Rev 0

Prepared for: 09074200 BC Ltd (Developer)

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File #: TE-2017-40

REDWATER INDUSTRIAL PARK AREA STRUCTURE PLAN (ASP)

TECKERA CIVIL ENGINEERING CONSULTANTS

#100, 18130-105 Avenue

Edmonton, Alberta T5S 2T4

Phone: 780-250-0899

Email: info@teckera.ca

www.teckera.ca

Contents

1. PURPOSE

Redwater is located 10 km's north of Alberta's Industrial Heartland and within Edmonton's regional marketplace, which is comprised of the City of Edmonton, Sturgeon County, Strathcona County, Leduc County, and Parkland County. The Town itself is in the northern portion of Sturgeon County.

Given the proximity to all these areas, Redwater is an ideal location for additional industrial opportunities. This development proposes an industrial area situated off 44st (east) and directly north of the existing industrial development; an area already zoned for this type of development within the Town's Municipal Development Plan.

With the activity surrounding the Town, there is a need for additional industrial lots to support this activity and serve as a base for services to the north.

This Area Structure Plan (ASP) is in support of such development in the Town of Redwater.

2. INTRODUCTION

This area structure plan (ASP) provides a general development framework for approximately 36.0 hectares (90 ac) of land legally described as the SW Quarter Section 29, Township 57, Range 21, West of 4th Meridian, and located northeast of the intersection of 51 Ave E and 44 St.

The proposed development is situated directly north of the Town's industrial park in the south-east sector of the Town. Based on market evaluation, there is a current need for additional lots to support local development and activities within the area.

Figures 1 and 2 highlight the location of the development.

The ASP will provide a planning framework for future redistricting (if required), subdivision, and development.

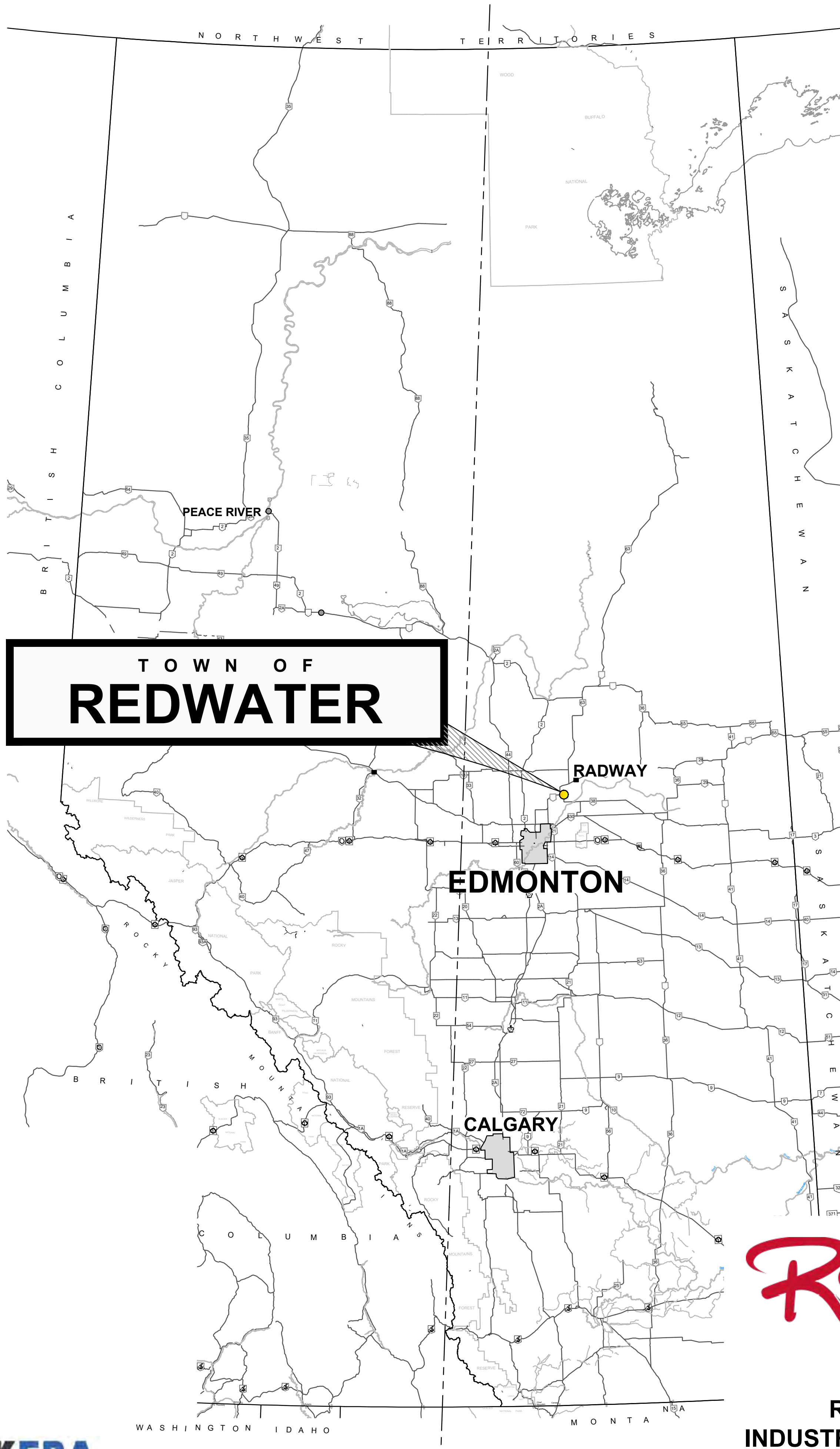
The area structure plan identifies:

- Current and Future land uses.
- External access points.
- Utility servicing concept.
- A roadway system for the plan area including future connectivity to adjacent lands

To determine project feasibility, several studies, as requested by the Town, were commissioned by the development group to support the subdivision concept. These included:

- Environmental assessment (Basin Environmental)
- Wetland assessment (Blackfly Environmental)
- Geotechnical investigation (ENC Testing)
- Traffic impact assessment (McElhanney and D&A Paulichuk Consulting Ltd)

All of these studies are contained within the appendices.



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TOWN OF Redwater A NATURAL HOME

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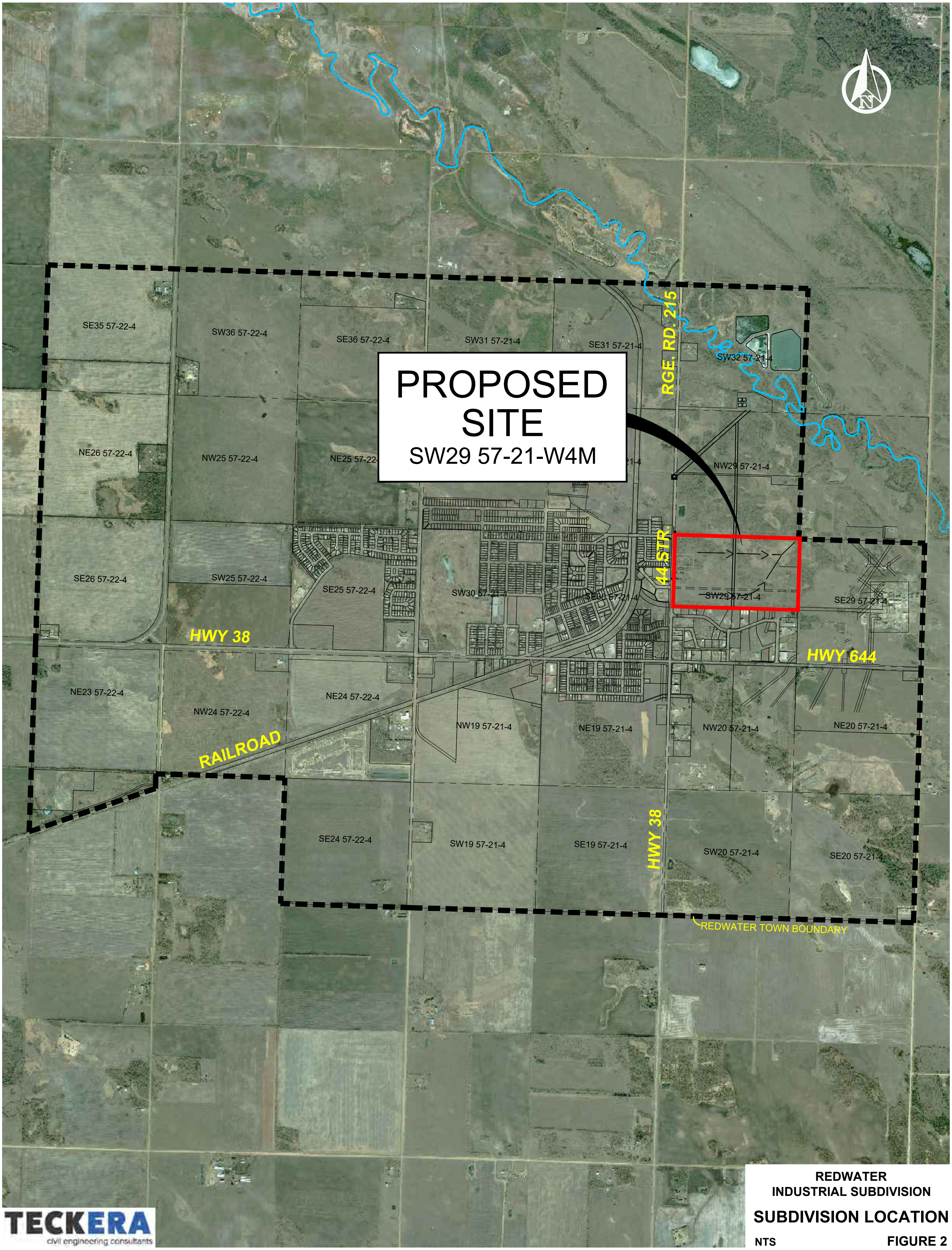
FIGURE 1



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SUBDIVISION LOCATION

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FIGURE 2

3. STATUTORY COMPLIANCE

3.1 MUNICIPAL GOVERNMENT ACT RSA

This ASP has been prepared in accordance with Section 633 of the Municipal Government Act. The Act states that an ASP is developed “for the purpose of providing a framework for subsequent subdivision and development of an area of land, a council may by bylaw adopt an area structure plan.

An area structure plan must describe:

i. the sequence of development proposed for the area,
ii. the land uses proposed for the area, either generally or with respect to specific parts of the area,
iii. the density of population proposed for the area either generally or with respect to specific parts of the area, and
iv. the general location of major transportation routes and public utilities, and
v. may contain any other matters the council considers necessary.

3.2 MUNICIPAL DEVELOPMENT PLAN

The Town of Redwater Municipal Development Plan (MDP), Bylaw No. 754, which was adopted in December 2009, is the overarching planning document that guides future growth and development within the Town of Redwater and informs all subsequent planning documents, including this Area Structure Plan (ASP). This ASP supports the policies and goals described by the MDP relative to neighborhood planning, housing, commercial development, and transportation. Specific policies of the MDP that directly influence this ASP are listed in Table 1 below.

Table 1: Municipal Development Plan Policies

MUNICIPAL DEVELOPMENT PLAN POLICIES				
#	DESCRIPTION	ADHERED TO		NOTES
		YES	NO	
6.1	**INDUSTRIAL AREAS**			
6.1.1	It is the policy of this Plan that the areas designated Industrial on the Future Land Use and Transportation Plan shall be developed in industrial uses, and that industrial development shall be directed to those lands designated Industrial.	✓		This concept adheres to the Town's future transportation and overall future development concepts
6.1.2	An "industrial area" encompassing lands east of 44th Street will be reserved for industry. This area has safe and convenient access to major arterial roadways and rail facilities.	✓		Project within allocated industrial lands
6.1.3	The Town will encourage concentrated industrial growth by directing future industrial development to the industrial area in order to minimize conflicts with neighboring land uses, to facilitate the economical provision of municipal services, and to promote an efficient industrial land use pattern.	✓		Project within allocated industrial lands
6.1.4	The Town may encourage the gradual relocation of industrial uses which are not in industrial areas to the industrial area.	✓		Project within allocated industrial lands
6.1.5	The sizing and servicing of industrial sites should reflect the requirements of a wide range of industrial activities such as construction, trucking, manufacturing and wholesaling activities, together with petrochemical-related spin-off activities such as plastics, synthetic fibers, paints, etc.	✓		The project will comprise various lot sizes to accommodate the different requirements for industrial developments
6.1.6	The Town will endeavor to ensure the most cost-effective development of land in the industrial area.	✓		Servicing design is cost effective as it services lots on both sides
6.1.7	Existing and future industrial activities in the industrial area will be protected by preventing encroachment of non-industrial uses.	✓		A MR buffer along east side of 44th Street In addition to the roadway will provide a separation between industrial and 44th Street
6.1.8	Future industrial development will demonstrate adequate fire flow capacities prior to development approval and after completion of construction to the satisfaction of the Town's Fire Department.	✓		The looping of the watermain and sizing was determined based upon the Town's current Master Servicing Agreement
6.1.9	Future industrial development within the Industrial Area will be connected to a paved road network in a manner that meets with the satisfaction of the Town's Public Works Department and the Town's engineer.	✓		This development proposes one access off of 44th Street (at 54th Ave) and one at the extension of 47th street with the provision for an internal future arterial road as per Town's transportation planning concepts
6.2	**SITE PLANNING**			

6.2.1	The visual appearance of industrial buildings, the location of roadways, landscaping and buffering will be considered in order to ensure compatibility with surrounding uses. The Town will include building and landscaping standards in its land use bylaw as a means of encouraging the development of more attractive industrial structures and improving compatibility with surrounding uses.	✓		The development will ensure adherence to the Town's requirements for aesthetics and landscaping
6.2.2	Industrial development which is adjacent to residential areas along 44th Street should have the best possible visual appearance and provide appropriate buffering measures.	✓		A MR buffer along east side of 44th Street In addition to the roadway will provide a separation between industrial and 44th Street
10.1	**TRANSPORTATION**			
10.1.2	The Town will endeavor to protect from encroachment by other uses sufficient land for future arterial road rights-of-way.	✓		This concept adheres to the Town's future transportation and development concepts
10.1.3	Control of access along sections of 48 Avenue and 44 Street, which comprise part of the Provincial Highway system (Highway #38), shall meet the requirements of Alberta Transportation.	✓		This concept adheres to the Town's future transportation and development plan. A traffic impact assessment has been prepared and has provided recommendations for any required upgrades to the affected intersections
10.1.4	Direct access to arterial roads from adjacent properties will be limited in order to emphasize the most important function of these roadways, which is to accommodate high volume traffic flows.	✓		This development proposes one access off of 44th Street (at 54th Ave) and one at the extension of 47th street with the provision for an internal future arterial road as per Town's transportation planning concepts
10.2	**MUNICIPAL SERVICES**			
10.2.1	The Town will require the provision, throughout the Town, of a reliable water supply and distribution system in terms of capacity and supply rate, an environmentally acceptable sanitary sewage collection and treatment system, and an efficient stormwater collection and management system. The provision of these systems will be funded either by senior levels of government or by new development."	✓		The internal water distribution, sanitary sewer collection and stormwater management are consistent with the Town's Master Servicing Plan to provide efficient, reliable servicing
10.2.4	Where appropriate, municipal services in new areas will be integrated with existing facilities.	✓		All services are designed to be connected to existing services from within the Town
10.2.5	The Town will require the preparation of a servicing scheme and a detailed geo-technical study prior to area structure plan or large area subdivision approval.	✓		Servicing concept has been included with this ASP along with a geotechnical investigation report
10.3	**PIPELINES**			
10.3.1	Any new subdivision near a pipeline right-of-way shall be designed in such a manner that a 15.2 m (50 ft.) setback from the nearest edge of any pipeline right-of-way to any permanent structure, may be provided on all lots adjacent to the right-of-way.	✓		Easements are proposed to address long term access to the reclaimed wellsite's (2). The existing pipelines are proposed to be removed / abandoned as the development progresses. A commitment letter from the pipeline owner to remove the pipelines is enclosed within the appendices

3.3 TOWN OF REDWATER LAND USE BYLAW N0. 811

This ASP is consistent with the Town of Redwater Land Use Bylaw No. 811 which came into effect on September 17, 2013. The subject lands are designated as Industrial (M2) District in accordance with the by-law.

4. BACKGROUND

4.1 LAND USE

The site is rectangular and is in an area currently zoned Industrial District (M2) according the Redwater Municipal Development Plan and Land Use Bylaw, consistent with the surrounding areas. The site is currently a vacant, uncultivated land with a single-family residence located in the north-west corner of the property. Two reclaimed well sites are contained within the ASP area and a series of ten abandoned and two active pipelines. These are shown within Figure 6.

Adjacent to the property:

- North of the site is similar to the subject property, comprised of vacant uncultivated land and contains a previous “nuisance grounds” in the north east extent.
- East of the site is an existing ARC Resources Redwater Gas Plant.
- South of the site is an established Industrial development, mainly comprised of multi-use services that support the oil and gas industry. It is currently the only industrial area in Redwater.
- West of the site on the west side of 44th Street is a small residential development.
- A site tagged as a previous “nuisance ground” was identified by the Town north-west of the subject property (north of 54th Ave and west of 44th street).

4.2 TOPOGRAPHY

The site is generally undeveloped land with natural drainage to the north-east as it drops off to the Redwater River, approximately 750 meters to the north. The change in elevation from the south-west corner to the north east corner of the lot is 8 meters.

A site inspection conducted on September 14th, 2017 verified that the easterly extent of the site is low and was holding water at the time, primarily due to the lack of discharge ditches to convey the water north. The north-east corner is the lowest elevation within the site and the proposed location of the stormwater management facility. This is consistent with the Town’s Master Servicing Plan Concepts.

The lands contain clusters of treed areas throughout the site with a perimeter around the existing residence on the west side.

Figure 3 highlights the site features. Figure 4 shows the area topography and features.

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EXISTING SITE FEATURES

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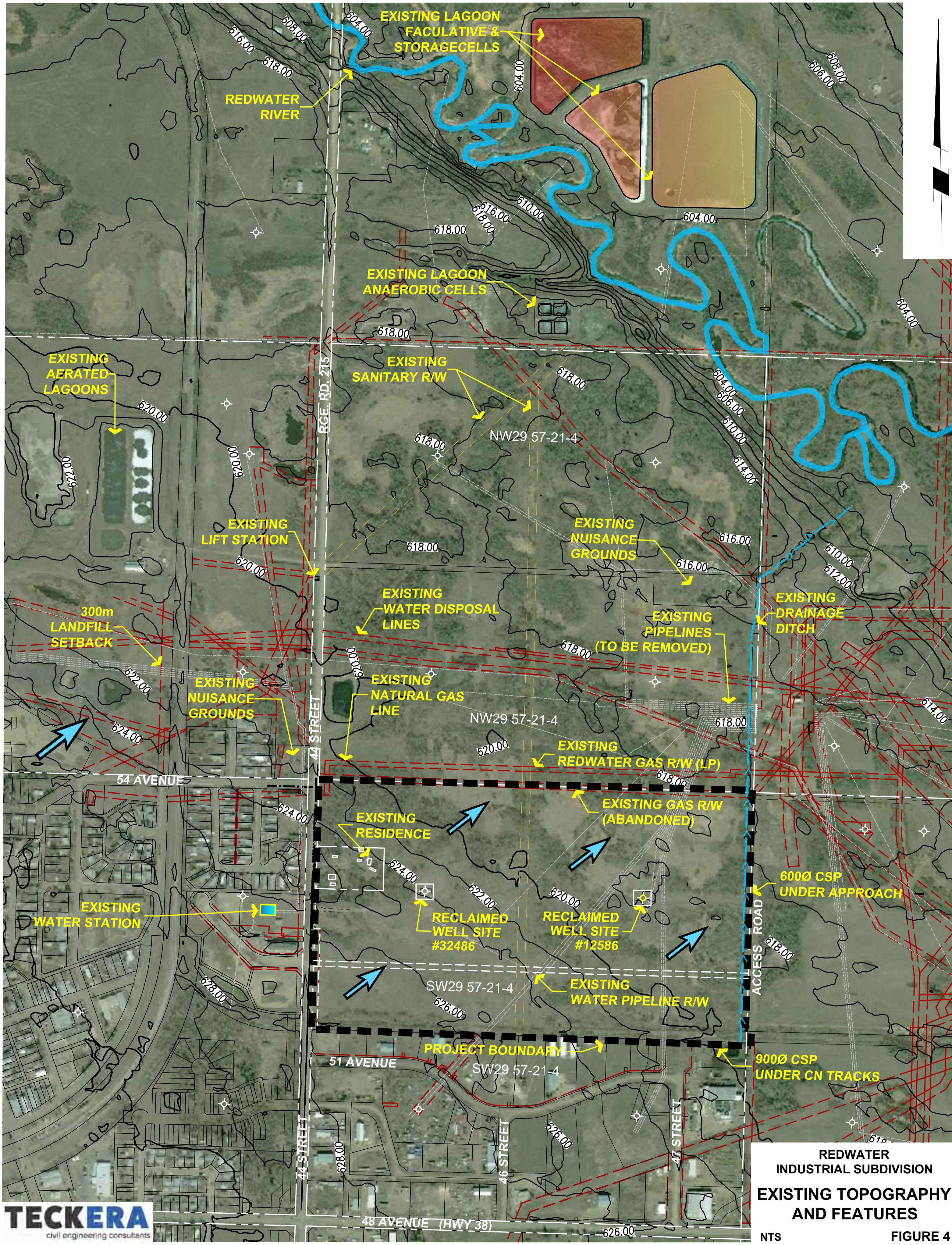
FIGURE 3



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EXISTING TOPOGRAPHY AND FEATURES

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FIGURE 4

5. STUDIES & INVESTIGATIONS

5.1 ENVIRONMENTAL ASSESSMENT

A Phase I Environmental Assessment by Basin Environmental was commissioned in August 2015 (Appendix A). The objective of the report was to identify areas of potential environmental concern with past and present activities and to determine what other investigation may be required.

The study detected the following key features:

- 2 abandoned well sites
- 9 abandoned oil pipelines

It should be noted that in addition to the features identified in the Phase I Environmental Assessment, the site also contains:

- Operating (active) - Potable water distribution line (to Arc Resources)
- Operating (active) – Natural Gas line (owned by the Town of Redwater)
- Abandoned – Natural Gas Line (owned by Town of Redwater)

For a total of 12 pipelines within the subject area shown within the section 6.2.1 table.

Methane levels were tested in the most westerly well with no anomalies identified. Reclamation certificates were issued for both well sites. As documentation was not provided (by Imperial Oil) associated with the abandonment/reclamation of the wells at the time, the author of the Phase 1 EA report had recommended a Phase II EA be completed. Based on an updated assessment completed in late 2018, an addendum letter (Appendix A) from the stated the following:

“Given the presentation of new information on the 100/05 and 100/06 oil and gas wells, Basin is issuing an addendum to the Phase I ESA completed in September 2015 stating that a Phase II ESA relating to the 100/05 and 100/06 oil and gas wells is not required at this time.”

Also, as per a letter from ARC Resources (Appendix B), ARC has committed to working with the Town and the developer to remove all portions of the pipelines that would be affected by the proposed development.

5.2 WETLAND ASSESSMENT

A Wetland Assessment was conducted by Black Fly Environmental, commencing in October 2018. The wetland assessment impact report (WAIR) of the Study Area consisted of the following:

- a review of available historical aerial photographs to determine historical wetland boundaries.
- a summary of the field assessment of the wetlands encountered on site, conducted on October 10, 2018.
- a determination of the value of the wetlands based on the field observations and the results of ABWRET-A received from Alberta Environment & Parks (AEP) on January 4, 2019 (original ABWRET -F submitted to AEP on November 27, 2018); and,
- description of the avoidance, mitigation, and replacement strategy of the project

The assessment revealed five identified Wetlands varying in size and characteristics. (See Appendix D for full details). The reports identified the potential impacts of any development on the site to the Wetlands. They are as follows:

- Alterations to wetlands resulting in change of wetland type or permanence.
- Loss of habitat for plants and animals.
- Disruption of drainage patterns within the wetland resulting in flooding and an increased potential sediment runoff; and,
- Increased abundance of noxious species in newly disturbed areas.

The report also identified the strategies to avoid or minimize potential impacts as outlined by the Alberta Wetland Mitigation Directive. They are as follows:

1. Avoidance – In this case, wetland avoidance is not practicable as the area is to be developed into an industrial park and the lands are zoned accordingly by the Town of Redwater.
2. Minimization – Disturbance to the wetlands in the long term cannot be avoided; however, the existing wetlands will be incorporated into the stormwater management system, where feasible.
3. Replacement **-** Minimization of adverse effects to the wetlands is not possible for the proposed development, and a resulting permanent loss of wetland area will occur. In lieu, fee payments will be made to offset the permanent loss of wetland, as required under AEP policy.

The proposed lot configuration has taken into consideration the large wetland that lies along the eastern part of the site and will utilize these lands for the stormwater pond or constructed wetland. This location is consistent with the Town's proposed stormwater facility as per the 2010 Master Servicing Plan.

A Water Act application for Phase 1 of the development was submitted by Blackfly Environmental in January 2019. An approval was granted in December 2019 and the developer has paid the fees associated with the wetland disturbance agreed upon by Alberta Environment and Parks.

A copy of the Wetland Assessment Impact Report is included within Appendix D.

5.3 GEOTECHICAL REPORT

A geotechnical investigation was completed by ENC Testing on January 24-25, 2019. Eleven test holes were advanced, in 1.5-meter increments, to a maximum depth of 9.1m within the proposed land area.

A continuous visual description was recorded on site, which included the soil types, depths, moistures, and other pertinent observations. Slightly disturbed samples were removed and collected at intervals of 0.75 meters from the auger for further testing at the laboratory.

Overall, the underlying soils are conducive for construction of underground utilities, roads and buildings. Most of the soils are comprised of stiff to hard clay mixed with sporadic seams of sand and silt. The lower depth clays are high plastic and will require special attention during construction to maintain soil moistures levels within an acceptable range to allow for safe installation of the deep utilities. Stabilization of the sub-grade may be required in some areas.

The water table is considered high in some areas and will need to be evaluated during construction for installation of the deep utilities (i.e. water and sewer lines). De-watering strategies will likely be required for some installations.

The developer is prepared to ensure that all development will follow the recommendations based on the results provided in the report. (See Appendix C for results and recommendations).

5.4 HISTORICAL RESOURCES

A review of the historical resource (HRV) rating for this site obtained from the department of Alberta Culture and Tourism indicated an HRV of 5, category A. This suggests that the site could contain a historical archaeological resource.

A Historical Resources Act clearance was submitted, and an approval granted. A copy of the HRA clearance letter is included in Appendix G.

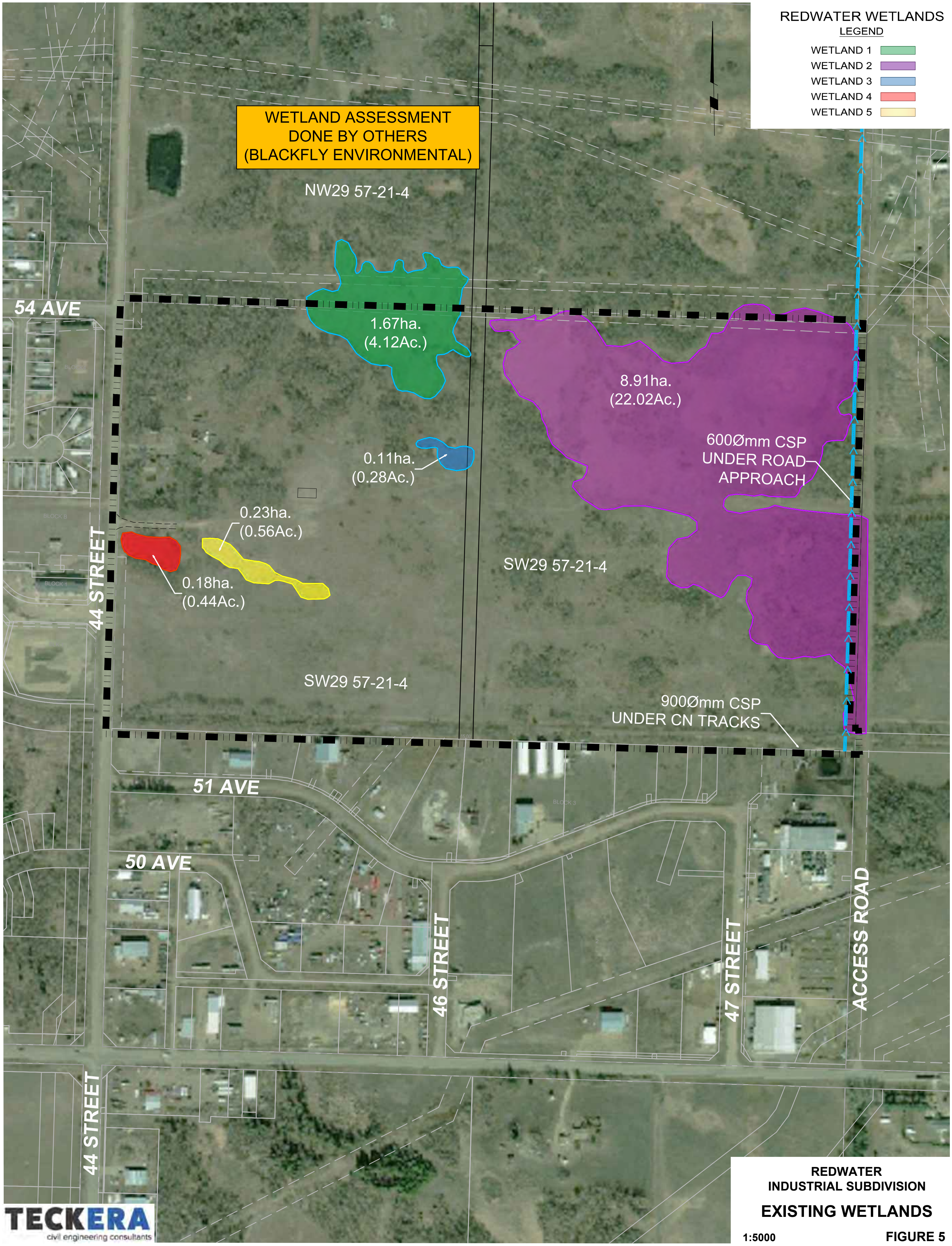
6. DEVELOPMENT CONSTRAINTS

6.1 NATURAL FEATURES

The site has significant topographical relief, which is conducive to good drainage. Due to the limited discharge features from the site currently, the easterly portion of the site hold large pockets of water as identified within the aerial imagery and as per the wetland assessment (Blackfly Environmental, Appendix D).

