lethbridge	February 2012

Figure 2

APPENDIX A

ENVIRONMENTAL PHASE I REPORT – GENERAL CONDITIONS

GENERAL CONDITIONS

ENVIRONMENTAL PHASE I REPORT

This report incorporates and is subject to these "General Conditions".

1.0 USE OF REPORT AND OWNERSHIP

This report pertains to a specific site, a specific development, and a specific scope of work. It is not applicable to any other sites.

This report and the assessments and recommendations contained in it are intended for the sole use of EBA's Client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. EBA's instruments of professional service will be used only and exactly as submitted by EBA.

Electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the Client agrees that notification to such bodies or persons as required may be done by EBA in its reasonably exercised discretion.

4.0 INFORMATION PROVIDED TO EBA BY OTHERS

During the performance of the work and the preparation of the report, EBA may rely on information provided by persons other than the Client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

APPENDIX B

SITE PHOTOGRAPHS

Photo 1: Looking south at western boundary from northwest corner of site. Note Hardieville to the west and the powerline extending south across the west side. The ATCO high pressure gas line runs parallel to this powerline.

Photo 2: Looking east at the northern boundary of the site. Note the agricultural land use to the north and the powerline extending across the northern side. The pad mounted transformer is also located under the powerline.

Photo 3: Looking south across the site from the northern boundary. Note the Uplands residential subdivision in the background.

Photo 4: Looking northwest across the site from the southeast corner. Note Hardieville on the left and Legacy Ridge residential subdivision centre and right.

Photo 5: Land use to the west on the south side: 13 Street North followed by Legacy Ridge residential subdivision.

Photo 6: Land use to the south: Uplands residential subdivision.

Photo 7: Land use to the east: Agricultural crop land followed by Blackwolf residential subdivision.

Photo 8: Land use to the north: Agricultural cropland.

Photo 9: Location of former service station in Hardieville (1236/1240 – 13 Street North) adjacent to the site to the west.

Photo 10: Transformer located on the northwest side of the site.

APPENDIX C

PHASE I ENVIRONMENTAL SITE ASSESSMENT INFORMATION

GOVERNMENT OF THE PROVINCE OF ALBERTA

HISTORICAL LAND TITLE CERTIFICATE

CURRENT TITLE WITH HISTORICAL DATA

S

LINC	SHORT LEGAL	TITLE NUMBER
0034 421 685	4;21;9;17;;11,14	101 239 380 +112

LEGAL DESCRIPTION

MERIDIAN 4 RANGE 21 TOWNSHIP 9
SECTION 17
LEGAL SUBDIVISIONS 11 AND 14
CONTAINING 32.4 HECTARES(80 ACRES) MORE OR LESS
EXCEPTING THEREOUT:

PLAN	NUMBER	HECTARES	ACRES	MORE OR LESS
SUBDIVISION	1013066	0.084	0.21	

EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: CITY OF LETHBRIDGE

REFERENCE NUMBER: 821 153 047

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
101 239 380	12/08/2010	SUBDIVISION PLAN		

OWNERS

THE CITY OF LETHBRIDGE.
OF 910 - 4TH AVE. SOUTH, LETHBRIDGE
ALBERTA

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
871 177 437	28/09/1987	UTILITY RIGHT OF WAY GRANTEE - THE CITY OF LETHBRIDGE.

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
951 080 304	06/04/1995	CORRECTION OF INSTRUMENT AFFECTS INSTRUMENT: 871177437 "PARTY NAME CHANGED FROM: THE CTTY OF LETHBRIDGE TO: THE CITY OF LETHBRIDGE"
101 239 380	12/08/2010	SUBDIVISION PLAN 1013066 TITLE CANCELLED AS TO PART AND NEW TITLE ISSUED FOR THE REMAINDER

TOTAL INSTRUMENTS: 003

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 3 DAY OF FEBRUARY, 2012 AT 08:43 A.M.

ORDER NUMBER:20551563

CUSTOMER FILE NUMBER: 6887363

END OF CERTIFICATE

GOVERNMENT OF THE PROVINCE OF ALBERTA

HISTORICAL LAND TITLE CERTIFICATE

CURRENT TITLE WITH HISTORICAL DATA

S LINC 0022 173 348	SHORT LEGAL 4;21;9;17;;13	TITLE NUMBER 821 153 047 A .

LEGAL DESCRIPTION
MERIDIAN 4 RANGE 21 TOWNSHIP 9
SECTION 17
LEGAL SUBDIVISION 13
EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME
AREA: 16.2 HECTARES (40 ACRES) MORE OR LESS

ESTATE: FEE SIMPLE

MUNICIPALITY: CITY OF LETHBRIDGE

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
821 153 047	03/09/1982		$306,625	

OWNERS

THE CITY OF LETHBRIDGE.
OF 910 - 4TH AVE. SOUTH, LETHBRIDGE
ALBERTA

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
2834IC .	19/09/1960	UTILITY RIGHT OF WAY GRANTEE - CANADIAN WESTERN NATURAL GAS COMPANY LIMITED. AS TO PORTION OR PLAN:2602IC "0.89 OF AN ACRE"
6585IW .	29/04/1964	MORTGAGE OF UTILITY RIGHT OF WAY MORTGAGEE - MONTREAL TRUST COMPANY.

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
		AFFECTS INSTRUMENT: 2834IC .
831 079 200	03/05/1983	UTILITY RIGHT OF WAY GRANTEE - ALBERTA HOME MORTGAGE CORPORATION. AS TO PORTION OR PLAN:8211477
871 177 437	28/09/1987	UTILITY RIGHT OF WAY GRANTEE - THE CITY OF LETHBRIDGE. AS TO PORTION OR PLAN:8711228 (DATA UPDATED BY: 951080304)
941 101 597	25/04/1994	DISCHARGE OF MORTGAGE OF UTILITY RIGHT OF WAY 6585IW.
951 080 304	06/04/1995	CORRECTION OF INSTRUMENT AFFECTS INSTRUMENT: 871177437 "PARTY NAME CHANGED FROM: THE CTTY OF LETHBRIDGE TO: THE CITY OF LETHBRIDGE"

TOTAL INSTRUMENTS: 006

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 3 DAY OF FEBRUARY, 2012 AT 08:43 A.M.

ORDER NUMBER:20551563

CUSTOMER FILE NUMBER: 6887363

END OF CERTIFICATE

GOVERNMENT OF THE PROVINCE OF ALBERTA

HISTORICAL LAND TITLE CERTIFICATE

CURRENT TITLE WITH HISTORICAL DATA

S LINC	SHORT LEGAL	TITLE NUMBER
0022 352 389	4;21;9;17;;12	821 153 047 B .

LEGAL DESCRIPTION

MERIDIAN 4 RANGE 21 TOWNSHP 9
SECTION 17
LEGAL SUBDIVISION 12 IN THE NORTH WEST QUARTER
CONTAINING 16.2 HECTARES (40 ACRES) MORE OR LESS
EXCEPTING THEREOUT:
UNPATENTED CROWN ROAD SHOWN ON GRANT 804F
CONTAINING 0.809 OF A HECTARE (2.00 ACRES) MORE OR LESS
EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: CITY OF LETHBRIDGE

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
821 153 047	03/09/1982		$291,294	

OWNERS

THE CITY OF LETHBRIDGE.
OF 910-4 AVE S
LETHBRIDGE
ALBERTA

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
2834IC .	19/09/1960	UTILITY RIGHT OF WAY GRANTEE - CANADIAN WESTERN NATURAL GAS COMPANY LIMITED.

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
		AS TO PORTION OR PLAN:2602IC "FOR GAS PIPE LINES"
6585IW .	29/04/1964	MORTGAGE OF UTILITY RIGHT OF WAY MORTGAGEE - MONTREAL TRUST COMPANY. AFFECTS INSTRUMENT: 2834IC .
831 079 200	03/05/1983	UTILITY RIGHT OF WAY GRANTEE - ALBERTA HOME MORTGAGE CORPORATION. AS TO PORTION OR PLAN:8211477
941 101 597	25/04/1994	DISCHARGE OF MORTGAGE OF UTILITY RIGHT OF WAY 6585IW.

TOTAL INSTRUMENTS: 004

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 3 DAY OF FEBRUARY, 2012 AT 08:43 A.M.

ORDER NUMBER:20551563

CUSTOMER FILE NUMBER: 6887363

END OF CERTIFICATE

PETROLEUM TANK
MANAGEMENT
ASSOCIATION
OF ALBERTA

Petroleum Tank Management
Association of Alberta
Suite 980, 10303 Jasper Avenue
Edmonton, Alberta T5J 3N6
PH: (780)425-8265 or 1-866-222-8265
FAX: (780)425-4722

January 31, 2012

Michele Crawford
EBA Engineering Consultants Ltd.
14940 123 Avenue
Edmonton, AB
T5V 1B4

Dear Michele Crawford:

As per your request, the PTMAA has checked the registration of active tank sites and inventory of abandoned tank sites and there are no records for the property with the legal land description:

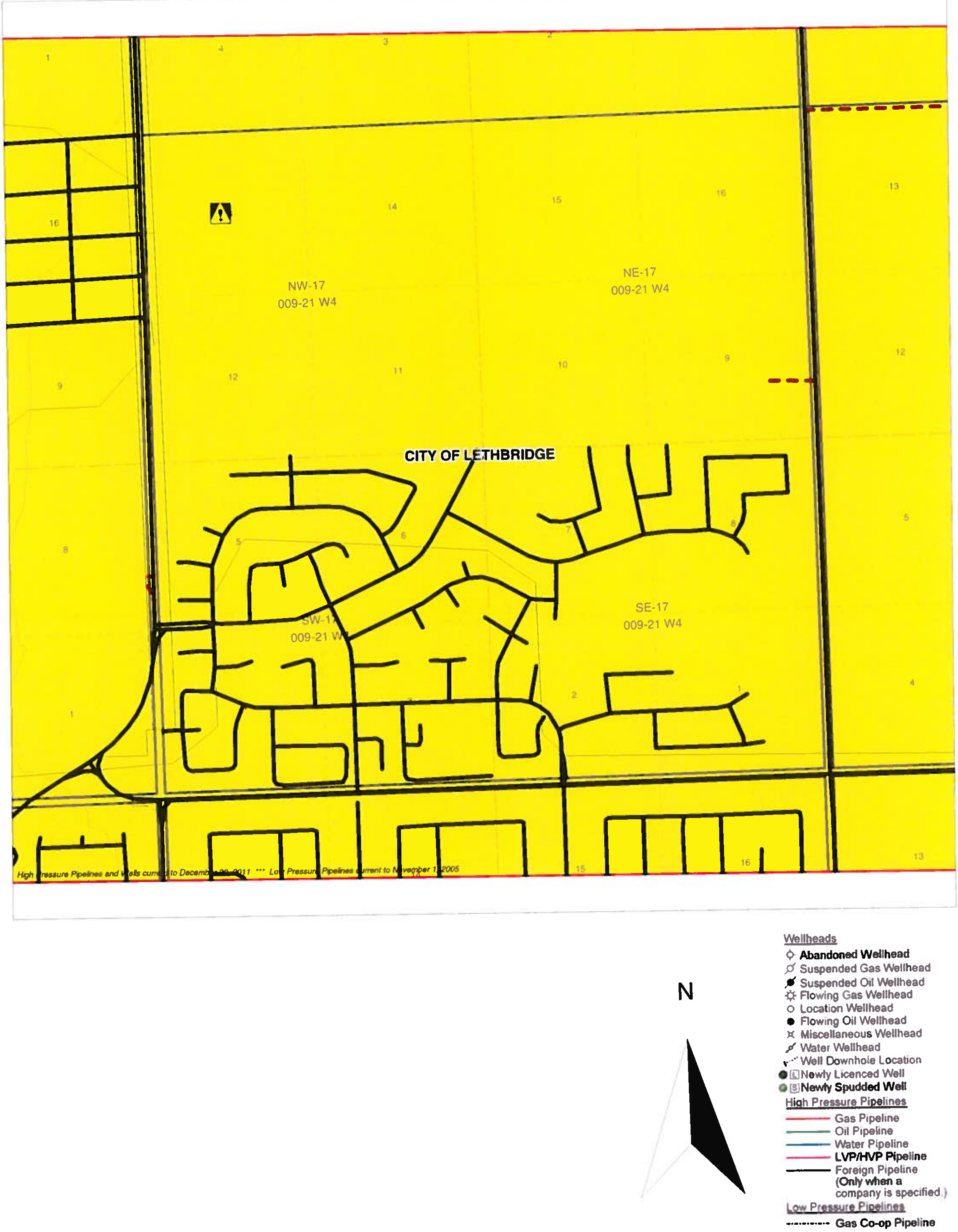
NW 17-9-21-W4, Lethbridge

Please note that both databases are not complete. The main limitation of these databases is that they only include information reported through registration or a survey of abandoned sites completed in 1992 and should not be considered as a comprehensive inventory of all past or present storage tank sites. The PTMAA **cannot** guarantee that tanks do not or have not existed at this location. Information in the databases is based on information supplied by the owner and the PTMAA cannot guarantee its accuracy. Information on storage tanks or on past or present contaminant investigations may be filed with the local Fire Department or Alberta Environment.

Yours truly,

Connie Jacobsen
PTMAA

NW-17-09-21-W4M



ERCB SPILL / COMPLAINT INCIDENTS
FOR
13-17-009-21W4M

SPILL - AUGUST 11, 1997 - INCIDENT NUMBER: 19972884

ERCB NOTIFIED:	AUGUST 11, 1997	**INCIDENT COMPLETE:**	AUGUST 11, 1997
LICENCE #:	2150 - 10 (Pipeline Licence)		
LICENCEE:	ATCO GAS AND PIPELINES LTD. (SOUTH)		
SOURCE:	NATURAL GAS PIPELINE		
PIPELINE DAMAGE:	LEAK	**PRESSURE TEST FAILURE?**	NO
PIPELINE OD:	323.9	**PIPELINE WT:**	5.56
PIPELINE GRADE:	A		
CAUSE:	CONVERSION		
FAILURE TYPE:	GIRTH WELD FAILURE		
JURISDICTION:			
STRIKE AREA:	BROXB	**FIELD CENTRE:**	MEDICINE HAT
# OF INJURIES:	0	**# OF DEATHS:**	0
SPILL OFFSITE?	NO	**SENSITIVE AREA?**	NO
PUBLIC AFFECTED:	CONVERSION FROM ENV SYSTEM		
WILDLIFE AFFECTED:	CONVERSION FROM ENV SYSTEM		
AREA AFFECTED:	CONVERSION FROM ENV SYSTEM		
ENVIRONMENT AFFECTED:			
# EVACUATED:		**CLEANUP DATE:**	AUGUST 11, 1997
SUBSTANCES SPILLED:	1 (1000m^3) GAS PRODUCTION (RAW) (0 (1000m^3) RECOVERED)		

OPTIONS

View Licensee Info

Print Screen

Close Screen

ERCB DATA | ATTACHED FILES

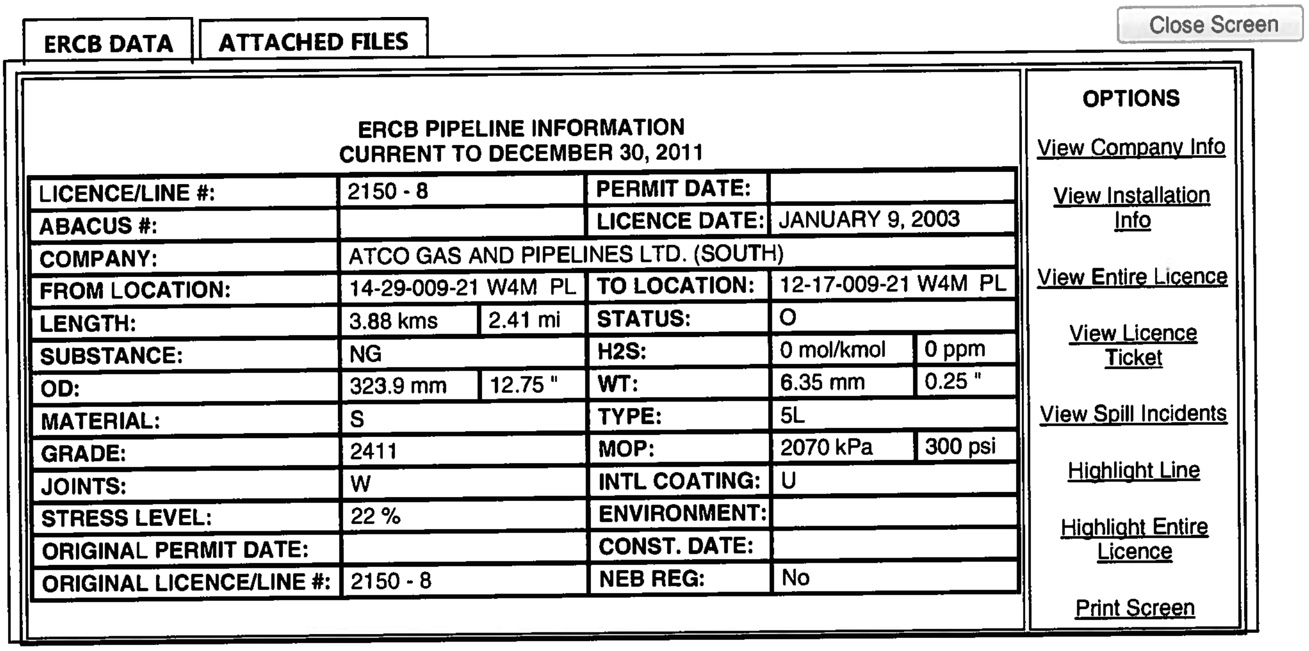
Close Screen

ERCB PIPELINE INFORMATION
CURRENT TO DECEMBER 30, 2011

LICENCE/LINE #:	2150 - 12		**PERMIT DATE:**	OCTOBER 30, 2007	
ABACUS #:			**LICENCE DATE:**	SEPTEMBER 27, 2007	
COMPANY:	ATCO GAS AND PIPELINES LTD. (SOUTH)				
FROM LOCATION:	16-19-009-21 W4M BE		**TO LOCATION:**	01-18-009-21 W4M BE	
LENGTH:	3.12 kms	1.94 mi	**STATUS:**	A	
SUBSTANCE:	NG		**H2S:**	0 mol/kmol	0 ppm
OD:	219.1 mm	8.63 "	**WT:**	9.99 mm	0.39 "
MATERIAL:	S		**TYPE:**	UUUUUU	
GRADE:	UUUU		**MOP:**	0 kPa	0 psi
JOINTS:	W		**INTL COATING:**	U	
STRESS LEVEL:	0 %		**ENVIRONMENT:**		
ORIGINAL PERMIT DATE:			**CONST. DATE:**		
ORIGINAL LICENCE/LINE #:	0 - 0		**NEB REG:**	No	

OPTIONS

- View Company Info
- View Installation Info
- View Entire Licence
- View Licence Ticket
- View Spill Incidents
- Highlight Line
- Highlight Entire Licence
- Print Screen



ERCB PIPELINE INFORMATION
CURRENT TO DECEMBER 30, 2011

LICENCE/LINE #:	2150 - 8		**PERMIT DATE:**		
ABACUS #:			**LICENCE DATE:**	JANUARY 9, 2003	
COMPANY:	ATCO GAS AND PIPELINES LTD. (SOUTH)				
FROM LOCATION:	14-29-009-21 W4M PL		**TO LOCATION:**	12-17-009-21 W4M PL	
LENGTH:	3.88 kms	2.41 mi	**STATUS:**	O	
SUBSTANCE:	NG		**H2S:**	0 mol/kmol	0 ppm
OD:	323.9 mm	12.75 "	**WT:**	6.35 mm	0.25 "
MATERIAL:	S		**TYPE:**	5L	
GRADE:	2411		**MOP:**	2070 kPa	300 psi
JOINTS:	W		**INTL COATING:**	U	
STRESS LEVEL:	22 %		**ENVIRONMENT:**		
ORIGINAL PERMIT DATE:			**CONST. DATE:**		
ORIGINAL LICENCE/LINE #:	2150 - 8		**NEB REG:**	No	

OPTIONS

View Company Info
View Installation Info
View Entire Licence
View Licence Ticket
View Spill Incidents
Highlight Line
Highlight Entire Licence
Print Screen

Skip To Navigation

Skip To Content

Environment

-

Alberta.ca > Environment > ESAR > Search

- Search Form
- Map Search

Alberta Township System (ATS) Search

W 4 - 21 - 9 - 17 -[NW] -[ ] Search ATS

Format: MER-RGE-TWP-SEC-[QTR]-[LSD]
[ ] denotes that the quarter section and legal subdivision are optional.

Plan Block Lot (PBL) Search

Search Results

0 Result(s)

No results found for this ATS.

Document Results

A marker identified as ESA is the location of a site where Alberta Environment has received scientific and/or technical information. A marker identified as REC is the location of a site where Alberta Environment has received an application for a reclamation certificate.

General Help

An ESA document does not necessarily mean the site is, or ever was, contaminated. Please refer to the studies and reports to determine the condition of the site.

Comments and questions can be directed to:
ESAR-Support@gov.ab.ca

<—The main part of this search page is organized into panels on the left.

Document searches can be performed by Alberta Township System (ATS) or by Plan Block Lot (PBL). Click on a heading on the left to open up the panel for your desired search type.

Site search results and document results are also organized in panels.

ATS Help

The Alberta Township System (ATS) format is as follows:

MER - (Meridian)	(West of the 4th,5th or 6th)
RGE - (Range)	(1-30)
TWP - (Township)	(1-126)
SEC - (Section)	(1-36)
QTR - (Quarter Section)	(N,S,E,W,NE,NW,SE,SW)

Government of Alberta

Water Well Drilling Report

View in Metric

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy.
The information on this report will be retained in a public database.

GIC Well ID 106315
GoA Well Tag No.
Date Report Received

1. Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Postal Code
#6 GALT MINE				

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NW	17	009	21	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 49.738242 *Longitude* -112.818239
How Location Obtained
Not Verified

Elevation ft
How Elevation Obtained
Not Obtained

2. Drilling Information

Method of Drilling	Type of Work	Proposed Well Use
Unknown	Unknown	Unknown

3. Formation Log

Measurement in Imperial

Depth from ground level (ft)	Water Bearing	Lithology Description
214.00		Unknown
242.00		Gravel
354.00		Shale
355.00		Coal
373.00		Shale
376.00		Coal
377.00		Shale

4. Well Completion

Measurement in Imperial

Total Depth Drilled	Finished Well Depth	Start Date	End Date
377.00 ft			1908/04/01

Borehole

Diameter (in)	From (ft)	To (ft)
0.00	0.00	377.00

Surface Casing (if applicable)
Size OD : 0.00 in
Wall Thickness : 0.000 in
Bottom at : 0.00 ft

Well Casing/Liner
Size OD : 0.00 in
Wall Thickness : 0.000 in
Top at : 0.00 ft
Bottom at : 0.00 ft

Perforations

From (ft)	To (ft)	Diameter (in)	Interval (in)

Perforated by

Annular Seal
Placed from 0.00 ft *to* 0.00 ft
Amount

Other Seals

Type	At (ft)

Screen Type
Size OD : 0.00 in

From (ft)	To (ft)	Slot Size (in)

Attachment
Top Fittings *Bottom Fittings*

Pack
Type *Grain Size*
Amount

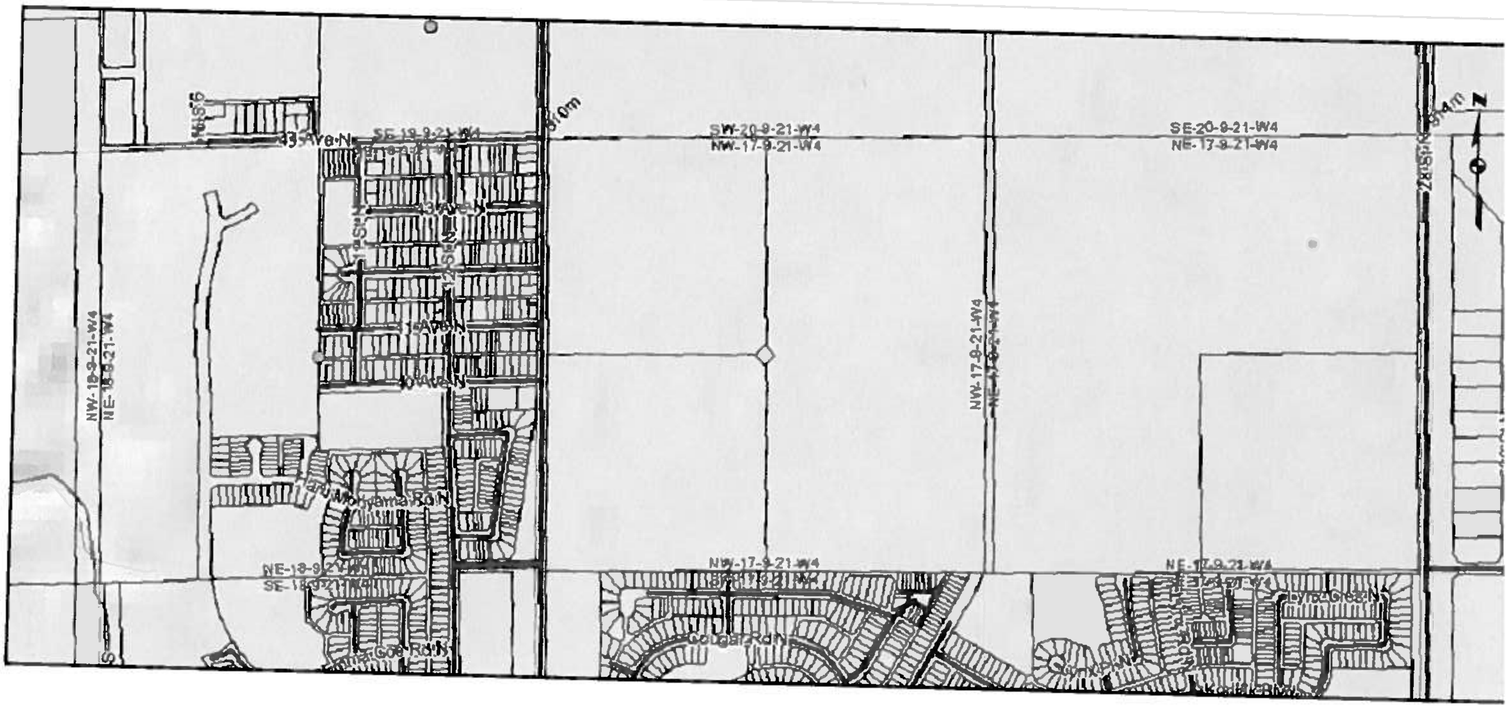
7. Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Company Name
UNKNOWN DRILLER

Certification No
1

Copy of Well report provided to owner *Date approval holder signed*



Legend

Groundwater Well ●

Selected Groundwater Well ○

Selection or Drawing area ▢

Base Data provided by Spatial Data Warehouse Ltd.
Road Network data provided by GeoBase®
Alberta Environment

Groundwater Information Centre Map

Projection	Datum	Date
ALBERTA 10TM	NAD 83	2012-Jan-30

http://www.envinfo.gov.ab.ca/GroundWater/#

protection
&
enforcement

Alberta
ENVIRONMENT

Last Update/Review: **April 1, 2000**

Authorization /Approval Viewer

For advanced search help see: **Authorization / Approval Viewer Help**

The search used the following values:

Legal Land Location: M: 4 Rge: 21 Twp: 9 Sec: 17 QS: NW

Show Inactive Authorizations / Approvals: No

The resulting Authorizations / Approvals based on the search criteria will be displayed below. A 📄 will appear next to the Authorization / Approval when documentation is available for viewing or downloading. **Please click Authorization / Approval Viewer Help if you encounter problems viewing the approval document.**

The documents referenced from this page are in Adobe Acrobat Writer (.pdf) format. Click on Get Acrobat Reader to download Adobe Acrobat Reader.

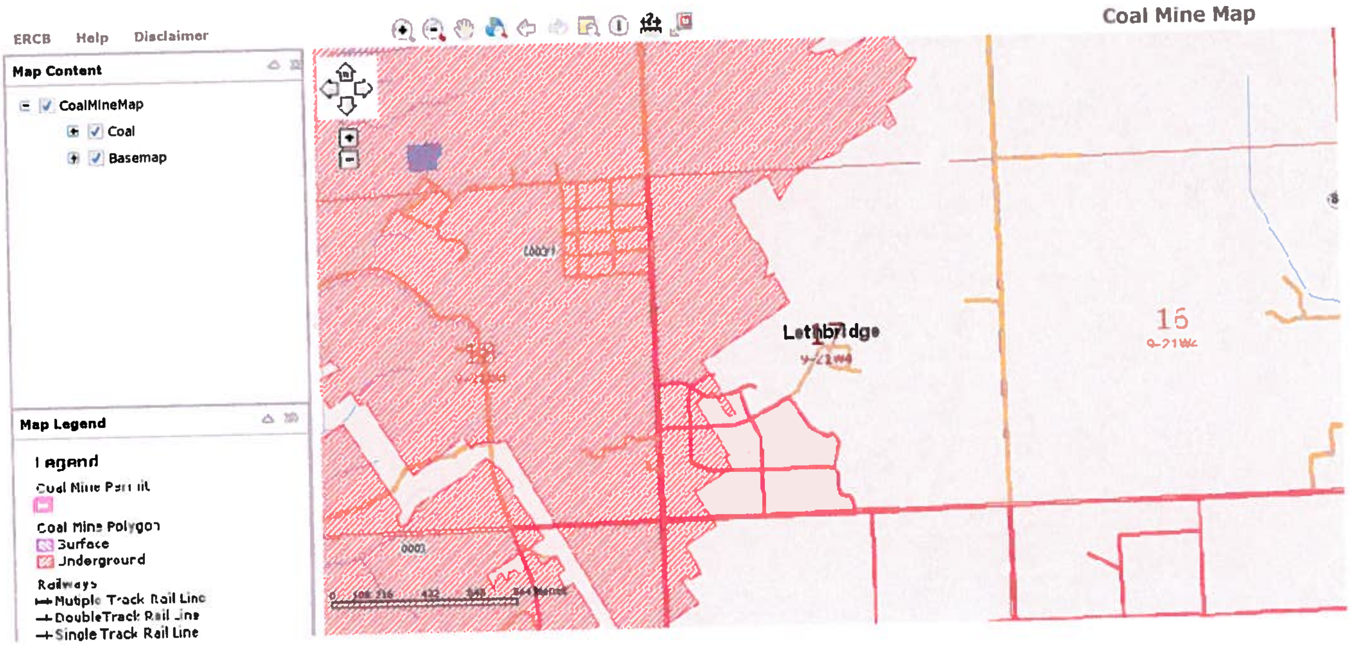
No records match the search criteria.

Back to Search Page | Protection and Enforcement | Water | Top of Page

Comments regarding the Alberta Environment Authorization / Approval Viewer page may be directed to the Regulatory Approvals Centre RAC.Environment@gov.ab.ca

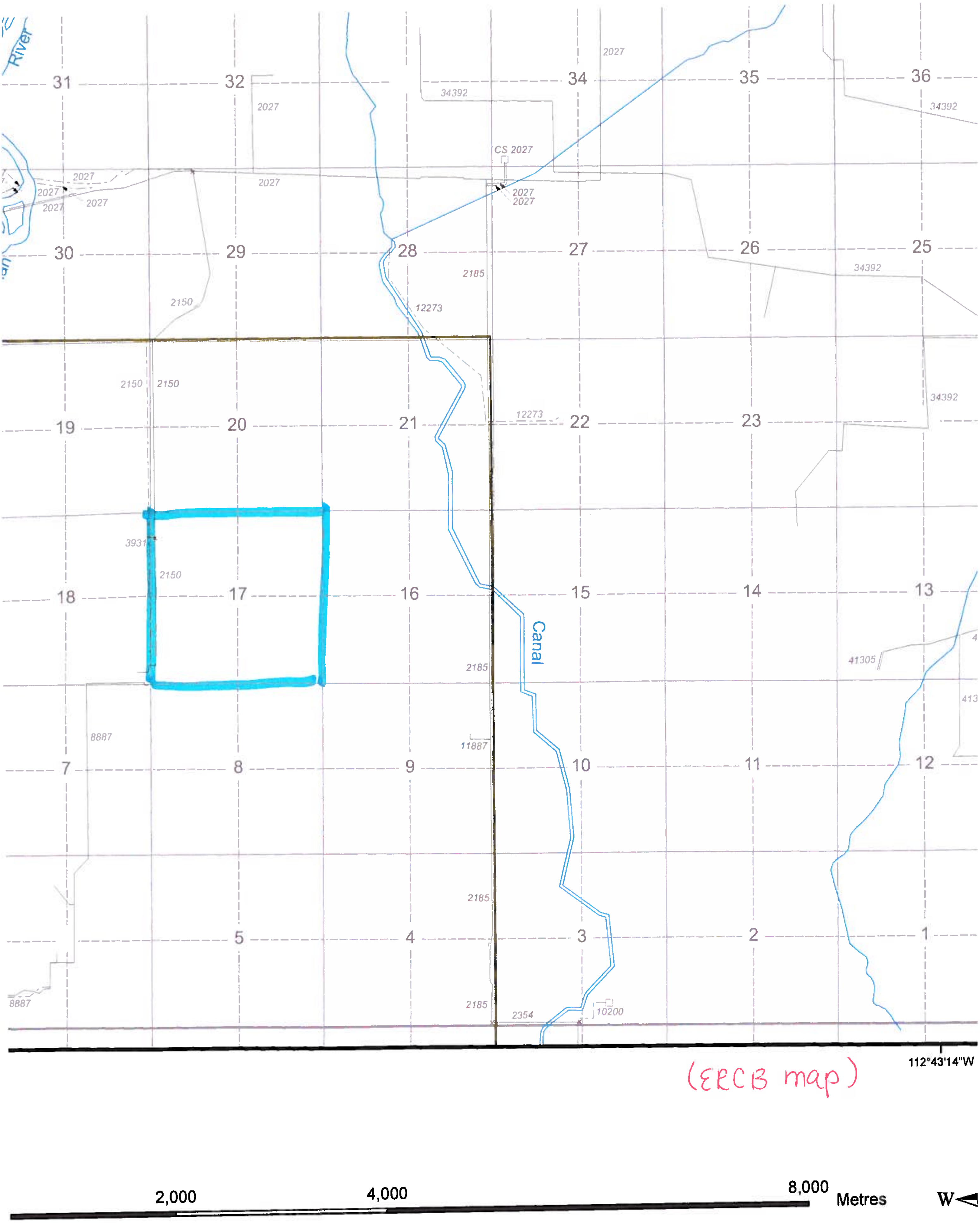
Alberta Connects

Alberta
GOVERNMENT OF ALBERTA


Coal Mine Map
ERCB
Help
Disclaimer
Map Content
CoalMineMap
Coal
Basemap
Map Legend
Legend
Coal Mine Permit
Coal Mine Polygon
Surface
Underground
Railways
Mutiple Track Rail Line
DoubleTrack Rail Line
Single Track Rail Line
Lethbridge
15
9-21W4
0003

Incident Number	19750822
Incident Type	Release
Location	07-24-009-20W4
Licence Number	0044335
Licence Type	Well Licence
Incident Date	02 Jul 1975
Incident Notification Date	02 Jul 1975
Incident Complete Date	04 Jul 1975
Source	Gas Well
Cause	Conversion Conversion
Failure Type	Blowdown
Injury Count	0
Fatality Count	0
Field Centre	Medicine Hat
Jurisdiction	Crown Public Lands
Strike Area	LEOPARD
Licensee	0R46 Husky Oil Operations Limited
Pipeline Lic Segment ID	
Pipeline Lic Line No	
Damage Type	
Test Failure	
Pipeline OD (mm)	
Pipe Grade	
Wall Thickness (mm)	
Substance Released	Gas Production (Marketable)
Volume Released	2.8 103m3
Volume Recovered	0.0 103m3
Substance Released	Salt/Produced Water
Volume Released	1.0 m3
Volume Recovered	0.0 m3
Substance Released	Waste
Volume Released	0.0 m3
Volume Recovered	44.0 m3
Substance Released	Salt/Produced Water
Volume Released	100.0 m3
Volume Recovered	82.5 m3
Release Offsite	Yes
Environment Affected	Air/Land
Sensitive Area	No
Wildlife/Livestock Affected	Conversion from ENV system
Public Affected	Conversion from ENV system
Area Affected	Conversion from ENV system
Public Evacuated Count	
Release Cleanup Date	04 Jul 1975

Incident Number	19972884
Incident Type	Release
Location	13-17-009-21W4
Licence Number	2150
Licence Type	Pipeline Licence
Incident Date	11 Aug 1997
Incident Notification Date	11 Aug 1997
Incident Complete Date	11 Aug 1997
Source	Natural Gas Pipeline
Cause	Conversion Conversion
Failure Type	Girth Weld Failure
Injury Count	0
Fatality Count	0
Field Centre	Medicine Hat
Jurisdiction	
Strike Area	BROXB
Licensee	0144 ATCO Gas and Pipelines Ltd. (SC
Pipeline Lic Segment ID	5787
Pipeline Lic Line No	10
Damage Type	Leak
Test Failure	No
Pipeline OD (mm)	323.9
Pipe Grade	A
Wall Thickness (mm)	5.56
Substance Released	Gas Production (Raw)
Volume Released	1.0 103m3
Volume Recovered	0.0 103m3
Substance Released	Salt/Produced Water
Volume Released	1.0 m3
Volume Recovered	0.0 m3
Substance Released	Waste
Volume Released	0.0 m3
Volume Recovered	44.0 m3
Substance Released	Salt/Produced Water
Volume Released	100.0 m3
Volume Recovered	82.5 m3
Release Offsite	No
Environment Affected	
Sensitive Area	No
Wildlife/Livestock Affected	Conversion from ENV system
Public Affected	Conversion from ENV system
Area Affected	Conversion from ENV system
Public Evacuated Count	
Release Cleanup Date	11 Aug 1997

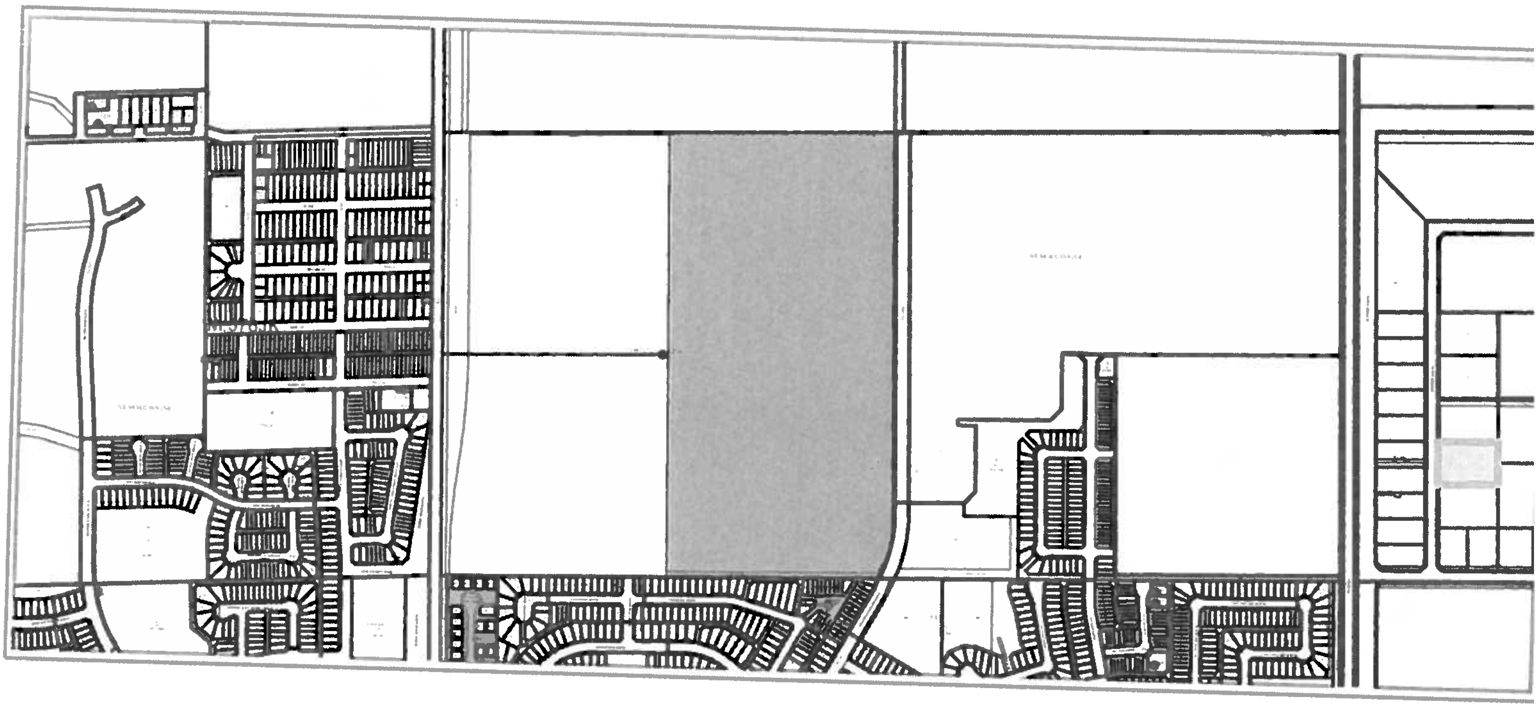


(ERCB map)

Coordinate System: 10TM

LEGEND

Alberta Spatial Information System



01:36PM Monday January 30, 2012

City of Lethbridge

NW-17-9-21-W4M

Printed using the City of Lethbridge Property Information Mapping System.