The development concept has been designed to avoid the large wetland along the east side in order to minimize the disturbance.

The majority of the east wetland will be utilized to house a stormwater management facility. This facility will be developed as a wet pond, as a constructed wetland or combination thereof, in consultation with Alberta Environment and in adherence to any of their requirements or directives.


REDWATER WETLANDS
LEGEND
WETLAND 1
WETLAND 2
WETLAND 3
WETLAND 4
WETLAND 5
WETLAND ASSESSMENT DONE BY OTHERS (BLACKFLY ENVIRONMENTAL)
NW29 57-21-4
54 AVE
1.67ha. (4.12Ac.)
8.91ha. (22.02Ac.)
600Ømm CSP UNDER ROAD APPROACH
0.11ha. (0.28Ac.)
0.23ha. (0.56Ac.)
0.18ha. (0.44Ac.)
SW29 57-21-4
SW29 57-21-4
44 STREET
900Ømm CSP UNDER CN TRACKS
51 AVE
50 AVE
46 STREET
47 STREET
ACCESS ROAD
44 STREET
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EXISTING WETLANDS
1:5000
FIGURE 5

6.2 MAN MADE FEATURES

6.2.1 PIPELINES

Twelve separate pipelines were identified within the site area as shown within Figure 6. They are protected via easement caveats on the title. One natural gas pipeline (north side of property) and the water supply line (east-west near middle of property) are active while the other ten pipelines are abandoned.

The table below details the particulars of each line including contents and pipe size.

PIPELINES							
License #	Location From	Location To	Length (KM)	Licensee Name	Pipeline Status	Pipeline Substance	Pipeline Size (mm) /Material
9042-1	04-29-057-21 W4M *BE*	10-29-057-21 W4M *BE*	0.98	ARC Resources Ltd.	Abandonded	Oil Well Effluent	88.9 Steel
9042-9	03-29-057-21 W4M *BE*	10-29-057-21 W4M *BE*	0.8	ARC Resources Ltd.	Abandonded	Oil Well Effluent	88.9 Steel
9042-10	03-29-054-21 W4M *BE*	10-29-057-21 W4M *BE*	0.84	ARC Resources Ltd.	Abandonded	Oil Well Effluent	88.9 Steel
9042-12	06-29-057-21 W4M *BE*	10-29-057-21 W4M *BE*	0.43	ARC Resources Ltd.	Abandonded	Oil Well Effluent	88.9 Steel
9042-15	05-29-057-21 W4M BE	10-29-057-21 W4M *BE*	0.78	ARC Resources Ltd.	Abandonded	Oil Well Effluent	88.9 Steel
9042-37	06-29-057-21 W4M *BE*	10-29-057-21 W4M *BE*	0.44	ARC Resources Ltd.	Abandonded	Oil Well Effluent	33.1 Fiberglass
9042-43	04-29-057-21 W4M *BE*	10-29-057-21 W4M *BE*	0.94	ARC Resources Ltd.	Abandonded	Oil Well Effluent	88.9 Steel
9042-46	03-29-057-21 W4M *BE*	10-29-057-21 W4M *BE*	0.91	ARC Resources Ltd.	Abandonded	Oil Well Effluent	83.1 Fiberglass
9042-48	05-29-057-21 W4M *BE*	10-29-057-21 W4M *BE*	0.93	ARC Resources Ltd.	Abandonded	Oil Well Effluent	53.1 Fiberglass
3886-3	05-29-057-21 W4M *PL*	01-30-057-21 W45 *RS*	2.62	Town of Redwater	Abandoned	Natrual Gas	60.3 Steel
12003-1	08-30-057-21 W4M *PL*	08-29-057-21 W4M *PL*	1.53	ARC Resources Ltd.	Operating	Fresh Water	168.3 Steel
17393-2	09-29-057-21 W4M *MS*	08-30-057-21 W4M *RS*	1.49	Town of Redwater	Operating	Natrual Gas	60.3 Steel

All the oil pipelines (9) are abandoned and as per the commitment letter from ARC Resources included in Appendix B, the lines can be removed by the operator to accommodate the development. Any pipelines left in place will meet any setback requirements to the development features.

6.2.2 WELLS & LEASES

There are two abandoned well sites within the subject property, both owned by Imperial Oil. Both have been reclaimed and certificates issued.

The table below details the particulars of each site including any reclamation certificate information:

RECLAIMED WELLSITES					
License Surface Location Label	License Number	Licensee Name	License Status	Primary Status Fluid	Reclaimation #
05-29-057-21W4	0000482	Imperial Oil Resources Limited	RecCertified	CRUDE OIL	32468
06-29-057-21W4	0001045	Imperial Oil Resources Limited	RecCertified	CRUDE OIL	12586

These wells, even in a reclaimed state, require long term protection. The development will accommodate for this and provide for the minimum setbacks to allow access to the well head center. As per directive 079 of the Alberta Energy Regulator, the minimum radius around an abandoned well to be free and clear of any structures is 5 meters.

6.2.3 ADJACENT LAND USES

ARC Resources Plan

The ARC Resources gas processing plant lies in the quarter section to the east of this proposed development. This is a Level 1 facility.

According to the Oil and Gas Conservations Regulations, a level 1 facility is a sour gas well with a potential H2S release rate of 0.3 m^3 /s or less, or any other sour gas facility with a potential to release 300 m^3 of H2S or less. The minimum setback is 0.1km.

Newalta Redwater Processing Plant

This plant is situated in the north-east extend of the existing industrial subdivision directly south of this proposed development. Based upon a minimum setback distance of 180 meters from the building, it is not anticipated that it will impact the proposed development.

Residential

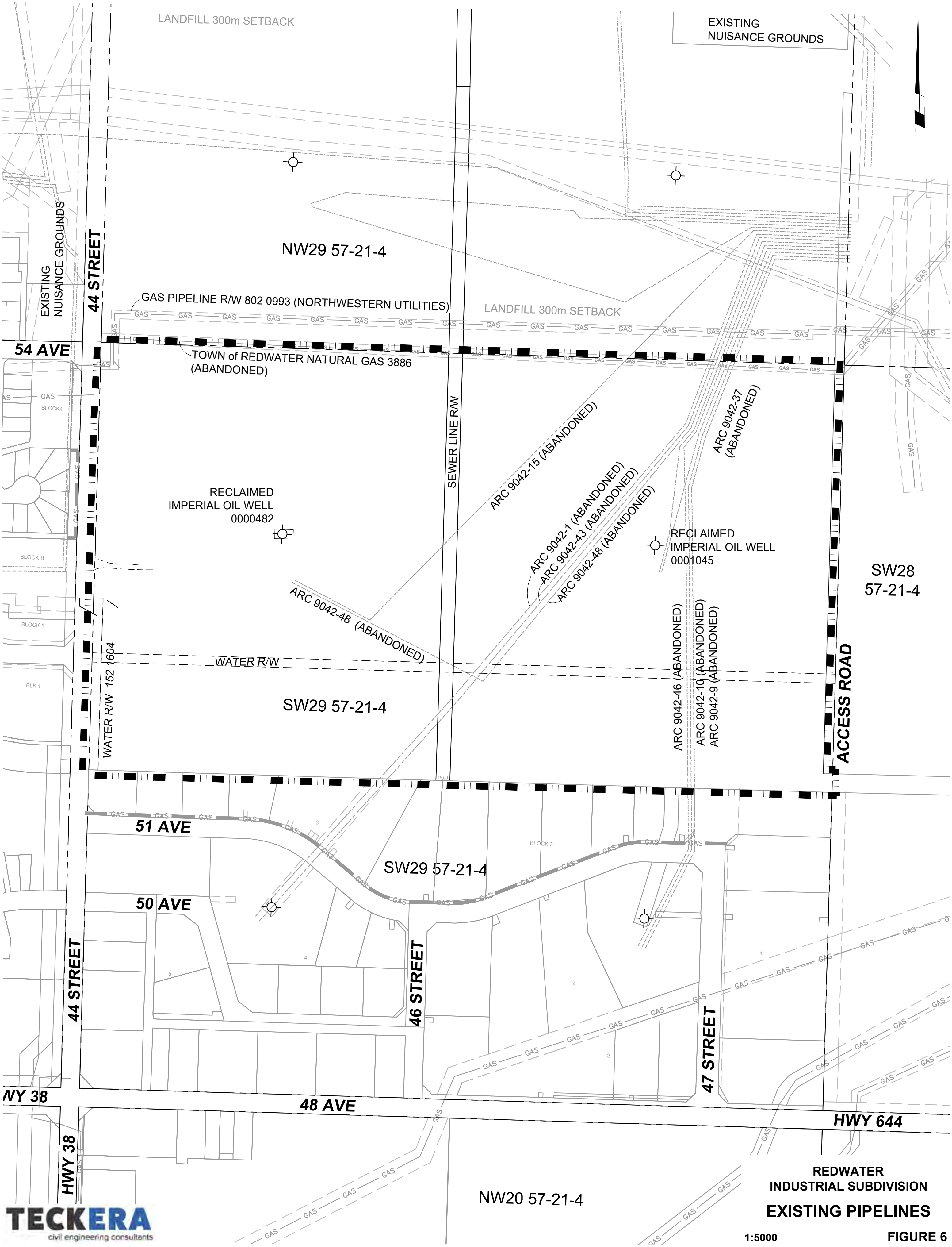
There is an existing residential development on the west side of 44th Street. Although there are no setback concerns, it is proposed that a buffer (MR) along the west side of this development be maintained to provide a separation between the two land uses along with 44th Street.

Nuisance Grounds

The Town has indicated that there is an existing "Nuisance Grounds" located on the corner (north-west of intersection) of 54th Avenue and 44th Street. In consultation with the registered landowner's engineering consultant, a phase 1 and phase 2 environmental assessment has been prepared. The results indicate that there is no adverse contamination.

The consultant is working with the Town to finalize the documentation to have the caveat removed from the title.

There is no setback requirement for an industrial lot development.



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EXISTING PIPELINES

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FIGURE 6

7. DEVELOPMENT CONCEPT

7.1 LAND USE CONCEPT

The subdivision is a proposed industrial development comprised of thirty-four, minimum 0.4 Ha (1 Acre) lots and one to three larger lots.

The development will be fully serviced with municipal water, gravity sewer, power and gas piping.

Access to the site would be from 44th street with the extension of 54th avenue and at the south from the extension of 47th street. Provisions have been made to allow for future connection to the Town's future arterial road proposed through the site.

A stormwater management facility is proposed for the north-east area. This lot would be allocated as a public utility lot (PUL).

The design concept as shown within Figures 7 and 8 is comprised of:

Phase 1:

- Larger industrial lot/(s), 4.81 Ha
- Extension of 54th Avenue to west internal road intersection
- West internal road to extent of phase 1 development
- Temporary water and sewer servicing

Phase 2:

- Maximum of 34 industrial lot (average of 0.4 Ha, 1 Ac. per lot)
- Extension of 54th Avenue and construction of south-east loop road (arterial road) within the project site
- Construction of remaining internal roads
- Stormwater Management Facility (PUL)

A 12m road widening and 6m MR is being provided along the east side of 44th Street. This will ensure a separation between land-uses in addition to the roadway. Should additional MR be required, a walking trail or other amenity could be provided around the stormwater management facility.

The table below indicates the breakout of areas by category:

Table 1 - Land Use Statistics

	Area (ha)	% Area
Total Area (ha)	**36.54**	100.00%
Total ER (ha)	0.00	0.00%
Gross Developable Area (ha)	**36.54**	100%
Public Utility Lot (storm pond)	9.55	26.14%
UR (Utility Rights of Way)	0.54	1.48%
Road ROW (44th St Road Widening, 54th Ave & internal roads)	6.38	17.46%
MR	0.26	0.71%
TOTAL Non-Industrial Area	**16.73**	**45.79%**
Net Lot Area (Ha)	**19.81**	**54.21%**
Total	**36.54**	**100%**

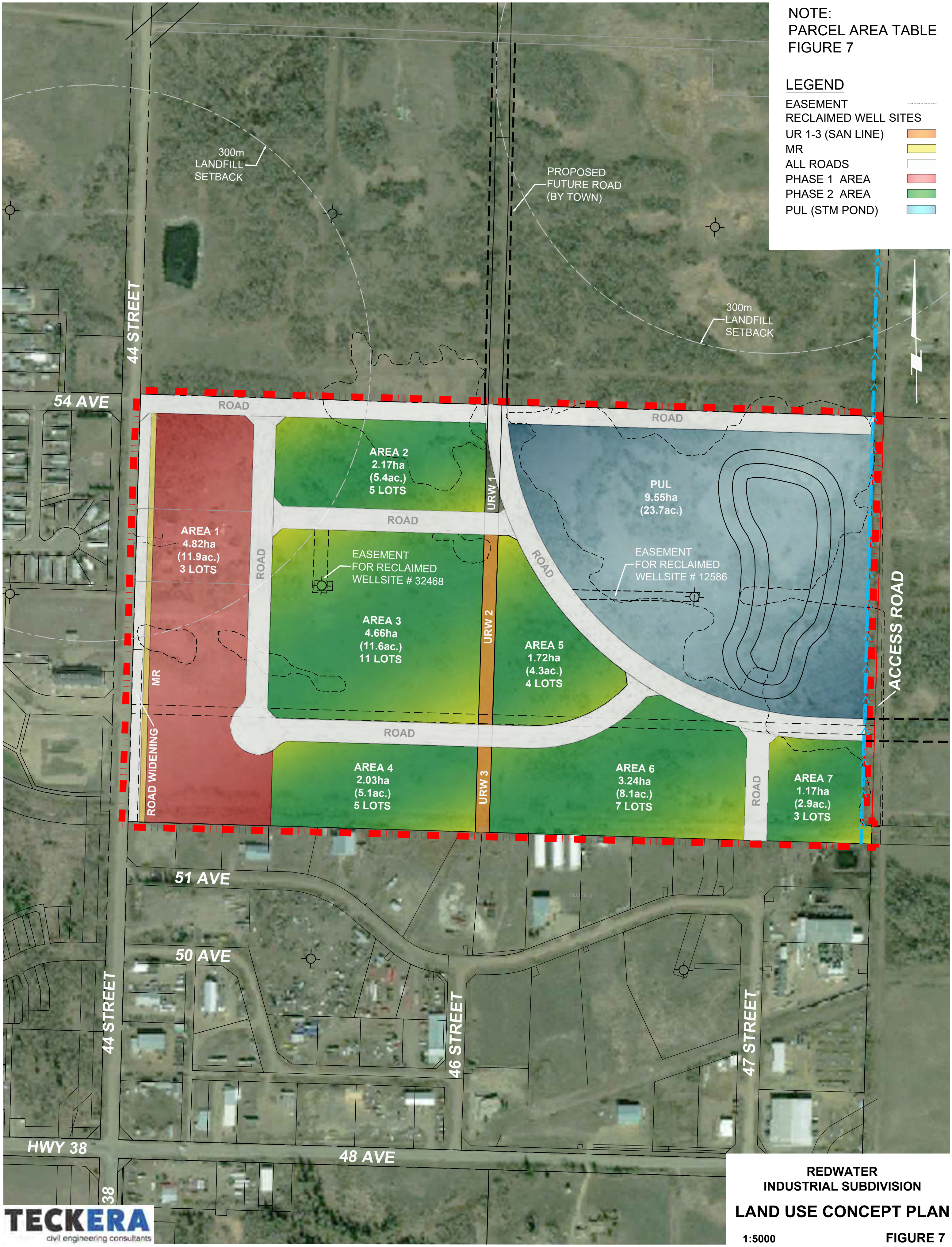
Lots

Phase 1 Units	4.82	24.33%
Phase 2 Units	14.99	75.67%
Total	**19.81**	**100%**

NOTE:
PARCEL AREA TABLE
FIGURE 7

LEGEND

EASEMENT	
RECLAIMED WELL SITES	
UR 1-3 (SAN LINE)	
MR	
ALL ROADS	
PHASE 1 AREA	
PHASE 2 AREA	
PUL (STM POND)	



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LAND USE CONCEPT PLAN

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FIGURE 7

LEGEND

- ROADS (MAIN)
- MR
- PHASE 1
- PHASE 2
- LOCAL RDS
- PUL (STM POND)

AREA TABLE			
Parcel #	Area m^2	Hectares (ha.)	Acre (ac.)
AREA 1	48151.74m^2	4.82ha.	11.9ac.
AREA 2	21743.11m^2	2.17ha.	5.4ac.
AREA 3	46573.23m^2	4.66ha.	11.6ac.
AREA 4	20253.80m^2	2.03ha.	5.1ac.
AREA 5	17237.62m^2	1.72ha.	4.3ac.
AREA 6	32400.27m^2	3.24ha.	8.1ac.
AREA 7	11687.72m^2	1.17ha.	2.9ac.
ROAD	19883.76m^2	1.99ha.	5.0ac.
ROAD	6238.01m^2	0.62ha.	1.6ac.
ROAD	2902.01m^2	0.29ha.	0.8ac.
ROAD	7496.30m^2	0.75ha.	1.9ac.
ROAD	7914.45m^2	0.79ha.	2.0ac.
ROAD	14229.26m^2	1.42ha.	3.6ac.
MR	2648.00m^2	0.26ha.	0.7ac.
PUL	95514.77m^2	9.55ha.	23.7ac.
RD WIDEN	5246.26m^2	0.52ha.	1.3ac.
URW 1	873.23m^2	0.09ha.	0.3ac.
URW 2	3092.27m^2	0.31ha.	0.8ac.
URW 3	1377.78m^2	0.14ha.	0.4ac.

TECKERA
civil engineering consultants

REDWATER INDUSTRIAL SUBDIVISION

PARCEL AREA TABLE

FIGURE 8

7.2 DESIGN GUIDELINES

The Town of Redwater utilizes the City of Edmonton Design and Construction Standards. It is proposed that this development would be designed to meet the minimum these requirements of the design criteria and as outlined in the 2010 Master Services Plan Update Report (2010) and the Interim Servicing Supplement (March 2017), prepared by the Town's Engineers, Associated Engineering. This information, in conjunction with the Town's documentation (MDP, LUB, etc.) and guidelines from Alberta Environment and criteria set out in any applicable regulations and acts, would be used to finalize the design.

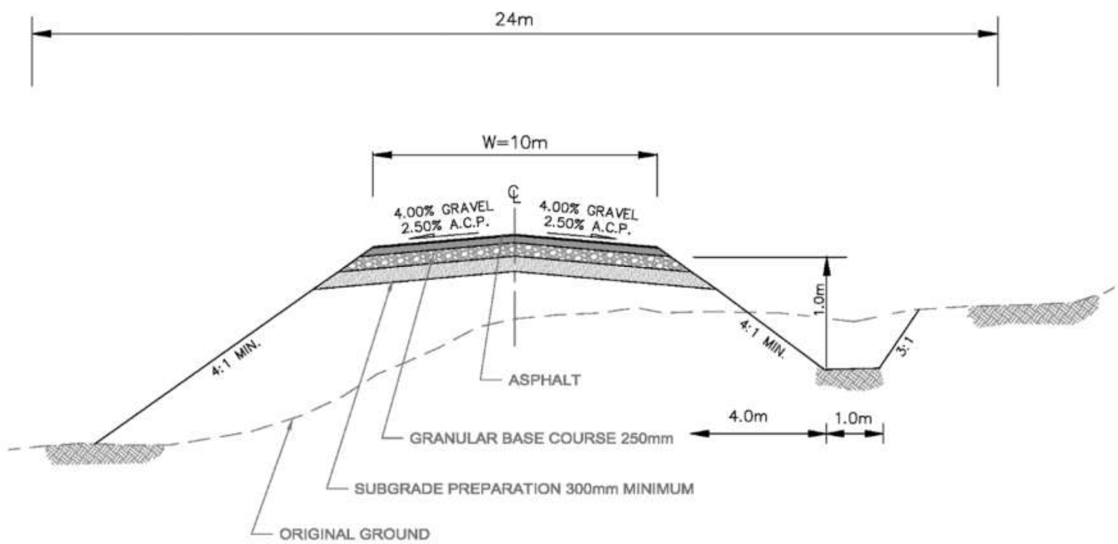
8. TRANSPORTATION

The proposed roadways are shown within the design concept, Figure 7. The primary access off of 44th Street would be through the extension of 54th Avenue. There is also connectivity from the south-east corner into the existing industrial development to the south with the extension of 47th street. This street intersects with Highway 644.

The design is looped to allow for larger truck movements and emergency exit. There are plans for a future access to the north quarter section when that parcel is developed.

To match the existing industrial development to the south, the roads are intended to be designed using a rural cross section with ditching; however, the Town has the option to construct the new development to an urban standard with curbs and gutters. This decision can be made at the subdivision development stage.

The proposed cross section is shown below:



As per the Town's 2010 Master Services Update Report and the Interim Servicing Supplement (March 2017), 44th Street is ultimately slated to a 4-lane arterial roadway. A provision to accommodate a road widening from the west side of the development has been provided.

Shown within Figure 6.6 of the report Master Services Update Report, the road extending from 48th street (east side of development) is a proposed major collector that would take future traffic from the east and south through this development to the north.

A traffic impact assessment (TIA) was prepared by McElhanney in April of 2019 and updated in September 2020, when a change in the development concept was made. D&A Paulichuk completed an amendment to the McElhanney TIA in late 2020 to include an assessment of traffic existing along 47th street onto Highway 644.

The findings from the TIA include:

<u>44th Street & Hwy 38 / Hwy 644</u>

- This proposed development (at full build-out) represents 8.7% of the total traffic volumes for the intersection
- A Type IIc intersection treatment is currently warranted and has been for several years
- A Type IIc intersection will be sufficient for the next 24 years (i.e. full development realized in 2045)
- The current intersection treatment can provide a level of service category C for the next 24 years
- Partial illumination is warranted in 2025; however, no action if required since full urban street lighting exits on all four legs of the intersection
- Traffic signals at this intersection are not warranted for the next 24 years
- Site distance for design vehicles of semi-trailer combination at the posted speed of 50kph is sufficient

<u>47th Street & Hwy 644</u>

- A Type IIa intersection is warranted in 2035, at 50% of the proposed development capacity
- Illumination is not warranted at this intersection for the next 24 years
- Traffic signals at this intersection are not warranted for the next 24 years
- Site distance for design vehicles of semi-trailer combination at the posted speed of 70kph is sufficient

<u>44th Street & 54th Avenue</u>

- Using Synchro 10 software (based upon HCM 2000 and HCM 2010 methodology), the existing intersection treatment shows that the intersection has sufficient capacity to support traffic movements to a Level of Service of A for the next 24 years, with the proposed development fully utilized in 2045
- Illumination is not warranted at this intersection for the next 24 years
- Traffic signal are not warranted for the next 24 years
- Site distance for design vehicles of semi-trailer combination at the posted speed of 50kph is sufficient

These reports have been included in Appendix E1 and E2 respectively.

9. UTILITY SERVICING

The Town of Redwater's 2010 Master Services Update Report (Associated Engineering) and the Interim Servicing Supplement (March 2017) was reviewed and provides the basis for the design concepts presented for this development.

9.1 WATER

The proposed watermain network is shown within Figure 9. A series of 250mm and 300mm PVC pipes would be designed to service the development. As per Figure 3.5 of the Town's Master Services Report, it suggests that a 300mm watermain through this site is proposed in the future. PRV's will be added, where necessary, to control line pressures. The location and pertinent details will be subject to the detailed design phase.

The proposed lines would be connected to the existing industrial subdivision to the south for looping purposes and the 300mm watermain along 44th Street, as shown. This will ensure redundancy in the event of line breakages and improve fire flow capabilities.

Fire hydrants would be placed at maximum 90 meter spacing or as required by Town specifications. The exact sizing of the lines would be determined in consultation with the Town at the development stage once the end users are better known.

9.2 SANITARY

There is an existing sanitary sewer trunk main (375mm / 450mm) that runs north-south through the property, near its midpoint. Currently this line conveys sewage from the south industrial development to the existing sewage lagoons, approximately 800 meters to the north. As per the Town's 2017 Interim Servicing Supplement Report (Associated Engineering), the 375mm diameter pipe can accommodate approximately 70 Ha of land development. Any future development south of 48th Avenue would require this trunk main to be upsized accordingly.

The proposed servicing would comprise of installation of 200mm sewage mains west and east of the trunk main. The proposed lots in the south-east corner of the development would employ a low-pressure sewer system and discharge south to the existing industrial development's sanitary sewer system. The cost to purchase and maintain the sewage tanks for these lots would be borne by the lot owner. As per the 2010 Master Services Report, the existing system is capable to accommodating increased flow from these lots.

As per the 2010 Master Services Update Report, the Interim Servicing Supplement (March 2017) and our discussion with Town personnel, it is understood that in order to service this full development, either the existing lift station must be replaced and lowered.

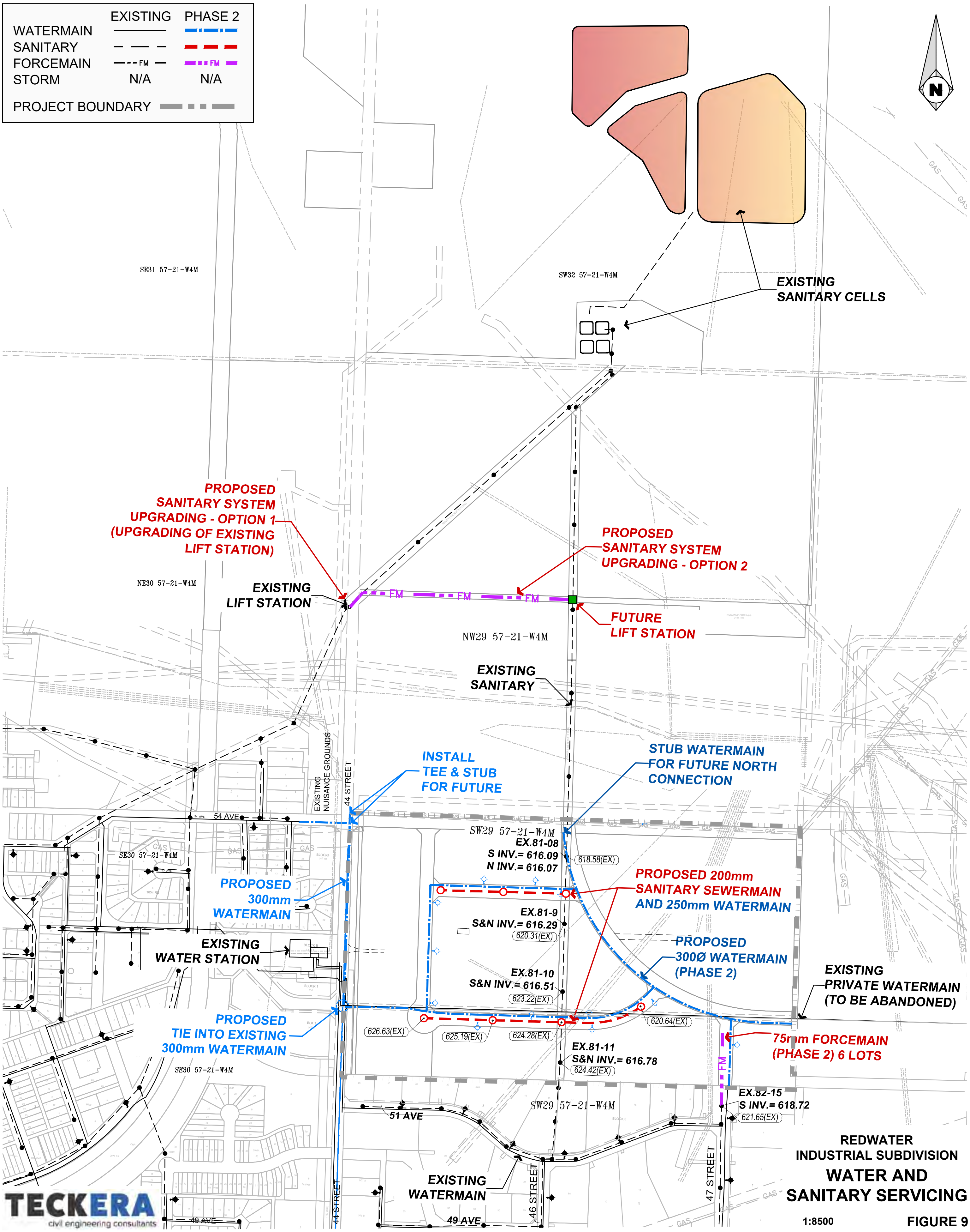
Should the existing lift station be replaced at its current location, an intercept line would be constructed from the north-south sewer trunk main west to this lift station. This would terminate the direct discharge into the Town's north lagoon - anaerobic cells.

In agreement with the Town in 2018, the developer intends on servicing the phase I lot/(s) by connecting to existing services along 44th Street. This is detailed further in the phasing section of this report.

The proposed sanitary sewer is illustrated within Figure 9.