APPENDIX D

SPECIAL ATTENTION ITEMS – BACKGROUND INFORMATION

BACKGROUND INFORMATION

D1 POLYCHLORINATED BIPHENYLS [PCBS]

The federal Environmental Contaminants Act (1976) has restricted the use and controlled the phase out of polychlorinated biphenyls (PCBs) in Canada. Additionally, the storage and disposal of PCBs is regulated. The Act prohibited the use of PCBs in electrical equipment installed after July 1, 1980. PCBs are commonly found in light ballasts, electrical transformers (pole or ground-mounted) and various other types of electrical equipment (i.e., rectifiers) dating back to the early 1980s or earlier.

PCB containing light ballasts or electrical equipment should be disposed of appropriately at the end of their useful life.

D2 OZONE-DEPLETING SUBSTANCES [ODS]

In December of 1998, The Government of Canada enacted the Ozone-depleting Substances (ODS) Regulations, which governs the use, handling, and release of ODS. ODS may include, but are not limited to, chlorofluorocarbons (CFCs), halons, carbon tetrachloride, and methyl bromide. ODS are usually associated with operations such as: fire extinguishing systems; foam manufacturing; fumigant and pesticide application; prescription metered dose inhalers; refrigeration and air conditioning units; and solvent cleaning and degreasing facilities. ODS are not a health issue for people in the building, but are more a maintenance issue to limit or prevent their release. This is accomplished by regular maintenance by trained personnel.

D3 RADON

Radon gas is a product of the decay series that begins with uranium. Radon is produced directly from radium that is often found in bedrock that contains black shale and/or granite. The gas and its by-products occur naturally everywhere, in soil, water, and air, but usually in concentrations too low to pose a threat. Radon gas can migrate through the ground and enter buildings through porous concrete or fractures. Certain building materials including concrete and gyprock can also release radon. Natural radon concentrations are low in Alberta and radon gas concentrations are usually well below target limits set for Canada. Potential anthropogenic sources of radon gas should be considered.

D4 METHANE

Methane gas is a product of anaerobic decomposition of organic material (e.g., buried fill high in organic material). Methane is also associated with natural gas deposits. Methane gas can migrate through the ground and enter buildings through porous concrete, joints, or fractures. Methane presents a potential explosive hazard when it accumulates to concentrations greater than the lower explosive limit (LEL) in the presence of an ignition source.

E

APPENDIX E

Statement of Justification for Historical Resources Act

Statement of Justification for *Historical Resources Act* Requirements for projects other than small-scale oil and gas

This document contains sensitive information about Historic Resources that are protected under the provisions of the *Alberta Historical Resources Act.* This information is to be used to assist in planning the proposed project only. It is not to be disseminated, and no copies of this document are to be made without written permission of the Historic Resources Management Branch, Alberta Culture and Community Spirit.

Project Name or Project Identifier
North Lethbridge Subdivision NW 17-9-21 W4

Disposition Type & Number: n/a

Name: Neil Mirau
Corporate name of consulting company: Arrow Archaeology Limited
Phone number: 403 345 2812
Fax number: 403 345 2817
E-mail address: nmirau@shaw.ca

Name of proponent contact: Michael Kelly, Manager
Company: The City of Lethbridge
Address: 910-4th Avenue South, Lethbridge Alberta
Phone number:403-329-7355
Fax number:
E-mail address: land@lethbridge.ca

Name of agent: Devin Huber
Corporate name of agent: Stantec
Address: #290, 220-4 Street S., Lethbridge, Alberta T1J 4J7
Phone number: 403 329 3344
Fax number: 403 328 0664
E-mail address: devin.huber@stantec.com

Lands Affected

Legal Description	Land Ownership Type	HRV
11,12,13,14-17-009-21 W4	freehold	No assigned value

Activity type and Anticipated Ground Disturbance
The area is a planned residential subdivision. The current surface will be completely disturbed by new development including roads, buildings and subsurface infrastructure. This review considers the nature of these impacts including the installation of relatively deep infrastructure including water and sewer and other underground services for the subdivision.

Project size
Approx. 65 ha

Existing Disturbance
The proposed subdivision is entirely in cultivated land. Although the date that it was first cultivated is unknown, it has been actively cultivated since at least 1950 and the eastern portion of the subdivision was cultivated before 1939, The western portion, i.e. LSs 12 and 13 appear to have been broken for the first time

between 1939 and 1950. Since the subject land quarter section was broken in the first half of the 20th century, it does not appear to have had any other use than cultivation. See air photos below.

Landscape and Environmental Information

The subdivision is within the limits of the City of Lethbridge and is located on level prairie upland, approximately 1 km east of the break of slope to the Oldman River valley and is just east of the northwest Lethbridge neighbourhood of Hardieville. The modern channel of the Oldman River is approximately 2.5 km from the western boundary of the subdivision. There are no other culturally important or significant topographic features within 5 km of the subdivision area.

Surface and near surface sediments are primarily glaciolacustrine with minor amounts of Holocene aeolian sediments overlying the glaciolacustrine silts and clays which in turn overly glacial ground moraine/till deposits. Although not analyzed in detail, aeolian deposits are composed of primarily silt-sized particles and may date to as recently as the 20th century. There is no evidence of earlier Holocene sandy bluff-top deposits seen elsewhere east of the Oldman River valley in the general area of the City of Lethbridge.

Soil in the area is typically Brown Chernozemic. Some lithic clasts have been observed at the surface in the subdivision area. The observed lithic types (primarily granites, quartzites, gneisses) were transported to the area by Laurentide ice during the Pleistocene Epoch. The subdivision area is approximately 910 masl.

The general area is within the Mixed Grass Prairie ecoregion of southern Alberta and native vegetation would have been the normal suite of short and medium height grasses common in the plains of southwestern Alberta. (*Stipa, Agropyron* spp. and other species commonly found with these grasses).

Archaeological Resources

The proposed project area is located within Borden Block DkPe which has 61 recorded sites.

Borden #	**HRV**	**Relationship to activity (distance and direction from project)**	**Anticipated Impacts**
DkPe-17	0	within project area	see below
DkPe-18	0	within project area	see below
DkPe-19	0	ca. 1 km southeast of project area	None
DkPe-20	0	ca. 500 m from project area	None
DkPe-21	0	ca. 500 m from project area	None

Historic Structure(s)	**Anticipated Impacts**
none	none

Permit Number(s)	Relationship to proposed development footprint
80-043	within project area and adjacent sections.

Illustrative Materials

Project area map, topographic map sections, air photos, satellite images, photos

Evaluation

The section in which this proposed development is located has no Historical Resource Value according to the *Listing of Significant Historical Sites and Areas* (2012 edition*).*

The proposed subdivision is located on level glaciolacustrine terrain that has been under more or less continuous cultivation for more 60 years. There are no archaeologically significant topographic features or other aspects of the area that would suggest that the area has potential to contain surface or buried historical resources. This area has low potential to contain undisturbed archaeological or other historical resources and there is no probability that the project will impact any fossiliferous bedrock.

Sites DkPe 17 and 18 are located within the project area and sites DkPe 19, 20 and 21 are located within 1 km of project area. These sites were recorded in 1980 under permit 80-43 during a general examination of areas of north Lethbridge slated for future development. This historical resources impact assessment was completed for the North Lethbridge Urbanization Report completed in 1980. All five of these sites were recorded as scatters of firebroken rock located in cultivation. No features, lithic debitage or other materials were recorded and these sites have been assigned an HRV of 0. The subject quarter was within the survey area of the project completed under permit 80-43. Since DkPe 17 and 18 are HRV 0 sites and consisted minor, out of context, disturbed and questionable cultural materials, they are not significant in terms of the history or archaeology of this area.

Based on the results of that work, the current and recent land use and considering the overall biogeophysical situation of this quarter section, there is little potential for the presence of historical resources at or near the surface in this area.

We examined available historical air photos for this area and searched local history books, but found no evidence that the subject lands were used for a homestead, farmyard or other buildings. Hardieville School, originally constructed in 1912 was located just south of this subdivision area. The building was demolished in the last several years and the school’s footprint is now within an existing residential subdivision.

The geomorphology of this area, specifically that the project area is located on thin Holocene Epoch deposits overlying culturally sterile Pleistocene glacial and glaciolacustrine deposits means that the area has low potential to contain any intact cultural materials below the modern plough zone.

Palaeontological Sensitivity
The subdivision is located entirely on glaciolacustrine and postglacial, mostly aeolian, sediments and there is no exposed bedrock in or near the area. The subdivision is therefore considered to have low palaeontological potential and sensitivity. It is estimated that Cretaceous bedrock is more than 10 m below glacial and glaciolacustrine deposits in this area.

Recommendations A Historical Resources Impact Assessment is not recommended and we recommend clearance for this project; however, pursuant to Section 31 of the *Alberta Historical Resources Act,* should historic resources be discovered during construction the Historic Resources Management Branch of Alberta Culture is to be contacted immediately.

Our recommendation for clearance without a Historical Resources Impact Assessment is based on the data and information provided in this report.

(*Recommendations regarding archaeological resources must be made by a professional archaeologist.)*

Recommendations made by: Neil Mirau, Arrow Archaeology Limited	Date: November 23, 2012

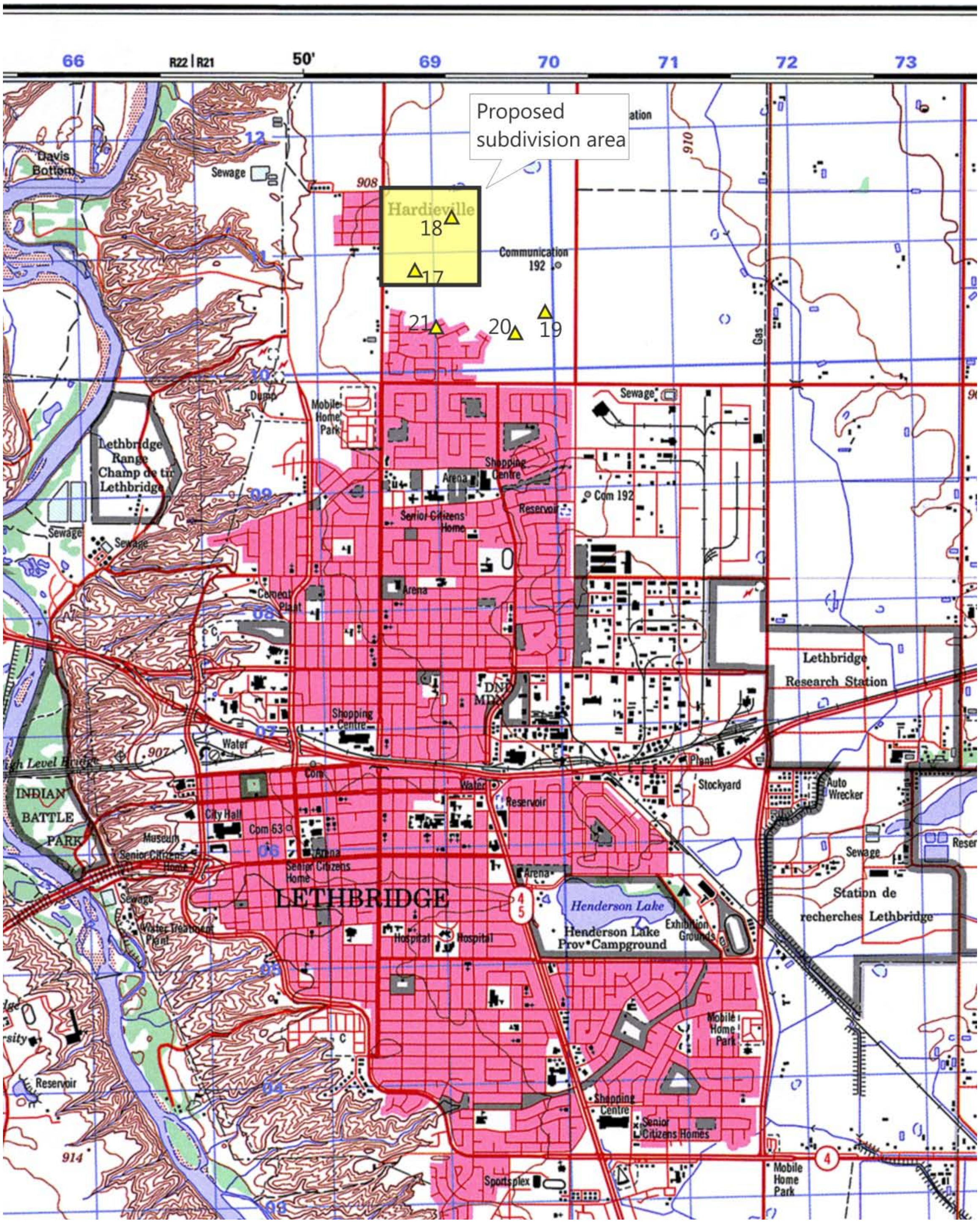


Figure 1. Project location shown in yellow on NTS 82H/10 1:50000 map sheet section.

Figure 2. Satellite image of the project area. Subdivision area outlined in yellow. See following images. Hardieville just west (left) of subdivision area.

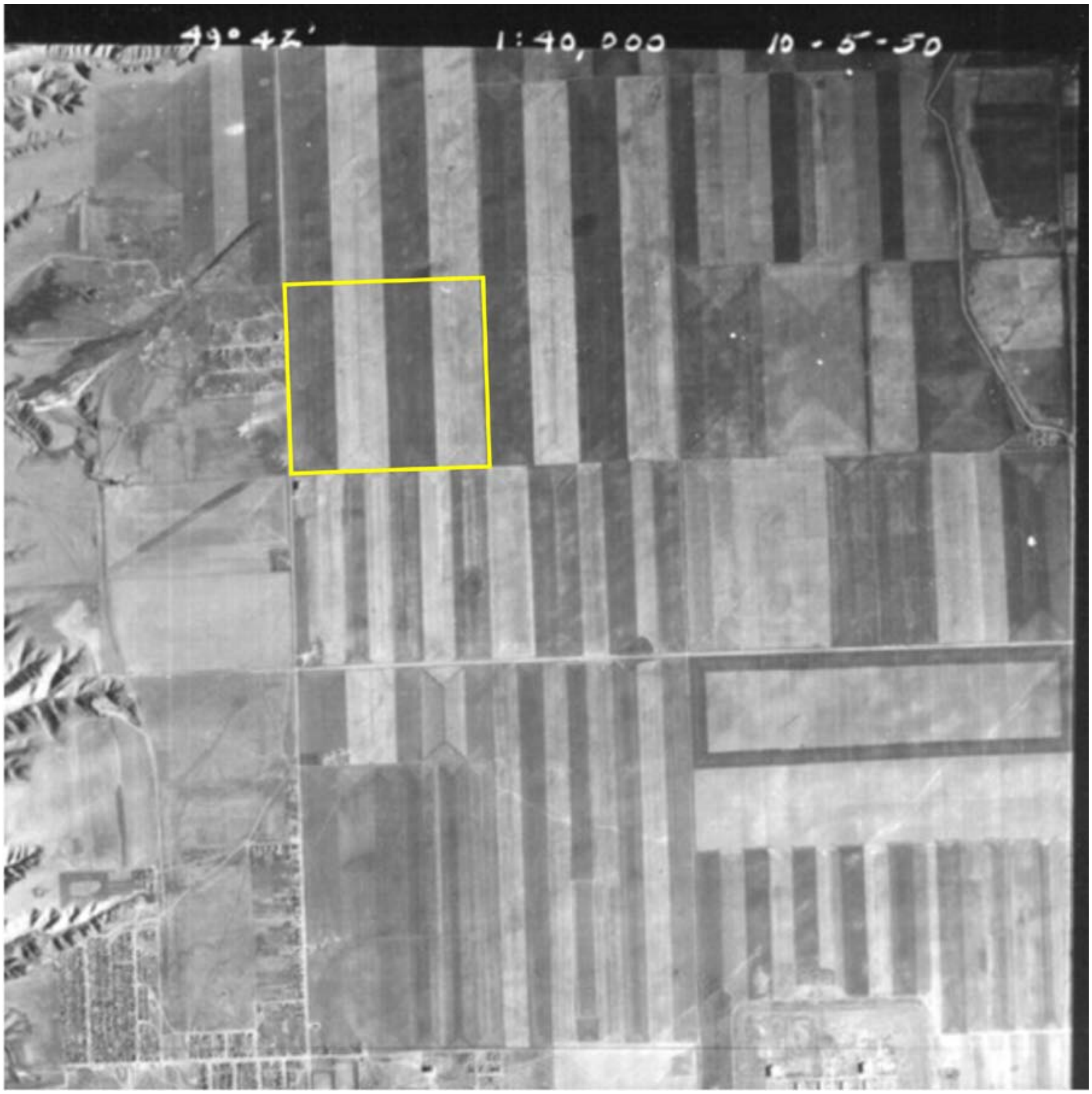


Figure 3. 1950 air photo showing project area (outlined in yellow), orientation of photo same as satellite image above. Cultivation of project area is obvious in this photo.

Figure 4. 1939 air photo of project area (outlined in yellow). The eastern half of the proposed subdivision was cultivated as of the date of this photo however the western half appears to be native grassland, albeit slightly disturbed by trails.

Figure 5. View south western portion of project area running parallel to 13th Street North.

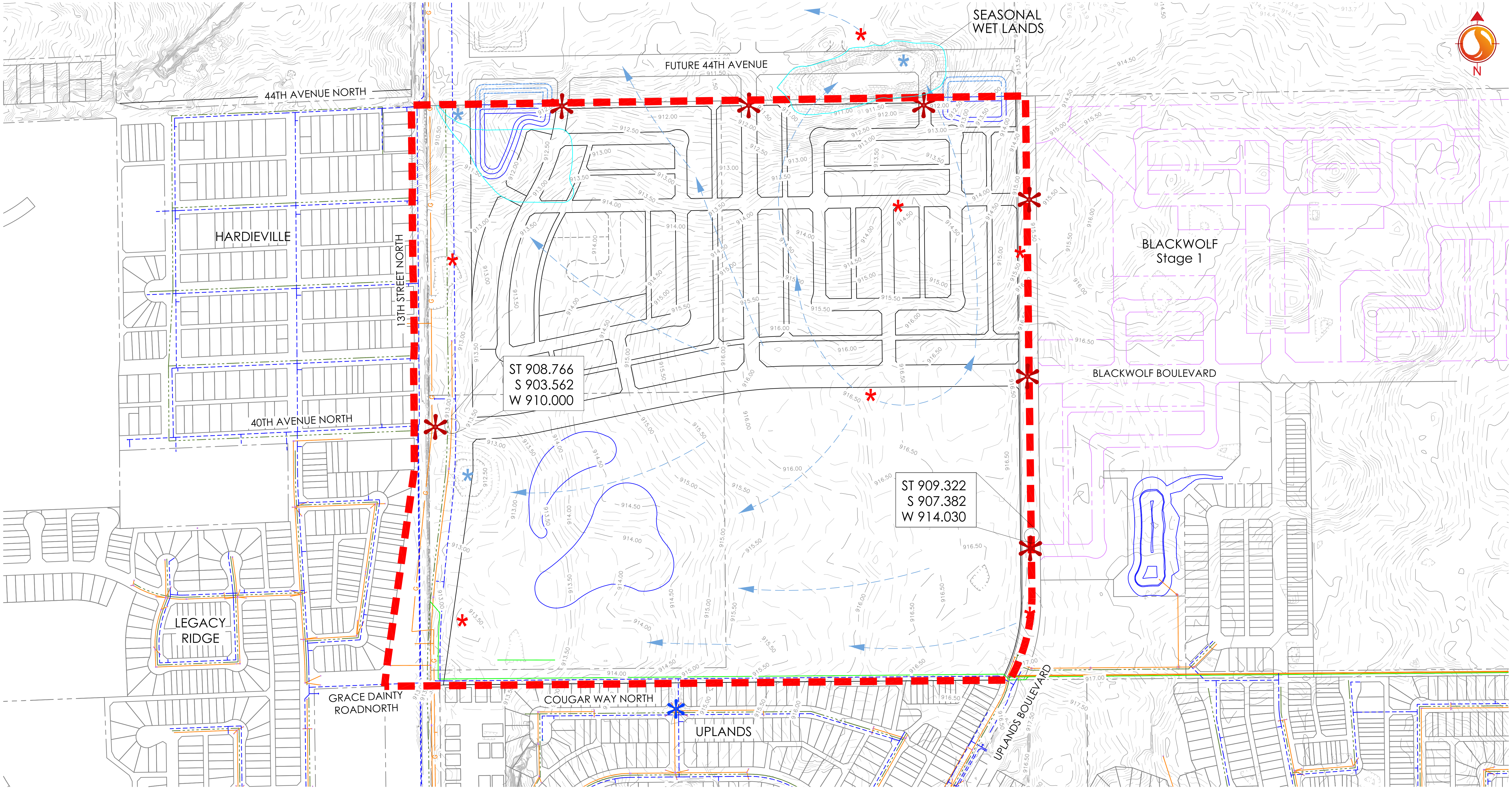
Figure 6. View southeast of project area. Uplands neighborhood visible in the distance.

Figure 7. View east view of project area showing cultivated field and neighborhood of Uplands on the distant right.

Figure 8. View northeast of project area taken from 13th Street north.

Figure 9. Close up of the northeast view of project area showing its recent use for cultivation of grains.

Figure 10. View north of the western side of the project area, Hardieville is visible on left side of image.



NTS

Design with community in mind

Community focus. Built with integrity.

112945510
December 5, 2013

V:\1129\active\112945510\drawing\planning\sheet_files\olp_figures\gate3\bw_gt3-fig_2.3-Fig_Constraints.dwg

LEGEND

▬ ▬ ▬	BlackWolf Stage 2 Boundary
- - - -	Existing Sanitary Sewer
——	Existing Sanitary Forcemain
——	Existing Storm Sewer
- - - -	Existing Water Line
—— G ——	High Pressured Gas Line
◄- - -	Overland Flow & Spill Direction
*	High Point
*	Low Point
✱	Transportation Access Point
✱	Dead end of Marmot Road North to be closed & converted into walkway access

BLACKWOLF STAGE 2 | FIGURE 2.3

Outline Plan

Site Constraints

PREPARED FOR: CITY OF LETHBRIDGE - RELD

F

APPENDIX F

Wetland Classification and Delineation Assessment

A TETRA TECH COMPANY

November 21, 2013

ISSUED FOR USE
EBA FILE: 704-ENVIND03027-01
Via Email: devin.huber@stantec.com

Stantec Consulting Ltd.
290, 220 – 4 Street South
Lethbridge, AB T1J 4J7

Attention: Mr. Devin Huber

Subject: Wetland Classification and Delineation Assessment for the Lands North of Uplands NW 17-9-21 W4M

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Stantec Consulting Ltd. and their agents. EBA, Engineering Consultants Ltd. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than Stantec Consulting Ltd., or for any project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. This report is subject to the terms and conditions of the Master Consulting Terms and Conditions executed between Stantec Consulting Ltd. and EBA Engineering Consultants Ltd.

1.0 INTRODUCTION

EBA Engineering Consultants Ltd., operating as EBA, A Tetra Tech Company (EBA) was retained by Stantec Consulting Ltd. (Stantec) to assess two suspected wetland locations within a proposed residential subdivision [Lands North of Uplands (the Project)], located in NW 17-9-21 W4M (the Project Site), in North Lethbridge, Alberta (Figure 1). The two suspected wetlands (Figure 2) were identified as part of a Phase I environmental site assessment (ESA) prepared for the Project Site by EBA (EBA, A Tetra Tech Company 2012)., Suspected). The objective of this assessment is to confirm the presence of these wetlands, and if present, conduct a wetland impact assessment (including classification and delineation of identified on-site wetlands) and provide permitting support relative to the Alberta *Water Act*.

According to Alberta's Provincial Wetland Restoration/Compensation Guide, a 'wetland' is land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation and various kinds of biological activity which are adapted to a wet environment (Alberta Environment and Sustainable Resource Development [ESRD] 2007). Lands meeting these criteria are typically subject to the *Water Act* application process.

2.0 METHODS

2.1 Desktop Review

2.1.1 Historical Aerial Photography Review

EBA reviewed historical aerial photographs of the Project Site (captured 1950, 1961, 1970, 1979, 1988, 1999, 2013; Figure 3), and identified suspected wetland areas with potential to be impacted by the Project and determined surrounding land uses. Review of the aerial imagery for the Project Site assisted with determining the historical ecological context of the suspected wetlands to identify any changes over time (e.g., natural or anthropogenic).

2.1.2 Vegetation Resources

A search of the Alberta Conservation Information Management System (ACIMS) database was conducted to determine if there were any historical occurrences of vegetation elements of conservation concern recorded within the Project Site (Alberta Parks Tourism and Recreation [ATPR] 2013a and 2013b). Vegetation elements of conservation concern include ecological communities and species elements for which data has been collected, reviewed and given a conservation rank based on how rare or common the element may be (ATPR 2013c). Those elements that current data suggests may be rare are placed on a tracking or watch list (ATPR 2013b).

2.1.3 Wildlife Resources

A search of the Fish and Wildlife Management Information System (FWMIS) database was conducted to determine if there were any historical occurrences of observations of species of conservation concern recorded within a nine kilometre (km) radius of the Project Site (ESRD 2013). Species of conservation concern include those listed as 'At Risk', 'May Be At Risk' or 'Sensitive' under the General Status of Alberta Wild Species (GSAWS) (Alberta Sustainable Resource Development 2011) or those listed as 'Endangered', 'Threatened' or 'Species of Special Concern' under Alberta's *Wildlife Act* (2000) or the federal *Species at Risk Act*.

2.2 Field Survey

A site visit was conducted to identify the suspected wetlands and to determine if they met the criteria described in Section 2.0. This included a meander around and through each suspected wetland; recording vegetation and incidental wildlife species observed; using a soil hand auger to a depth of 30 centimetres (cm) to determine soil moisture characteristics and evidence of water modified soil conditions (i.e., mottling or gleying); and noting characteristics of wetland function (e.g., habitat, water quality improvement).

3.0 RESULTS

3.1 Desktop Review

3.1.1 Historical Aerial Photography Review

A review of historical aerial photography indicates that, over the past 50 years, land use within the Project Site has been primarily characterized by agricultural development (Figure 3). Aerial photos from 1950 suggest the outline of a wetland on the northern boundary (Suspected Wetland 2); however, it appears to be cultivated. Aerial imagery from 1970 suggests cultivation extends around Suspected Wetland 2 and, by 1979, it appears to contain water. In 1988, it is smaller, appears to contain no water and is no longer visible within the Project Site; the portion that is visible is located on the adjacent property to the north. In 1999, Suspected Wetland 2 has been cultivated through and there is a powerline visible along the north side of the Project Site. Additionally, there seems to be a low area (Suspected Wetland 1) on the west side of the Project Site but there is no evidence of it containing water. In 2005, both suspected wetlands are cultivated through and are only slightly visible on aerial imagery. In 2013, both suspected wetlands continue to be cultivated through.

3.1.2 Vegetation and Soils Resources

A search of the Alberta Conservation Information Management System (ACIMS) database revealed that no historical occurrences of vegetation elements of conservation concern have been recorded within the Project Site (ATPR 2013a and 2013b).

3.1.3 Wildlife Resources

A FWMIS search revealed that the Project Site is located within Sensitive Amphibian Ranges, Sensitive Raptor Ranges and Sharp-tailed Grouse Survey Areas, with eighteen wildlife species of conservation concern known to occur within 9 km of the Project Site (ESRD 2013), two of which are wetland-dependant: northern leopard frog (*Rana pipiens*) and painted turtle (*Chrysemys picta*).

3.2 Field Survey

The site visit took place on October 23, 2013, during partly cloudy conditions with a temperature of between seven and 10 degrees Celsius. Complete plant and wildlife inventories were not recorded due to late survey timing. Photos were taken of each suspected wetland and surrounding land use (Photos 1 to 5).

Suspected Wetland 1 was dry at the time of assessment and contained two sanitary sewer manholes (Photographs 1, 2 and 3). The area within a few feet of the wells had been cropped with common wheat (*Triticum aestivum*). The area immediately surrounding the wells contained primarily common wheat and weeds such as Canada thistle (*Cirsium arvense*) and wild oats (*Avena fatua*). Soils augered to a depth of 30 cm were relatively dry and contained very little to no mottling. There were no rare plants or vegetation elements of conservation concern observed during the field survey.

Suspected Wetland 2 is confined to SW 20-09-21 W4M, north of the Project Site (Photos 4 and 5). There is a gradient, sloping upwards from the suspected wetland location in SW 20-09-21 W4M southward to the powerline right-of-way bordering the Project Site. The suspected wetland area identified as part of the Phase I ESA within the Project Site is dry and the soils are not mottled. The depression in SW 20-09-21 W4M is cropped through with common wheat. In addition to common wheat, three individual cattails (*Typha latifolia*) were observed, broken off near the base, in the centre of the depression. Soils within the depression contained a considerable amount of mottling. This offsite portion is likely a Class II Temporary Wetland according to the Classification of Natural Ponds and Lakes in the Glaciated Prairie Region (Stewart and Kantrud 1971); however, the wetland has been modified by anthropogenic activity (due to cultivation).

One mouse (*Peromyscus* spp.) was observed within Suspected Wetland 1. Many (10+) mouse/rodent burrows were also observed around and between the sewer manholes. No evidence of wildlife was observed within Suspected Wetland 2. There were no amphibian species observed during the field survey.

4.0 DISCUSSION

Although the timing of the site visit was not typical for a wetland classification and delineation assessment, EBA's confidence level with respect to the characterization of any on-site wetlands is high, based on historical air photo review and observed on-site conditions.

Historically, both suspected wetlands seem to have been impacted by cultivation. Cultivation can impact wetland function by altering soil moisture and vegetation. Suspected Wetland 1 appears to have been cultivated through from 2005 (or earlier) to present. It currently does not contain hydrophytic vegetation or hydric soils and therefore is not considered to be a functioning wetland. Suspected Wetland 2 has been cultivated through periodically since 1950 and consistently from 1999 to present. The period of time (1970 to 1979) when cultivation extended around the wetland allowed water to accumulate; however, based on current site conditions, the on-site portion of Suspected Wetland 2 identified in the Phase I ESA is not considered to be a functioning wetland.

The off-site portion of Suspected Wetland 2 contained mottled soils and a limited cover of hydrophytic vegetation at the time of assessment. It was cropped through with common wheat. Based on the historical aerial photo review and observation of current conditions, this area of Suspected Wetland 2 likely has the defining characteristics of a wetland but, given the history of cultivation, it is likely low in value with respect to wetland function. It is recommended that the results of this assessment be reviewed by ESRD to determine if any obligations, pursuant to the Water Act (including mitigation measures), are required with respect to the off-site portion of Suspected Wetland 2 prior to construction. No vegetation or wildlife species observed during the field survey are listed according to GSAWS (ESRD 2011), the federal *Species at Risk Act,* or the Alberta *Wildlife Act*, although they would not be expected to be present in late October.

Based on the background review and observation of current on-site conditions, it is unlikely that an application under the Alberta *Water Act* will be required for the on-site areas investigated as part of this assessment; however, EBA recommends that the findings of this report be reviewed with ESRD.

5.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
EBA Engineering Consultants Ltd.

Aynsley Shirriff

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/anm

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Stewart, R.E. and H.A. Kantrud. 1971. Classification of Natural Ponds and Lakes in the Glaciated Prairie Region. Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Washington, D.C., USA. Resource Publication 92. 57 pp.

Statutes Cited

Federal

Species at Risk Act, S.C. 2002, c. 29

Provincial (Alberta)

Water Act, R.S.A. 2000, c. W-3

Wildlife Act, R.S.A. 2000, c. W-10

FIGURES

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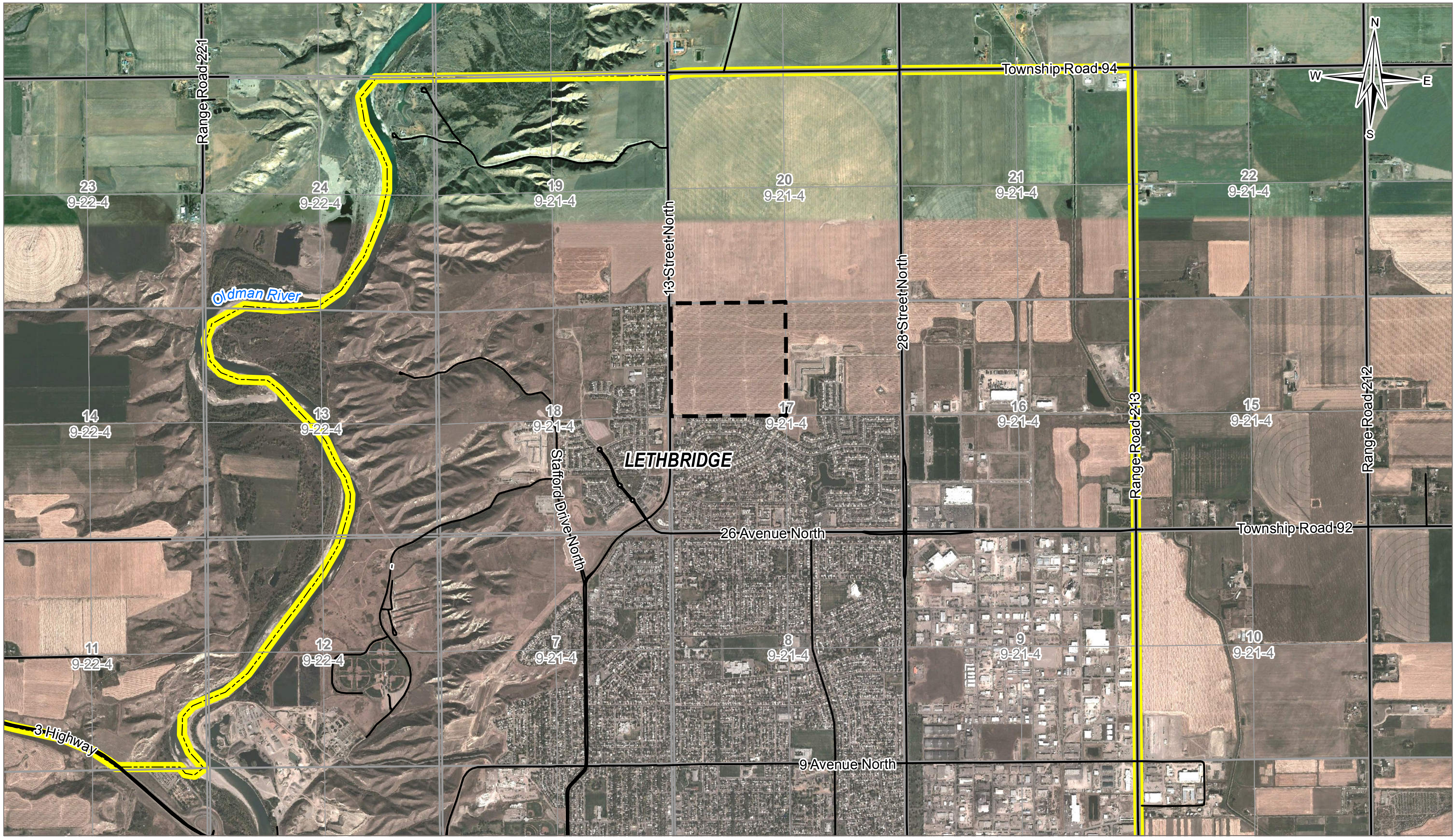

LEGEND

— Road

⬚ Site Location

🟨 Urban Area

NOTES
Base data source: CanVec (1:50,000) & ESRI
Imagery: Google Earth Pro

Scale: 1:40,000
800 400 0 800
Metres

PROJECTION
UTM Zone 11

DATUM
NAD83

FILE NO.
ENVIND03027_Figure1.mxd

CLIENT
Stantec Consulting Ltd.

eba
A TETRA TECH COMPANY

STATUS
ISSUED FOR REVIEW

WETLAND CLASSIFICATION AND DELINEATION ASSESSMENT FOR THE LANDS NORTH OF UPLANDS NW 17-9-21 W4M

Site Location Plan

PROJECT NO.	DWN	CKD	APVD	REV
ENVIND03027	BB	MS	AS	0

OFFICE
EBA-RIV

DATE
November 14, 2013

Figure 1

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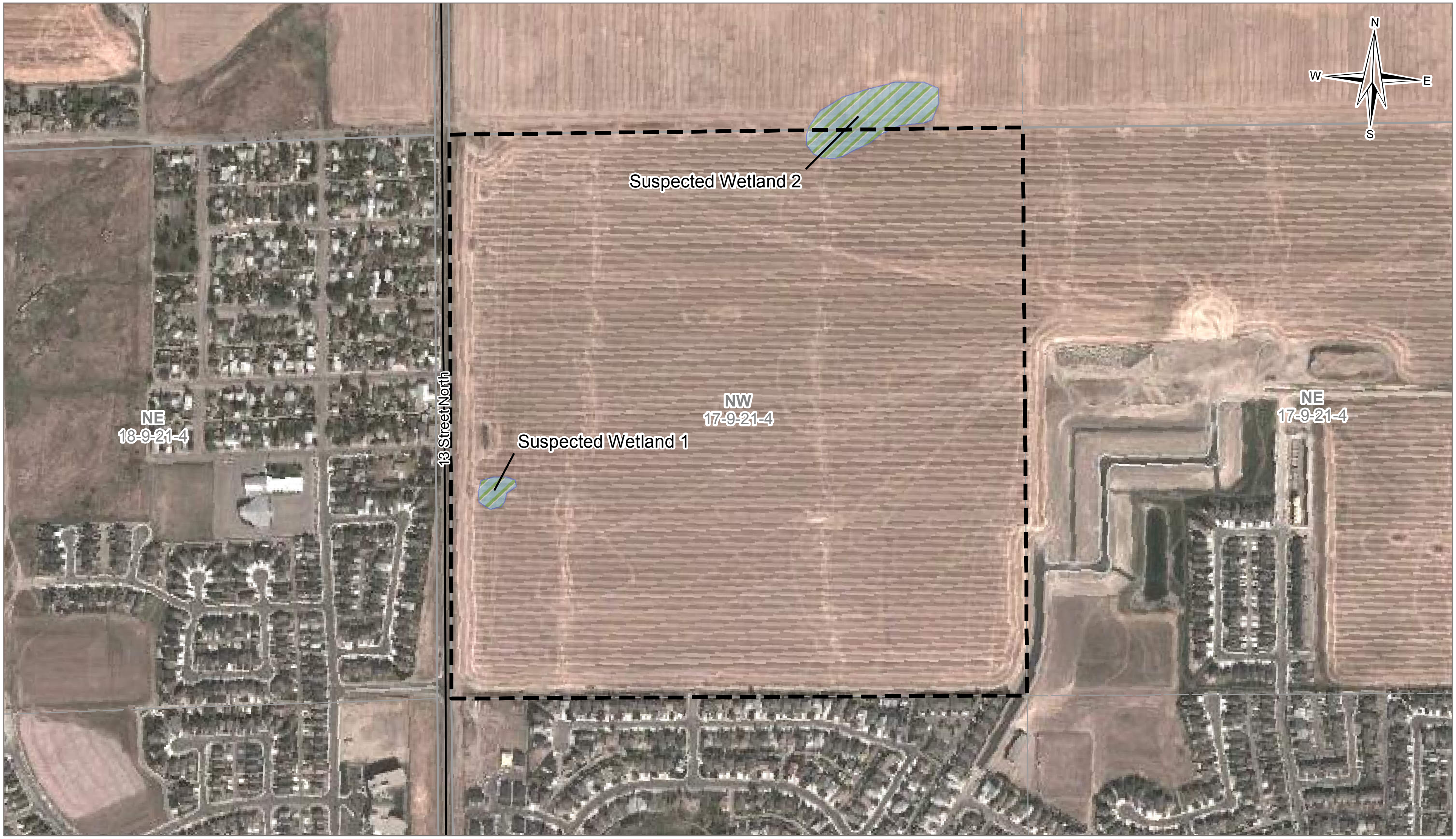

LEGEND

——— Road

▭ Site Location

▨ Suspected Wetland

NOTES
Base data source: CanVec (1:50,000) & ESRI
Imagery: Google Earth Pro

STATUS
ISSUED FOR REVIEW

Scale: 1:8,000
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Metres

PROJECTION
UTM Zone 11

DATUM
NAD83

FILE NO.
ENVIND03027_Figure2.mxd

CLIENT
Stantec Consulting Ltd.