9.3 UTILITY PHASING

Except for the watermain extension along 44th Street for Phase 1 and the temporary sanitary sewer servicing as noted above, all of the utility servicing and features would be constructed in Phase II of the development.


EXISTING
PHASE 2
WATERMAIN
SANITARY
FORCEMAIN
FM
STORM
N/A
N/A
PROJECT BOUNDARY
N
SE31 57-21-W4M
SW32 57-21-W4M
EXISTING SANITARY CELLS
PROPOSED SANITARY SYSTEM UPGRADING - OPTION 1 (UPGRADING OF EXISTING LIFT STATION)
PROPOSED SANITARY SYSTEM UPGRADING - OPTION 2
NE30 57-21-W4M
EXISTING LIFT STATION
FUTURE LIFT STATION
NW29 57-21-W4M
EXISTING SANITARY
INSTALL TEE & STUB FOR FUTURE
STUB WATERMAIN FOR FUTURE NORTH CONNECTION
EXISTING NUISANCE GROUNDS
44 STREET
54 AVE
SW29 57-21-W4M
EX.81-08
S INV.= 616.09
N INV.= 616.07
618.58(EX)
SE30 57-21-W4M
PROPOSED 300mm WATERMAIN
PROPOSED 200mm SANITARY SEWERMAIN AND 250mm WATERMAIN
EX.81-9
S&N INV.= 616.29
620.31(EX)
EXISTING WATER STATION
PROPOSED 300Ø WATERMAIN (PHASE 2)
EX.81-10
S&N INV.= 616.51
623.22(EX)
EXISTING PRIVATE WATERMAIN (TO BE ABANDONED)
PROPOSED TIE INTO EXISTING 300mm WATERMAIN
626.63(EX)
625.19(EX)
624.28(EX)
620.64(EX)
75mm FORCEMAIN (PHASE 2) 6 LOTS
EX.81-11
S&N INV.= 616.78
624.42(EX)
SE30 57-21-W4M
EX.82-15
S INV.= 618.72
621.65(EX)
51 AVE
SW29 57-21-W4M
EXISTING WATERMAIN
46 STREET
47 STREET
49 AVE
44 STREET
TECKERA
civil engineering consultants
REDWATER INDUSTRIAL SUBDIVISION
WATER AND SANITARY SERVICING
1:8500
FIGURE 9

9.4 STORMWATER

The development will convey surface runoff via roadway gutters or ditches. A proposed stormwater management facility (SWMF) is proposed for the north-east corner of the site, which would be constructed during phase 2.

This design concept is in-line with the Town's long-term planning for stormwater management. Figure 5.3 of the report (Master Services Update Report) illustrates their overall future concepts. The proposed pond (referred to as Pond "C" within the report) has a proposed capacity of 64,000 m^3, requiring approximately 5.0 Ha (12 Ac.) of land.

9.4.1 MINOR SYSTEM

In general, a minor system is designed for drainage to accommodate the runoff, which would occur in relatively frequent (e.g. 1:5 year) return period rainfall events. More specifically, the minor system is typically applied to the buried drainage network of local and trunk sewers, inlets and street gutters, which have traditionally provided conveyance of storm water runoff from road surface. Ditches for rural roadways can also be considered part of the minor system and/or the major system.

9.4.2 MAJOR SYSTEM

The major system is typically designed to control flooding to accommodate runoff rates and volumes for a 100-year or more return period rainfall event. For instance, when the rate of storm runoff generated by less frequent, more intense, rainfall events may exceed the capacity of the minor system, subsequent ponding may occur in depression areas or follow whatever overflow escape route is available. This network of planned or unplanned ponding areas and overland flow routes is referred to as the "major system".

9.4.3 SITE DRAINAGE

The drainage for this site is designed to be conveyed via a series of gutters and/or ditching to the stormwater pond. The lots would be graded to the roadways. The drainage along the extension of 54th Avenue would be directed easterly to the stormwater management facility.

9.4.4 STORMWATER MANAGEMENT FACILITY (SWMF)

The pond is intended to be designed as a wet pond, constructed wetland or combination thereof. Both options would provide both water quality enhancements and flow control (to pre-development rates). Which type of SWMF is most suited would be determined at detailed design phase and in consultation with the Town.

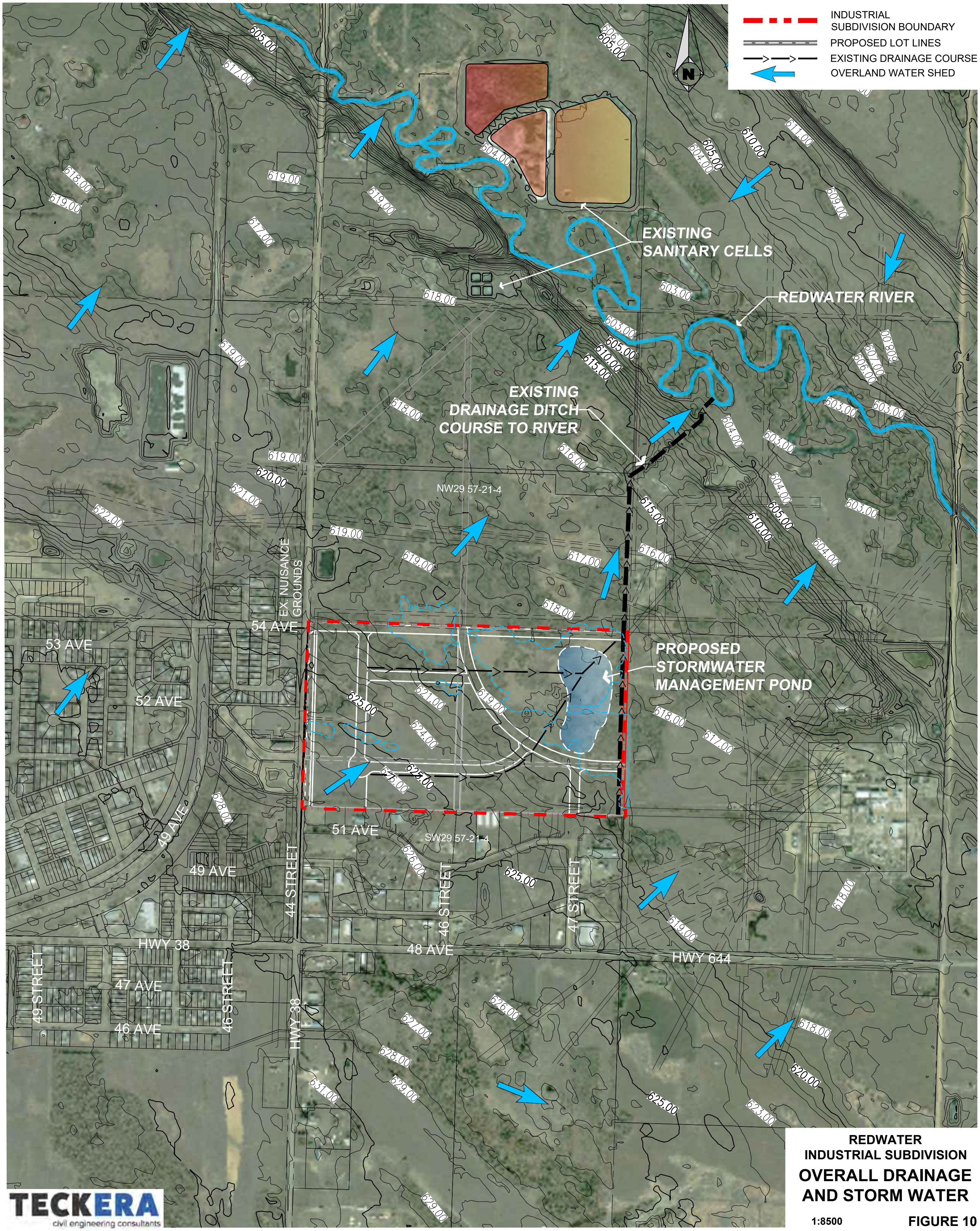
The SWMF would discharge at a controlled rate to an existing drainage ditch that runs along the east side of the development. This ditch conveys stormwater north and into the Redwater River.

The SWMF is proposed to be constructed as part of the Phase 2 development.

For Phase 1 drainage, it is suggested that the Town provide a caveat on the developer to provide a design, satisfactory to the Town, that would ensure minimal impact of any increased runoff through their own stormwater management controls. A proposed ditch would be constructed easterly from phase 1 to the proposed SWMF, where an existing north-south drainage ditch would convey the runoff to the Redwater River. The proposed runoff ditch would contain a flow control device (ex/ culvert with orifice) to restrict flow to pre-development condition.

The developer's representative contacted Alberta Environment and Parks to seek approval for the stormwater system; however, they were advised that a detailed review by AEP would only be done at the design phase.

Figure 10 shows the overall area drainage. Figure 11 illustrates the proposed drainage within the site.



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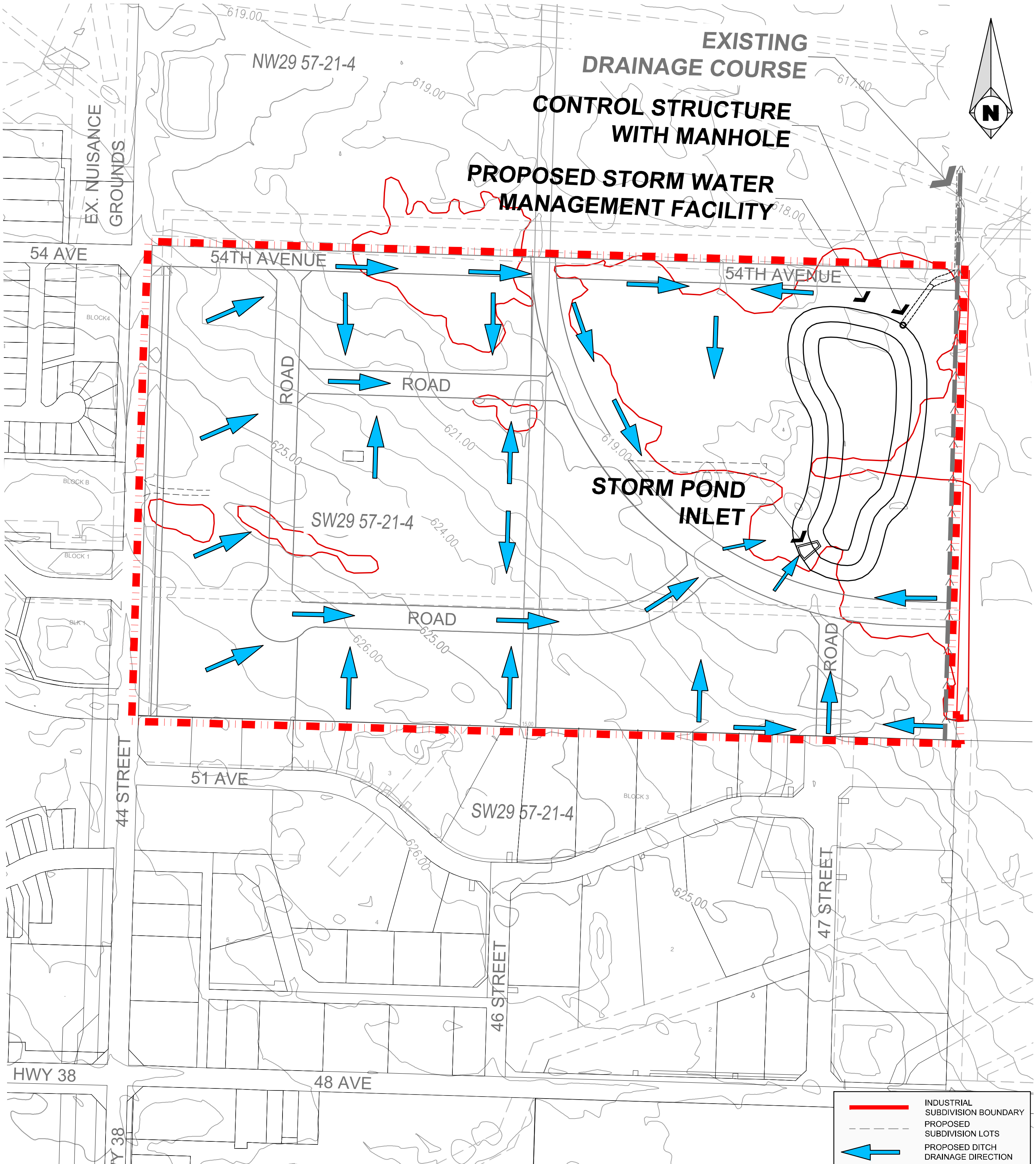
REDWATER
INDUSTRIAL SUBDIVISION
OVERALL DRAINAGE AND STORM WATER

1:8500

FIGURE 10



REDWATER
INDUSTRIAL SUBDIVISION

SITE DRAINAGE
AND STORM WATER

1:5000

FIGURE 11

TECKERA
civil engineering consultants

10. PHASING

The proposed phasing of the development is shown within Figure 12.

10.1PHASE 1

Phase 1 is comprised of the proposed lot/(s) that lies adjacent to 44th street. This is intended to one to three lots.

As per previous agreement with the Town, for the sanitary sewer, this phase would be serviced separately from the remainder of the development. It is proposed that an onsite tank and pump system be constructed. The sewage would be pumped via force main to the Town's existing sanitary sewer system along 54th Avenue. The developer would be responsible for the construction costs for the temporary sewer installation and any future decommissioning including removal, if necessary, of the forcemain and connection to the Town's manhole including any restoration of disturbed areas. The owner of the lot would be responsible for the repair and maintenance of the tank and force main piping up to the discharge location. Depending upon the finalized lot configuration for phase 1 lot owners, there may be an opportunity to connect the sewer to the sewer trunk main to the east at phase 1; however, this will need to be evaluated at the development stage.

The magnitude of sewage flows from Phase 1 into the Town's system are considered minimal. At the time of detailed design, the system could be configured to discharge during off peak periods to minimize any impact to the existing lift station flows.

For the water servicing for Phase 1, the existing 300mm water main along 44th street would be extended to 54th Avenue and connected to the existing water main to provide looping for system redundancy and improved fire protection. A service would be connected off 44th street (new water main) to service the Phase 1 lots.

For stormwater management, it is suggested that the Town provide a caveat on the developer to provide a design, satisfactory to the Town, that would ensure minimal impact of any increased runoff through their own stormwater management controls. The discharge would be directly easterly via constructed ditching to the proposed SWMF, where an existing drainage ditch would convey the runoff to the Redwater River. In the event that Phase 2 of the development is delayed or cancelled, the maintenance of the ditches to the proposed SWMF would the responsibility of the developer. Alternatively, the developer would seek an agreement for maintenance with the Town as part of the phase 1.

The SWMF will be constructed as part of phase 2 development. Upon development of subsequent phasing, the servicing for phase 1 would be re-constructed, if needed, to connect to the internal water and sewer lines.

Phase 1 is proposed to be constructed in 2021. The servicing for phase 1 is shown on Figure 12.

10.2 PHASE 2

It is proposed that Phase 2 construction would commence in 2023.

REDWATER
INDUSTRIAL SUBDIVISION

SUBDIVISION PHASING PLAN

1:5000

FIGURE 12

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Respectfully Submitted,

TECKERA CONSULTING LTD.

TeckEra Consulting Ltd.
Permit #11655
The Association of Professional Engineers, Geologists & Geophysicists of Alberta

Date: August 10, 2021

Rev 0

Note

This Area Structure Plan was prepared by TeckEra Consulting for 09074200 BC Ltd (Developer). The material in this report reflects TeckEra Consulting's best judgement in light of the information available at the time of preparation.

TECKERA CIVIL ENGINEERING CONSULTANTS

#100, 18130-105 Avenue

Edmonton, Alberta T5S 2T4

Phone: 780-250-0899

Email: info@teckera.ca

www.teckera.ca

Appendix A1

ESA Level 1 Addendum Letter

(Basin Environmental)

David Boychuk
#397 – 22555 Township Road 530
Sherwood Park, AB
T8A 4T7

December 4, 2018

Attention: David Boychuck

Re: SW-29-057-21, W4M – Phase I ESA Addendum

Background

In September 2015, Basin Environmental Ltd. (Basin) conducted a Phase I Environmental Site Assessment (ESA) for David Boychuck (Client) on the quarter section of land located at SW-29-057-21, W4M. in Redwater, AB (subject site).

Basin recommended further work at the subject site given the two historical oil and gas wells present (100/05 and 100/06), and the lack of relevant reclamation certification for each well.

Discussion

In November 2018, Basin received a copy of reclamation certificate No. 125586, dated August 16, 2017, stating that Alberta Energy Regulator (AER) reviewed the information provided for the application and concluded that the 100/06 oil and gas well complies with the conservation and reclamation requires of the Environmental protection and Enhancement Act. As such, no reclamation inquiry was held.

On December 3, 2018, Basin had a telephone conversation with Doug Rowden and Shweta Patel, representatives from Imperial Oil Limited (IOL), and confirmed a section within the AER Reclamation Process and Criteria for Oil and Gas Sites guidelines stating the following: "Even after we (AER) issue a reclamation certificate, a company (the owner of the site) remains responsible for surface issues related to reclamation, such as topography, vegetation, soil texture, and drainage, for 25 years, and remains permanently responsible for contamination and any infrastructure left beneath the surface."

IOL confirmed that they will remain responsible if any subsurface contamination is discovered at the 100/05 well site, for the lifetime of the site.

As such, given the presentation of new information on the 100/05 and 100/06 oil and gas wells, Basin is issuing an addendum to the Phase I ESA completed in September 2015 stating that a Phase II ESA relating to the 100/05 and 100/06 oil and gas wells is not required at this time.

Closure

We trust the above meets your present requirements. If you have any questions or require additional details, please contact the undersigned.

Report prepared by:
Basin Environmental, Ltd.

Wes Walkeden, Dipl. EnvSci.
Project Coordinator
(Author)

Renee Burns, C.E.T.
Environmental Project Manager
(Reviewer)

References

Alberta Energy Regulator. 2018. *Reclamation Process and Criteria for Oil and Gas Sites*. Regulation Development, Division, Edmonton, AB. Website: https://www.aer.ca/regulating-development/project-closure/reclamation/oil-and-gas-site-reclamation-requirements/reclamation-process-and-criteria-for-oil-and-gas-sites#audits

Basin Environmental Ltd. (Basin 2015). September 2015. *"Phase I Environmental Site Assessment, Surface Location of SW-29-057-21, W4M."* Basin No. B-0150-15

APPENDIX A

COPY OF AER REGULATIONS

Reclamation Inspections and Audits

Even after we issue a reclamation certificate, a company remains responsible for surface issues related to reclamation, such as topography, vegetation, soil texture, and drainage, for 25 years, and remains permanently responsible for contamination and any infrastructure left beneath the surface.

To ensure that companies meet our reclamation standards and guidelines, we conduct regular inspections and audits of reclaimed sites. We audit reclamation-certified sites every year, either randomly or based on risk. We perform two types of audits: desktop audits and field audits.

If we find a company is providing false or misleading information, or is not meeting reclamation standards, we may take enforcement action to bring the company back into compliance.

Desktop Audit

In a desktop audit, our staff verify documentation provided by the company. We conduct desktop audits to ensure that companies are providing us with correct information. If we identify any risks associated with an application, we will conduct a more comprehensive desktop audit. Based on our findings, we may also conduct a field audit.

Field Audits

Out in the field, our staff will assess whether the company's reclamation work meets our reclamation requirements. We will also inspect the following:

- vegetation quality and quantity
- soil quality and quantity
- site topography and landscape
- evidence of remaining facilities
- visual indicators of contamination
- any other parameters flagged by the desktop audit

We may also inspect the site for contamination below the land surface (subsurface contamination). This work might include collecting soil samples for lab analysis or conducting electromagnetic surveys.

APPENDIX B

RECLAMATION CERTIFICATE

Alberta

ENVIRONMENTAL PROTECTION

Land Reclamation Division

3rd Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
Canada T5K 2J6

Telephone (403)427-6212
Fax (403)422-0080

RECLAMATION CERTIFICATE NO. 32486

This reclamation certificate is issued pursuant to section 123 of the Environmental Protection and Enhancement Act, following an inquiry on

July 11, 1995. (Date)

This certifies that the surface of the land held by Imperial Oil Resources Limited

within SW Sec. 29 Tp. 57 Rge. 21 W4M

in connection with or incidental to Imp Redwater No. 37 well, as shown outlined in yellow on the attached plan, complies with the conservation and reclamation requirements of Part 5 of the Act.

Issued this 11 th day of July, 19 95

Henry Kaup

Inspector (s)

Operator/Agent:

Imperial Oil Resources Limited
237 4TH AVE SW
CALGARY AB T2P 0H6

Owners/Occupants:

Henry Yarmola

Section 84 of the Environmental Protection and Enhancement Act may provide a right of appeal against this decision to the Chair, Environmental Appeal Board. There may be a strict time limit for filing such an appeal. For further information, please contact the Executive Director of the Environmental Appeal Board at #400, Alberta Treasury Branches Plaza, 9925 109 Street, Edmonton, Alberta T5K 2J8; telephone 427-6207; fax 427-4693.

ADDENDUM ATTACHED: ___ YES ✓ NO

SAD 104

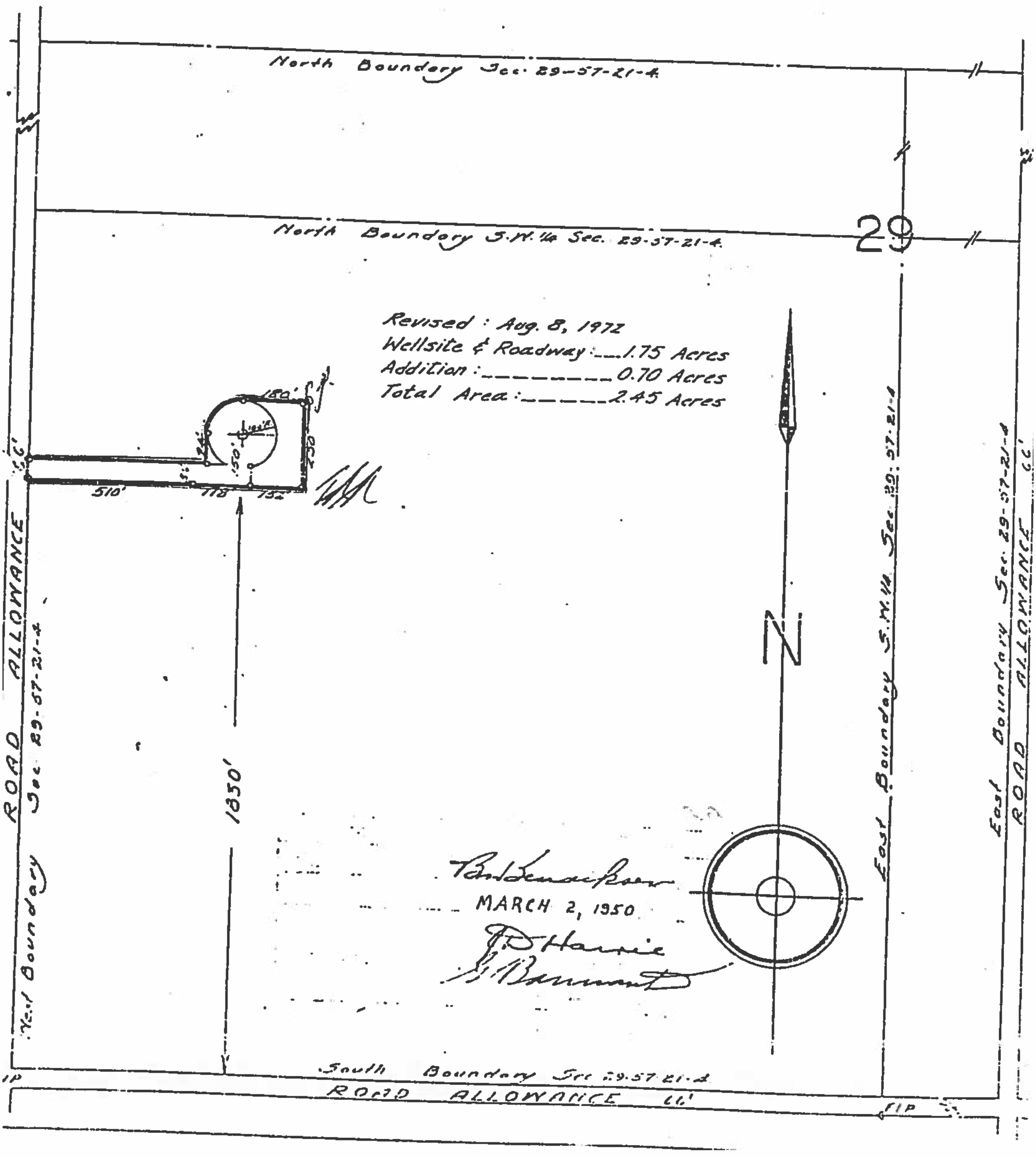
PLAN SHOWING

WELLSITE AND ROADWAY

IMPERIAL REDWATER No 37 WELL

L.S.D. 5 SEC. 29 TWP. 57 RGE. 21 W.4 M.

GROUND LEVEL ELEVATION · 2045·59'



OPERATOR LIABILITY AFTER RECLAMATION CERTIFICATE

Section 15 subsection (1)(a) and (b), and subsection (2) of the Environmental Protection and Enhancement Act, "Conservation and Reclamation Regulations", outlines the operator liability after a reclamation certificate is issued as follows:

(15)(1) Where a reclamation certificate is issued under the Act to an operator in respect of any activity referred to in section 1(w)(i) to (vi) or (viii) (SEE NOTE 1 BELOW), no environmental protection order regarding conservation and reclamation may be issued under section 127(2) of the Act

(a) more than 5 years after the date of the reclamation certificate, in a case where no approval was required in respect of the activity, or

(b) after the date of the reclamation certificate, in a case where an approval was required in respect of the activity.

(2) Where a reclamation certificate is issued under the Act in respect of an activity referred to in section 1(w)(vii) (SEE NOTE 2 BELOW), no environmental protection order regarding conservation and reclamation may be made under section 127(2) of the Act more than 25 years after the date of the reclamation certificate.

<u>NOTE 1:</u> Section (1)(w)(i) to (vi) and (viii) states:

⋮

"specified land" means land that is being or has been used or held for on in connection with

(i) the construction, operation or reclamation of a well;

(ii) the construction, operation or reclamation of a pipeline or telecommunications line;

(iii) the construction, operation or reclamation of a mine, pit or quarry;

(iv) the construction of public roadways;

(v) the conduct or reclamation of exploration operations;

(vi) the construction, operation or reclamation of landfill;

(viii) the construction, operation or reclamation of a extra-territorial undertaking;

⋮

<u>NOTE 2:</u> Section (1)(w) (vii) states:

⋮

"specified land" means land that is being or has been used or held for or in connection with

⋮

(vii) the construction, operation or reclamation of a plant;

⋮

Abandonment and Reclamation - Profile Checklist

LSD:	ARTS ID(s):	Versatile ID:
05-29-57-21 W4M		OPA DE RED 00105

Phase I Environmental Site Assessment		
Documentation	Present ✓	Comments
• Phase I Assessment Report		
• Aerial Photo Assessment		
• Limited Invasive Assessment		
• Spill Records / Other Historical Information		
• Pipeline Plot		
• Geophysical Assessment		

Phase II Environmental Site Assessment		
Documentation	Present ✓	Comments
• Phase II Site Assessment Report		
• Supplemental Report		
• Groundwater Monitoring Report		
• Vegetation Stress Assessments/ Infrared Survey		
• Other External Assessments		

Remediation		
Documentation	Present ✓	Comments
• Remediation Option Report (Technical Review)		
• Consultant's Remediation Report		
• Groundwater Recovery Report (spillsites)		
• Risk Assessments		

Reclamation		
Documentation	Present ✓	Comments
• Vegetation Monitoring Report		
• Detailed Soil Assessment		
• Landowner Releases (for improvements left in place)		
• Seed Tags		

Regulatory		
Documentation	Present ✓	Comments
• AEUB Approvals		
• AEnv Approvals		
• Water Act Annual Report (spill sites)		
• Significant Correspondence		
• Reclamation Certificate		

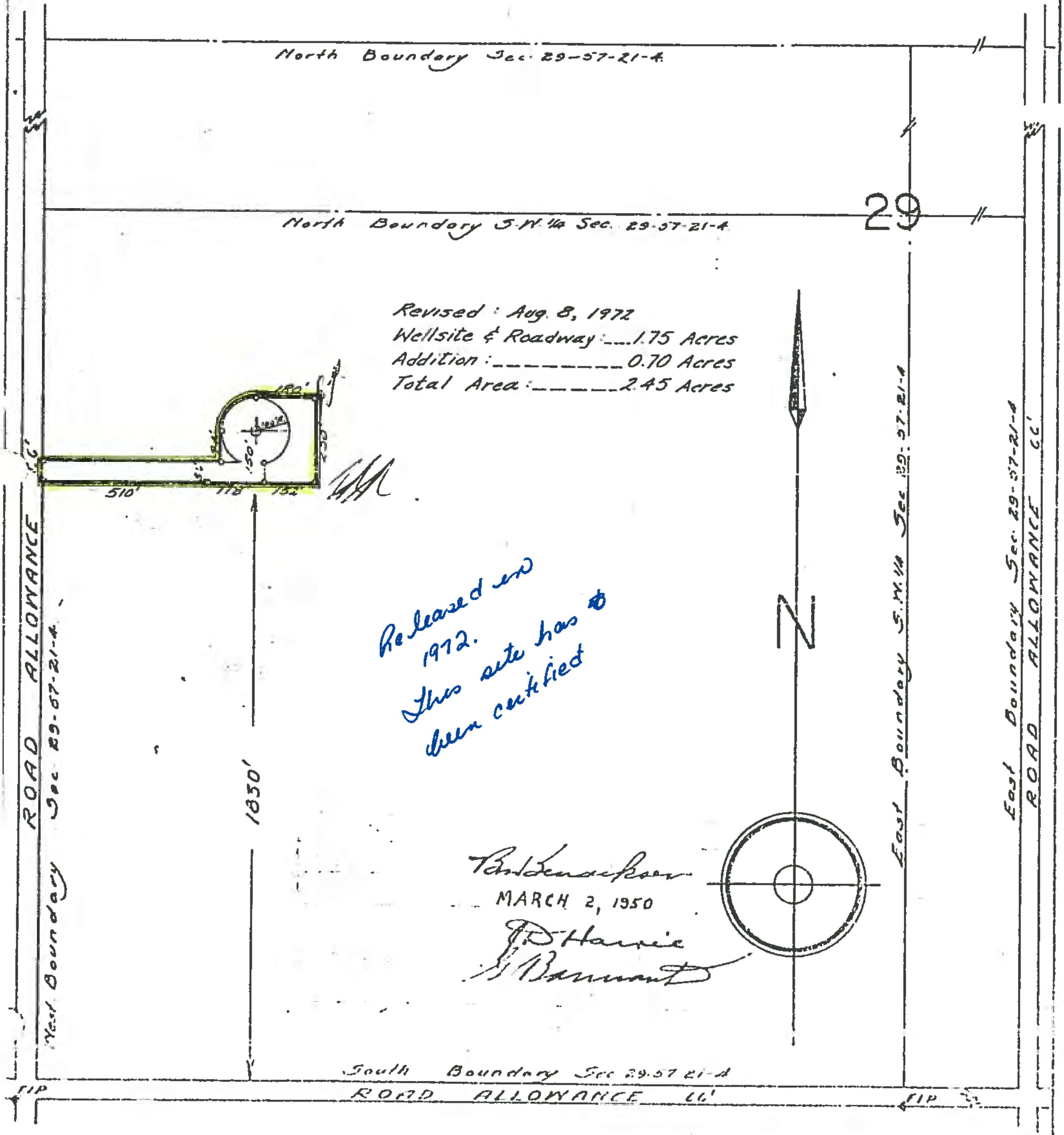
Background / Miscellany		
Documentation	Present ✓	Comments
• Lease Plans / Lease Abandonment Form		
• Significant Field Notes		
• Decision Records		

PLAN SHOWING
WELLSITE AND ROADWAY

IMPERIAL REDWATER Nº 37 WELL

L.S.D. 5 SEC. 29 TWP. 57 RGE. 21 W.4M.