A TETRA TECH COMPANY

WETLAND CLASSIFICATION AND DELINEATION ASSESSMENT FOR THE LANDS NORTH OF UPLANDS NW 17-9-21 W4M

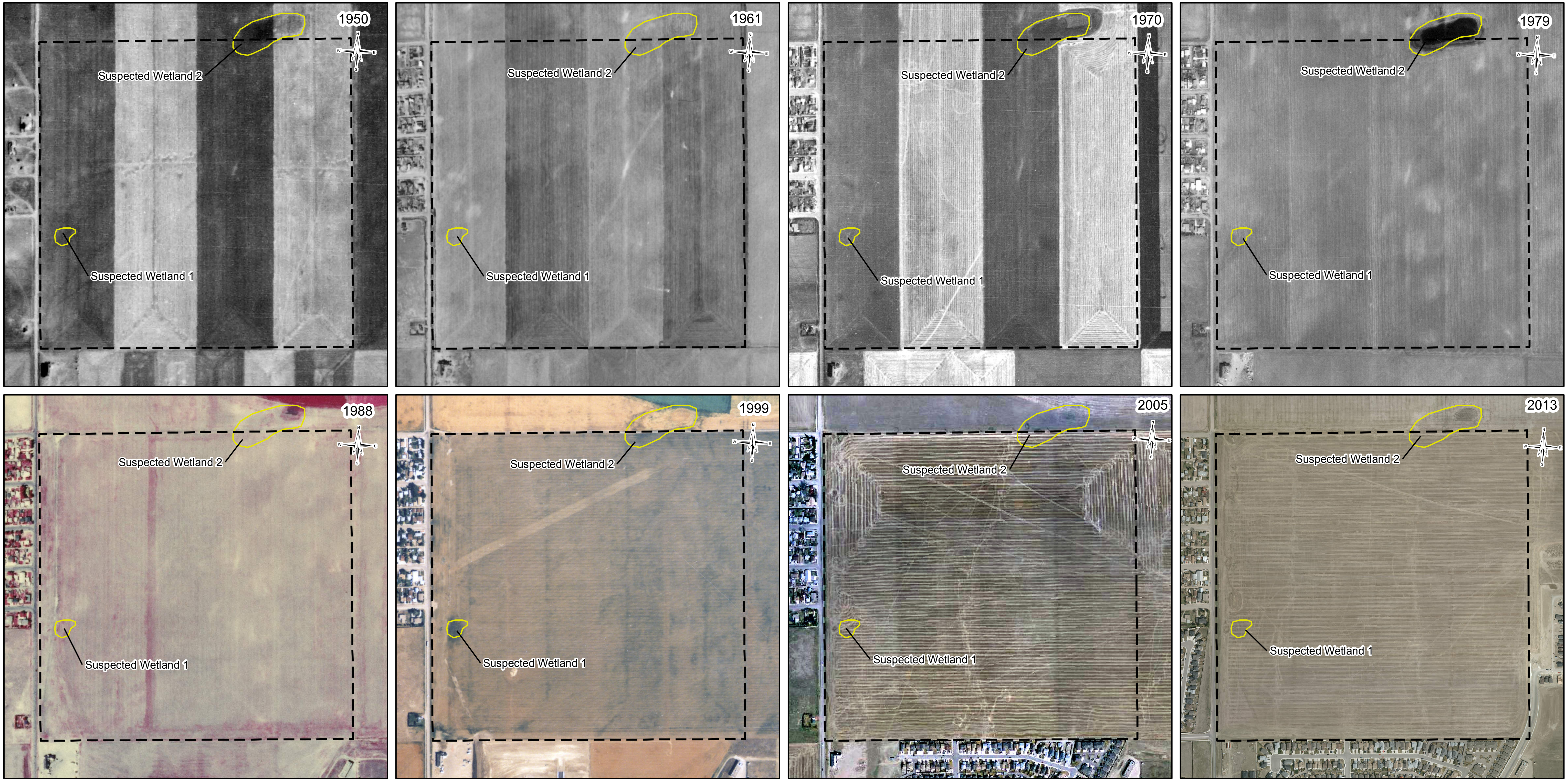
Detailed Site Plan

PROJECT NO.	DWN	CKD	APVD	REV
ENVIND03027	BB	MS	AS	0

OFFICE
EBA-RIV

DATE
November 20, 2013

Figure 2



LEGEND

- ▭ Suspected Wetland
- ⌜⌟ Site Location

NOTES
Alberta Sustainable Resource Development
(1950, 1961, 1970, 1979, and 1999) & The City of Lethbridge
(2005 & 2013)

WETLAND CLASSIFICATION AND DELINEATION ASSESSMENT FOR THE LANDS NORTH OF UPLANDS NW 17-9-21 W4M

Historical Aerial Photographs

PROJECTION	DATUM	CLIENT
UTM Zone 11	NAD83	Stantec Consulting Ltd.

Scale: 1:10,000
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Metres

FILE NO.
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PROJECT NO.	DWN	CKD	APVD	REV
ENVIND03027	BB	MS	AS	0

OFFICE	DATE
EBA-RIV	November 20, 2013

A TETRA TECH COMPANY

Figure 3

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PHOTOGRAPHS

Photo 1	Suspected Wetland 1 – view looking north
Photo 2	Sanitary Sewer 1 found within Suspected Wetland 1
Photo 3	Sanitary Sewer 2 found within Suspected Wetland 1
Photo 4	Suspected Wetland 2, located on adjacent property to the north, not within Project Site – view looking east
Photo 5	Suspected Wetland 2, located on adjacent property to the north, not within Project Site – view looking northeast

Photo 1: Suspected Wetland 1 - view looking north.

Photo 2: Sanitary Sewer 1 found within Suspected Wetland 1.

Photo 3: Sanitary Sewer 2 found within Suspected Wetland 1.

Photo 4: Suspected Wetland 2, located on adjacent property to the north, not within Project Site – view looking east.

Photo 5: Suspected Wetland 2, located on adjacent property to the north, not within Project Site – view looking northeast.

APPENDIX A

EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEO-ENVIRONMENTAL REPORT

This report incorporates and is subject to these "General Conditions".

1.0 USE OF REPORT AND OWNERSHIP

This report pertains to a specific site, a specific development, and a specific scope of work. It is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site or proposed development would necessitate a supplementary investigation and assessment.

This report and the assessments and recommendations contained in it are intended for the sole use of EBA's client. EBA does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA's Client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. The Client warrants that EBA's instruments of professional service will be used only and exactly as submitted by EBA.

Electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by EBA in its reasonably exercised discretion.

4.0 INFORMATION PROVIDED TO EBA BY OTHERS

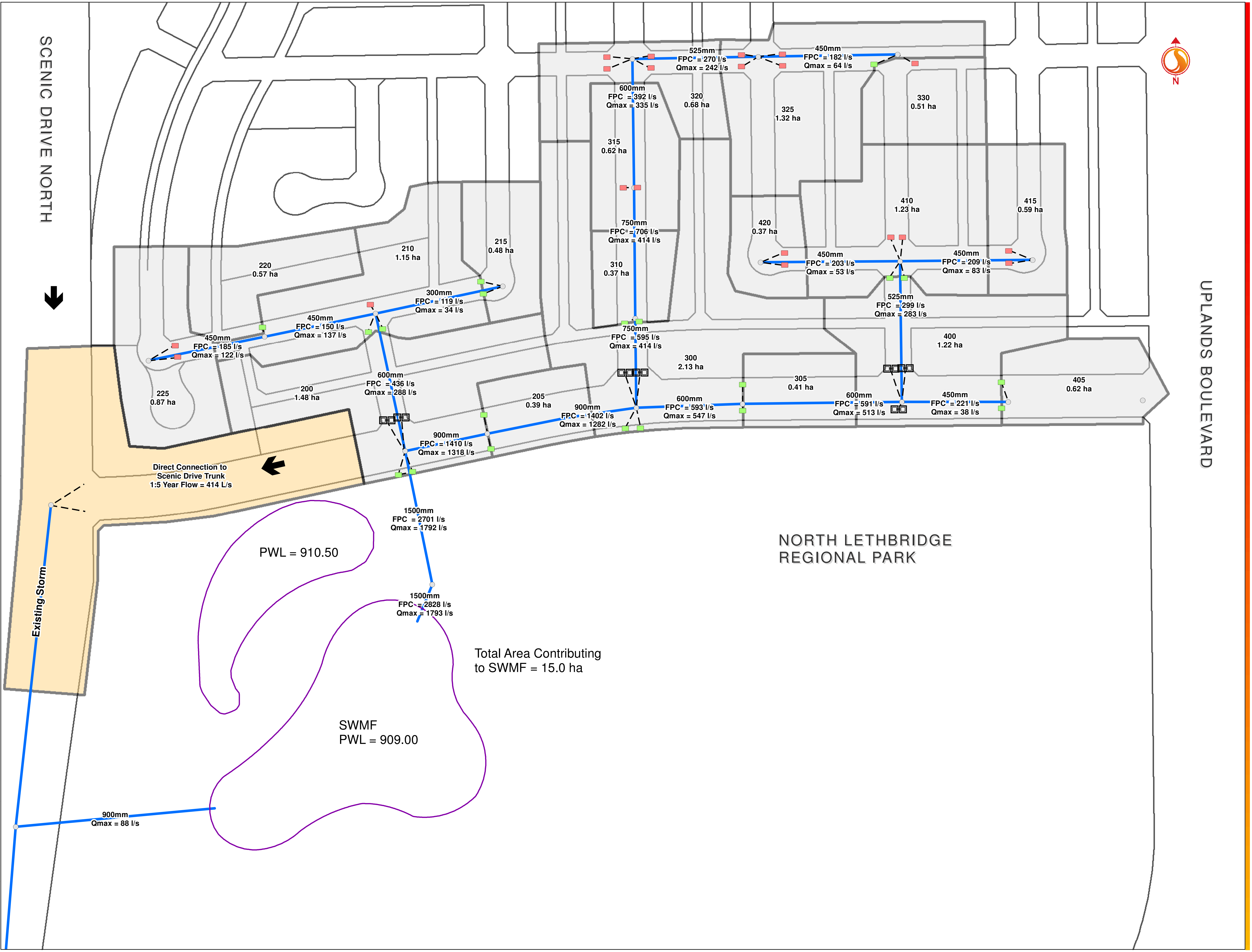
During the performance of the work and the preparation of the report, EBA may rely on information provided by persons other than the Client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

G

APPENDIX G

BlackWolf Boulevard
Storm Water Management
Preliminary Design

Coordinate System: CT Transverse Mercator WGS 84



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Stantec Consulting Ltd.
290 - 220 4th St S
Lethbridge AB Canada
T1J 4J7
Tel. (403) 329-3344
Fax. (403) 328-0664
www.stantec.com

Legend

- 🟩 Flow By CB
- 🟥 Single CB
- ◻◻ Twin CB
- ○ Manholes
- – – CB Lead
- ━ Minor System Sewers
- ▭ Scenic Drive Catchment
- ▭ Subcatchments

Notes

****

FOR INFORMATION ONLY

****

Client/Project

CITY OF Lethbridge

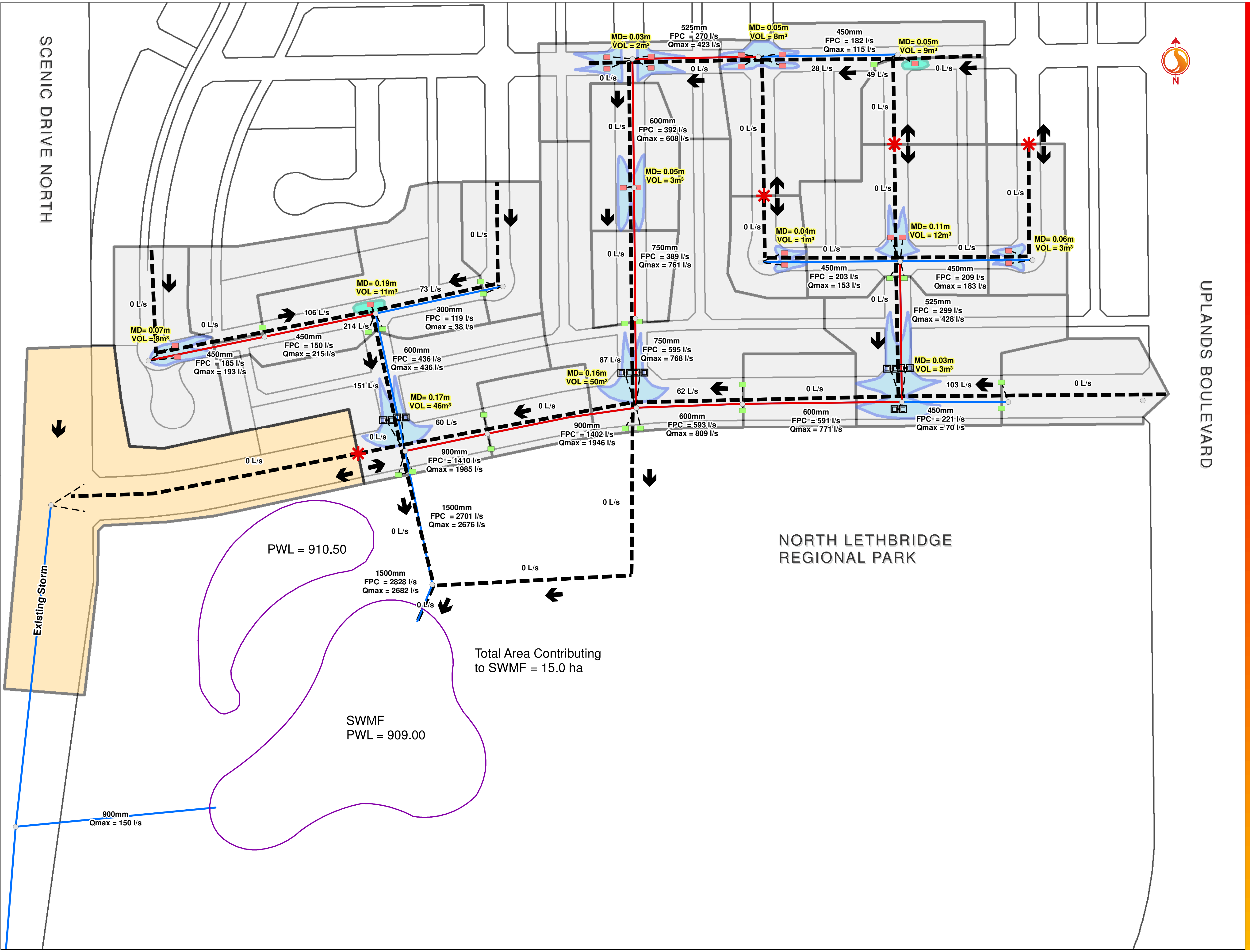
BALCKWOLF STAGE 2
OLP
Lethbridge AB, Canada

Title

MINOR SYSTEM
1:5 YEAR PERFORMANCE

Project No.	Scale
112945510	0 15 30 45 60 m

Drawing No.	Issue/Revision
1.0	A/



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Legend

- ✱ High Point
- ○ Manholes
- 🟩 Flow By CB
- 🟥 Single CB
- ▯▯ Twin CB
- – – CB Lead
- — Surcharged Minor System Sewers
- — Minor System Sewers
- ■ ■ Major System Conveyance

Trap Low Ponding Extents @ Spill Depth

- 🟩 25yr Overland Spill
- 🟦 No Spill
- 🟧 Scenic Drive Catchment
- ▢ Subcatchments

FPC = Full Pipe Capcity
Qmax = Peak Flow
MD = Maximum Trap Low Depth
Vol = Maximum Trap Low Volume

**Note: Actual Ponding Extents for Specific Rainfall Event Not Shown*

Notes

****

FOR INFORMATION ONLY

****

Client/Project

City of Lethbridge

**BLACKWOLF STAGE 2
OLP**
Lethbridge AB, Canada

Title

**MAJOR SYSTEM
1:25 YEAR PERFORMANCE**

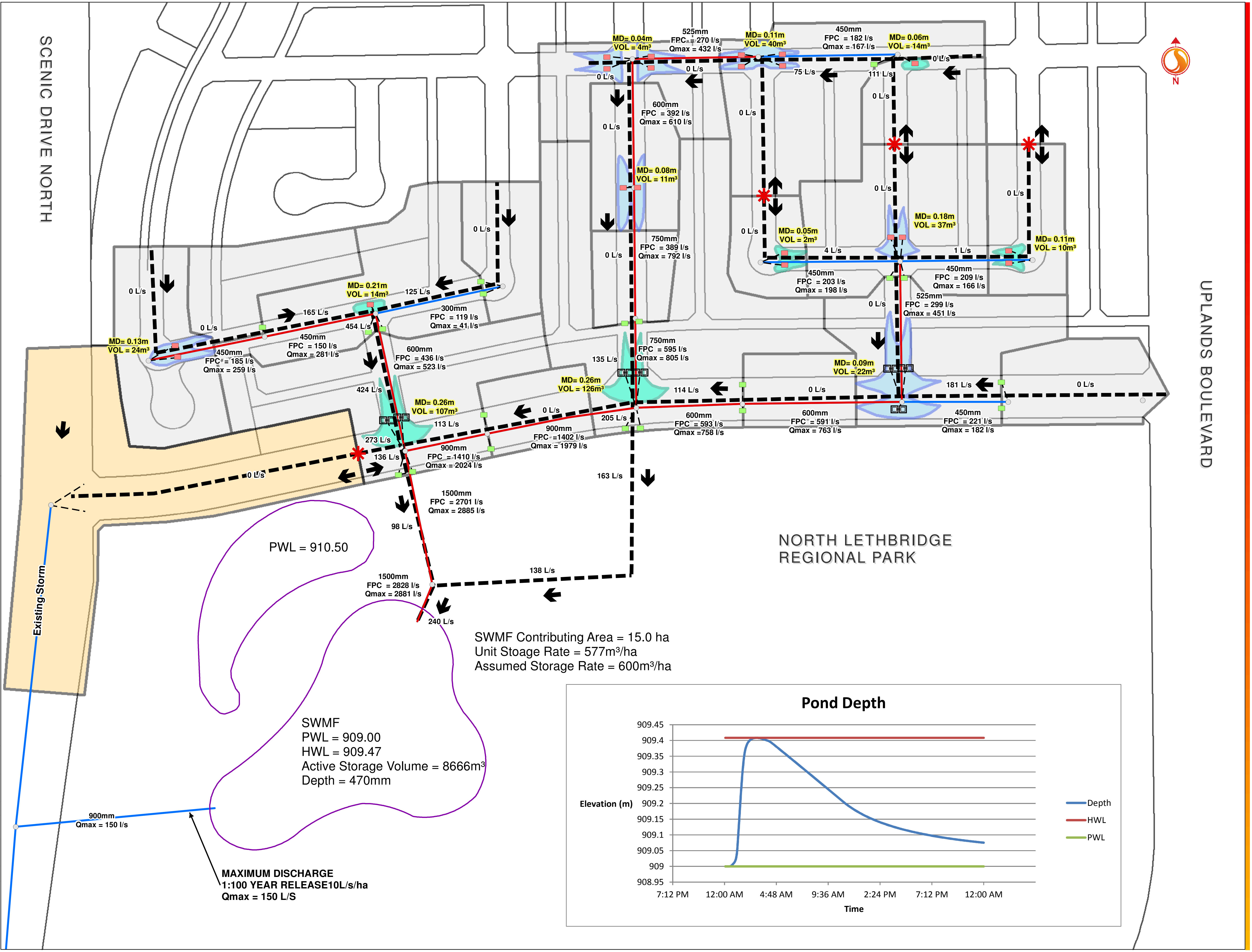
Project No.
112945510

Scale
0 15 30 45 60 m

Drawing No.
2.0

Issue/Revision
A/

Coordinate System: NAD 1983 3TM 114



SWMF Contributing Area = 15.0 ha
Unit Stoage Rate = 577m³/ha
Assumed Storage Rate = 600m³/ha

SWMF
PWL = 909.00
HWL = 909.47
Active Storage Volume = 8666m³
Depth = 470mm

MAXIMUM DISCHARGE
1:100 YEAR RELEASE10L/s/ha
Qmax = 150 L/S

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Legend

✱ High Point
🟩 Flow By CB
🟥 Single CB
▢▢ Twin CB
○ Manholes
– – CB Lead
— Surcharged Minor System Sewers
— Minor System Sewers
▬ ▬ Major System Conveyance

Trap Low Ponding Extents @ Spill Depth
🟩 100yr Overland Spill
🟦 No Spill
🟧 Scenic Drive Catchment
⬜ Subcatchments
FPC = Full Pipe Capcity
Qmax = Peak Flow
MD = Maximum Trap Low Depth
Vol = Maximum Trap Low Volume

**Note: Actual Ponding Extents for Specific Rainfall Event Not Shown*

Notes

****

FOR
INFORMATION
ONLY

****

Client/Project

CITY OF Lethbridge

BLACKWOLF STAGE 2
OLP
Lethbridge AB, Canada

Title

MAJOR SYSTEM
1:100 YEAR PERFORMANCE

Project No.
112945510

Scale
0 15 30 45 60 m

Drawing No.
3.0

Issue/Revision
A/

H

APPENDIX H

High Intensity Fire Response Analysis
City of Lethbridge

CITY OF
Lethbridge

OFFICE OF
PLANNING & DEVELOPMENT SERVICES DEPARTMENT
PLANNING SECTION
Telephone No. 320-3920

June 6, 2014

RE: Fire Response Times – Blackwolf Stage 2 Outline Plan

The above referenced Outline Plan was evaluated to determine the extent to which it is located within the fire department’s ten minute response area. This evaluation only considers what areas will or will not be within the fire department’s ten minute response area at its ultimate “build-out”.