GROUND LEVEL ELEVATION · 2045·59'



REVISED

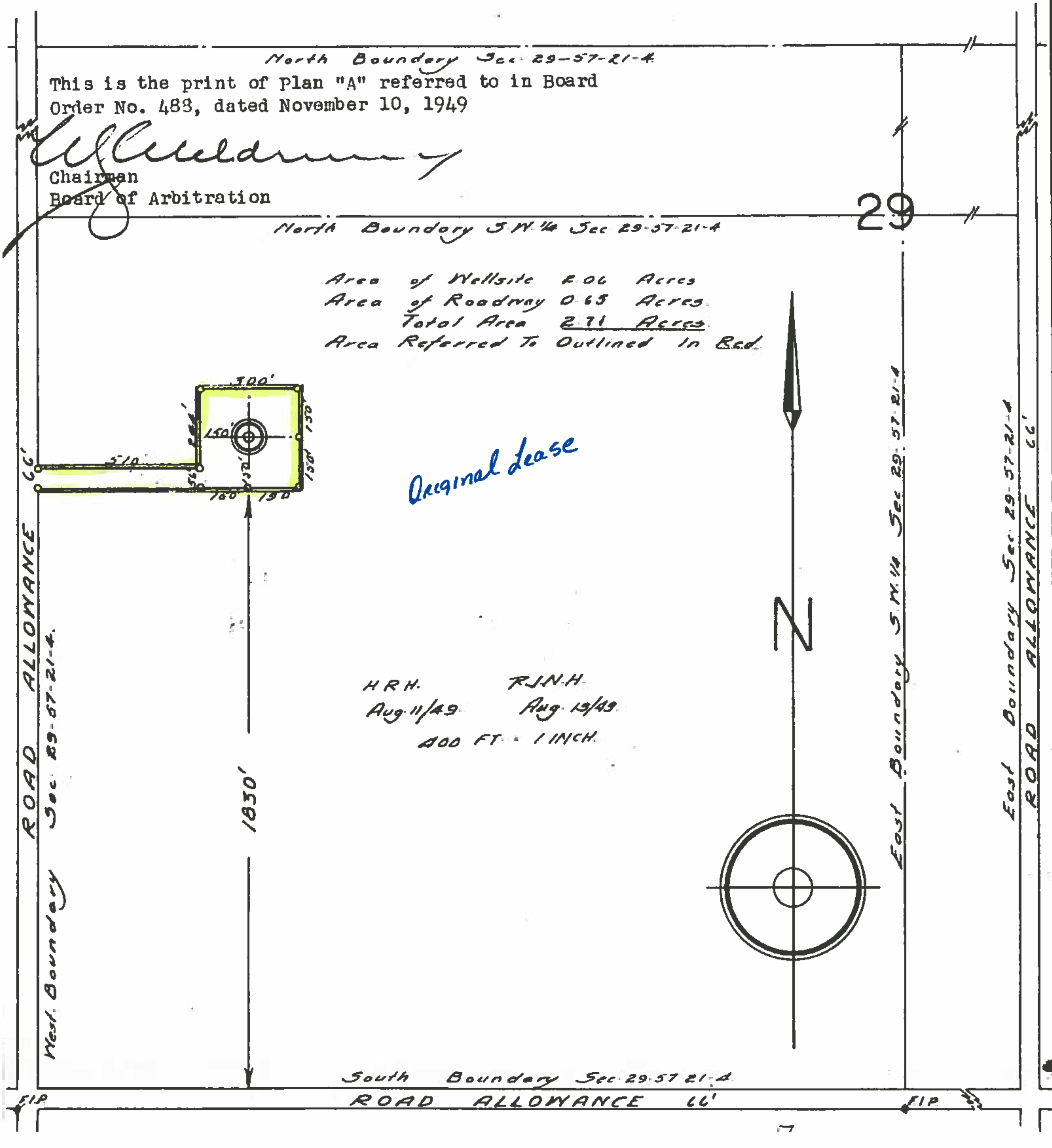
PLAN SHOWING
WELLSITE AND ROADWAY
IMPERIAL REDWATER Nº 37 WELL

L.S.D. 5 SEC.29 TWP.57 RGE.21 W.4M.

GROUND LEVEL ELEVATION · 2045·59'

This is the print of Plan "A" referred to in Board Order No. 483, dated November 10, 1949

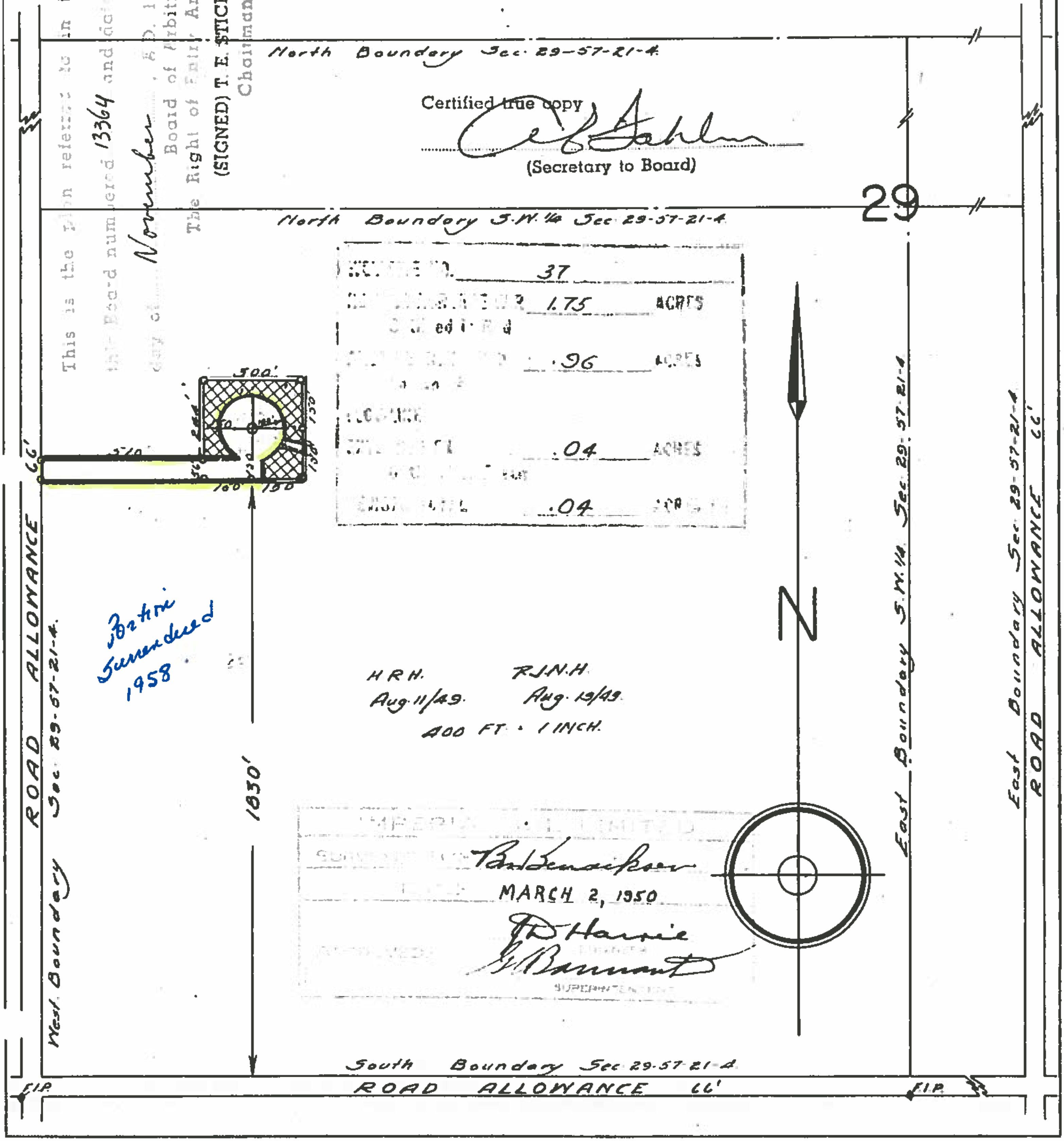
Chairman
Board of Arbitration



PLAN SHOWING
WELLSITE AND ROADWAY

IMPERIAL REDWATER № 37 WELL

L.S.D. 5 SEC. 29 TWP. 57 RGE. 21 W.4 M.
GROUND LEVEL ELEVATION · 2045·59'



REVISED ... SEPT. 8, 1958

RECLAMATION CERTIFICATE NO. 125586

This reclamation certificate is issued pursuant to section 138 of the Environmental Protection and Enhancement Act (the act), following a review of the information provided in the application. No reclamation inquiry has been held.

This certifies that the surface of the land held by Imperial Oil Resources Limited, in connection with or incidental to the activities:

Activity Type	Licence/Segment	LLD	Asset Name
	0001045	SW 6-29-57-21-W4M	ESSO REDWATER EX 6-29-57-21
Access Road		6-29-57-21-W4M	

as shown outlined in yellow on the attached plan(s), complies with the conservation and reclamation requirements of Part 6 of the act.

Issued on August 16, 2017

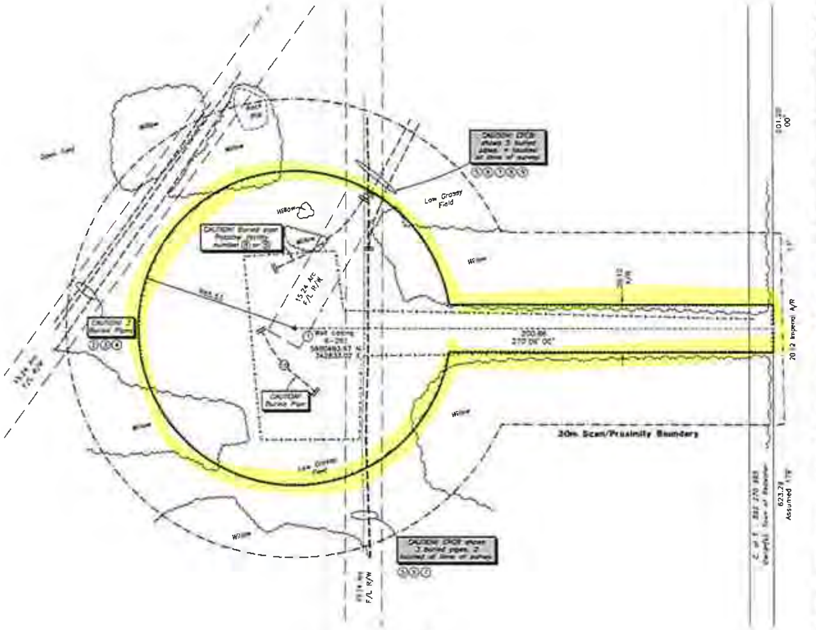
Designated Inspector Under the Act

Operator/Agent:
Imperial Oil Resources Limited
PO Box 2480 Stn M 505 Quarry Park Blvd SE
Calgary

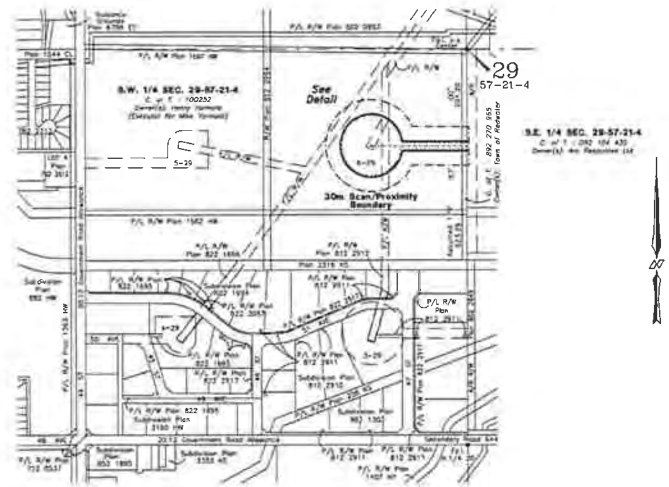
The AER may cancel this reclamation certificate pursuant to section 139 of the act where it is of the opinion that further work may be necessary to conserve and reclaim the above specified land to which this certificate relates.

The Responsible Energy Development Act (REDA) permits the filing of a request for a regulatory appeal by an eligible person in regards to an appealable decision as defined in section 36 of REDA.
If you are eligible to file a request for a regulatory appeal and you wish to do so, you must submit your request in the form and manner and within the timeframe required by the AER. Filing requirements are set out in section 30 of the Alberta Energy Regulator Rules of Practice available on the AER website, www.aer.ca, under Rules & Directives > Acts, Regulations and Rules. Regulatory appeal requests should be e-mailed to RegulatoryAppeal@aer.ca.

Alberta Energy Regulator Suite 1000, 250 Street SW, Calgary, Alberta T2P 0R4



DETAIL
Scale 1:1,500



LOCATION PLAN
Scale 1:5,000

Distances are in metres and decimals thereof

No.	OWNER	SIZE (O.D.mm)	SUBSTANCE TYPE OF LINE	STRUCTURE MATERIAL	M.O.P.	DESCRIPTION	LINE/LIC
10	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	BURIED PIPE	UNKNOWN
9	ARC	[illegible]	OIL WELL EFFLUENT	FIBREGLASS	[illegible]	[illegible] (ABANDONED)	[illegible]
8	ARC	88.9	OIL WELL EFFLUENT	STEEL	[illegible]	[illegible] (ABANDONED)	[illegible]
7	ARC	88.9	OIL WELL EFFLUENT	STEEL	[illegible]	[illegible] (ABANDONED)	[illegible]
6	ARC	88.9	OIL WELL EFFLUENT	STEEL	[illegible]	[illegible] (ABANDONED)	[illegible]
5	ARC	[illegible]	OIL WELL EFFLUENT	FIBREGLASS	[illegible]	[illegible] (ABANDONED)	[illegible]
4	ARC	88.9	OIL WELL EFFLUENT	STEEL	[illegible]	[illegible] (ABANDONED)	[illegible]
3	ARC	88.9	OIL WELL EFFLUENT	STEEL	[illegible]	[illegible] (ABANDONED)	[illegible]
2	ARC	[illegible]	OIL WELL EFFLUENT	FIBREGLASS	[illegible]	[illegible] (ABANDONED)	[illegible]
1	IMPERIAL	N/A	OIL	N/A	N/A	WELL CASING – [illegible] (ABANDONED)	[illegible]

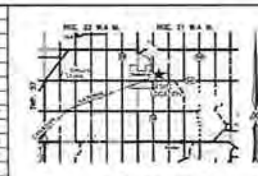
TABLE OF FACILITIES

LEGEND:
Bush line
Buried pipe
End of buried pipe locate
Buried pipe (not located)
Fence
Lease bdy. in question
Work Area
30m proximity boundary :
Iron post found
Calculated point
Well casing

CROSSINGS APPROVED BY:

WELL SITE CENTER COORDINATES
5980483.97 N
343853.02 E

No.	REVISIONS	BY	DATE	CKD
4	UPDATED DRAWING (23385)	DHP	05/11/12	DHP
3	ADDED MONITORING WELLS (21984)	[illegible]	07/27/09	RJB
2	UPDATED DRAWING (21220)	KM	06/24/09	[illegible]
1	UPDATED DRAWING (21220)	KM	[illegible]	[illegible]
0	DRAWING COMPLETED	[illegible]	09/07/04	[illegible]



DRAWING REVIEW

PROJECT ENGINEER

JOB No. 321115690

IMPERIAL OIL LIMITED

OPERATING AREA: BATTLE RIVER SOUTH
PLAN TYPE: SITE PLAN
FACILITY TYPE: WELL SITE AND ACCESS ROAD
LOCATION: 6-29-57-21-4
PLAN: 1 of 1

SCALE: AS SHOWN	McElhanney Land Surveys (Alta.) Ltd Ph. (780) 451-3420 Fax (780) 452-7033
DATE: SEPT. 7, 2004	LAND REF. No.
REVISION No.: 4	IORL DWG No.: 69594

Appendix A2

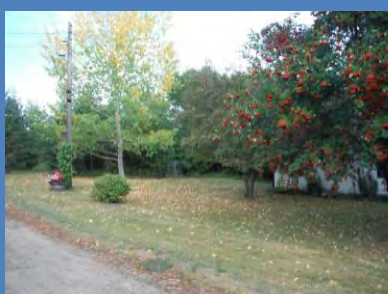
ESA Level 1 Report (Basin Environmental

David Boychuck

Phase I Environmental Site Assessment

Surface Location of SW-29-057-21 W4M

Reference number: B-0150-15



Prepared by:

Basin Environmental Ltd.
215 Nottingham Road
Sherwood Park, Alberta T5A 5M3
Phone: 780.910.0615

Submitted to:

David Boychuck
#397 - 22555 Township Road 530
Sherwood Park, Alberta T8A 4T7
September 24, 2015

EXECUTIVE SUMMARY

In August 2015, David Boychuck (Client) retained Basin Environmental Ltd. (Basin) to conduct a Phase I Environmental Site Assessment (ESA) on a property located within the Town of Redwater, Alberta. The subject site is located within the Alberta Township System (ATS) southwest portion of Section 29, Township 057, Range 21, West of the 4th Meridian (SW-29-057-21, W4M).

The subject site is approximately 38 hectares (94 acres) and is rectangular in shape. The subject site consists of a single-family residence (SFR) in the west central portion, and vacant uncultivated land in the remaining portions.

The objective of a Phase I ESA is to identify areas of potential environmental concerns associated with past and present activities that have taken place on the subject site. The Phase I ESA is also used to determine if additional assessment and/or site remediation measures are required. As part of the Phase I ESA, Basin reviewed available historical and current information pertaining to the subject site, including; aerial photographs, regulatory records, well and pipeline records, and spill and complaints records. Interviews and a site visit were conducted to assess the site for evidence of potential environmental issues.

Basin prepared this report in general accordance with the Canadian Standards Association (CSA) document "Z768-01 Phase I Environmental Site Assessment", dated November 2001.

The subject site has been used solely for residential and agricultural operations since its development in the 1940's.

Based on the results of the Phase I ESA completed by Basin, the following could result in potential subsurface impacts at the Site:

- The former well sites (100/05 and 100/06) located in the west-central and east-central portions, respectively, of the subject site.

Based on the findings above, Basin recommends completing a Phase II ESA at the Site.

TABLE OF CONTENTS

Tables and Appendices

1.0 INTRODUCTION

1.1 SITE LOCATION AND BACKGROUND

In August 2015, David Boychuck (Client) retained Basin Environmental Ltd. (Basin) to conduct a Phase I Environmental Site Assessment (ESA) on a property located within the Town of Redwater, Alberta. The subject site is located within the Alberta Township System (ATS) southwest portion of Section 29, Township 057, Range 21, West of the 4^{th} Meridian (SW-29-057-21, W4M).

1.2 OBJECTIVE

The objective of the Phase I ESA is to identify areas of potential environmental concern associated with past and present activities that have taken place on the site or adjacent properties. The results of the Phase I ESA can also be used to determine whether additional assessment and/or site remediation measures are required.

A Phase I ESA assists in reducing uncertainty about potential environmental liabilities, and can be used as a basis for further investigation of a site. Potential concerns may be related to infrastructure or disposal areas, oil and gas activity, building materials, pesticides, and fertilizers.
Basin prepared this report in general accordance with the Canadian Standards Association (CSA) document "Z768-01 Phase I Environmental Site Assessment" (CSA 2001).

1.3 SCOPE OF WORK

A Phase I ESA involves evaluating and reporting on information collected from public records, interviews and a site inspection. A Phase I ESA does not include any sampling or testing of air, soil, groundwater, surface water or building materials. These activities are carried out in a Phase II ESA, if required.

The scope of work for this ESA included the following tasks:

- Conduct interviews;
- Conduct a site inspection;
- Review of historic land uses using land titles and aerial photographs;
- Review of available records and site data; and
- Compile and develop a written report that documents the findings.

2.0 SITE INSPECTION

On September 8, 2015, Basin conducted a Phase I ESA site inspection of the subject site. The Client indicated that he was the person most knowledgeable of the Site conditions, and is hereafter referred to as the Site Representative.

2.1 SITE DESCRIPTION

The subject site is approximately 38 hectares (94 acres) and is rectangular in shape. The subject site consists of a single-family residence (SFR) in the northwest portion, and vacant uncultivated land in the remaining portions.

A Key Map and Site and Surrounding Land Use Map are included in Appendix I. Photographs of the site are provided in Appendix III.

2.2 POLYCHLORINATED BIPHENYLS

The use of polychlorinated biphenyls (PCBs) as dielectric fluids in electrical equipment such as transformers and hydraulic equipment was common up until about 1980. The Federal PCB Regulations, SOR/2008-273, regulate the manufacture, import, export, sale, use and processing of PCBs.

Given the year of construction of the SFR buildings (mid 1940s), there is a potential that the on-Site electrical equipment (i.e., fluorescent light ballasts) may contain PCBs. No staining or leakage was noted in the vicinity of the on-Site electrical equipment.

No electronic transformers or hydraulic equipment was observed at the subject site and none was reported.

2.3 ASBESTOS CONTAINING MATERIALS

Asbestos-containing materials (ACMs) are commonly found in building construction materials (particularly in buildings constructed prior to 1986). Friable asbestos (friable as defined as a material that can be crumbled, powdered or pulverized by hand pressure) was widely used in spraying fireproofing until 1973, and in decorative or finishing plasters, and thermal systems insulation until the early 1980s. Non-friable or manufactured asbestos products were widely used in building construction including in vinyl floor tiles, sheet flooring, ceiling tiles, pipe gaskets, roofing materials, asbestos cement boards, and numerous other products until the mid-1980s. A very limited number of non-friable asbestos products in limited quantities are still in use currently in building construction.

Given the year of construction of the SFR buildings (mid 1940s), there is a potential for friable and non-friable ACMs to be present in the site buildings.

An asbestos survey should be performed in buildings that are known or suspected of containing ACMs. If an asbestos survey confirms the presence of ACMs, a management plan should be developed and implemented.

2.4 LEAD-BASED PAINTS

Although paints containing lead were banned from uses on exterior or interior surfaces of buildings, furniture or household items produced in the 1970s, various commercial paints (e.g. road paint) are still known to contain lead.

Given the year of construction of the SFR buildings (mid 1940s), there is a potential for paints containing lead to be present on-Site, including Site Building interior surfaces. A lead-based paint (LBP) survey was not conducted as part of this Phase I ESA.

2.5 MOULD AND WATER DAMAGE

The presence of mould or other microbiological contamination in buildings has become a concern to building tenants and owners due to potential health effects on occupants and users. Provincial Ministries of Labour have recently issued guidelines on enforced regulations to protect the health of construction workers who are exposed to mould in the course of building renovations. The presence of water leaks or high humidity can cause the growth or amplification of mould within building environments.

A comprehensive inspection for mould, which would require intrusive testing, was not performed as part of this Phase I ESA. Visible mould or water damaged areas were not observed at the time of the site inspection. The Site Representative was not aware of the presence of mould in the site buildings.

2.6 STAINING AND STRESSED VEGETATION

No evidence of historical chemical discharges or releases (i.e., staining or stressed vegetation) was observed during the Site visit. The Site Representative reported that no known historical chemical spills have occurred on-site.

2.7 SURFACE WATER

Standing water was observed along the east boundary and in the northeast corner of the subject site. General drainage is directed northeast.

2.8 EROSION

No areas of erosion were noted on the subject site.

2.9 STORAGE HANDLING AND RECYCLING

The majority of the subject site consisted of vacant undeveloped land at the time of the site visit. The refuse produced by the SFR on the subject site is assumed to be collected by the Town of Redwater on a weekly basis.

2.10 AIR DISCHARGES

No sources of air emissions suspected to result in residual contamination to the site were identified at the site during the site visit. In addition, no strong, pungent, or noxious odours were noted.

2.11 SUMP/SEWER/SANITARY SYSTEM

Wastewater discharges occurring at the SFR on-Site are inferred to be contained within a sewage system. No other potential sources of environmental contamination related to wastewater discharges were observed or reported during the site visit.

2.12 SPILL AND STAIN AREAS

There were no stains or spills noted during the site inspection, and none were reported by the Site Representative.

2.13 HAZARDOUS / WASTE MATERIALS

At the time of the site visit, no hazardous or waste materials were observed. There are no pesticides reportedly used on the subject site as well as no spills or releases reported.

The above list does not represent a comprehensive chemical inventory for the site there may be additional chemicals used at the site that were not observed during the course of the Phase I ESA site visit. Basin was not supplied with a formal inventory of chemicals stored at the subject site. Based on the observed storage areas, the stored chemicals noted do not represent a potential environmental concern to the subject site.

2.14 GENERAL HOUSEKEEPING

The subject contained no significant debris or materials. Overall the subject site had good housekeeping.

2.15 ADJACENT PROPERTY DESCRIPTION

The adjacent properties consisted of residential land to the west and light industrial/commercial to the north, east and south.

Table 1 - Surrounding Land Use

	North Adjacent	South Adjacent	West Adjacent	East Adjacent
Land Use	Vacant	Light Industrial /commercial Land Use	Residential Land Use	Light Industrial /commercial Land Use
Description	Vacant uncultivated land	Various Industrial /Commercial Use	44 Street followed by single family residences (SFR) and a Multi-tenant residential (MTR) building	A gravel road followed by vacant uncultivated land.
Evaluation	No obvious potential environmental concerns observed.	No obvious potential environmental concerns observed.	No obvious potential environmental concerns observed.	No obvious potential environmental concerns observed.

3.0 ENVIRONMENTAL FILE REVIEW

3.1 AERIAL PHOTOGRAPH REVIEW

Historical aerial photographs were obtained from Alberta Sustainable Resources Development (ASRD) Aerial Photograph Record System (APRS, 2001) to obtain information regarding the historical land use of the site. Nine (9) aerial photographs were obtained for the time period as noted in **Table 2**. The summary and description of relevant features or structures visible in the aerial photographs of the site and adjacent properties is presented below in **Table 2**.

Table 2 – Aerial Photograph Summary

YEAR	DESCRIPTION
1949	The subject site appears to consist of a farming homestead in the northwest portion, a square shaped development, inferred to be an oil and gas lease also located in the northwest portion, and vacant agricultural land in the remaining areas. There appears to be a cleared pathway, inferred to be a pipeline right of way entering the subject site from the northeast corner and exiting in the southwest corner. A second cleared pathway is visible traversing the central portion of the subject site from east to west.
1968	Similar to the 1949 aerial photograph with the exception of a gravel road and development inferred to be an oil and gas lease is visible in the northeast portion of the subject site. The cleared pathway traversing the subject site from east to west is now inferred to be a rail line. The pathway entering the subject site from northeast to southwest is no longer visible.
1976	Similar to the 1968 aerial photograph.
1983	Similar to the 1976 aerial photograph.
1990	Similar to the 1983 aerial photograph.
1996	Similar to the 1990 aerial photograph, with the exception of various stands of vegetation are visible throughout the vacant cultivated portions of the subject site.
2004	Similar to the 1996 aerial photograph, with the exception of both inferred oil and gas leases appear to not be in production. The rail line traversing the subject site from east to west is no longer visible.
2011	Similar to the 2004 aerial photograph. Several gravel roads appear to enter the subject site from the west, east, and south portions.
2015	Similar to the 2011 aerial photograph. Inferred bodies of water

The surrounding area appears to have consisted of residential land use to the southeast and southwest since the late 1940s. Residential development to the west of the subject site appears to occur during the late 1970s. Commercial/light industrial development to the south of the subject site appeared to occur in the early 1980s.

3.2 LAND TITLE REVIEW

A copy of the current land title was obtained by Basin from the Spin 2 online registry. Based on information listed within the title document, the Site is described as "Meridian 4, Range 21, Township 57, Section 29, and Quarter South West". The land title indicated that "Henry Yarmola of c/o Stack, Smith & Co." was listed as the registered owner of the Site at the time of this assessment. No liens or other encumbrances indicating potential environmental concern were noted within the current title.

A copy of the current land title is included in Appendix II.

3.3 WELLS, PIPELINES, AND RELEASES

An Alberta Energy Regulator (AER) search was conducted through the Abacus Datagraphics website (www.abacusdatagraphics.com). Their search results indicated there were nine abandoned pipelines present entering the subject site from the northeast. Five of the pipelines exit the south-central and southeast portion of the subject site, two pipelines travel to the former oil and gas lease in the east-central portion, and two travel to the former oil and gas lease in the west-central portion of the subject site. All nine pipelines are owned by ARC Resources Ltd., abandoned, constructed of steel, and formerly contained oil well effluent. One abandoned, steel natural gas pipeline, owned by the Town of Redwater, transverses the north portion of the subject site, and one operating, steel fresh water pipeline, owned by ARC Resources Ltd., transverses the south portion of the subject site.

One oil and gas well, 100/05-29-057-21 W4M, owned by Imperial Oil Resources Limited, was located in the west-central portion of the subject site. It was drilled in 1950, abandoned in 1996, and reportedly produced crude oil. A second oil and gas well, 100/06-29-057-21 W4M, owned by Imperial Oil Resources Limited, was located in the east-central portion of the subject site. It was drilled in 1949, abandoned in 1994, and reportedly produced crude oil.

Refer to section 3.7 for reclamation information regarding these two well sites.

Search results from the AER are provided in Appendix II.

3.4 STORAGE TANKS

Basin requested a database search from the Petroleum Tank Management Association of Alberta (PTMAA, 2015) for information relating to active and/or abandoned aboveground and underground storage tanks for the subject site.

The search revealed no active or inactive tanks were reported at that site. Results indicated several storage tanks south of the subject site, but due to their distance (approximately 100m), the results were not reviewed.

There are no records available from the PTMAA prior to 1992. The PTMAA databases are incomplete and cannot guarantee that tanks do not or have not existed at the subject site.

Search results from the PTMAA are provided in Appendix II**.**

3.5 ENVIRONMENTAL LAW CENTRE

Basin requested a search of the Environmental Law Centre (ELC, 2015) for information relating to any environmental or hazardous incidents on the subject site while owned by: Henry Yarmola. The Environmental Enforcement Historical Search indicated that there has been no enforcement actions issued as per the Alberta Environmental Protection and Enhancement Act and its predecessor legislation.

Search results from the ELC are provided in Appendix II.

3.6 HISTORICAL HENDERSON DIRECTORIES AND FIRE INSURANCE PLANS

Searches of the Historical Henderson Directories and Fire Insurance Plans were not conducted as part of this Phase I ESA. It is expected that there is sufficient site listing information gathered from historical land titles, landowner interviews and previous Phase I ESA reports completed for the property.

3.7 PREVIOUS REPORTS AND ENVIRONMENTAL SITE ASSESSMENT REPOSITORY RESULTS

An inspection letter report was provided for Basin's review for the former oil well 100/06-29-057-21 W4M (located in the east-central portion of the subject site). The letter report makes note that Imperial Oil tested surficial and subsurface methane levels on July 15, 2015, at the well center and immediate area. Imperial reported that methane levels at well center and the immediate surrounding area were consistent with naturally varying concentrations of methane in the soil of the area. Imperial concluded that no methane anomalies exist at the location of this well site. However, no information indicating a remediation report, or Phase I/ II ESA had been completed during the decommissioning of this well was made available to Basin.

Given the lack of Phase I or II Environmental Site Assessments and remediation reports completed during the abandonment of this well site, it is Basin's opinion that the 100/06 well site has potential to cause subsurface impacts to the subject site.

A reclamation certificate for the former oil well 100/05-29-057-21 W4M (located in the west-central portion of the subject site) was provided for Basin's review by the Client. The reclamation certificate was issued to Imperial Oil Resources Limited within SW 29-57-214 W4M on July 11, 1995. The reclamation certificate indicates that no Phase I or II Environmental Site Assessments were completed, and no remediation reports were completed for the well site.

Given the lack of Phase I or II Environmental Site Assessments and remediation reports completed during the abandonment of this well site, it is Basin's opinion that the 100/05 well site has potential to cause subsurface impacts to the subject site.

The Environmental Site Assessment Repository (ESAR) (http://www.esar.alberta.ca/) database was searched for records pertaining to any environmental assessments completed on or adjacent to the subject site. Their search results indicated that reclamation certificates were available for the subject site, but were not reviewed by Basin, as more relevant documents for the same locations were provided by the Client.

4.0 RECOMMENDATIONS

Based on the results of the Phase I ESA completed by Basin, the following could result in potential subsurface impacts at the Site:

- The former well sites (100/05 and 100/06) located in the west-central and east-central portions, respectively, of the subject site.

Based on the findings above, Basin recommends completing a Phase II ESA at the Site.

5.0 LIMITATIONS

The material contained in this report reflects Basin's best judgment in light of the information available at the time the environmental consulting services and report preparation ("Services") were conducted. Basin may have also relied on information provided by third parties while conducting the Services. The accuracy of this report is affected by the accuracy of this information.

The reported information is believed to provide a reasonable representation of the general environmental conditions in the areas assessed. The data presented was collected at specific locations and the conditions may be different in other locations where specific information was not collected. Findings outlined in this report cannot and should not be extrapolated to areas that were not specifically investigated. In addition, only those parameters specifically addressed in this report have been evaluated.

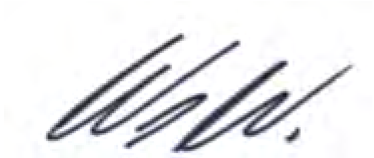
The assessment, conclusions and recommendations provided in this report are intended for the sole use of the Client for the specific Services referenced herein and for no other purpose whatsoever. Any other reliance on this report by the Client or a third party is not authorized and Basin accepts no responsibility for any such use or reliance.

Services performed by Basin for this Project have been conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Technical judgment has been applied in developing the conclusions and / or recommendations provided in this report. No other warranty or guarantee, expressed or implied, is made concerning the test results, conclusions, recommendations, or any other portion of this report.

6.0 CLOSURE

This report has been prepared by Basin Environmental Ltd., for the exclusive use of the Client, using generally accepted scientific and technical practices and environmental guidelines, regulations and criteria/standards in effect at the time of report preparation.

The Phase I ESA report prepared by the following individuals:



Wes Walkeden, Dipl. EnvSci., EPt
Environmental Technologist
(Author)

Darcy O'Brien, B. Sc., RPF
Principal, Senior Project Manager
(Reviewer)

7.0 REFERENCES

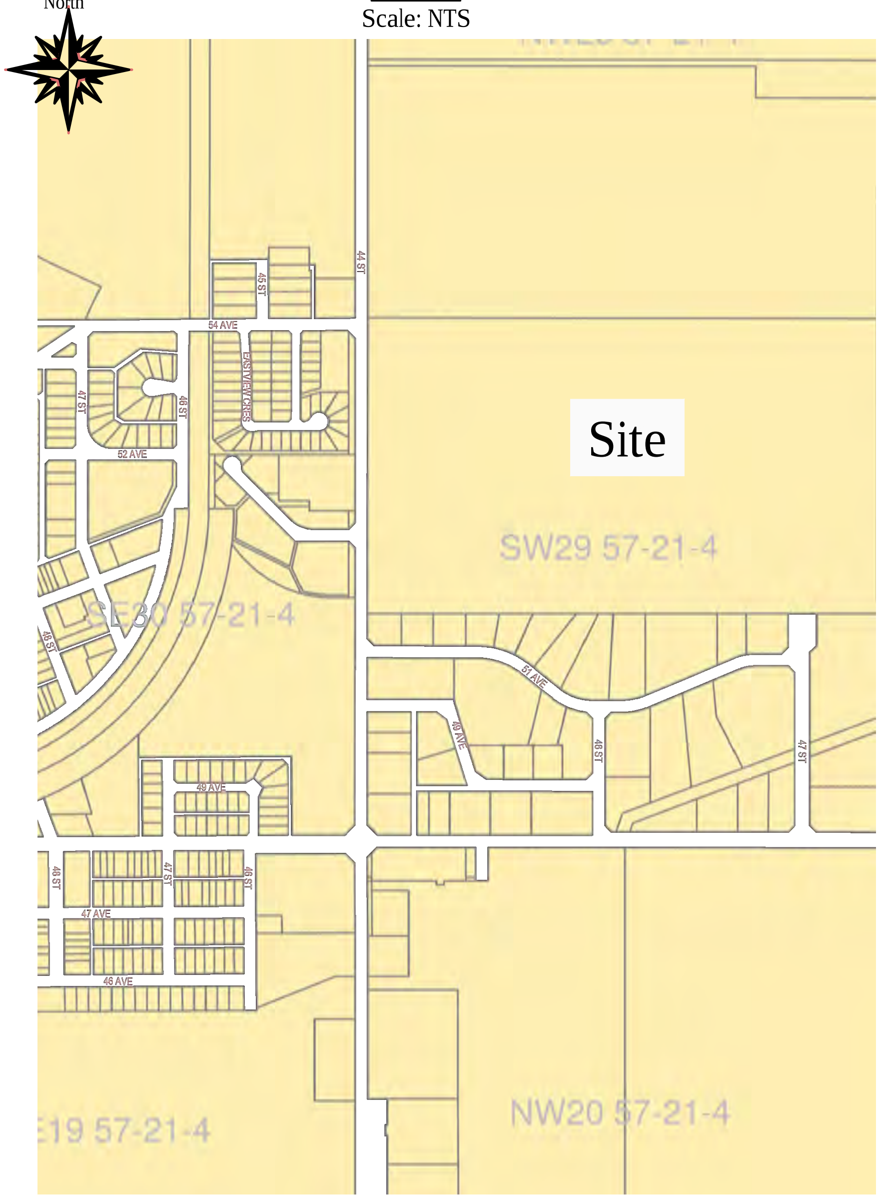
- Abacus Datagraphics Ltd. (Abadata), 2013. Abadata Oilfield Mapping Software. (www.abacusdatagraphics. com/index.asp).
- Alberta Environment (AENV) Environmental Site Assessment Repository (ESAR 2013). (www.esar.alberta.ca/ESARmap.aspx).
- Alberta Environment (AENV), 2013. Groundwater Information Centre (GWIC 2013). (http://www.envinfo.gov.ab.ca/GroundWater/)
- Canadian Standards Association (CSA), 2001. CSA Standard: Z768-01 Phase I Environmental Site Assessment. Toronto, ON.
- Environmental Law Center (ELC), 2013. Environmental Enforcement Historical Search Service. (www.elc.ab.ca/pages/home/default.aspx).
- Government of Alberta, 2010. Spin2 Spatial Information System (Spin2, 2013). (www.alta.registries.gov.ab.ca).
- Alberta Sustainable Resources (ASRD). Aerial Photographic Records System (APRS), 2013. (https://securexnet.env.gov.ab.ca/aprs/index.html).
- Petroleum Tank Management Association of Alberta (PTMAA), 2013. Petroleum Tank Management Association of Alberta. (http://www.ptmaa.ab.ca/).

APPENDIX I

FIGURES

North

Key Map
Scale: NTS



Surrounding Detail

Area of Detail

Legend:

Site Location.................................

References: Google Earth Imagery
Town of Redwater Maps

BASIN environmental

David Boychuck

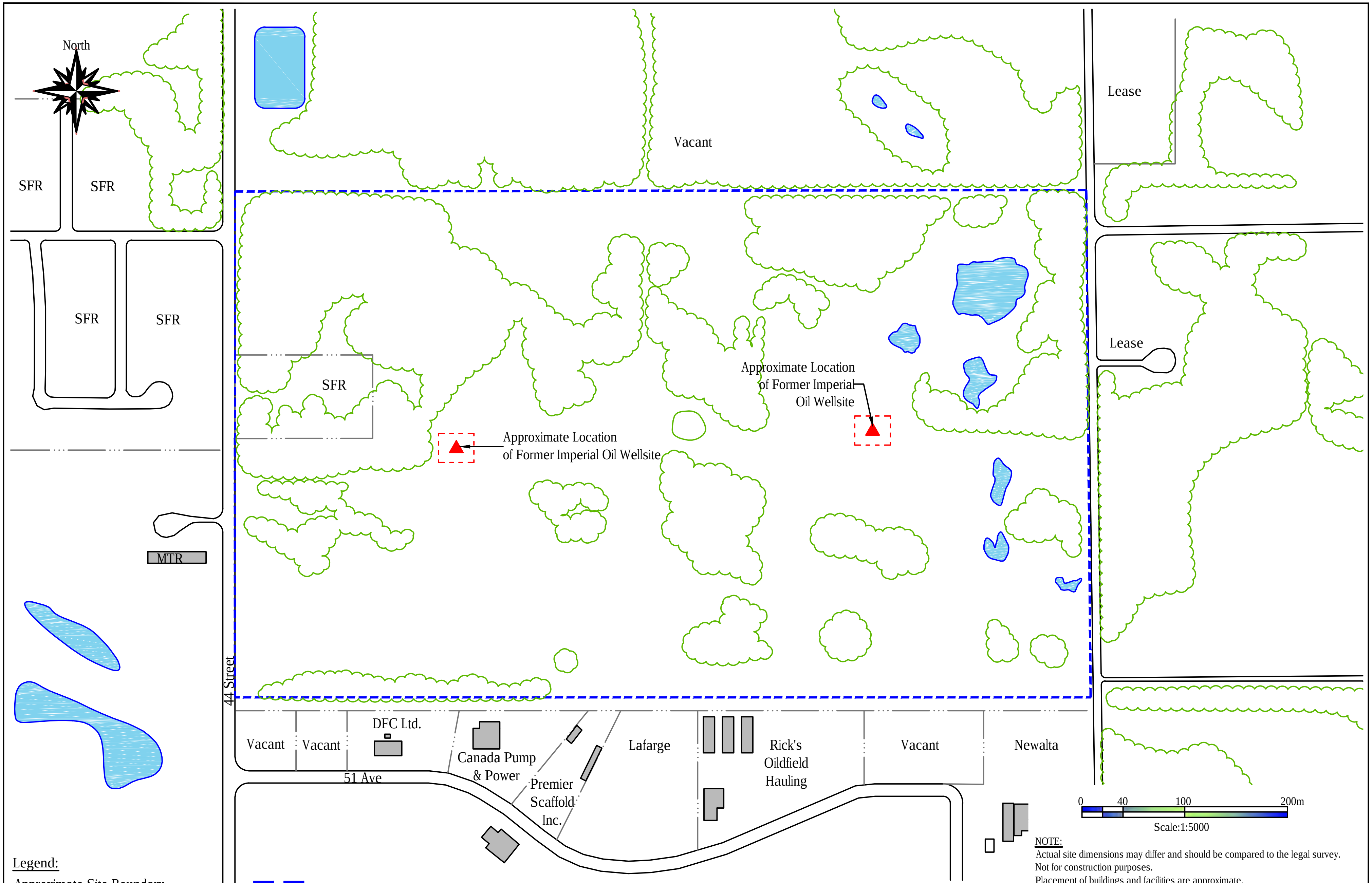
Phase I Environmental Site Assessment

SW-29-057-21 W4M

Key Map

Date:	Checked By:	Drawn By:	Project #:
September 2015	W.Walkeden	The Pacific Coast Drafting Co.	B-0150-15

Figure: 1



NOTE:
Actual site dimensions may differ and should be compared to the legal survey.
Not for construction purposes.
Placement of buildings and facilities are approximate.

Legend:

Approximate Site Boundary......................
Area of Potential Environmental Concern...
Other Property Boundaries........................
Treed Areas..
Water..
Multi-Tenant Residential............................ MTR
Single Family Residential........................... SFR

David Boychuck

Phase I Environmental Site Assessment

SW-29-057-21 W4M

Site and Surrounding Land Use

Date:	Checked By:	Drawn By:	Project #:
September 2015	W.Walkeden	The Pacific Coast Drafting Co.	B-0150-15

Figure: 2

APPENDIX II

REGULATORY SEARCHES

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0021 720 610	4;21;57;29;SW	10Q252

LEGAL DESCRIPTION

MERIDIAN 4 RANGE 21 TOWNSHIP 57
SECTION 29
QUARTER SOUTH WEST
CONTAINING 64.7 HECTARES (160 ACRES) MORE OR LESS
EXCEPTING THEREOUT:
(A) 3.88 HECTARES (9.60 ACRES) MORE OR LESS SUBDIVIDED UNDER PLAN 3190HW
(B) ALL THAT PORTION DESCRIBED AS FOLLOWS: COMMENCING AT THE POINT OF INTERSECTION OF THE WEST BOUNDARY OF THE SAID QUARTER SECTION AND THE NORTH LIMIT OF NORTH AVENUE AS SHOWN ON SUBDIVISION PLAN 3190HW; THENCE EASTERLY ALONG THE SAID NORTH LIMIT AND ITS PRODUCTION EASTERLY FOUR HUNDRED AND FORTY (440) FEET; THENCE NORTHERLY AND PARALLEL TO THE SAID WEST BOUNDARY TWO HUNDRED AND EIGHT AND SEVENTY HUNDREDTHS (208.70) FEET; THENCE WESTERLY AND PARALLEL TO THE SAID NORTH LIMIT TO THE SAID WEST BOUNDARY; THENCE SOUTHERLY ALONG THE SAID WEST BOUNDARY TO THE POINT OF COMMENCEMENT, CONTAINING 0.849 HECTARES (2.10 ACRES) MORE OR LESS.
(C) 22.87 HECTARES (56.51 ACRES) MORE OR LESS AS SHOWN ON SUBDIVISION PLAN 8120796
(D) THE MOST EASTERLY TEN (10) METRES IN PERPENDICULAR WIDTH THROUGHOUT, LYING NORTH OF THE NORTH LIMIT OF RIGHT-OF-WAY PLAN 2316KS
EXCEPTING THEREOUT ALL MINES AND MINERALS

ESTATE: FEE SIMPLE

MUNICIPALITY: TOWN OF REDWATER

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
10Q252	02/12/1971			NOT ESTABLISHED

OWNERS

HENRY YARMOLA
OF C/O STACK, SMITH & CO
2420-#3 MC CAULEY PLAZA

(CONTINUED)

10025 JASPER AVE
EDMONTON
ALBERTA
EXECUTOR FOR MIKE YARMOLA

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
3004HL	19/01/1950	CAVEAT CAVEATOR - ARC RESOURCES LTD. 1200-308-4 AVE SW CALGARY ALBERTA T2P0H7 (DATA UPDATED BY: TRANSFER OF CAVEAT 142406429)
1173HN	17/02/1950	CAVEAT CAVEATOR - ARC RESOURCES LTD. 1200-308-4 AVE SW CALGARY ALBERTA T2P0H7 (DATA UPDATED BY: TRANSFER OF CAVEAT 142407148)
2597HR	18/10/1950	CAVEAT CAVEATOR - IMPERIAL OIL LIMITED.
3484KF	17/01/1956	CAVEAT CAVEATOR - ARC RESOURCES LTD. PO BOX 6776,STATION D CALGARY ALBERTA T2P2E7 (DATA UPDATED BY: TRANSFER OF CAVEAT 072517379) (DATA UPDATED BY: CHANGE OF ADDRESS 152105217)
2981TF	29/08/1972	CAVEAT CAVEATOR - IMPERIAL OIL LIMITED.
1126VA	20/08/1974	CAVEAT CAVEATOR - ARC RESOURCES LTD. PO BOX 6776,STATION D CALGARY ALBERTA T2P2E7 (DATA UPDATED BY: TRANSFER OF CAVEAT 072516592) (DATA UPDATED BY: CHANGE OF ADDRESS 152149325)
802 065 866	25/03/1980	CAVEAT

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
		CAVEATOR - ARC RESOURCES LTD. PO BOX 6776,STATION D CALGARY ALBERTA T2P2E7 (DATA UPDATED BY: TRANSFER OF CAVEAT 062528194) (DATA UPDATED BY: CHANGE OF ADDRESS 152145753)
802 106 564	13/05/1980	CAVEAT CAVEATOR - CAPITAL REGION NORTHEAST WATER SERVICES COMMISSION. 10005 - 102 STREET, FORT SASKATCHEWAN ALBERTA T8L2C5 "DATA UPDATED BY: TRANSFER OF CAVEAT #862046493"
812 078 423	07/04/1981	CAVEAT RE : DEFERRED RESERVE CAVEATOR - EDMONTON REGIONAL PLANNING COMMISSION.
822 036 232	18/02/1982	UTILITY RIGHT OF WAY GRANTEE - THE TOWN OF REDWATER. AS TO PORTION OR PLAN:8122954
042 472 904	28/10/2004	UTILITY RIGHT OF WAY GRANTEE - THE TOWN OF REDWATER. PO BOX 397 4924-47 STREET REDWATER ALBERTA T0A2W0 (DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY 042500224)

TOTAL INSTRUMENTS: 011

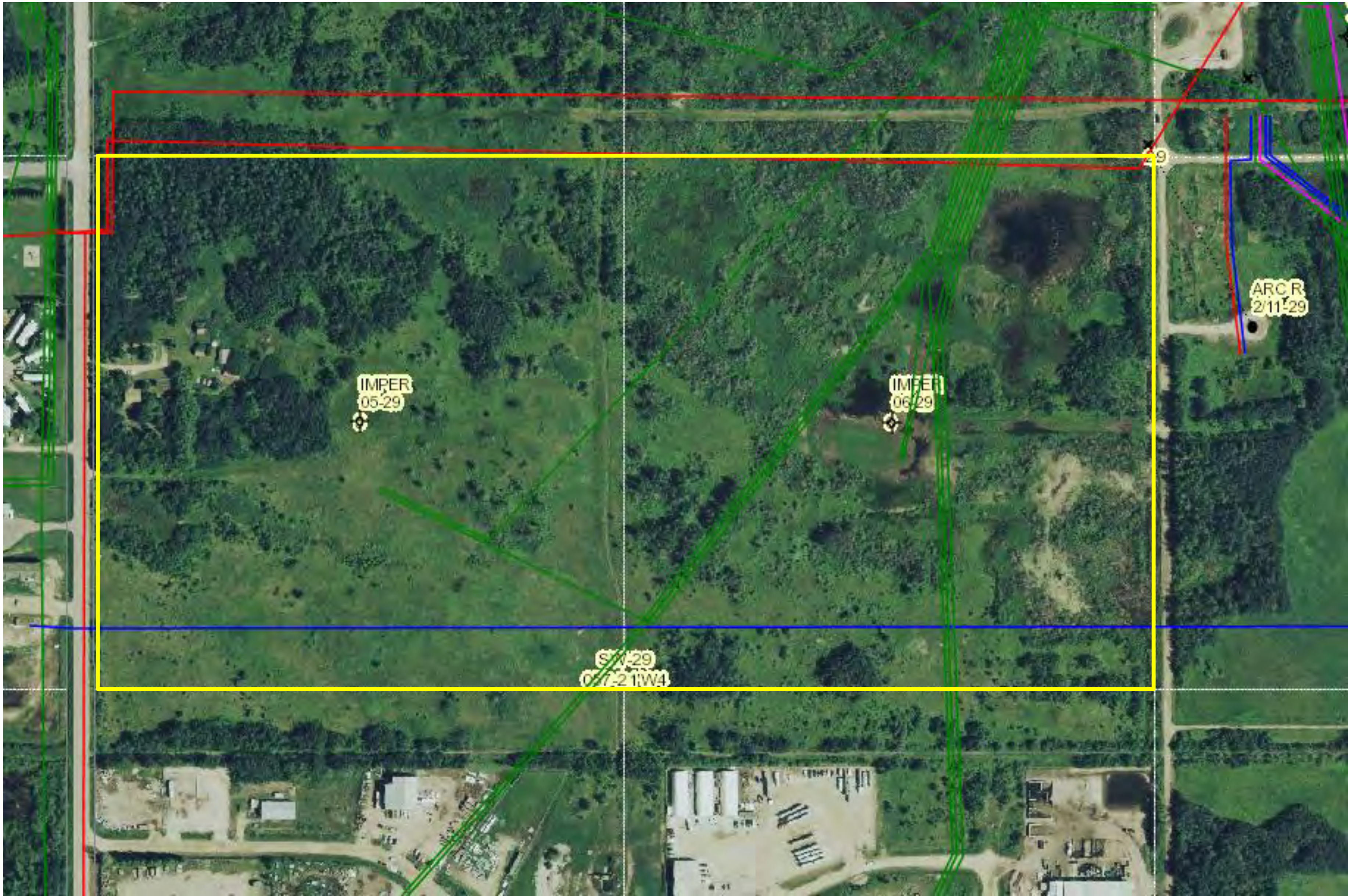
THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 9 DAY OF SEPTEMBER, 2015 AT 08:51 A.M.

ORDER NUMBER: 29226995

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

AER Map



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

September 10, 2015

Wes Walkeden
Basin Environmental Ltd
115 Nottingham Road,
Sherwood Park, AB
T8A 5M3

Dear Wes Walkeden:

As per your request, the PTMAA has checked the registration of active tank sites and inventory of abandoned tank sites and have included records for the property with the legal land description:

SW 29-057-21-W4

Information is provided is governed by the Freedom of Information and Protection of Privacy Act. 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

TMS - Tank Management System

Site Tank Detail by Site by Site Name

(Section A General Information)

1. Site Name: TARTAN TRANSPORT & CONST.LTD

Site Number: 6240 Class: B

Status: Decommission

2. Reference:

3a.Urban: Address: INDUSTRIAL PARK

City/Town: 090-05 REDWATER TOWN (P)

3b.Rural: County/MD/ID:

3b.Legal Land Description: LSD: SW ¼ of Sec. 29 / Twp. 57 / Rge. 21 / W. of 4 Mer.

Lot: Block: Plan:

4. Owner: 5192		5. Operator: 5192	
TARTAN TRANSPORT & CONSTRUCTION LTD.		TARTAN TRANSPORT & CONSTRUCTION LTD.	
PO BOX 9		PO BOX 9	
REDWATER		REDWATER	
AB T0A 2W0		AB T0A 2W0	
Contact: 1 Dave McDonald		Contact: 1 Dave McDonald	
Transport Manager	(780) 942 - 3802	Transport Manager	(780) 942 - 3802

6. Type of Facility: a. Petroleum Sales:

b. Facility Owner Usage: 4 Commercial / Industrial

7. Supplier of petroleum products:

8. Number of Tanks: Underground: 0 Aboveground: 0

Under the authority of the Safety Codes Act, this information is being collected by the Petroleum Tank Management Association of Alberta (PTMAA) and will be released to the public upon request in accordance with the Freedom of Information and Protection of Privacy (FOIP) Act. If you have any questions, please contact the PTMAA at the address noted on the form or call (780)425-8265.

TMS - Tank Management System

Site Tank Detail by Site by Site Name

(Section B Petroleum Tank Information)

Site Name: TARTAN TRANSPORT & CONST.LTD

Site Number: 6240

1. Tank I.D. Number: 1
2. Tank Type:
3. Tank Serial #:
4. Year & Month of Removal: 12 / 03
   Removal Company: Unknown (AST)
   Foreman's Certification #:
   Foreman's Name: Unknown
   Reason for Removal: 1 No Longer Required
5. Is the tank a:
   Facility Design Engineer's:
   Firm:
   Professional Registration #:
   Installer Company Name:
   Foreman's Name:
   Foreman's Certification #:
6. Year and Month of Installation:
7. Condition at Installation:
   Year of previous service:
8. Status of Tank:
   year & month of last use:
9. Tank Material:
   Other Tank Material:
10. Contents:
   Allied Petroleum Products:
11. Tank Capacity:
   Other:
12. Tank Construction Specifications:
   Other:
13. Cathodic Corrosion Protection:
14. Secondary Containment System:
   Other:
16. Spill Containment:
   (Underground Tanks)
17. Overfill Prevention:
   Other:
   Upgrade required:
18. Tank Leak Test:
   Date:
   Method:
   Other Methods:
   Result:
19. Underground, horizontal piping:
20. Leak Detection Employed At This Site : Y Other
   Other : Visual
   Upgrade required: 2 No

TMS - Tank Management System

Site Tank Detail by Site by Site Name

Site Name: TARTAN TRANSPORT & CONST.LTD

Site Number: 6240

(Section C Piping System Information)

1. Piping Material: 1 Bare Steel
   Other:
2. Piping Secondary Containment: 3 None
   Other:
3. Steel Piping Cathodic Corrosion Protection: 3 None
4. Type of Pumping System:
5. Line Leak Detection Installed: 5 None
   Other:
   Upgrade required:

(Section D Site Sensitivity)

1. Tanks located within 500 metres of a groundwater well: 2 No
2. Tanks located within 200 metres of a surface water body: 2 No
   Type of surface water:
   Other:
3. Tanks located within 150 metres of a major underground structure: 2 No
   Type of underground structure:
   Other:

(Section E Other Information)

1. Site Diagram: 2 No

3. Questionnaire Completed By: David McDonald   Phone: (403) 942 - 3802

4. Signature on the form: 1 Yes   Date: 1996/10/24   Information Complete: 1 Yes

   Date form sent: 1997/06/17   Date form received: 1996/10/24

(Notepad)

Note:

Oct. 24, 1996 - as per original registration form, tank is temp. out of service.