Fire response times can increase or decrease depending on the phasing of new subdivisions and the actual construction of new road segments into an area. As such, subdivision applications submitted to the Subdivision Authority will also be assessed to verify whether the proposed lots are within the fire department’s ten minute response area.

Areas that do not fall within the fire department’s ten minute response area must address the level of fire protection that is required on exterior walls and the distance between adjacent structures, as outlined by the Alberta Building Code Sub-Sections 9.10.14 & 9.10.15.

Yours Truly,

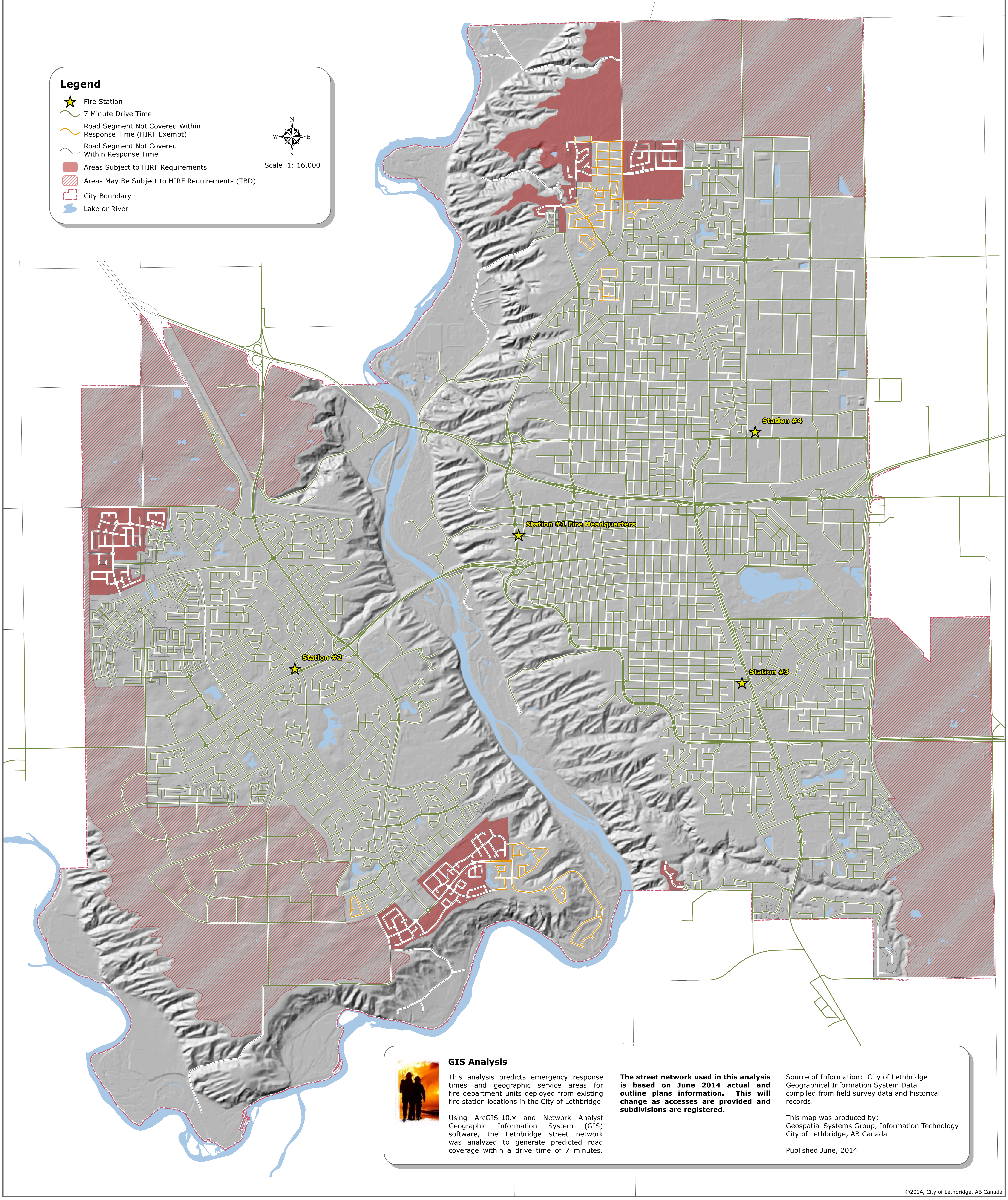
Senior Subdivision Planner
City of Lethbridge

cc. Chief, Fire and EMS
Chief, Fire Marshall
Building Safety & Inspection Services Manager

ALBERTA BUILDING CODE INTERPRETATION
HIGH INTENSITY RESIDENTIAL FIRE ANALYSIS

~ PLANNING & DEVELOPMENT DEPARTMENT ~

JUNE 2014



Legend

★ Fire Station

7 Minute Drive Time

Road Segment Not Covered Within Response Time (HIRF Exempt)

Road Segment Not Covered Within Response Time

🟥 Areas Subject to HIRF Requirements

▨ Areas May Be Subject to HIRF Requirements (TBD)

City Boundary

Lake or River

Scale 1: 16,000

GIS Analysis

This analysis predicts emergency response times and geographic service areas for fire department units deployed from existing fire station locations in the City of Lethbridge.

Using ArcGIS 10.x and Network Analyst Geographic Information System (GIS) software, the Lethbridge street network was analyzed to generate predicted road coverage within a drive time of 7 minutes.

The street network used in this analysis is based on June 2014 actual and outline plans information. This will change as accesses are provided and subdivisions are registered.

Source of Information: City of Lethbridge Geographical Information System Data compiled from field survey data and historical records.

This map was produced by:
Geospatial Systems Group, Information Technology
City of Lethbridge, AB Canada

Published June, 2014

I

APPENDIX I

Gate 1 Sign-Off

City of Lethbridge
Outline Plan – Gated Review Process
Sign-Off Template

Stantec Consulting Ltd.
Project: Lands North of Uplands
Outline Plan

Submittal Date: January 31, 2012
File: 112945510

GATE 1 – Information Gate

1. Project Team

• Developers:	City of Lethbridge Real Estate & Land Development Michael Kelly, (403) 320-3194, michael.kelly@lethbridge.ca
• Consultants:	Stantec Consulting Ltd. Chris Martino, (403) 329-3344, chris.martino@stantec.com Devin Huber, (403) 329-3344, devin.huber@stantec.com
• City of Lethbridge:	Development Review Committee (DRC) (Contact: Barry Peat (403) 320-3927, barry.peat@lethbridge.ca)

2. Confirmation of Gated Process Template

- Gated Plan/Master Servicing Plans Gated Process Template, September 25, 2008 (copy attached).

3. Authority/Permission to Proceed with Planning

- Permission to proceed with planning granted August 4, 2011, Planning & Development Services Dept.

4. Area to be Planned

- Project Limits provided on Figure 1.0 Area Context Plan as per Hardieville/Legacy Ridge/Uplands Area Structure Plan
- Project Legal Description: NW¼-17-9-21-W4M

5. Potential Connection Points

- Preliminary Transportation Network - Figure 2.5 Opportunities & Constraints
- Connection Points Sanitary - Figure 2.5 Opportunities & Constraints
- Connection Points Water - Figure 2.5 Opportunities & Constraints
- Connection Points Stormwater – Figure 2.5 Opportunities & Constraints

6. Existing Reference Plans

- Hardieville/Legacy Ridge/Uplands Area Structure Plan
- Adjacent Outline Plan: Uplands
- Adjacent Outline Plan: Legacy Ridge Stage I
- Adjacent Outline Plan: Legacy Ridge Stage II
- Adjacent Outline Plan: Legacy Ridge Stage III
- Adjacent Outline Plan: BlackWolf
- North Lethbridge Regional Park Needs Assessment, Public Engagement Study and Site Recommendation
- MDP / ICSP

7. Constraints/Opportunities

- Gas Service – high pressure line located on east side of 13th St.
- Stormwater – Need to provide drainage alignment north around Hardieville to Legacy Ridge/Hardieville storm pond (see Figure 2.5)
- School site (Holy Spirit) – possible switch to K-6 size, location to be comfirmed and may relocate to North
- Drainage coming from BlackWolf site on East needs to be addressed
- Sanitary Trunk Requirement for BlackWolf Stage 2 at South Boundary in PUL
- ROW re-alignment of 13th Street
- City of Lethbridge Public Consultation process for the Hardieville 13th Street access/ closure

8. Supporting Studies Required

- Traffic Impact Assessment (TIA) including a consideration for the effects of the proposed North Uplands road connections on existing adjacent intersections.
- Geotechnical Investigation
- Environmental Site Assessment (ESA)
- Historical Resource Impact Assessment (HRIA)

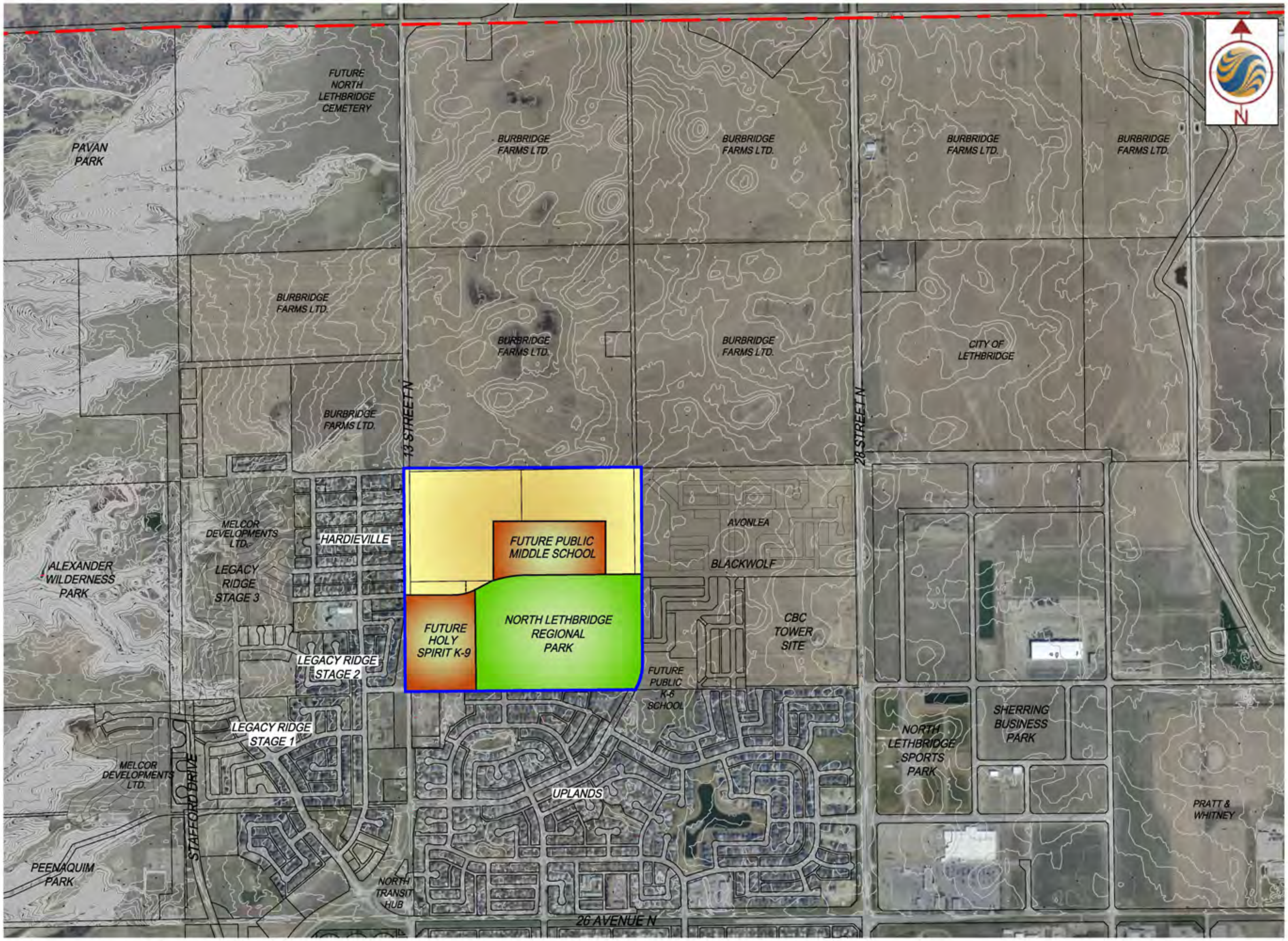
9. Agreed Change Process

- Change to a previous gate decision must be requested
- Request must document all impacts of the change
- City to review request and determine if it is deemed either inconsequential or require more supporting analysis and the impact to subsequent gate approvals

10. Schedule/Timelines

Gate #1 – Information Gate	January 31, 2012
Gate #2 – Preliminary Land Use Gate	April 30, 2012
Gate #3 – Initial Concept Gate	July 30, 2012
Gate #4 – Draft Plan Gate	September 30, 2012
Gate #5 – Final Document Gate	October 30, 2012
MPC/Council Submission	November 30, 2012

Gate 1 Sign-Off	City of Lethbridge	Barry Peat Print Name	February 2, 2012 Date
Gate 1 Sign-Off	City of Lethbridge (RELD)	Michaël Kelly Print Name	Jan 31, 2012 Date



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2011-12-15 02:08PM By: amcnamara

Stantec

Legend

- Proposed Outline Plan Boundary
- City of Lethbridge Boundary

0 200 600 1000m

1:20000

112945510

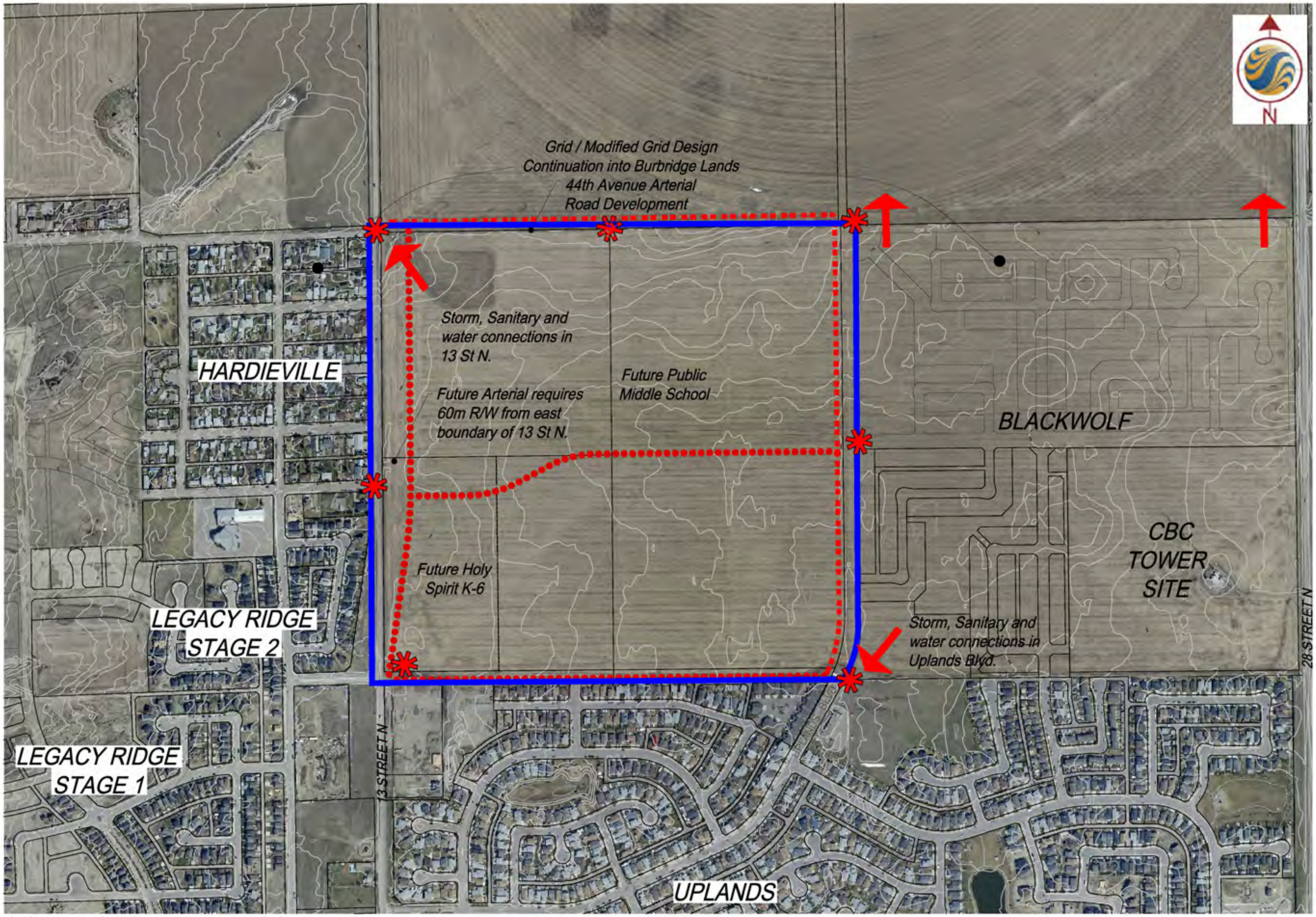
Client/Project

City of Lethbridge - RELD

Lands North of Uplands
Outline Plan

Figure No.
1.0

Title
Area Context Plan



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2011-08-08 03:02PM By: cmartino

Stantec

1:10000 0 100 300 500m

Notes:

~ *Historical & Interpretive Themes Could Assist in the 3 School Sites & Regional Park*

Legend

━ Proposed Outline Plan Boundary
┈ Pedestrian & Bikeway Routes
╍ Local Pathway
✱ Excellent Access Points for Pedestrian & Traffic Circulation
← Natural Drainage

112945510

Client/Project

City of Lethbridge - RELD

Lands North of Uplands
Outline Plan

Figure No.
2.5

Title

Opportunities & Constraints

J

APPENDIX J

Gate 2 Sign-Off

City of Lethbridge
Outline Plan – Gated Review Process
Sign-Off Template

Stantec Consulting Ltd.
Project: BlackWolf Stage 2 OLP
Submittal Date: October, 2012

GATE 2 – Preliminary Land Use

File: 112945510

1. **Confirmation of Previous Gate**
   - Gate 1 completed and signed off on February 2, 2012
2. **Public Consultation**
   - The public consultation component will be a one night Open House held after formal approval of Gate 3
3. **Developer's Vision**
   - The vision of BlackWolf Stage 2 will confirm continuity of the vision established in the BlackWolf Stage 1 Outline Plan as well as endeavor to complement the North Regional Park and surrounding community.
4. **Concept Land Use**
   - Figure 2.0 Land Use Concept
   - Figure 3.0 Site Constraints
5. **Conceptual Open Space Layout**
   - Figure 2.0 Land Use Concept
6. **Conceptual Road Network**
   - Figure 2.0 Land Use Concept
7. **Conceptual Zoning District**
   - Figure 2.0 Land Use Concept
8. **Conformance to Governing Documents**
   - Area Structure Plan: Hardieville/ Legacy Ridge/Uplands Area Structure Plan
   - Adjacent Outline Plans: Uplands, Legacy Ridge Stage I, Legacy Ridge Stage II, Legacy Ridge Stage III, and BlackWolf
9. **Infrastructure Design Basis Memorandum**
   - As proposed in Gate 1, the Infrastructure Design Basis Memorandum will set the framework for future analysis

Gate 2 Sign-Off ____________ Maureen Goehring Nov 16/12
City of Lethbridge — Print Name — Date
-see accompanying letter of Nov16/12

Gate 2 Sign-Off ____________ Michael Kelly Dec 19. 2012
Real Estate and Land Development — Print Name — Date

Stantec

Stantec Consulting Ltd.
290-220 4th Street South
Lethbridge AB T1J 4J7
Tel: (403) 329-3344
Fax: (403) 328-0664

October 25, 2012
File: 112945510

City of Lethbridge
Development Services
910 – 4th Avenue South,
Lethbridge, Alberta
T1J 0P6

Attention: **Maureen Gaehring,**
Community Planning Manager

Dear Ms. Gaehring:

RE: Lands North of Uplands Outline Plan – Gate 2 Submission – Revision 2

Further to DRC's comments as outlined in your letter of September 14, 2012, (attached) please see our submission below that we have prepared for your consideration.