Nov. 7, 1996 - Registration certificate was issued, not sure when tank was taken out of serv.

Mar 9, 2012 - Per email on file by owner. All tanks have been removed from site.

TMS - Tank Management System

Site Tank Detail by Site by Site Name

(Section A General Information)

1. Site Name: THORHILD CO-OP-REDWATER

Site Number: 8261 Class: B

Status: Active

2. Reference:

3a.Urban: Address: 46 STR. & 51 AVE. E

City/Town: 090-05 REDWATER TOWN (P)

3b.Rural: County/MD/ID:

3b.Legal Land Description: LSD: SW ¼ of Sec. 29 / Twp. 57 / Rge. 21 / W. of 4 Mer.

Lot: 8&9 Block: 2 Plan: 8122910

4. Owner: 7056
THORHILD CO-OPERATIVE ASSOC. LTD
PO BOX 160
THORHILD
AB T0A 3J0
Contact: 1 Kory Kralkay
General Manager (780) 398 - 3975

5. Operator: 7056
THORHILD CO-OPERATIVE ASSOC. LTD
PO BOX 160
THORHILD
AB T0A 3J0
Contact: 1 Kory Kralkay
General Manager (780) 398 - 3975

6. Type of Facility: a. Petroleum Sales: 3 Cardlock or Keylock

b. Facility Owner Usage:

7. Supplier of petroleum products: 3 Federated Co-op

8. Number of Tanks: Underground: 0 Aboveground: 6

TMS - Tank Management System

Site Tank Detail by Site by Site Name

(Section B Petroleum Tank Information)

Site Name: THORHILD CO-OP-REDWATER

Site Number: 8261

1.	Tank I.D. Number:	1	2	3	4
2.	Tank Type:	2 Aboveground	2 Aboveground	2 Aboveground	2 Aboveground
3.	Tank Serial #:	59N10071	59N10071	59N10064	59N10068
4.	Year & Month of Removal:				
	Removal Company:				
	Foreman's Certification #:				
	Foreman's Name:				
	Reason for Removal:				
5.	Is the tank a:	1 New Installation	1 New Installation	1 New Installation	1 New Installation
	Facility Design Engineer's:	Cohos Evamy	Cohos Evamy	Cohos Evamy	Cohos Evamy
	Firm:	Gerald Carson	Gerald Carson	Gerald Carson	Gerald Carson
	Professional Registration #:	P10020	P10020	P10020	P10020
	Installer Company Name:	KW Petro. Serv.	KW Petro. Serv.	KW Petro. Serv.	KW Petro. Serv.
	Foreman's Name:	Brad Nessel	Brad Nessel	Brad Nessel	Brad Nessel
	Foreman's Certification #:	282	282	282	282
6.	Year and Month of Installation:	10/07 - 1 Known	10/07 - 1 Known	10/07 - 1 Known	10/07 - 1 Known
7.	Condition at Installation:	1 New	1 New	1 New	1 New
	Year of previous service:				
8.	Status of Tank:	1 Currently in service	1 Currently in service	1 Currently in service	1 Currently in service
	year & month of last use:				
9.	Tank Material:	1 Steel	1 Steel	1 Steel	1 Steel
	Other Tank Material:				
10.	Contents:	2 Diesel	1 Gasoline	2 Diesel	2 Diesel
	Allied Petroleum Products:				
11.	Tank Capacity:	4 15,000 litres	7 35,000 litres	Y	4 15,000 litres
	Other:			50,000 litres	
12.	Tank Construction Specifications:	14 ULC 653	14 ULC 653	14 ULC 653	14 ULC 653
	Other:				
13.	Cathodic Corrosion Protection:				
14.	Secondary Containment System:	4 Steel	4 Steel	4 Steel	4 Steel
	Other:				
16.	Spill Containment: (Underground Tanks)				
17.	Overfill Prevention:	4 High Level Detection	4 High Level Detection	4 High Level Detection	4 High Level Detection
	Other:				
	Upgrade required:				
18.	Tank Leak Test:	2 No	2 No	2 No	2 No
	Date:				
	Method:				
	Other Methods:				
	Result:				
19.	Underground, horizontal piping:	1 Yes	1 Yes	1 Yes	1 Yes

20. Leak Detection Employed At This Site : 4 Monitoring of Secondary Containment, 5 Daily Inventory Reconciliation

Other :

Upgrade required:

TMS - Tank Management System

Site Tank Detail by Site by Site Name

(Section B Petroleum Tank Information)

Site Name: THORHILD CO-OP-REDWATER

Site Number: 8261

1.	Tank I.D. Number:	5	6
2.	Tank Type:	2 Aboveground	2 Aboveground
3.	Tank Serial #:	59N10068	59W10069
4.	Year & Month of Removal:		
	Removal Company:		
	Foreman's Certification #:		
	Foreman's Name:		
	Reason for Removal:		
5.	Is the tank a:	1 New Installation	1 New Installation
	Facility Design Engineer's:	Cohos Evamy	Cohos Evamy
	Firm:	Gerald Carson	Gerald Carson
	Professional Registration #:	P10020	P10020
	Installer Company Name:	KW Petro. Serv.	KW Petro. Serv.
	Foreman's Name:	Brad Nessel	Brad Nessel
	Foreman's Certification #:	282	282
6.	Year and Month of Installation:	10/07 - 1 Known	10/07 - 1 Known
7.	Condition at Installation:	1 New	1 New
	Year of previous service:		
8.	Status of Tank:	1 Currently in service	1 Currently in service
	year & month of last use:		
9.	Tank Material:	1 Steel	1 Steel
	Other Tank Material:		
10.	Contents:	1 Gasoline	2 Diesel
	Allied Petroleum Products:		
11.	Tank Capacity:	7 35,000 litres	Y
	Other:		50,000 litres
12	Tank Construction Specifications:	14 ULC 653	14 ULC 653
	Other:		
13.	Cathodic Corrosion Protection:		
14.	Secondary Containment System:	4 Steel	4 Steel
	Other:		
16.	Spill Containment: (Underground Tanks)		
17.	Overfill Prevention:	4 High Level Detection	4 High Level Detection
	Other:		
	Upgrade required:		
18.	Tank Leak Test:	2 No	2 No
	Date:		
	Method:		
	Other Methods:		
	Result:		
19.	Underground, horizontal piping:	1 Yes	1 Yes

20. Leak Detection Employed At This Site : 4 Monitoring of Secondary Containment, 5 Daily Inventory Reconciliation

Other :

Upgrade required:

TMS - Tank Management System

Site Tank Detail by Site by Site Name

Site Name: THORHILD CO-OP-REDWATER

Site Number: 8261

(Section C Piping System Information)

1. Piping Material: 4 Flexible Plastic
   Other:
2. Piping Secondary Containment: 1 Double Walled Pipe
   Other:
3. Steel Piping Cathodic Corrosion Protection:
4. Type of Pumping System: 2 Submersible Turbine (Pressure)
5. Line Leak Detection Installed: 4 Intersititial Monitoring of Double Walled Pipe, Y Other
   Other: Sump Sensors
   Upgrade required:

(Section D Site Sensitivity)

1. Tanks located within 500 metres of a groundwater well: 2 No
2. Tanks located within 200 metres of a surface water body: 2 No
   Type of surface water:
   Other:
3. Tanks located within 150 metres of a major underground structure: 2 No
   Type of underground structure:
   Other:

(Section E Other Information)

1. Site Diagram: 1 Yes
3. Questionnaire Completed By: Murray Bazarkiewicz   Phone: (306) 227 - 3779
4. Signature on the form: 1 Yes   Date: 2010/09/16   Information Complete: 1 Yes
   Date form sent: 2015/06/24   Date form received: 2010/09/22

(Notepad)

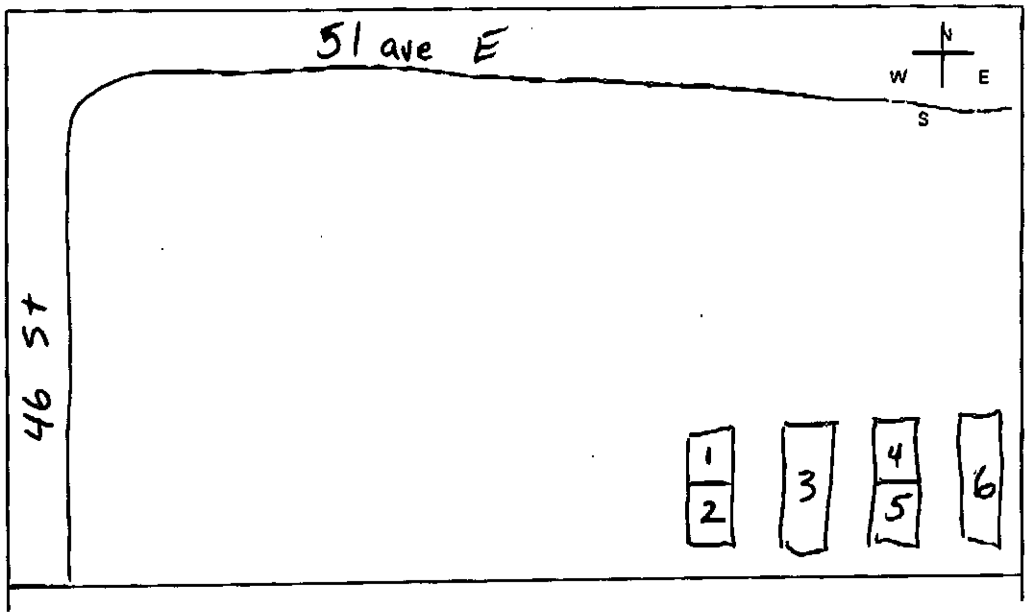
Note:

Sept 22, 2010 - Plan Review # 1237/Permit 0265-10-142 on file.
- Precision Test Results on file.
- VOC on file.

8172-8261

SECTION E: OTHER INFORMATION

1. **Site Diagram:** (Please number tanks in accordance with information provided and illustrate in relation to streets and buildings.)



2. **Comments:**

3. **Questionnaire Completed By:** Murray Bazarkiewicz (Name, Please Print) 306-227-3779 (Bus. Phone #)

4. **I hereby confirm that the information provided on this questionnaire is complete and accurate to the best of my knowledge.**

2010/09/16
(YY/MM/DD)

Signature (Owner of Tank(s) or Authorized Representative)

Under the authority of the Safety Codes Act, this information is being collected by the Petroleum Tank Management Association of Alberta (PTMAA) and will be released to the public upon request in compliance with the Freedom of Information and Protection of Privacy (FOIP) Act. If you have any questions, please contact the PTMAA at the address noted on this form or call (780)425-8265.

[redacted]

ENVIRONMENTAL LAW CENTRE
Suite 800, 10025 - 106 Street, Edmonton, AB T5J 1G4
Phone: (780) 424-5099 Fax: (780) 424-5133
Internet: www.elc.ab.ca E-Mail: elc@elc.ab.ca

September 9, 2015 Our File: 102716

Mr. Wes Walkeden
Basin Environmental Ltd.
4233 112 Avenue
Edmonton, AB T5W 0N1

Dear Mr. Walkeden:

RE: Search Requested - Henry Yarmola

In response to your request of September 9, 2015, we have searched the Environmental Enforcement Historical Search Service database for an exact match with respect to the above request, and can advise that as of today's date, there have been NO enforcement actions issued pursuant to the Alberta "Environmental Protection and Enhancement Act" ("EPEA") and its predecessor legislation, the "Hazardous Chemicals Act", "Agricultural Chemicals Act", "Clean Water Act" and "Clean Air Act" to 1971, and/or pursuant to the "Water Act" from 1999 onwards.

This search is limited to the following enforcement actions under EPEA and its predecessor legislation: Tickets, Prosecutions, Administrative Penalties, Warnings, Enforcement Orders, Enforcement Orders Concerning Waste, Environmental Protection Orders, Emergency Environmental Protection Orders, Emission Control Orders, Chemical Control Orders, Water Quality Control Orders and Stop Orders. This search is limited to the following enforcement actions under the Water Act: Prosecutions, Administrative Penalties, Water Management Orders, Warnings and Enforcement Orders. It does not include Clean Up Orders issued under the Litter Act or Environmental Protection Orders respecting unsightly property issued under EPEA; this information may be available from the local municipality.

Enforcement actions are entered in the database following: (1) the decision date, for prosecutions; (2) the date an administrative penalty was paid or due (30 days after issuance), whichever is sooner; and (3) the date the document was issued for all other enforcement actions.

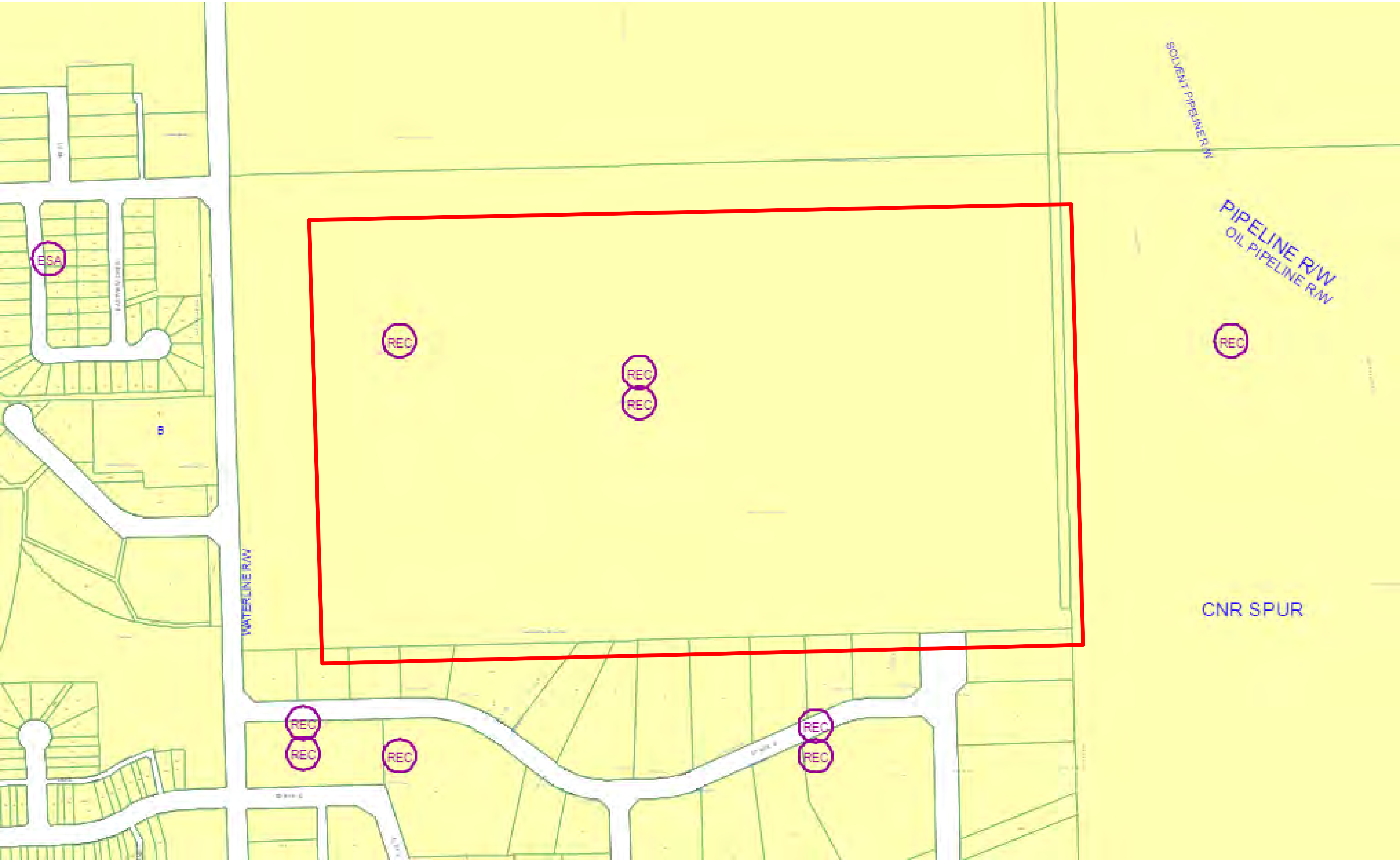
These search results are based on information provided by Alberta Environment ("AENV"). AENV advises that they try to provide the best information possible. However, AENV advises that it cannot guarantee that the information provided is complete or accurate and that any person relying on these search results does so at their own risk. More information may be gained by referring to original enforcement documents.

Copies of orders are available from the Environmental Law Centre. Any other enforcement information may be available directly from Alberta Environment.

Yours sincerely,

Cindy Dewing
Enforcement Search Service
Encl.

ESAR Map



SOLVENT PIPELINE R/W
PIPELINE R/W
OIL PIPELINE R/W
ESA
REC
REC
REC
REC
REC
B
WATERLINE R/W
CNR SPUR
REC
REC
REC
REC
REC

APPENDIX III

PHOTOGRAPHS

Picture 1 - View of Single Family Residence in the northwest portion of the subject site.

Picture 2 - View to the north of the subject site.

Picture 3 - View of the east property line of the subject site, facing south.

Picture 4 - View of the south property line of the subject site, facing east.

Picture 5 - View to the west of the subject site.

Picture 6 - View of the buildings at the residence in the northwest portion of the subject site.

Picture 7 - Additional view of the buildings at the residence in the northwest portion of the subject site.

Picture 8 - View of the northwest portion of the subject site.

Picture 9 - View of the southwest portion of the subject site.

Picture 10 - View of the southeast portion of the subject site.

Picture 11 - View of the standing water area in the southeast portion of the subject site.

Picture 12 - View of the standing water along the east property line of the subject site.

Picture 13 - View of the wet area in the northeast portion of the subject site.

Picture 14 - View of the central portion of the subject site.

Picture 15 - Additional view of the central portion of the subject site.

Picture 16 - View of a located buried former well center in the east-central portion of the subject site.

Appendix B

Letter from ARC Resources

RESOURCES LTD.

Land

Suite 2100
440 2 Avenue SW
Calgary, Alberta, Canada
T2P 5E9
Tel 403 503 8600
Fax 403 503 8645
www.arcresources.com

July 4, 2016

1876827 Alberta Inc.
C/O David Boychuk
#397-2235 TWP 530
Sherwood Park, Alberta
T8A 4T7

VIA E-MAIL

Re: ARC Resources Ltd. ("ARC")
Abandoned pipelines in S ½ NW 29-57-21-W4M

As per our recent telephone conversations regarding your intentions to apply for a development permit in the S ½ NW 29-57-21-W4M.

ARC is committed to working with landowners on a case by case basis to mitigate any issues related to an abandoned line. We would request that any developments applications and further approvals be forwarded to our office, so we can determine the proper and reasonable course of action. Depending on the nature of disturbance/crossing/encroachment the lines may be able to stay in place and have no effect on your proposed development.

ARC may also consider partial removal of abandoned pipelines when they have the potential to physically impede a development that has been approved by the local authority (Town of Redwater).

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

Yours truly,

John Dmetruik
Senior Surface Landman
ARC Resources Ltd.
Phone: (780) 942-6501/Cell: (780) 220-4805

cc: Mark Roblin, ARC Resources Ltd.
Pete Dickson, ARC Resources Ltd.

Appendix C

Geotechnical Investigation

(ENC Testing)

ENC TESTING INC.

#270, 120 Pembina Road
Sherwood Park, Alberta
T8H 0M2
Phone: (780) 467-1334
Fax: (780) 467-1336

Project No.: T18 –1005 ENC File: 500 – 0

February 15, 2019

0974200 BC Ltd.
c/o Teckera Civil Engineering Consultants Ltd.
#90, 210 McLeod Avenue
Spruce Grove, Alberta
T7X 2K5

Ph: (780) 948-1444; Cell: (780) 803-0571; Email: glen@Teckera.ca

Attention: Mr. Glen Pitt, P.L.(Eng.) Engineering Manager, Principal

Geotechnical Investigation Report
Proposed Redwater Area Structure Plan - Portion of SW 29-57-21-W4
Redwater, Alberta

As requested, ENC Testing Inc. has completed a geotechnical investigation at the above noted site. Please find enclosed our report with respect to the above noted investigation. In brief, this report presents the geotechnical recommendations for design and construction aspects of this project.

We hereby give assurance that this geotechnical investigation enclosed was prepared by or under the direct supervision of this registered Professional, complying with the Alberta Building Code.

We trust this report meets your engineering design requirements. If you should have any questions or comments, please feel free to contact ENC Testing Inc.

Yours truly,
ENC Testing Inc.

Nafisul Islam.

Nafisul Islam, M.Eng., P. Eng.

Geotechnical Investigation Report
Proposed Redwater Area Structure Plan - Portion of SW 29-57-21-W4
Redwater, Alberta

Prepared For:

0974200 BC Ltd.
c/o Teckera Civil Engineering Consultants Ltd.
#90, 210 McLeod Avenue
Spruce Grove, Alberta
T7X 2K5

Date of Report:
February 2019

Materials Testing by:
ENC Testing Inc.
Sherwood Park, Alberta

Geotechnical Investigation Report
Proposed Redwater Area Structure Plan - Portion of SW 29-57-21-W4
Redwater, Alberta

TABLE OF CONTENTS

List of Pictures

Geotechnical Investigation

Project: Proposed Redwater Area Structure Plan

Location: Portion of SW 29-57-21-W4, Redwater, Alberta

Client: Teckera Civil Engineering Consultants

Attention: Mr. Glen Pitt, P.L.(Eng.), Engineering Manager, Principal

1. INTRODUCTION

As requested, ENC Testing Inc. (ENC) has completed a geotechnical investigation made on the above noted site. In brief, this report presents the geotechnical recommendations for design and construction aspects of this project. The objectives of the investigation were to determine the subsoil conditions to aid in design and construction.

ENC understands that Teckera Civil Engineering Consultants Ltd. (Teckera) is preparing an Area Structure Plan (ASP) for 90 acres of land in the Town of Redwater located within SW 29-57-21-W4M. The land will be developed as a commercial/industrial area with possible usages as RV storage yards, welding shops, and other similar businesses. There is no plan of building residential houses for this development. ENC understands that the commercial buildings will not incorporate a basement. The development will also include installation of underground water line at depths between 3m and 5m, and sewer lines at depths between 4m and 5m. Gravel surfaced roadways will also be constructed. Teckera Provided a traffic impact assessment (TIA) report, titled 'Redwater Industrial Park 44th Street, Highway 38:10 & 47th Street, Highway 644:02', prepared by D&A Paulichuk Consulting Ltd., dated February 15, 2019.

Written authorization signed by Mr. Glen Pitt, P.L.(Eng.), Engineering Manager, Principal, was received through email on January 9, 2019. Fieldwork was completed on January 24 and 25, 2019. This geotechnical investigation was conducted as outlined in proposal S18-1005 dated January 3, 2019 and is subject to the terms and conditions contained therein.

Previous land utilization, environmental concerns, buried objects unless encountered, or other geotechnical issues not specifically noted are beyond the scope of this report. All recommendations are based on the soils encountered in the testholes. Should different soils be encountered between the testholes, additional recommendations may be provided. The recommendations provided apply only to the outlined structure. Other forms may require alternative recommendations.

2. SITE DESCRIPTION

The proposed 90 acres of land for the development is located on the northeast corner of 44 Street and a railway spur north of 51 Avenue East in the Town of Redwater, Alberta. The land is within SW 29-57-21-W4M. During the fieldwork, the site was covered with snow. There were treed areas on the northwest portion of the site and sporadically treed areas on the other portions of the site. There are some low-lying areas on the east side of the site. Some residential dwelling house structures were located on the west side of the site. A contour drawing provided by Teckera showed that the site generally sloped towards the northeast and an elevation difference of approximately 10.0m existed from the southwest corner to the northeast corner of the site.

Picture 1: Facing north from the location of Testhole T9

Utilities checked included electric power, telecommunication and gas service lines. Underground utilities found on site were avoided during testhole probing.

3. FIELD INVESTIGATION

The soil investigation was conducted using a tracked rig contracted from Evergreen Drilling Ltd. and equipped with solid stem augers. Eleven testholes were advanced, in 1.5 metre increments, to a maximum depth of 9.1m within the proposed land area. These are all recorded on the testhole logs and site plan in the Appendix. A continuous visual description was recorded on site, which included the soil types, depths, moistures, and other pertinent observations. Slightly disturbed samples were removed and collected at intervals of 0.75 metres from the auger for further testing at the laboratory. Standard Penetration Tests (SPT's) were conducted at selective depths to determine the soil strength.

Standpipes were installed in all of the testholes. The locations of the testholes were determined by a hand-held GPS with an accuracy of ±3m. No surveying was conducted to determine the elevation of the testholes, however, based on the location of the testholes and the provided contour drawing, an approximate elevation of the testholes was determined and presented on the testhole logs.

4. LABORATORY TESTING

All samples returned to the laboratory were tested for moisture content. Eight representative samples were further tested to determine the liquid and plastic limits of the Atterberg Limit series, and eight for the concentration of soluble soil sulphates. The results of all laboratory and field testing are provided on the attached testhole logs in the Appendix.

5. SUBSURFACE SOIL CONDITIONS

A detailed description of the soils encountered is found on the attached testhole logs in the Appendix. In general, the subsurface soil profile at this site may be described as surficial topsoil followed by clay underlain by bedrock. Sporadic layers of sand, silt, and clay till was noted within the clay layer. In one of the testholes, Testhole T8, sand fill and clay fill soil was noted.

5.1 Topsoil

Topsoil was encountered at grade in all of the testholes and extended to depths ranging between 0.25m and 0.45m. The topsoil was A-horizon organic, clayey or sandy, damp, and black in colour.

At the time of fieldwork, the ground was frozen to depths between 0.15m and 0.5m.

5.2 Sand Fill/ Clay Fill

Sand fill was noted in one of the testholes, Testhole T8, below the topsoil at 0.3m and extended to 0.9m. The sand fill was clayey, low plastic, damp, and medium brown in colour. One moisture content test on a representative sand fill sample showed 9.7%.

Clay fill was noted in one of the testholes, Testhole T8, below the sand fill at 0.9m and extended to 1.7m. The clay fill was sandy, medium plastic, stiff, damp, and medium brown-grey in colour. One moisture content test on a representative clay fill sample showed 21.5% and a pocket penetrometer reading of 100kPa.

5.3 Clay

Clay was encountered in all of the testholes at depths ranging between 0.3m and 2.1m and extended to depths ranging between 2.6m and 5.3m. Sporadic layers of sand, silt, and clay till were noted within the clay layer in some of the testholes. The clay was silty to sandy, low to high plastic, stiff to hard, damp to moist, medium brown to medium brown-grey in colour, and contained traces of oxides. Moisture content tests within the clay varied between 8.7% and 31.5% and averaged 21.5%. The pocket penetrometer readings within the clay varied between 100kPa and 450kPa, and averaged 355kPa, indicating very stiff consistency. Five Standard Penetration Tests (SPTs) within the clay layer showed blow counts between 14 and 39 for 300mm of penetration, indicating stiff to hard consistency. Four Atterberg Limit tests on representative clay samples, from Testholes T1, T4, T8 at 2.3m and Testhole T6 at 3.0m depths, showed Liquid Limits to vary between 46.5% and 65.9%, Plastic Limits to vary between 16.7% and 22.2%, Plasticity Indices to vary between 29.8% and 46.6%, indicating medium to high plasticity.

Sand layers were noted in Testholes T1, T6, and T9 at 2.7m, 0.3m, and 0.3m and extended to 3.5m, 1.8m, and 0.9m respectively. The sand was clayey to silty, dry to damp, and reddish-brown to medium brown in colour. Moisture content tests within the sand varied between 9.2% and 20.5% and averaged 14.6%.

A silt layer was encountered in one of the testholes, Testhole T7, at 0.9m and extended to 2.4m. The silt was clayey, medium plastic, stiff to very stiff, damp, and medium brown-grey in colour. Two moisture content tests on representative samples from the silt layer showed 19.5% and 17.9% and the pocket penetrometer readings of 200kPa and 225kPa. One Atterberg Limit test on a representative silt sample from Testhole T7 at 1.5m showed a Liquid Limit of 31.9%, Plastic Limit of 19.0%, Plasticity Index of 12.9%, indicating medium plasticity.

A clay till layer was encountered in one of the testholes, Testhole T11, at 0.5m and extended to 2.1m. The clay till was sandy, medium plastic, very stiff, damp, medium brown-grey in colour, and contained traces of oxides. Two moisture content tests on representative samples from the clay till layer showed 19.0% and 17.0%, and the pocket penetrometer readings showed 300kPa and 375 kPa, indicating very stiff consistency.

5.4 Clay Shale/Sandstone Bedrock

Clay shale bedrock was encountered in all of the testholes at depths ranging between 2.6m and 7.2m and extended to the termination depths of the testholes, the maximum being 9.1m. The clay shale bedrock was highly weathered, silty, high plastic, hard, damp, and medium brown to medium grey in colour. Moisture content tests within the clay shale varied between 14.6% and 71.6% and averaged 25.2%. The pocket penetrometer readings within the clay shale varied between 250kPa and in excess of 450kPa, and averaged 430kPa, indicating hard consistency. Four Standard Penetration Tests (SPTs) within the clay shale layer showed blow counts between 39 and 73 for 300mm of penetration, indicating hard consistency. Two Atterberg Limit tests on representative clay shale samples, from Testhole T2 at 4.1m and Testhole T9 at 4.5m depths, showed Liquid Limits of 68.6% and 60.6%, Plastic Limits of 21.5% and 20.2%, and Plasticity Indices 47.1% and 40.4%, indicating high plasticity.

Sandstone bedrock was encountered in three of the testholes, Testholes T5, T7, and T11, at depths of 4.4m, 5.3, and 4.9m and extended to 5.6m, 5.6m, and 7.2m respectively. The sandstone bedrock was clayey, low to medium plastic, hard, damp, and medium grey to brown-grey in colour.

Moisture content tests within the sandstone varied between 15.1% and 20.9% and averaged 17.2%. The pocket penetrometer readings within the sandstone varied between 250kPa and in excess of 450kPa, and averaged 410kPa, indicating hard consistency. Two Standard Penetration Tests (SPTs) within the sandstone layer showed blow counts of 66 and 85 for 300mm of penetration, indicating hard consistency. One Atterberg Limit test on a representative sandstone sample from Testhole T5 at 4.6m showed Liquid Limit of 43.2%, Plastic Limit of 16.8%, and Plasticity Index of 26.4%, indicating medium plasticity.

6. GROUNDWATER CONDITIONS

Following drilling, groundwater readings and slough conditions were measured and piezometric standpipes were installed in all of the testholes. The water level was measured 6 and 7 days after drilling. Results are tabulated below:

Testhole Number (Probe Depth, m)	Ground Elevation at Testhole* (m)	Depth Below Ground Surface at End of Drilling(m)		Below Ground Surface on January 31, 2019 (m)	
		Slough	Groundwater	Depth	Elevation
T1 (5.8)	622.50	No	Dry	5.09	617.41
T2 (6.1)	618.75	No	Dry	1.00	617.75
T3 (6.9)	618.25	No	Dry	3.50	614.75
T4 (6.1)	618.50	No	Dry	1.50	617.00
T5 (5.8)	621.75	No	Dry	2.57	619.18
T6 (9.1)	623.00	No	Dry	3.52	619.48
T7 (5.8)	625.00	No	Dry	3.64	621.36
T8 (6.1)	624.00	No	Dry	4.44	619.56
T9 (9.1)	626.25	No	Dry	2.77	623.48
T10 (5.8)	619.00	No	Dry	2.75	616.25
T11 (9.1)	621.00	No	Dry	Dry	-
*Testhole elevations were estimated from the provided contour map, therefore, approximate.					

From the above Table, it can be seen that the shallowest groundwater was noted at 1.0m at this site. In terms of elevation, the approximate shallowest groundwater elevation was at 623.48m. It should be noted that groundwater level may fluctuate on a seasonal or yearly basis, and after periods of heavy rainfall or extended dry weather. Water levels may vary between the testhole locations.

7. RECOMMENDATIONS

7.1 General Construction

1. There is an elevation difference of approximately 10.0m across the proposed site, therefore, cut and fill will be required for the site development. The design grade of the proposed development is not known to ENC at this time of report preparation.
2. Fill soil to a depth of 1.7m was noted in one of the testholes, Testhole T8. Fill soil of unknown depths can be present within the site other than at this testhole location. The

history of the fill soil is not known and should be considered as non-engineered fill. The shallowest groundwater was noted at 1.0m at this site. Excavations deeper than the groundwater depth may accumulate water into the excavation.

3. The foundation system may consist of shallow foundations such as strip and spread footings in the areas of cut. Shallow foundations can also be used in areas with fill height shallower than 1.5m. Alternatively, cast in place concrete piles can be used. Areas with fill thicknesses greater than 1.5m should utilize cast in place concrete piles.

4. It is recommended that all surface grading be sloped away from the buildings at a minimum grade of 10% for a distance of 3.0 metres. Where pavements are provided, this may be reduced to 2%. It is imperative that drainage be maintained during construction and over time.

5. It is recommended that all soil materials be tested by ENC Testing Inc. to verify adequate compaction, before additional materials are placed.

6. Allowance for or acceptance of differential movement between different foundation conditions within the structure, between any staging of construction, and between the structure and any slabs on grade must be made. In general, mixing of foundation types within the structure is not recommended.

7. The planting of large trees and landscaping should be designed in such a manner that desiccation or saturation of soil does not occur. Care should also be taken that excess water from sprinklers does not cause the subgrade soils to become saturated and eventually swell.

8. The following values correspond to ultimate limit states (ULS) and serviceability limits states (SLS) as defined in the Canadian Foundation Engineering Manual 4th Edition 2006, section 8.2 and can be used as such. Serviceability limit states are numerically equivalent to the working stress and should include both dead and live loads. The resistance factor (ϕ) from the Canadian Foundation Engineering Manual has been provided. The theoretical ULS value must not be used for purposes other than ULS design with the appropriate resistance and load factors. SLS design must be checked.

7.2 Site Grading

1. All topsoil should be stripped off the entire site and wasted.

2. Following determination of design grades, the site should be graded by cut and fill. Fill soil should be clean of organics and any other deleterious materials and be placed and compacted to 98% of Standard Proctor Density (SPD) over 0 to 2% of Optimum Moisture Content (OMC) in compacted lift thicknesses of 150mm.

3. Imported fill where needed can consist of medium plastic clay or clay till material and should be placed and compacted to 98% of Standard Proctor Density (SPD) over 0 to 2% of Optimum Moisture Content (OMC) in compacted lift thicknesses of 150mm.

7.3 Footings

1. The footing parameters can be accurately provided when the location of the buildings are determined. However, footings are feasible for areas where there is cut, i.e., native soil at grade and for areas where the fill depth following site grading is less than 1.5m. A preliminary range of footing design parameters are provided here based on the strength of the soil samples encountered in the testholes. The bearing values that may be used are as follows:

Table 3: Preliminary Footing Design Parameters			
Soil Stratum	**Bearing Value (kPa)**		
On native undisturbed clay, clay till, silt, or sand	SLS	Resistance Factor	Factored ULS
Strip footing	155 - 175	0.5	235 - 265
Spread footing	185 - 205	0.5	280 - 310

2. To provide frost cover and moisture protection, the exterior footings should be placed at least 1.5 metres below finished grade within a continuously heated structure. The interior footings within a heated structure should be provided with at least 0.6m of soil cover. All footings for a non-continuously heated structure should be placed 2.7 metres below the finished grade or frost mitigation measures installed. Differential settlements are anticipated to be less than 25 millimetres.

3. To ensure adequate performance of the foundation system, continuous footings should be designed as a beam with adequate reinforcing and should be integrated with the foundation walls, if applicable. Such design procedures would permit foundation components to withstand a small amount of differential movement induced by any soil volume changes.

4. Should any organic, soft, wet, or weak footing foundation areas, not shown by the testholes, be encountered during construction, ENC Testing Inc. should be contacted so that additional recommendations may be supplied.

5. No loose, disturbed, remoulded, or sloughed material should be allowed to remain in the open footing excavations. Hand cleaning is advised if an acceptable surface cannot be prepared by mechanical equipment. Excavations should be dug with equipment operating remote from the bearing surface. It is recommended that all bearing surfaces be inspected to verify the correct soil type, and to check for local pre-existing disturbances or soft areas.

6. Footing excavations should be protected from drying, rain, snow, freezing, and the ingress of groundwater. If groundwater is noted in the excavation, the undersigned should be contacted to assess the situation. Care should be taken during construction to prevent excessive changes in moisture content of this material. Where practical, weeping tile should be utilized to assist in control of infiltration water. Protection from desiccation is also recommended to minimize volume change. This is accomplished by not using below slab hot air heating and keeping large deep-rooting trees a sufficient distance away from

the building.

7. All interior backfill against foundation walls should be an inorganic material and should be compacted to an equivalent of at least 98% of the corresponding Standard Proctor Density at optimum moisture content. The backfill should be placed in lifts not greater than 150 millimetres after compaction.

8. Surface grading of the fill around the proposed building should be made sloping away from the foundation walls. Exterior fill should be compacted, and be of low permeability materials. Lateral pressures on the foundation should be considered during backfill.

9. During winter construction, it is essential that all interior fill and load bearing materials remain frost-free. Should freezing of the foundation support soils occur, additional movements can be expected. Recommended winter construction practices, with respect to hoarding and heating of the forms and the fresh concrete, must be strictly followed. If doubts remain as to the suitability of the foundation during construction, the owner should consult ENC Testing Inc.

10. The footing excavations should be inspected by ENC Testing Inc. to verify that the undisturbed native soil is exposed at all locations.

7.4 Cast-in-Place Piles

1. A cast in place concrete pile foundation system can be utilized for this building. The structure may be founded on an adequately reinforced grade beam or pile cap supported by bored, cast in place, concrete friction piles.

2. The skin friction values that may be used are as follows:

Soil Stratum Elevation, metres	**Skin Friction Values (kPa)**	
	Resistance Factor, (ϕ)	Factored ULS
Grade to below 1.5m or fill depth, whichever is greater	0	0
Below 1.5m or fill depth whichever is greater – 614.5	0.4	23
614.5 – 610.4	0.4	35

3. For skin friction piles, the ultimate shaft resistance is mobilized with relatively small pile displacement, less than 10mm and as such, serviceability limit states (SLS) is not of a concern. No end-bearing resistance should be considered in design of skin friction piles.

4. Considering the effects of frost and seasonal moisture changes, the friction value for the first 1.5 metres of pile should not be considered in design for unheated or isolated piles. This may be reduced to 0.6 metres for interior piles of continuously heated buildings. No frictional values should be considered within the fill depth.

5. Piles installed within the fill soil will be subject to negative skin friction or down-drag. Structural resistance and pile settlement are the two main design considerations for drag loads. Once the location of the structures, fill depth and fill placement records at such locations are known, proper recommendations can be provided for negative skin friction considerations in design. Down-drag can substantially be reduced by placing a double polyethylene wrapped sonotube throughout the fill depth to reduce settlement.

6. The minimum length of pile should consider the frost heave force as described in Section 7.6.

7. Reinforcing should have similar minimum lengths. The minimum pile shaft diameter for all piles should be 400mm, with minimum pile spacing of 2.5 times the pile diameter on centre for skin friction piles.

8. The mixing of piles, pile types, or footings within one structural element is not recommended as differential movements may occur.

9. The end-bearing values that may be used are as follows:

Soil Stratum	End-Bearing Value (kPa)		
	SLS	Resistance Factor (ϕ)	Factored ULS
Native Clay	330 – 415	0.4	400 – 500
Bedrock (Clay Shale/Sandstone)	665 - 830	0.4	800 - 1000

10. Due to the 10m difference in existing grade across the site, the depth or elevation of the bell could not be provided. Once the locations of the structures are identified, the recommended depth of bell formation can be provided. Bell diameters should be a minimum to two and a maximum of three times the shaft diameter. The ratio of the depth to bell base and bell diameter should be minimum 2.5. Belled piles subject to uplift should have reinforcement extending to the base of the bell.

11. Pile bells cannot be formed within sloughing layers. To provide adequate support for the roof of a bell where wet sloughing layers are encountered, the minimum distance from the underside of a sloughing layer to the top of the roof of a bell should be 0.6m. This may require altering the pile type or field alteration of bell elevation to confirm the bells are formed in acceptable bearing strata.

12. All pile holes must be clean and dry during and prior to placement of concrete. The pile concrete should be placed as soon as possible after the pile has been bored to minimize the potential of sloughing or ingressing groundwater.

13. Sloughing soil conditions were not noted; however, casing should be available on site to seal off zones if sloughing soil conditions are encountered during piling. The piling contractor should make its own determination as to the need for casing and ability to provide a clean pile. It is noted that different piling equipment requires different conditions to maintain clean and open pile holes.

14. All pile holes should be carefully inspected to ensure that no water or slough material is present prior to concrete placement. Full time inspection by ENC Testing Inc. is recommended for all piles and is required should the client require ABC Schedules.

15. Provisions should be made for the possible swelling of the subsoil and the effects of frost action by providing a suitable 100 millimetre void form beneath the grade beams.

16. It is recommended that all piles be adequately reinforced. Concrete for all piles should be adequately compacted.

7.5 Slabs on Grade

1. The site development will require grading and therefore there will be fill in some portions of the site and native soil on the remaining areas. Fill soil to a depth of 1.7m was also encountered at Testhole T8 location. This fill soil is considered to be non-engineered and should be removed if it falls under a building footprint.

2. The floor slabs placed on top of fill areas can be constructed as a structurally supported floor slab or, if it is desired and the owner is willing to accept the risk of potential slab movements, a slab on grade can be constructed ensuring construction supervision and following the recommendations below.

3. The existing fill soil, as noted in Testhole T8, should be excavated and stockpiled for reuse. Grading of the site should be completed as described in Section 7.2. In the cut areas, the top 150mm should be scarified, moisture conditioned to within 2 – 4% above the OMC and compacted to 96% of SPD. In the areas of fill location, for slab on grade, the fill from the design grade to fill depth up to a maximum depth of 1.5m should be placed 2 – 4% above the OMC and compacted to 96% of SPD in compacted lift thicknesses of 150mm. If the fill depth is less than 1.5m at any location, the required amount of fill should be placed 2 – 4% above the OMC and compacted to 96% of SPD in compacted lift thicknesses of 150mm.

4. Care should be taken during construction not to excessively dry or wet any of these materials. As moisture change of the supporting soil occurs, change in the volume of supporting materials will occur, with accompanying movement of the slab. It is recommended that the soil be placed at moisture content slightly over optimum moisture to reduce the potential for swelling.

5. A layer of clean granular material, 150 millimetres minimum, should be placed immediately below the slab on grade. This material should be compacted to an equivalent of at least 98% of the corresponding SPD at OMC.

6. A non-deteriorating vapour barrier should be placed beneath the concrete floor to reduce desiccation of the subgrade material. It is assumed that crack control reinforcing and joints will be utilized.

7. It is recommended that provisions for slab movement be designed into the structure. It is recommended that grade-supported floor slabs be structurally separated from other components of the proposed structure. The slabs should contain sufficient reinforcing to control cracking due to vertical movement caused by shrinkage and swelling of the underlying material. Other slab movement provisions may include adjustments for slab-supported equipment and space over partitions.

8. Where separation for the slab and foundation components is not practical, the slab should be reinforced to act as a structural slab, and some provision for volume change be made adjacent to the grade beam.

9. In such areas as furnace rooms, where there is an intense concentrated heat, adequate provisions should be made to protect the supporting subsoil from excessive desiccation. These areas should be well insulated so that soil volume changes beneath the floor slabs may be kept to a tolerable amount. Under slab air heating is not recommended.

10. Any areas with concrete floor slabs that will be exposed to deep frost penetration below the slabs are expected to move; hence, should not be rigidly attached to the structure, and should contain sufficient reinforcing to control crack width and vertical movements across the cracks and joints.

7.6 Frost Protection

1. Buried water lines should have a minimum frost cover of 3.3m if granular backfill is used. For cohesive backfill, the frost cover should be a minimum of 2.7m.

2. If less than the required soil cover is used, the pipes should be protected with insulation to avoid frost effects.

3. The design of piles should consider the adfreeze force. An adfreeze force of 65kPa along the upper 2.7m of the pile should be considered. The resistance to the adfreeze force will be the dead load acting on the pile, the weight of the pile and the resistance from below the frost zone of the pile.

7.7 Trench Excavation and Backfill

1. The excavation for this project will involve excavations for utility installations and site grading. The subsurface soil conditions encountered in the test holes are considered to be fair for the installation of underground utilities.

2. The shallowest depth of groundwater was 1.0m and excavations deeper than this depth may accumulate groundwater. Excavation should be dug in short sections and pumps should be used to dewater the excavation, where required.

3. The short term excavation that are deeper than 1.5m should have the sides shored and braced, or the slopes cut no steeper than 1.0H:1.7V. Where excavations are open for longer

than one month, or if significant groundwater seepage is encountered, the sideslopes should be cut not steeper than 1.0H:1.0V. The Occupational Health and Safety Act, General Safety Regulation should be strictly followed, except where superseded by this report. Please note that OH&S permits a vertical portion at the bottom of the trench, and this is not recommended in sands and silts.

4. To minimize pipe loading, trench widths should be minimal but compatible with safe construction operations. The trench width must be wide enough to accommodate pipe bedding and compaction equipment.

5. Long open trenches are not recommended as the sidewalls will fail over time. Protection for the workers is recommended for extended time excavations.

6. To overcome utility installation difficulties, it is recommended that a washed or screened rock and geotextile separator be utilized for the pipe bedding in areas of poor pipe bedding conditions. The washed rock and geotextile should surround the entire pipe with the exact dimensions determined in the field during construction. It is recommended that soft un-compactable material be replaced by washed rock to a minimum depth of 150 millimetres below the pipe. Depending upon the conditions of soil at the pipe base, additional rock may be required.

7. Pipe bedding should adhere to the pipe supplier's specifications or in absence of any such specifications, the City of Edmonton specifications can be followed. The backfill material beneath and up to the middle of the pipe should be an approved bedding sand material where conditions allow. This material should be hand placed and hand tamped with care taken to fill the underside of the pipe.

8. Minimum trench compaction recommendations are 98% of the corresponding Standard Proctor Density. A 150 millimetre maximum lift thickness should be used throughout.

9. Bedding first lifts will require lighter and smaller compaction equipment to avoid damage to the pipe installed. Ideally, each lift should be tested, the thickness determined and approval received before additional material is placed.

10. It should be noted that the ultimate performance of the trench backfill is directly related to the consistency and uniformity of the backfill compaction, as well as the underground contractor's construction procedures. In order to achieve this uniformity, the lift thickness and compaction criterion should be strictly enforced, including near the pipe zone. Sand, utilized to protect fragile pipe must also be compacted.

11. Temporary surcharge loads, such as spill piles, should not be allowed to within 2.0 metres of an unsupported excavation face while mobile vehicles should be kept back at least 1.0 metre. All excavations should be checked regularly for signs of sloughing or failures, especially after rainfall periods.

7.8 Gravel Pavement

1. The TIA report estimated traffic for the three phases as follows:

Phase	Year	Land Use	Total Traffic
1	2019	RV Park	480
2	2029	Industrial Park	386
3	2039	Industrial Park	626
		Total	1252

The type of the vehicle, such as single unit trucks (SUT) or tractor trailer combinations (TTC), were not mentioned in the TIA report. ENC assumed 95% of SUT and remaining 5% TTC. Based on the traffic volume of only Phase1, ENC has estimated a single axle, dual tire axle producing 8 x 10^5 Equivalent Single Axle Loads (EASLs) over a 20 year design life.

2. In the cut areas, the upper 150mm should be scarified and moisture conditioned to ±2% of OMC and compacted to 100% of SPD. In the fill areas, the fill should be placed as described in Section 7.2. and the top 150mm should be moisture conditioned to ±2% of OMC and compacted to 100% of SPD.

3. Following gravel structure can be provided:

    - 610 millimetres of 20 millimetres Crushed Gravel
    - with a woven geotextile for separation on sugbgrade

4. All granular layers should be compacted to 100% of SPD at ±2% of OMC. Gravel surfaces require periodic maintenance. If rutting occurs in the future, the ruts should be filled with 20mm crushed gravel and recompacted to ensure positive drainage.

5. As the calculated EASL's are high, for the future phases, it will be beneficial to consider asphalt surfaced pavements.

7.9 Concrete

Eight tests on selected soil samples from Testholes T1, T2, T4, T5, T6, T7, T8, and T9 at 2.3m, 3.8m, 2.3m, 4.5m, 3.0m, 1.5m, 2.3m, 4.5m respectively indicated a moderate potential for sulphate attack. Therefore, CSA Type MS or HS (formerly known as Type 50 Sulphate Resistant) cement at a maximum water/cementing material ratio of 0.50 should be used for concrete. CSA A23.1-14 Table 2 specifies air entrained concrete with a minimum 56-day compressive strength of 30 MPa for a Class-3 exposure. Concrete should be air entrained where freeze-thaw will occur. If imported fills are used for site grading, potential for sulphate attack of such soils should be tested.

7.10 Seismic Analysis

This investigation explored the soil to a maximum depth of 9.1m. Seismic site classification requires the strength of 30m of soil be looked at. Based on the soil strength encountered within the explored depth and reasonably assuming the soil strength to be greater with increasing depth, the seismic site classification for this site is “C” according to the 2014 Alberta Building Code (ABC) Table 4.1.8.4.A.

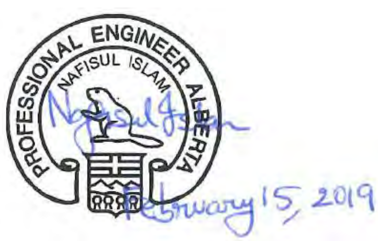
8. CLOSURE

This geotechnical investigation report was prepared for the exclusive and confidential use of 0974200 BC Ltd., Teckera Civil Engineering Consultants Ltd., and their agents, and applies only to the subject project. The recommendations given are based on the subsurface soil conditions encountered during testhole boring, current construction techniques, and generally accepted engineering practices. Soil conditions are known only at the test boring locations.

Due to the geological randomness of many soil formations, no interpolation of soil conditions between or away from the testholes has been made or implied. No other warranty, expressed or implied, is made. Should other soils be encountered during construction or other information pertinent to the structures become available, the recommendations may be altered or modified in writing by the undersigned.

We trust this information is satisfactory for your current needs. If you should have any further questions, please contact our office.

Respectfully yours,
ENC Testing Inc.
APEGA Permit 7111



Nafisul Islam, M. Eng., P. Eng.

A P P E N D I X

LIST OF CONTENTS

T18-1005 Tekera Redwater ASP SW 29-57-21-W4.dwg

Site Plan Showing Approximate Testhole Locations

Client: Teckera Civil Engineering Consultants Ltd. Date: February 6, 2019

Project: Proposed Area Structure Plan for Portions of SW 29-57-21-W4 — Redwater, AB

Drawn by: NI Checked by: LR Scale: NTS Figure: A1

LEGEND

Extent of the Site

TESTHOLE NUMBER Elevation Water Elev.

enc TESTING INC

ENC Testing Inc.
#270, 120 Pembina Road
Sherwood Park, Alberta T8H 0M2
Telephone: 780-467-1334
Fax: 780-467-1336

TESTHOLE T1

CLIENT 0974200 BC Ltd. c/o Teckera
DATE DRILLED 25-Jan-19
PROJECT NAME Redwater ASP
GROUND ELEVATION 622.50
PROJECT LOCATION SW 29-57-21-W4, Redwater, AB
GROUND WATER LEVELS:
PROJECT NUMBER T18-1005
AT END OF DRILLING Dry
DRILLING METHOD Solid Stem Auger
AFTER DRILLING ON 31-Jan-19
LOGGED BY KR **REVIEWED BY** NI
▽ **THE WATER LEVEL IS** 5.09 m / Elev 617.41 m
TESTHOLE LOCATION N 5980641.95 / E 362391.76

LEGEND **SAMPLE TYPE:** ⧓ SPT; Ⓐ SOLID STEM AUGER
SULPHATE: ▨ MODERATE
WELL BACKFILL: ■ BENTONITE; ▧ DRILL CUTTINGS; ⊞ SLOTTED PIPE

U.S.C.S.	ELEVATION (m)	DEPTH (m)	MATERIAL DESCRIPTION	SULPHATE	SAMPLE TYPE	SPT BLOW (N)	POCKET PEN. (kPa)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
TSOIL			(TSOIL) TOPSOIL (250mm), A-horizon organic, clayey, damp, black								
CI	622.2	0.3	(CI) CLAY, sandy, medium plastic, very stiff to hard, damp, medium brown -- frost encountered to 0.3m		A		400	13.5			
CH	621.3	1.2	(CH) CLAY, silty, high plastic, hard, damp, medium brown -- trace oxides at 1.2m		A		425	24.3			
				▨	A		450	22.9	62.6	22.2	40.4
					SPT	14	400	20.8			
SM	619.8	2.7	(SM) SAND, silty, dry, medium brown		A			19.4			
CH	619.0	3.5	(CH) CLAY, silty, high plastic, hard, damp, medium brown		A		450+	8.7			
					A		450+	25.0			
CH	617.6	4.9	(CH) CLAY SHALE, silty, high plastic, hard, damp, medium grey		A		450+	17.9			
					SPT	71	450+	17.7			
	616.7	5.8	End of testhole at 5.8m No slough Standpipe Installed Dry after drilling Water at 5.09m on 31-Jan-19 at 6 days								

DEPTH (m): 0, 1, 2, 3, 4, 5, 6, 7, 8

WELL DIAGRAM

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TESTHOLE T2

CLIENT 0974200 BC Ltd. c/o Teckera
DATE DRILLED 25-Jan-19
PROJECT NAME Redwater ASP
GROUND ELEVATION 618.75
PROJECT LOCATION SW 29-57-21-W4, Redwater, AB
GROUND WATER LEVELS:
PROJECT NUMBER T18-1005
AT END OF DRILLING Dry
DRILLING METHOD Solid Stem Auger
AFTER DRILLING ON 31-Jan-19
LOGGED BY KR **REVIEWED BY** NI
THE WATER LEVEL IS 1.00 m / Elev 617.75 m
TESTHOLE LOCATION N 5980629.15 / E 362698.72

LEGEND **SAMPLE TYPE:** SPT; SOLID STEM AUGER
SULPHATE: MODERATE
WELL BACKFILL: BENTONITE; DRILL CUTTINGS; SLOTTED PIPE

DEPTH (m)	U.S.C.S.	ELEVATION (m)	DEPTH (m)	MATERIAL DESCRIPTION	SULPHATE	SAMPLE TYPE	SPT BLOW (N)	POCKET PEN. (kPa)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0	TSOIL			(TSOIL) TOPSOIL (375mm), A-horizon organic, sandy, damp, black								
	CI	618.4	0.4	(CI) CLAY, sandy, medium plastic, stiff to very stiff, moist, medium brown-grey -- frost encountered to 0.5m		A		125	31.5			
1												
	CH	617.5	1.2	(CH) CLAY, silty, high plastic, very stiff, damp, medium brown-grey		A		400	26.4			
2				-- trace oxides at 2.3m		A		400	24.2			
	CH	616.2	2.6	(CH) CLAY SHALE, silty, high plastic, hard, damp, medium brown								
3						A		450+	20.4			
				-- wet dense coal seam from 3.4m - 4.0m		A			71.6			
4					Moderate	SPT	39	450+	14.6	68.6	21.5	47.1
						A		450+	31.4			
5						A		450+	34.3			
6						A		450+	27.1			
		612.7	6.1	End of testhole at 6.1m No slough Standpipe Installed Dry after drilling Water at 1.00m on 31-Jan-19 at 6 days								
7												
8												

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TESTHOLE T3

CLIENT 0974200 BC Ltd. c/o Teckera
DATE DRILLED 25-Jan-19
PROJECT NAME Redwater ASP
GROUND ELEVATION 618.25
PROJECT LOCATION SW 29-57-21-W4, Redwater, AB
GROUND WATER LEVELS:
PROJECT NUMBER T18-1005
AT END OF DRILLING Dry
DRILLING METHOD Solid Stem Auger
AFTER DRILLING ON 31-Jan-19
LOGGED BY KR **REVIEWED BY** NI
THE WATER LEVEL IS 3.50 m / Elev 614.75 m
TESTHOLE LOCATION N 5980568.57 / E 362820.44

LEGEND **SAMPLE TYPE:** A SOLID STEM AUGER
SULPHATE:
WELL BACKFILL: BENTONITE; DRILL CUTTINGS; SLOTTED PIPE

DEPTH (m)	U.S.C.S.	GRAPHIC LOG	ELEVATION (m)	DEPTH (m)	MATERIAL DESCRIPTION	SULPHATE	SAMPLE TYPE	POCKET PEN. (kPa)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	WELL DIAGRAM
0	TSOIL				(TSOIL) TOPSOIL (300mm), A-horizon organic, sandy, damp, black								
	CH		617.9	0.3	(CH) CLAY, silty, high plastic, stiff, moist, medium brown-grey -- frost encountered to 0.3m		A	100	29.9				
1							A	100	28.7				
2					-- hard at 2.3m -- dense coal seam from 2.4m - 2.7m		A	450+	30.4				
3					-- water ingresssing at 3.0m		A	450+	25.7				
4	CH		614.6	3.7	(CH) CLAY SHALE, silty, high plastic, hard, damp, medium grey		A	450+	39.6				
5							A	450+	29.4				
6							A	450+	35.8				
							A	450+	34.5				
7					-- dense coal seam from 6.5m - 6.9m		A	450+	51.0				
			611.4	6.9	End of testhole - refusal at 6.9m No slough Standpipe Installed Dry after drilling Water at 3.50m on 31-Jan-19 at 6 days								
8													
9													

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TESTHOLE T4

CLIENT 0974200 BC Ltd. c/o Teckera
DATE DRILLED 25-Jan-19
PROJECT NAME Redwater ASP
GROUND ELEVATION 618.50
PROJECT LOCATION SW 29-57-21-W4, Redwater, AB
GROUND WATER LEVELS:
PROJECT NUMBER T18-1005
AT END OF DRILLING Dry
DRILLING METHOD Solid Stem Auger
AFTER DRILLING ON 31-Jan-19
LOGGED BY KR **REVIEWED BY** NI
THE WATER LEVEL IS 1.50 m / Elev 617.00 m
TESTHOLE LOCATION N 5980439.06 / E 362854.10

LEGEND **SAMPLE TYPE:** SPT, SOLID STEM AUGER
SULPHATE: MODERATE
WELL BACKFILL: BENTONITE, DRILL CUTTINGS, SLOTTED PIPE

U.S.C.S.	ELEVATION (m)	DEPTH (m)	MATERIAL DESCRIPTION
TSOIL		0	(TSOIL) TOPSOIL (450mm), A-horizon organic, clayey, damp, black -- frost encountered to 0.3m
CI	618.0	0.5	(CI) CLAY, sandy, medium plastic, stiff, damp, medium brown-grey
CH	617.3	1.2	(CH) CLAY, silty, high plastic, very stiff, damp, medium brown
CH	615.8	2.7	(CH) CLAY SHALE, silty, high plastic, very stiff, damp, medium brown-grey -- water ingressing at 4.6m
	612.4	6.1	End of testhole at 6.1m No slough Standpipe Installed Dry after drilling Water at 1.50m on 31-Jan-19 at 6 days