Transportation

- Marmot Road N exists in the Uplands subdivision and dead ends at the south boundary of the regional park. This roadway should be identified in the outline plan as being closed; converting it to a walkway ***Revised on Figure 3.0 as requested.***

Underground Utilities

- Please see attached LNOU topo map showing overland storm catchment boundaries. Figure 5 should more closely resemble these boundaries. ***Revised as requested.***

- Section titled Design Assumptions; last sentence in last paragraph, please change 800m³/ha to 1000m³/ha and remove the rest of the sentence after the comma. ***Revised as requested.***

- Drainage from perimeter roadways must be accounted for in this plan. ***Agreed, and this was included on page 1 of the Design Memo.***

Planning

- The swing site is too large and there is not sufficient explanation even at this level to identify potential uses. ***The swing site has been removed.***
- Please clarify the use of the swing site in light of recent events with both school authorities in regards to school sitting on the north side. ***The swing site was originally to provide a 6.50ha parcel for a school site. As per the recent events with both school boards the use has been adjusted to single family as seen on the revised Figure 2.0.***

- Please review the Gate one comment for Figure 1and revise this figure. ***Figure 1.0 has been revised to reflect recent events with both school authorities as requested.***

RE: Lands North of Uplands - Outline Plan – Gate 2 Submission – Revision 2

- The plan needs a suitable name, has the developer anything in mind? ***The Lands North of Uplands will be titled "BlackWolf Stage 2". This is consistent with the area context and the adjacent developments.***

Parks

- Figure 2; to improve connectivity with the regional park, the north wet pond should be aligned in a north south configuration adjacent to the future Scenic Dr. ***The Current land use layout demonstrates excellent pedestrian connectivity from all directions, West, North and East. The connectivity will be evident in Gate 3. To optimize lot layout efficiency and existing topography we need to leave the wet pond aligned with the future 44th Avenue Arterial Road. Future Scenic Drive will be developed to a City Standard and it will provide great pedestrian connectivity.***

- Figure 2; please remove the pathways from the regional park to avoid confusion with the park designs' walkway layout. ***Figure 2.0 has been revised as requested.***

Trusting that we have met your requirements for Gate 2, included with our submission is a request for Gate 2 Sign-Off. Should you have any questions or concerns, please do not hesitate to call.

Sincerely,
STANTEC CONSULTING LTD.

Devin Huber

Devin Huber, CSLA, ASLA
Planning & Landscape Architecture Team Lead
Tel: (403) 329-3344
Fax: (403) 328-0664
devin.huber@stantec.com

Attachment: DRC Correspondence of September 14, 2012
Lands North of Uplands Design Memo
Gate 2 Sign-off document

c. Mr. Michael Kelly, City of Lethbridge RELD
Mr. Brad Schmidtke, Stantec Consulting Ltd.

CITY OF
Lethbridge

Office of:
Planning & Development Services Department
Planning Section
Phone No. 320-3920

September 14, 2012

Stantec Consulting Ltd.
Lethbridge, AB

Attention: Devin

Dear Sir:

RE: Uplands North Outline Plan – Gate 2 Review Comments

The DRC reviewed your Gate 2 submission and has the following comments:

Transportation

- Marmot Road N exists in the Uplands subdivision and dead ends at the south boundary of the regional park. This roadway should be identified in the outline plan as being closed; converting it to a walkway.

Underground Utilities

- Please see attached LNOU topo map showing overland storm catchment boundaries. Figure 5 should more closely resemble these boundaries.
- Section titled Design Assumptions; last sentence in last paragraph, please change 800m^3/ha to 1000m^3/ha and remove the rest of the sentence after the comma.
- Drainage from perimeter roadways must be accounted for in this plan.

Planning

- The swing site is too large and there is not sufficient explanation even at this level to identify potential uses.
- Please clarify the use of the swing site in light of recent events with both school authorities in regards to school sitting on the north side.

- Please review the Gate one comment for Figure 1and revise this figure.
- The plan are needs a suitable name, has the developer anything in mind?

Parks

- Figure 2; to improve connectivity with the regional park, the north wet pond should be aligned in a north south configuration adjacent to the future Scenic Dr.
- Figure 2; please remove the pathways from the regional park to avoid confusion with the park designs' walkway layout.

Please amend the Gate 2 submission as noted and resubmit to DRC for review.

Yours truly,

Barry Peat
Development Review Committee
City of Lethbridge

DESIGN BASIS MEMORANDUM

BlackWolf Stage 2 - Outline Plan

Gate 2 Submission
File: 112945510
October, 2012

INTRODUCTION

The BlackWolf Stage 2 Outline Plan development boundary is located in North Lethbridge, north of the existing community of Uplands, west of the BlackWolf Stage 1 community, east of future Scenic Drive North and south of future 44th Avenue North. Refer to ***Figure 1.0 Area Context Plan***. The site is comprised of approximately 57.34 ha (141.7 acres) excluding arterial road right of ways.

The purpose of our Design Basis Memorandum is to:

- Identify key site constraints and opportunities
- Identify Stantec's design assumptions that will be used as a basis for more detailed analysis

It is anticipated that this will allow us to make any necessary corrections in a more efficient manner prior to the development of more detailed documents in Gates 3 and 4.

SITE TOPOGRAPHY AND GRADING

The BlackWolf Stage 2 Outline Plan site drains from a plateau area (El. 916.50 – 917.00) to the north, north-west and west. Existing drainage flows to natural low areas as indicated on ***Figure 2.0 Land Use Concept***. The maximum elevation difference on the site is approximately 6.5 metres. Refer to ***Figure 3.0 Site Constraints***. Special consideration with regard to existing drainage will need to be considered along the existing 13 Street right of way, BlackWolf Stage 1 and Uplands development boundary.

Site grading designs will attempt to match existing terrain as much as possible in order to reduce excessive earthwork quantities and maintain grades/drainage around existing properties, roadways and infrastructure.

TRANSPORTATION

BACKGROUND INFORMATION

Access points have been defined by Uplands, BlackWolf Stage 1 and the Hardieville Accesses Management Study and further refined as indicated on ***Figure 3.0 Site Constraints***. Access points will meet City of Lethbridge requirements with regard to intersection spacing for arterial roads.

DESIGN ASSUMPTIONS

Drainage will be accommodated by internal storm water management facilities up to the centerline of the adjacent arterial road; drainage will be considered from beyond the centerline.

A meeting will be scheduled with Transportation to discuss preliminary road grading plans for 13th Street, 44th Avenue and Upland Boulevard adjacent to BlackWolf Stage 1 during Gate 3.

Land Use	Peak Period	Total Trip Ends (trips/du)	Inbound (trips/du)	Outbound (trips/du)
Low Density Residential (xxx units)	AM (PM)	0.77 (1.02)	0.20 (0.65)	0.57 (0.37)
Medium Density Residential (xxx units)	AM (PM)	0.75 (0.92)	0.22 (0.56)	0.53 (0.36)
Elementary school site (ITE code 522, per student)	AM (PM)	0.42 (0.28)	0.23 (0.13)	0.19 (0.15)

WATER DISTRIBUTION SYSTEM

BACKGROUND

The servicing of BlackWolf Stage 2 from the perspective of treated water, will be supported by connections to existing waterlines along 13th Street, along the north boundary of Uplands and an existing Uplands Boulevard water stub.

DESIGN ASSUMPTIONS

The servicing of BlackWolf Stage 2 from the perspective of treated water, will be supported by connections to existing waterlines along 13th Street, along the north boundary of Uplands and an existing Uplands Boulevard water stub.

The following acceptable delivery pressures are stated in the City of Lethbridge Design Standards, Level of Service Objectives:

- No less than 310 kPa (45 psi) during Peak Hour Demand
- No less than 345 kPa (50 psi) at Maximum Day Demand
- Maximum Delivery Pressure will not exceed 620 kPa (90 psi)
- Average Day Demand (ADD) = 415L/Cap/day
- Maximum Day Demand (MDD) = 2.2 x ADD
- Peak Hour Demand (PHD) = 3.5 x ADD

The development will be flanked on all sides by major distribution lines along arterial right of ways. Internal distribution networks will be grid style systems that allow for water looping during development phasing.

SANITARY COLLECTION SYSTEM

BACKGROUND

Currently, the BlackWolf Stage 2 Outline Plan Area has two possible sanitary sewer connection points.

The first is located at the termination of Uplands Boulevard North in the SW corner of Blackwolf Stage 1. This 675mm diameter storm sewer is installed at a depth of approximately 7-8m and currently services Blackwolf Stage 1 and Uplands. Flows from the Sherring Industrial Park area are currently bypassing the Uplands Blvd gravity trunk via a forcemain along the north boundary of Uplands to 13th Street. However, it is anticipated that future contributions from Sherring might utilize this sewer connection. Further discussion with City of Lethbridge Infrastructure during Gate 3 will be required to determine if a portion of the BlackWolf Stage 2 can drain its sewage to the Uplands Boulevard location. Specifically, the residential areas proposed along Uplands Boulevard and the SE quadrant of our OLP Area.

The second connection point for the BlackWolf Stage 2 has been identified on 13th Street and 40th Avenue. This 750mm sanitary sewer is installed at a depth of approximately 9-10m. This sewer currently receives sewage from the Sherring Industrial Park forcemain. The City of

Lethbridge has indicated that this sewer has the capacity to receive sewage from approximately 429Ha of undeveloped land which is well above the residential area within our OLP boundary. Given the depth of the installation of the sewer, servicing of the LNOU area can be completed with a gravity sewer from 13th Street. However, depending on planned development staging, the most practical servicing of the SE quadrant of the development would be from Uplands Boulevard. ***Figure 4.0 Sanitary Sewer Connections/Sewer Shed*** indicates future connection points and possible sewersheds.

We look forward to finalizing a servicing strategy for BlackWolf Stage 2 during Gate 3 development.

DESIGN ASSUMPTIONS

City of Lethbridge Design Standards for residential flows will be used for analysis.

Dry Weather Flow: 500L/cap/day
Wet Weather Flow: 400L/cap/day
Infiltration: 150L/cap/day
Harmon's Peaking Factor: [14/ (4+ P)] +1

POPULATION ASSUMPTIONS

Gate 3 Land Use Planning and population statistics will provide details of population densities per land use area. For the purpose of determining sanitary sewage generation, we will assume the total population of the development divided by a Gross Development Area excluding arterial roads to arrive at a density of people/ha. We have reviewed the analysis of the 6.5ha school site based on City of Lethbridge Standards. We anticipate that analyzing the school site based on our assumed population density will yield a similar or slightly higher sewage generation rate than if the site were analyzed as a school site. Therefore, for simplicity, the school site will be attributed a population weighting based on our defined density.

STORM WATER MANAGEMENT

BACKGROUND

Where practical, catchment boundaries will be defined by natural topography in an effort to minimize excessive earthwork; these boundaries will extend to the centerline of the adjacent arterial roadways thereby allowing for the combined control of runoff from the development and arterial roads.

Currently, the BlackWolf Stage 2 Outline Plan Area has two possible storm sewer connection points.

The first is located at the termination of Uplands Boulevard North in the SW corner of Blackwolf Stage 1. This 1500mm diameter sewer has been designed based upon a 1.6L/s/ha release rate. City Infrastructure is currently reviewing the ultimate catchment to this sewer based on previous master servicing plans. The second connection point for the Lands North of Uplands has been identified on 13th Street and 40th Avenue. The residual capacity of this line will need to be determined by City of Lethbridge Infrastructure. Based on the depth of 1200mm diameter storm line, Stantec anticipates that the balance of the BlackWolf Stage 2 can be serviced from this location. Stantec proposes to discuss and finalize with City Infrastructure the North Uplands drainage boundaries and their respective connection points during Gate 3. ***Figure 5.0 Storm Water Management and Connections*** outlines preliminary catchment boundaries and proposed connection points.

DESIGN ASSUMPTIONS

As specified in the City of Lethbridge 2011 Design Standards, storm water ponds must be designed to fully accommodate runoff from the 1:100 year, 24 hour rain event.

With regard to pond discharge, it is anticipated that the regional park wet pond will discharge flow to the Uplands Boulevard storm sewer, and the northwest wet pond will discharge flow to the 13th Street storm sewer. All ponds will be serviced by a minor storm sewer system sized for the 1:5 year rainfall event.

Overland flow routes are to be designed to convey the 1:100 year storm event and not exceed Alberta Environment guidelines for safe velocities and depths. Overland flow routes will incorporate trapped lows at strategic locations. Trapped low areas will:

- Increase surface run-off capture
- Provide for energy dissipation during extreme rain fall events (“stilling” basins)
- Allow for the practical creation of overland flow routes given localized topographical constraints
- Meet City of Lethbridge design guidelines for maximum depth of 300mm.

In addition to the above, overland flow within a drainage boundary will be proportioned in a way that evenly distributes the flow routes throughout the drainage boundary. Special attention at the detailed design stage may be required where two intersecting overland flow routes meet. Where possible, this point of intersection will occur in close proximity to a storm water management facility.

Emergency Overland Flow Routes beyond the 1:100 year event could be implemented at the northwest corner of the development. For planning purposes, ponds will be designed to accommodate 1000m^3/ha.

SHALLOW UTILITIES

ATCO PIPELINES

An existing ATCO high pressure gas line is currently installed along the east side of the 13th Street R/W. Based on the ultimate development of 13th Street to a 75m R/W, these existing facilities will be located just west of the new R/W centerline. Two options that are available to the ultimate development of this R/W are the accommodation of ATCO Pipelines Infrastructure, or the relocation of the infrastructure. During Gate 3, Stantec proposes to open up a dialogue with City Transportation and Planning to discuss the preferred development strategy around this infrastructure.

ATCO GAS

It is anticipated that the existing ATCO gas facilities will be relocated and integrated into the community at the subdivision detailed design stage.

TELUS

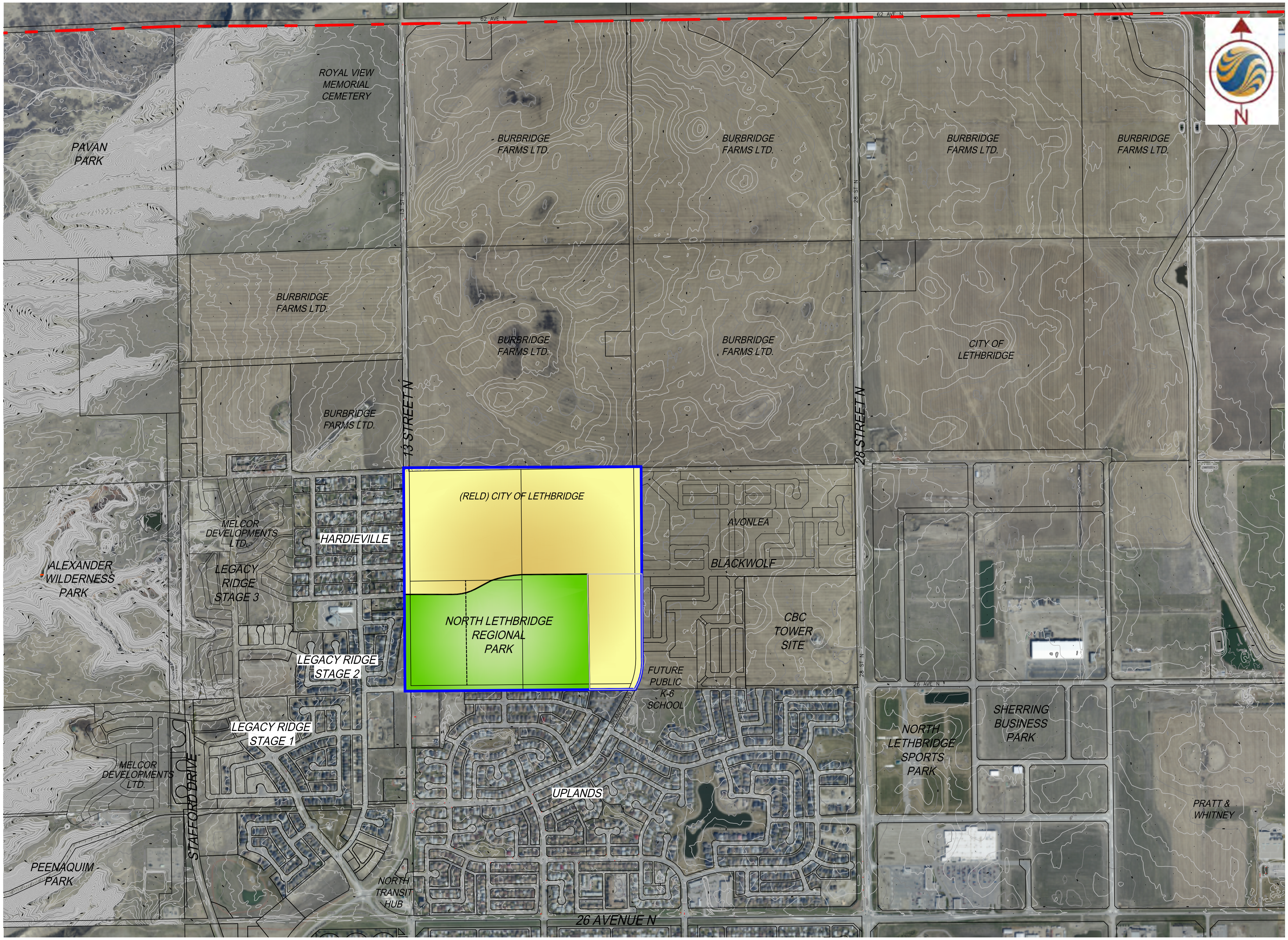
It is anticipated that the existing Telus facilities will be relocated and integrated into the community at the subdivision detailed design stage. Telus has indicated that they may require a line assignment along the north boundary of Uplands.

SHAW

Shaw has indicated that they may require a line assignment along the north boundary of Uplands.

FORTIS

It is anticipated that the existing Fortis facilities will be relocated and integrated into the community at the subdivision detailed design stage by the City of Lethbridge and their Electrical Department.



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Legend

▬	Proposed Outline Plan Boundary
– – –	City of Lethbridge Boundary

0 200 600 1000m
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112945510

Client/Project

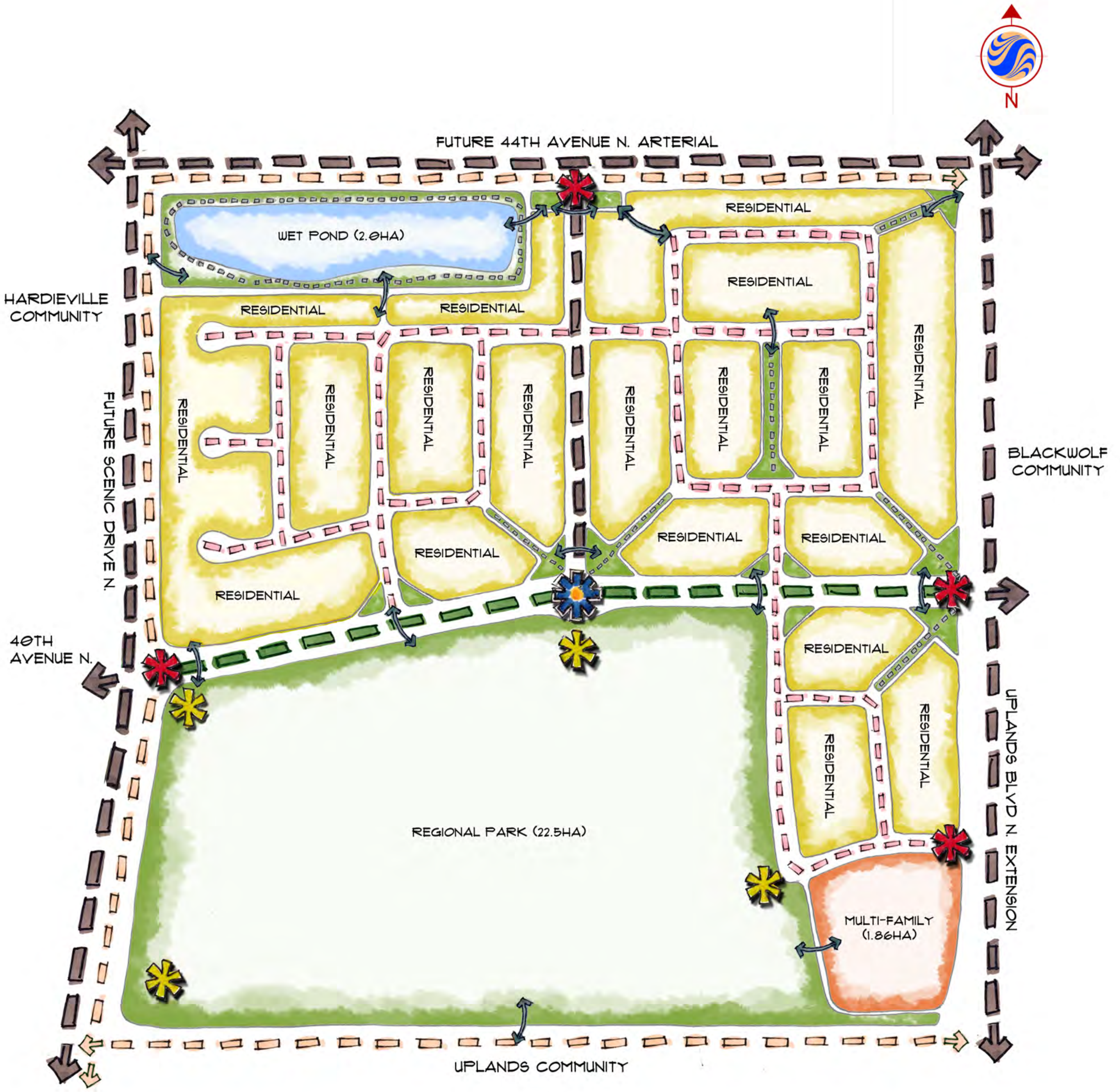
City of Lethbridge - RELD

BlackWolf - Stage 2
Outline Plan

Figure No.
1.0

Title

Area Context Plan



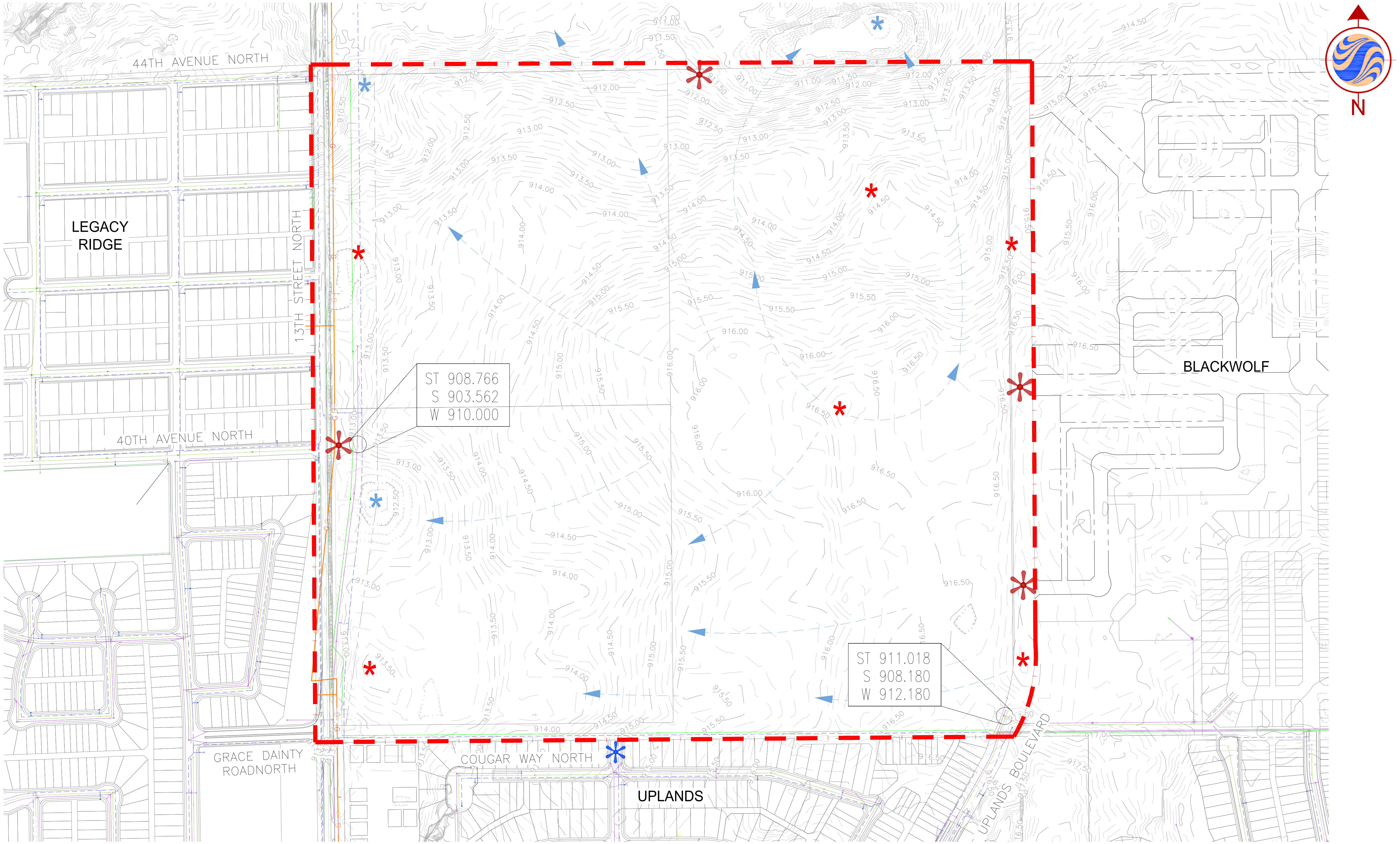
BLACKWOLF STAGE 2 - LAND USE LAYOUT

FIGURE 2.0 - SCALE NTS
OCTOBER 2012

LEGEND:

- ▬ ▬ MAJOR VEHICULAR CIRCULATION
- ▬ ▬ TREE LINED BOULEVARD & MEDIAN PARKWAY
- ▭ ▭ ▭ FUTURE REGIONAL PATHWAY
- ▭ ▭ ▭ RESIDENTIAL VEHICULAR CIRCULATION
- ▫▫▫▫▫ LOCAL CONNECTOR PATHWAY
- ↔ PEDESTRIAN CONNECTIONS
- ✱ CENTRAL WAY FINDING ROUNDABOUT
- ✱ GATEWAY TO COMMUNITY
- ✱ GATEWAY TO REGIONAL PARK

PRELIMINARY
FOR DISCUSSION ONLY



NTS

October 2012
112945510

Legend

— — —	Copperwood Stage 2 Boundary
——	Existing Sanitary Sewer
——	Existing Sanitary Forcemain
——	Existing Storm Sewer
- - - -	Existing Water Line
—— G ——	High Pressured Gas Line
◄ - - - -	Overland Flow & Spill Direction
*	High Point
*	Low Point
✱	Transportation Access Point
✱	Dead end of Marmot Road North to be closed & converted into walkway access

Stantec

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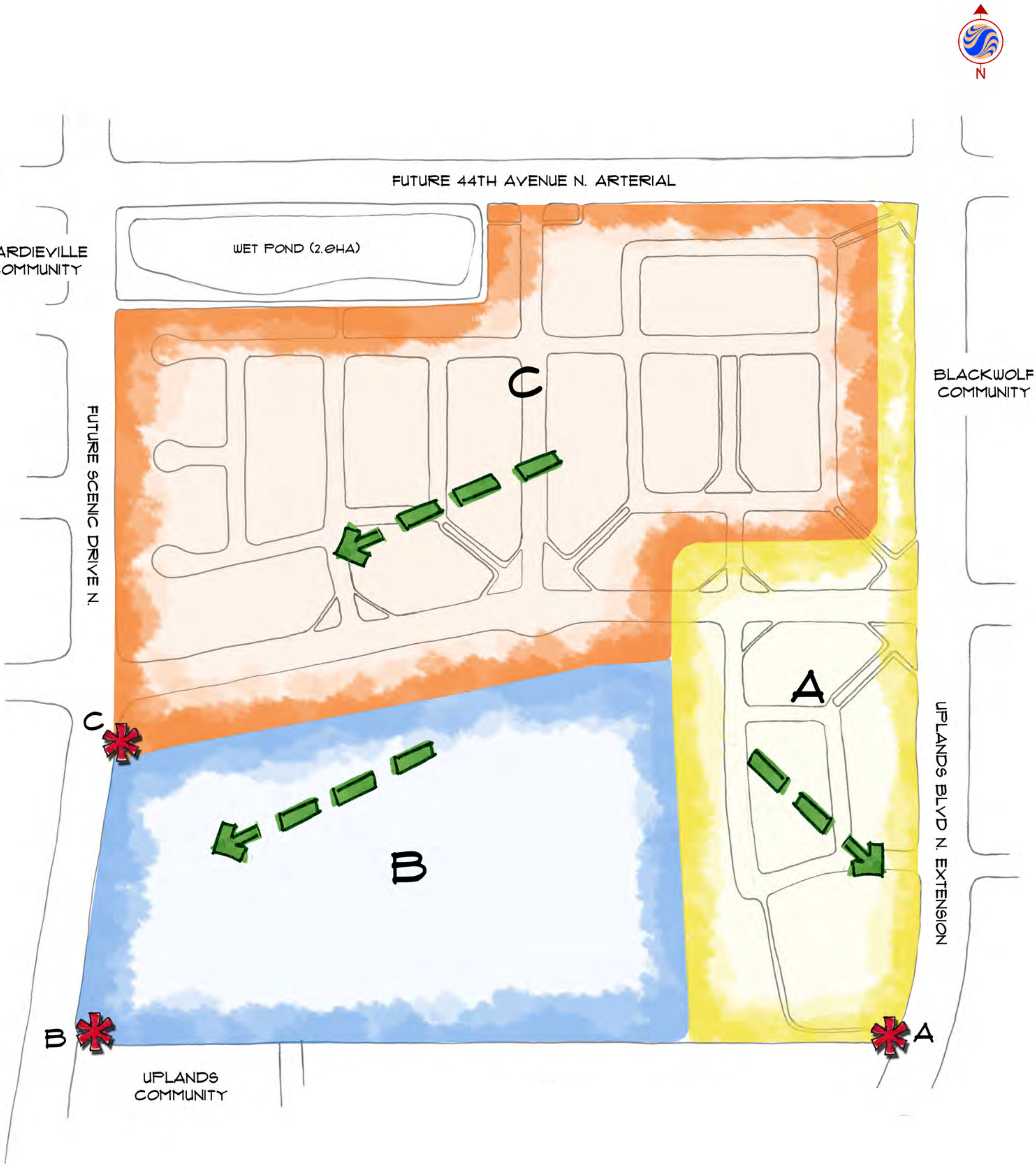
10/23/2012 8:46:43 AM By: mcnamara, amanda

Client/Project
City of Lethbridge RELD
BlackWolf - Stage 2
Outline Plan

Figure No.
3.0

Title
Site Constraints



BLACKWOLF STAGE 2 – SANITARY SEWER CONNECTIONS / SEWER SHED

FIGURE 4.0 – SCALE NTS
OCTOBER 2012

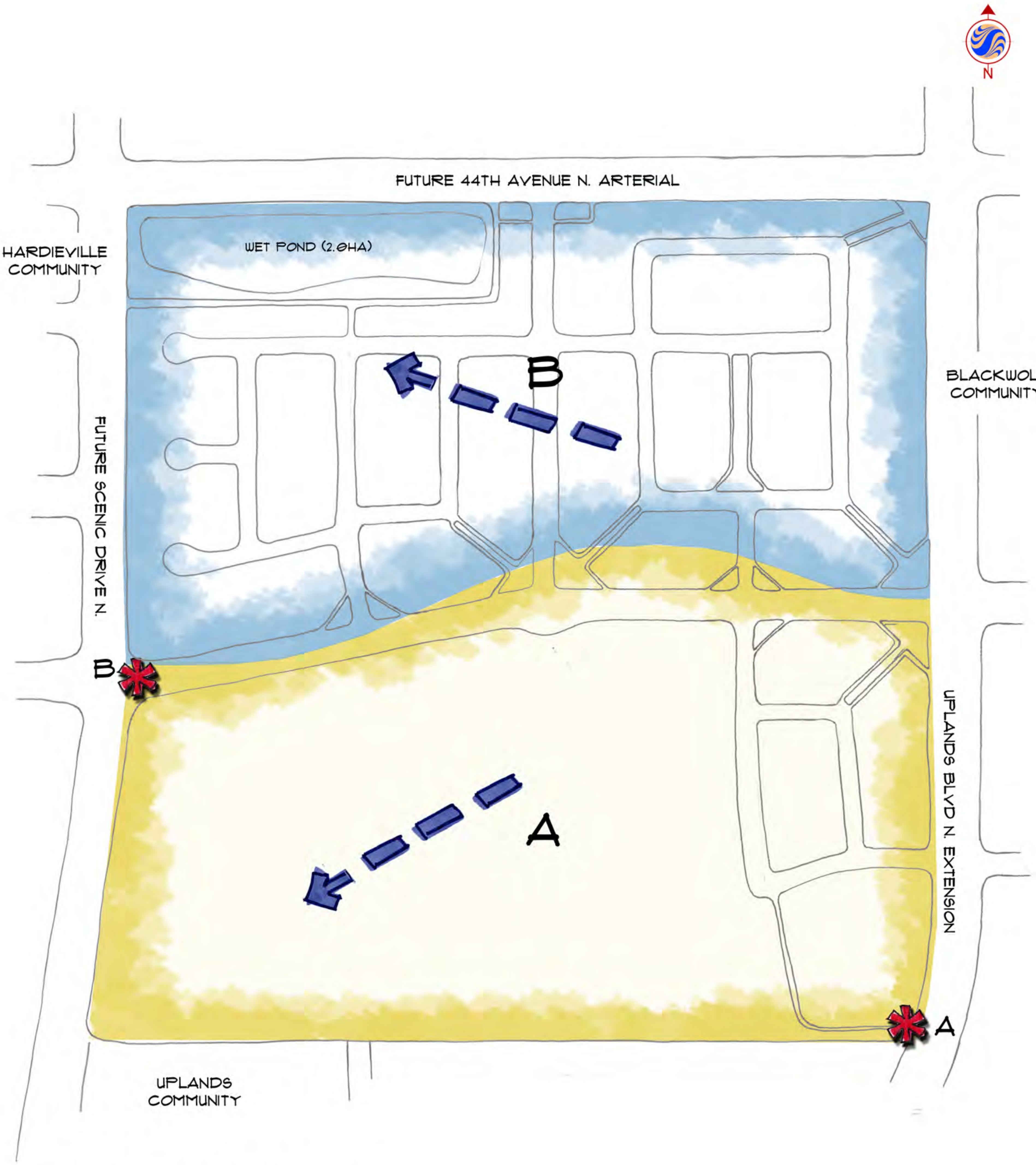
LEGEND:

✱ SANITARY SEWER CONNECTION POINT

▨ CONCEPTUAL SEWERSHED BOUNDARY

⇠ FLOW DIRECTION

PRELIMINARY
FOR DISCUSSION ONLY



BLACKWOLF STAGE 2 – STORM WATER MANAGEMENT AND CONNECTIONS

FIGURE 5.0 – SCALE NTS
OCTOBER 2012

LEGEND:

✱	STORM SEWER CONNECTION POINT
▨	CONCEPTUAL DRAINAGE BOUNDARY
← ▬ ▬	OVERLAND FLOW DIRECTION

PRELIMINARY
FOR DISCUSSION ONLY

K

APPENDIX K

Gate 3 Sign-Off

City of Lethbridge
Outline Plan – Gated Review Process
Sign-Off Template

Stantec Consulting Ltd.
Project: BlackWolf Stage 2
Submittal Date: December 20, 2013

GATE 3 – Initial Concept

File: 112945510

Stantec

1. **Confirm Previous Gate**
    - Gate 2 completed and signed off on November 16, 2012

2. **Refined Land Use Plan**
    - Figure 2.1 Area Context Plan
    - Figure 2.2 Neighbourhood Context Plan
    - Figure 2.3 Site Constraints
    - Figure 6.1 Open Space Network
    - Figure 7.1 Proposed Land Use Designations
    - Table 7.,1 Land Use Summary and Statistics

3. **Transportation Network Layout and Preliminary Road Classifications**
    - Figure 9.1 Preliminary Transportation Network
    - Figure 9.2 13th Street Arterial Existing Cross Section
    - Figure 9.3 13th Street Arterial Proposed Cross Section

4. **Contributing Areas**
    - Figure 11.1 Water Servicing & Connection Points
    - Figure 11.2 Sanitary Servicing & Connection Points
    - Figure 11.3 Stormwater Management & Connection Points

5. **Infrastructure and Transportation Connection Point Details**
    - Figure 6.1 Open Space Network
    - Figure 9.1 Preliminary Transportation Network
    - Figure 9.3 13th Street Arterial Proposed Cross Section
    - Figure 11.1 Water Servicing & Connection Points
    - Figure 11.2 Sanitary Servicing & Connection Points
    - Figure 11.3 Stormwater Management & Connection Points

6. **Preliminary Sewage Generation, Storm Pond Size, Storm Overland Routes**
    - Figure 11.1 Water Servicing & Connection Points
    - Figure 11.2 Sanitary Servicing & Connection Points
    - Figure 11.3 Stormwater Management & Connection Points
    - Table 11.1 Estimated Water Demands
    - Table 11.2 Sanitary Sewage Flow Estimates
    - Table 11.3 Pond Statistics
    - Table 11.4 Minor & Major Storm Flows
    - Refer to Section 11.0 Site Servicing for further details

7. Future Servicing Area

- Sanitary Sewer – Future sanitary sewer extensions will be extended from Scenic Drive North
- Water – Future water distribution and looping will be from Scenic Drive North and 44th Avenue North
- Stormwater Management – Stormwater management from areas north of BlackWolf Stage 2 may be accommodated by Scenic Drive storm trunk as an interim solution. Ultimately stormwater will be managed by a future outfall for lands north of BlackWolf Stage 2

Gate 3 Sign-off ____________________ Barry Peat January 6, 2014
City of Lethbridge Print Name Date

Gate 3 Sign-off ____________________ Michael Kelly Dec 20. 2013
Real Estate and Land Development Print Name Date