SULPHATE	SAMPLE TYPE	SPT BLOW (N)	POCKET PEN. (kPa)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
	A		200	19.0			
	A		275	25.1			
MODERATE	A		275	25.3	65.9	19.3	46.6
	A		300	23.3			
	A		300	23.0			
	SPT	51	450+	21.5			
	A		250	44.8			
	A		275	43.0			
	A		325	43.1			

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TESTHOLE T5

CLIENT 0974200 BC Ltd. c/o Teckera
DATE DRILLED 25-Jan-19
PROJECT NAME Redwater ASP
GROUND ELEVATION 621.75
PROJECT LOCATION SW 29-57-21-W4, Redwater, AB
GROUND WATER LEVELS:
PROJECT NUMBER T18-1005
AT END OF DRILLING Dry
DRILLING METHOD Solid Stem Auger
AFTER DRILLING ON 31-Jan-19
LOGGED BY KR **REVIEWED BY** NI
THE WATER LEVEL IS 2.57 m / Elev 619.18 m
TESTHOLE LOCATION N 5980281.80 / E 362824.16

LEGEND **SAMPLE TYPE:** SPT; SOLID STEM AUGER
SULPHATE: MODERATE
WELL BACKFILL: BENTONITE; DRILL CUTTINGS; SLOTTED PIPE

DEPTH (m)	U.S.C.S.	ELEVATION (m)	DEPTH (m)	MATERIAL DESCRIPTION	SULPHATE	SAMPLE TYPE	SPT BLOW (N)	POCKET PEN. (kPa)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0	TSOIL			(TSOIL) TOPSOIL (450mm), A-horizon organic, clayey, damp, black -- frost encountered to 0.3m								
	CH	621.3	0.5	(CH) CLAY, silty, high plastic, very stiff, damp, medium brown-grey, trace oxides		A		300	20.7			
1–2						A		350	23.9			
2						A		350	24.7			
						SPT	35	450+	21.9			
3				-- hard at 2.7m		A		450+	19.3			
4						A		450+	21.2			
	SC	617.3	4.4	(SC) SANDSTONE, clayey, low to medium plastic, hard, damp, medium grey	MODERATE	A		400	16.3	43.2	16.8	26.4
5						A		375	15.8			
						SPT	85	450+	15.1			
	CH	616.1	5.6	(CH) CLAY SHALE, silty, high plastic, hard, damp, medium brown-grey								
6		616.0	5.8	End of testhole at 5.8m No slough Standpipe Installed Dry after drilling Water at 2.57m on 31-Jan-19 at 6 days								

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Telephone: 780-467-1334
Fax: 780-467-1336

TESTHOLE T6

CLIENT 0974200 BC Ltd. c/o Teckera
DATE DRILLED 25-Jan-19
PROJECT NAME Redwater ASP
GROUND ELEVATION 623.00
PROJECT LOCATION SW 29-57-21-W4, Redwater, AB
GROUND WATER LEVELS:
PROJECT NUMBER T18-1005
AT END OF DRILLING Dry
DRILLING METHOD Solid Stem Auger
AFTER DRILLING ON 31-Jan-19
LOGGED BY KR **REVIEWED BY** NI
THE WATER LEVEL IS 3.52 m / Elev 619.48 m
TESTHOLE LOCATION N 5980348.43 / E 362669.78

LEGEND **SAMPLE TYPE:** A SOLID STEM AUGER
SULPHATE: MODERATE
WELL BACKFILL: BENTONITE, DRILL CUTTINGS, SLOTTED PIPE

U.S.C.S.	ELEVATION (m)	DEPTH (m)	MATERIAL DESCRIPTION
TSOIL			(TSOIL) TOPSOIL (300mm), A-horizon organic, sandy, damp, black
SC	622.7	0.3	(SC) SAND, clayey, damp, reddish-brown -- frost encountered to 0.3m
CI	621.2	1.8	(CI) CLAY, sandy, medium plastic, very stiff, damp, medium brown
CH	617.8	5.2	(CH) CLAY SHALE, silty, high plastic, hard, damp, medium grey
	613.9	9.1	End of testhole at 9.1m No slough Standpipe Installed Dry after drilling Water at 3.52m on 31-Jan-19 at 6 days

SULPHATE	SAMPLE TYPE	POCKET PEN. (kPa)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
	A		9.4			
	A		9.2			
	A	400	19.1			
MODERATE	A	450	18.9	46.5	16.7	29.8
	A	350	18.1			
	A	325	17.8			
	A	450+	16.9			
	A	450+	17.2			
	A	450+	17.6			
	A	450+	19.4			
	A	450+	19.7			
	A	450+	15.0			

DEPTH (m): 0 1 2 3 4 5 6 7 8 9 10 11 12

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TESTHOLE T7

CLIENT 0974200 BC Ltd. c/o Teckera
DATE DRILLED 24-Jan-19
PROJECT NAME Redwater ASP
GROUND ELEVATION 625.00
PROJECT LOCATION SW 29-57-21-W4, Redwater, AB
GROUND WATER LEVELS:
PROJECT NUMBER T18-1005
AT END OF DRILLING Dry
DRILLING METHOD Solid Stem Auger
AFTER DRILLING ON 31-Jan-19
LOGGED BY KR **REVIEWED BY** NI
▼ **THE WATER LEVEL IS** 3.64 m / Elev 621.36 m
TESTHOLE LOCATION N 5980276.97 / E 362546.99

LEGEND **SAMPLE TYPE:** SPT, SOLID STEM AUGER
SULPHATE: MODERATE
WELL BACKFILL: BENTONITE, DRILL CUTTINGS, SLOTTED PIPE

U.S.C.S.	ELEVATION (m)	DEPTH (m)	MATERIAL DESCRIPTION
TSOIL			(TSOIL) TOPSOIL (300mm), A-horizon organic, clayey, damp, black
CI	624.7	0.3	(CI) CLAY, sandy, low to medium plastic, stiff, damp, medium brown -- frost encountered to 0.3m
ML	624.1	0.9	(ML) SILT, clayey, medium plastic, stiff to very stiff, damp, medium brown-grey
CI	622.6	2.4	(CI) CLAY, sandy, medium plastic, very stiff to hard, damp, medium brown
CH	621.3	3.7	(CH) CLAY, silty, medium to high plastic, hard, damp, medium brown-grey
CI	620.6	4.4	(CI) CLAY, sandy, low plastic, very stiff, damp, medium brown-grey
SC	619.7	5.3	(SC) SANDSTONE, clayey, medium plastic, very stiff to hard, damp, medium brown-grey, trace oxides
CH	619.4	5.6	(CH) CLAY SHALE, silty, high plastic, hard, damp, medium grey
	619.2	5.8	End of testhole at 5.8m

End of testhole at 5.8m
No slough
Standpipe Installed
Dry after drilling
Water at 3.64m on 31-Jan-19 at 7 days

SULPHATE	SAMPLE TYPE	SPT BLOW (N)	POCKET PEN. (kPa)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
	A		150	13.8			
MODERATE	A		200	19.5	31.9	19.0	12.9
	A		225	17.9			
	SPT	14	450+	17.4			
	A		400	16.6			
	A		425	20.9			
	A		250	18.7			
	A		250	19.0			
	SPT	66	450+	17.1			

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Sherwood Park, Alberta T8H 0M2
Telephone: 780-467-1334
Fax: 780-467-1336

TESTHOLE T8

CLIENT 0974200 BC Ltd. c/o Teckera
DATE DRILLED 24-Jan-19
PROJECT NAME Redwater ASP
GROUND ELEVATION 624.00
PROJECT LOCATION SW 29-57-21-W4, Redwater, AB
GROUND WATER LEVELS:
PROJECT NUMBER T18-1005
AT END OF DRILLING Dry
DRILLING METHOD Solid Stem Auger
AFTER DRILLING ON 31-Jan-19
LOGGED BY KR **REVIEWED BY** NI
THE WATER LEVEL IS 4.44 m / Elev 619.56 m
TESTHOLE LOCATION N 5980476.81 / E 362453.78

LEGEND **SAMPLE TYPE:** SPT; SOLID STEM AUGER
SULPHATE: MODERATE
WELL BACKFILL: BENTONITE; DRILL CUTTINGS; SLOTTED PIPE

U.S.C.S.	ELEVATION (m)	DEPTH (m)	MATERIAL DESCRIPTION
TSOIL			(TSOIL) TOPSOIL (300mm), A-horizon organic, sandy, damp, black
FILL	623.7	0.3	(FILL) SAND FILL, clayey, low plastic, damp, medium brown -- frost encountered to 0.3m
FILL	623.1	0.9	(FILL) CLAY FILL, sandy, medium plastic, stiff, damp, medium brown-grey
CH	622.3	1.7	(CH) CLAY, sandy, medium to high plastic, very stiff, damp, medium brown
CH	620.3	3.7	(CH) CLAY, silty, high plastic, hard, damp, medium brown-grey
CH	619.6	4.4	(CH) CLAY SHALE. silty, high plastic, hard, damp, medium grey
	617.9	6.1	End of testhole at 6.1m No slough Standpipe Installed Dry after drilling Water at 4.44m on 31-Jan-19 at 7 days

SULPHATE	SAMPLE TYPE	SPT BLOW (N)	POCKET PEN. (kPa)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
	A			9.7			
	A		100	21.5			
MODERATE	A		350	21.8	48.5	17.4	31.1
	A		325	20.8			
	A		400	20.8			
	SPT	39	450+	19.1			
	A		450+	17.8			
	A		450+	18.4			
	A		450+	17.1			

DEPTH (m): 0, 1, 2, 3, 4, 5, 6, 7, 8

GRAPHIC LOG

WELL DIAGRAM

ENC TESTHOLE LOG CPT/SPT T18-1005 TECKERA 0974200 BC LTD SW 29-57-21-W4 REDWATER.GPJ GINT STD CANADA LAB.GDT 15-2-19

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TESTHOLE T9

CLIENT 0974200 BC Ltd. c/o Teckera
DATE DRILLED 24-Jan-19
PROJECT NAME Redwater ASP
GROUND ELEVATION 626.25
PROJECT LOCATION SW 29-57-21-W4, Redwater, AB
GROUND WATER LEVELS:
PROJECT NUMBER T18-1005
AT END OF DRILLING Dry
DRILLING METHOD Solid Stem Auger
AFTER DRILLING ON 31-Jan-19
LOGGED BY KR **REVIEWED BY** NI
THE WATER LEVEL IS 2.77 m / Elev 623.48 m
TESTHOLE LOCATION N 5980358.27 / E 362323.05

LEGEND **SAMPLE TYPE:** A SOLID STEM AUGER
SULPHATE: MODERATE
WELL BACKFILL: BENTONITE; DRILL CUTTINGS; SLOTTED PIPE

U.S.C.S.	ELEVATION (m)	DEPTH (m)	MATERIAL DESCRIPTION
TSOIL			(TSOIL) TOPSOIL (300mm), A-horizon organic, sandy, damp, black
SC	625.9	0.3	(SC) SAND, clayey, damp, medium brown -- frost encountered to 0.3m
CI	625.3	0.9	(CI) CLAY, silty, low to medium plastic, stiff to very stiff, moist, medium brown-grey
CH	622.6	3.7	(CH) CLAY, silty, high plastic, hard, damp, medium brown-grey
CH	622.0	4.3	(CH) CLAY SHALE, silty, high plastic, hard, damp, medium grey
	617.1	9.1	End of testhole at 9.1m No slough Standpipe Installed Dry after drilling Water at 2.77m on 31-Jan-19 at 7 days

SULPHATE	SAMPLE TYPE	POCKET PEN. (kPa)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
	A	150	20.5			
	A	100	22.5			
	A	200	22.4			
	A	250	18.3			
	A	400	20.1			
Moderate	A	450+	21.4	60.6	20.2	40.4
	A	450+	23.8			
	A	450+	23.0			
	A	450+	17.8			
	A	450+	17.6			
	A	450+	17.1			
	A	450+	19.3			

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TESTHOLE T10

CLIENT 0974200 BC Ltd. c/o Teckera
DATE DRILLED 24-Jan-19
PROJECT NAME Redwater ASP
GROUND ELEVATION 619.00
PROJECT LOCATION SW 29-57-21-W4, Redwater, AB
GROUND WATER LEVELS:
PROJECT NUMBER T18-1005
AT END OF DRILLING Dry
DRILLING METHOD Solid Stem Auger
AFTER DRILLING ON 31-Jan-19
LOGGED BY KR **REVIEWED BY** NI
THE WATER LEVEL IS 2.75 m / Elev 616.25 m
TESTHOLE LOCATION N 5980490.11 / E 362674.48

LEGEND **SAMPLE TYPE:** SPT, SOLID STEM AUGER
SULPHATE:
WELL BACKFILL: BENTONITE, DRILL CUTTINGS, SLOTTED PIPE

DEPTH (m)	U.S.C.S.	ELEVATION (m)	DEPTH (m)	MATERIAL DESCRIPTION	SULPHATE	SAMPLE TYPE	SPT BLOW (N)	POCKET PEN. (kPa)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0	TSOIL			(TSOIL) TOPSOIL (250mm), A-horizon organic, clayey, damp, black								
	CI	618.7	0.3	(CI) CLAY, sandy, medium to high plastic, very stiff, damp, medium brown -- frost encountered to 0.3m		A		325	17.5			
1						A		350	20.7			
2	CH	617.2	1.8	(CH) CLAY, silty, high plastic, hard, damp, medium brown-grey		A		450+	23.6			
						SPT	23	450+	28.3			
3						A		450+	19.1			
4						A		450+	18.8			
	CH	614.6	4.4	(CH) CLAY SHALE, silty, high plastic, hard, damp, medium brown-grey		A		450+	19.1			
5						A		450+	21.8			
						SPT	73	450+	17.5			
6		613.2	5.8	End of testhole at 5.8m No slough Standpipe Installed Dry after drilling Water at 2.75m on 31-Jan-19 at 7 days								
7												
8												

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Fax: 780-467-1336

TESTHOLE T11

CLIENT 0974200 BC Ltd. c/o Teckera
DATE DRILLED 25-Jan-19
PROJECT NAME Redwater ASP
GROUND ELEVATION 621.00
PROJECT LOCATION SW 29-57-21-W4, Redwater, AB
GROUND WATER LEVELS:
PROJECT NUMBER T18-1005
AT END OF DRILLING Dry
DRILLING METHOD Solid Stem Auger
AFTER DRILLING ON 31-Jan-19
LOGGED BY KR **REVIEWED BY** NI
THE WATER LEVEL IS Dry
TESTHOLE LOCATION N 5980574.22 / E 362536.45

LEGEND **SAMPLE TYPE:** A SOLID STEM AUGER
SULPHATE:
WELL BACKFILL: BENTONITE, DRILL CUTTINGS, SLOTTED PIPE

DEPTH (m)	U.S.C.S.	ELEVATION (m)	DEPTH (m)	MATERIAL DESCRIPTION
0	TSOIL			(TSOIL) TOPSOIL (450mm), A-horizon organic, clayey, damp, black -- frost encountered to 0.15m
	CI	620.5	0.5	(CI) CLAY TILL, sandy, medium plastic, very stiff, damp, medium brown-grey, trace oxides
	CH	618.9	2.1	(CH) CLAY, silty, high plastic, very stiff to hard, damp, medium brown
	SC	616.1	4.9	(SC) SANDSTONE, clayey, low to medium plastic, hard, damp, medium grey
	CH	613.8	7.2	(CH) CLAY SHALE, silty, high plastic, hard, damp, medium grey
		611.9	9.1	End of testhole at 9.1m No slough Standpipe Installed Dry after drilling Dry on 31-Jan-19 at 6 days

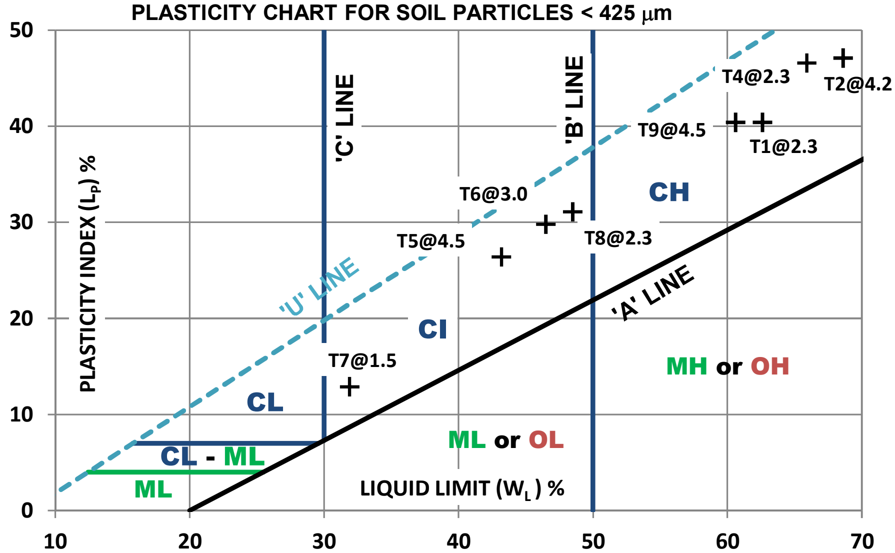
SULPHATE	SAMPLE TYPE	POCKET PEN. (kPa)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
	A	300	19.0			
	A	375	17.0			
	A	325	18.5			
	A	400	24.3			
	A	450+	28.7			
	A	450+	18.0			
	A	450+	20.9			
	A	450+	17.5			
	A	450+	16.5			
	A	450+	17.6			
	A	450+	17.6			
	A	450+	16.3			

MODIFIED (BY PFRA, 1985) **UNIFIED CLASSIFICATION SYSTEM** FOR SOILS

MAJOR DIVISION			GROUP SYMBOL	ENC SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE-GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75 µm)	**GRAVELS** > 50% > 4.75 mm	CLEAN GRAVELS WITH FEW OR NO FINES	GW		WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	Determine percentages of gravel and sand from grain size curve. Depending on percentages of fines (fraction smaller than 75 µm) coarse grained soils are classified as follows: Less than 5% GW, GP, SW, SP; More than 12% GM, GC, SM, SC 5% to 12% Borderline cases requiring the use of dual symbols	$C_U = \frac{D_{60}}{D_{10}} > 4;\ C_C = \frac{(D_{30})^2}{(D_{10})(D_{60})} = 1 - 3$
			GP		POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES		NOT MEETING ALL GRADATION REQUIREMENTS FOR GW
		GRAVELS WITH SIGNIFICANT AMOUNT OF FINES	GM		SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES		ATTERBERG LIMITS BELOW 'A' LINE, Ip < 4 — ABOVE 'A' LINE 4 < Ip < 7, ARE BORDERLINE CASES REQUIRING USE OF DUAL SYMBOLS
			GC		CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE 'A' LINE, Ip > 7
	SANDS ≥ 50% < 4.75 mm	CLEAN SANDS WITH FEW OR NO FINES	SW		WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES		$C_U = \frac{D_{60}}{D_{10}} > 6;\ C_C = \frac{(D_{30})^2}{(D_{10})(D_{60})} = 1 - 3$
			SP		POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES		NOT MEETING ALL GRADATION REQUIREMENTS FOR SW
		SANDS WITH SIGNIFICANT AMOUNT OF FINES	SM		SILTY SANDS, SAND-SILT MIXTURES		ATTERBERG LIMITS BELOW 'A' LINE, Ip < 4 — ABOVE 'A' LINE 4 < Ip < 7, ARE BORDERLINE CASES REQUIRING USE OF DUAL SYMBOLS
			SC		CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE 'A' LINE, Ip > 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75 µm)	**SILTS** (BELOW 'A' LINE - NEGLIGIBLE ORGANIC CONTENT)	$W_L < 50\%$	ML		INORGANIC SILTS & VERY FINE SANDS, ROCK FLOUR, SILTY / CLAYEY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY	CLASSIFICATION IS BASED ON PLASTICITY CHART (SEE BELOW)	
		$W_L > 50\%$	MH		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS		
	CLAYS (ABOVE 'A' LINE - NEGLIGIBLE ORGANIC CONTENT)	$W_L < 30\%$	CL		INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS		
		$30\% < W_L < 50\%$	CI		INORGANIC CLAYS OF MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS		
		$W_L > 50\%$	CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
	ORGANIC CLAYS & SILTS (BELOW 'A' LINE)	$W_L < 50\%$	OL		INORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW AND MEDIUM PLASTICITY		
		$W_L > 50\%$	OH		ORGANIC CLAYS OF HIGH PLASTICITY, ORGANIC SILTS		
HIGHLY ORGANIC SOILS			OR		PEAT OR OTHER HIGHLY ORGANIC SOILS	STRONG COLOR OR ODOR, OFTEN FIBROUS TEXTURE	

#270, 120 Pembina Road
Sherwood Park, AB
T8H 0M2

PLASTICITY CHART FOR SOIL PARTICLES < 425 µm



ADDITIONAL DESCRIPTORS

FRACTION	SIEVE SIZE PASSES	SIEVE SIZE RETAINS	RANGES, ADJECTIVES
BOULDER	900 mm	300 mm	
COBBLE	300 mm	75 mm	
GRAVEL			
COARSE	75 mm	19 mm	
FINE	19 mm	4.75 mm	> 35 % and 21 – 35 % ~ y* 10 – 20 % some >0 – 10 % trace
SAND			
COARSE	4.75 mm	2.0 mm	
MEDIUM	2.0 mm	425 mm	
FINE	425 mm	75 mm	
SILT / CLAY	75 mm	* GRAVELLY, SANDY, SILTY, CLAYEY ADJECTIVES AS ABOVE	

Appendix D

Wetland Assessment

(Blackfly Environmental)

BLACK FLY
ENVIRONMENTAL

WETLAND ASSESSMENT IMPACT REPORT

SW ¼ 29-57-21W4M

March 2019

Prepared For:

TECKERA
civil engineering consultants

Table of Contents

1.0 INTRODUCTION

Black Fly Environmental Ltd (Black Fly) was retained by Teckera Engineering Ltd (Teckera) to conduct a wetland assessment in support of a land development project at SW¼ 29-57-21-W4M (the Study Area) in Redwater, Alberta. The lands comprising the Study Area are planned to be developed into an industrial park.

This wetland assessment impact report (WAIR) of the Study Area consists of the following:

- a review of available* historical aerial photographs to determine historical wetland boundaries;
- a summary of the field assessment of the wetlands encountered on site, conducted on October 10, 2018;
- a determination of the value of the wetlands based on the field observations and the results of ABWRET-A received from Alberta Environment & Parks (AEP) on January 4, 2019 (original ABWRET - F submitted to AEP on November 27, 2018); and,
- description of the avoidance, mitigation and replacement strategy of the project

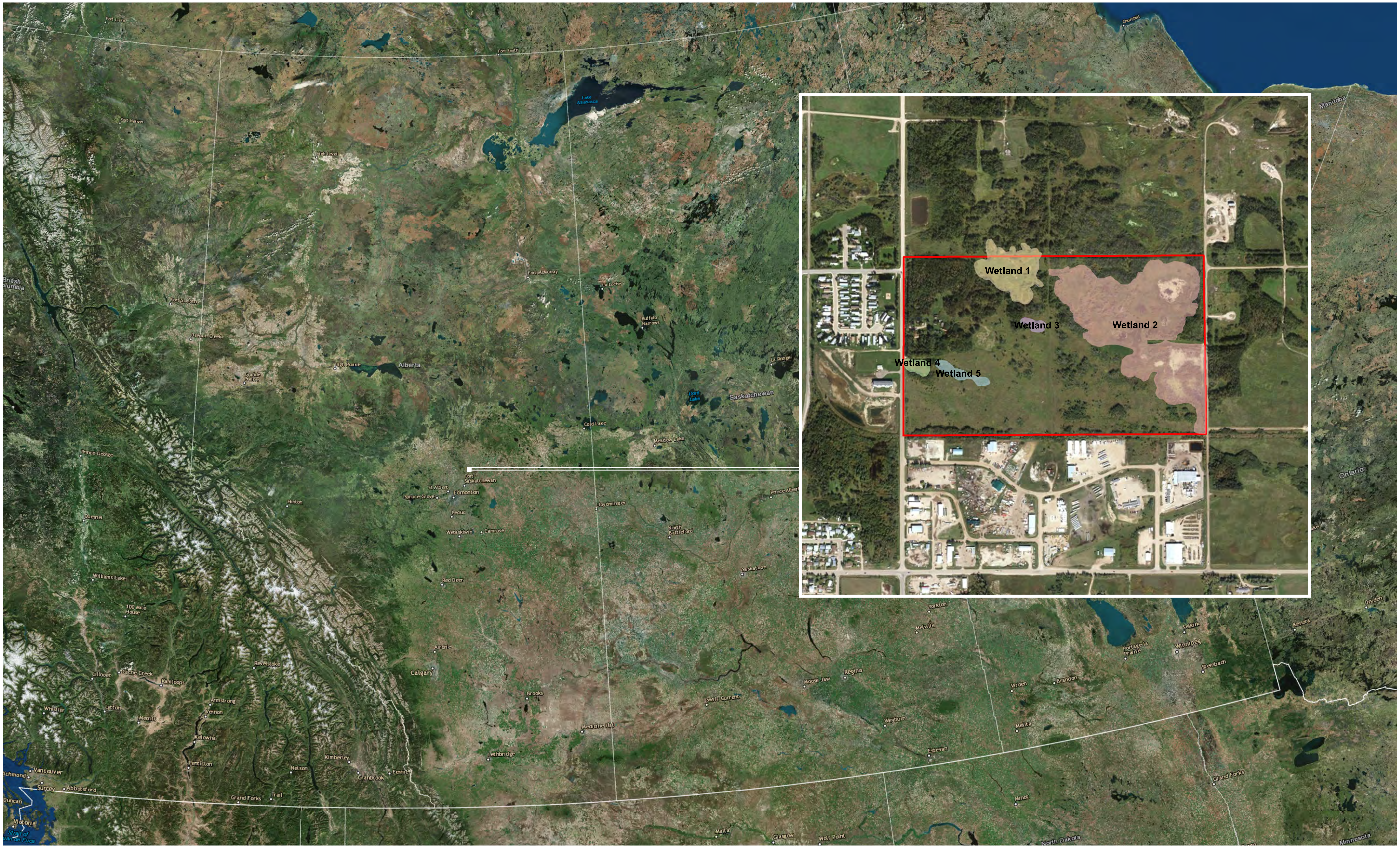
*due to a fire at the Government of Alberta Air Photo Library, historical imagery reviewed were selected based on availability rather than on climatic extremes.

2.0 SITE LOCATION

The Study Area is located on private land in the Town of Redwater, approximately 60 km northeast of Edmonton. It is situated in the Dry Mixwood Natural Subregion of the Boreal Forest Natural Region of Alberta (Natural Regions Committee, 2006).

The lands adjacent to the Study Area include residential, commercial, and industrial lands. The Study Area itself is predominantly gently rolling pasture with an old residential dwelling and outbuildings along the west boundary.

The Study Area is situated on a landscape of undulating, high relief landform with a variety of gravelly, very course parent materials with a limiting slope of 4%, and medium textured parent materials with a limiting slope of 3%. Soils are equally distributed between well drained Orthic Black Chernozems of the Ferintosh soil series that occur on mid-slopes and Eluviated Black Chernozems of the Ponoka soil series occurring on lower slopes. Soils in the Ponoka soil series are characterized by deep A horizons, reaching depths of over 50cm. Other soils in the area include well drained Orthic Black Chernozems of the Peace Hills soil series found on upper slopes (Government of Alberta, 2019b). Figure 1.0 illustrates the project setting and Study Area.



Service Layer Credits: Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community

Coordinate System: NAD 1983 10TM AEP Resource
Projection: Transverse Mercator
Datum: North American 1983

Revison Date: November 27, 2018
Drawn By: Nadine Clifton

N

Project Setting and Study Area

Project Name: Red Water Wetlands
Legal Land Description: SW-29-57-21 W4

Figure Number: 1.0

Prepared By: BLACK FLY ENVIRONMENTAL

Prepared For: TECKERA civil engineering consultants

3.0 METHODS

3.1 Mapping and Historical Imagery Review

Data collection and assessment methodologies were completed in accordance with applicable directives as per the Alberta Wetland Policy in support of a regulatory submission under the *Water Act*.

Identification and delineation of wetland within the Study Area, including the review of historical photographs and the field assessment, follow the methodology outlined in the Alberta *Wetland Identification and Delineation Directive* (Government of Alberta, 2015b).

Due to a fire at the Alberta Air Photo Distribution office in 2018, access to historical imagery was limited at the time of assessment. As such, all other available sources were used to evaluate wetland boundaries and permanence.

Imagery sources used the for the historical review include:

- Abadacus Datagraphics (Abadata) photos from 2006-2011;
- Google Earth (imagery source date August 2, 2015); and,
- an aerial photograph from 1980 that was previously acquired from the provincial archives.

Historical photographs used in the assessment of wetland permanence, including delineated wetland boundaries, are included in Appendix A.

Corresponding annual precipitation data for the historical photographs were derived from the Alberta Agriculture and Rural Development's Agroclimatic Information Service (ACIS) records (Government of Alberta, 2019b) and are detailed in Table 1.0. Annual average precipitation is presented graphically in Figure 2.0.

Table 1.0 Historical Aerial Photographs and Corresponding Climatic Data

Air Photo (mm/dd/yy)	Season (if avaliable)	Photo Source	Precipitation Year (Dry, Wet, Normal)	Yearly Precipitation (mm)
04/20/1980	Spring	Air Photo Library	Wet	530
2006	Unknown	Abadata	Wet	585
2007	Unknown	Abadata	Dry	335
2008	Unknown	Abadata	Dry	337
2009	Unknown	Abadata	Dry	285
2010	Unknown	Abadata	Dry	375
2011	Unknown	Abadata	Dry	395
08/02/2015	Summer	Google Earth	Dry	312

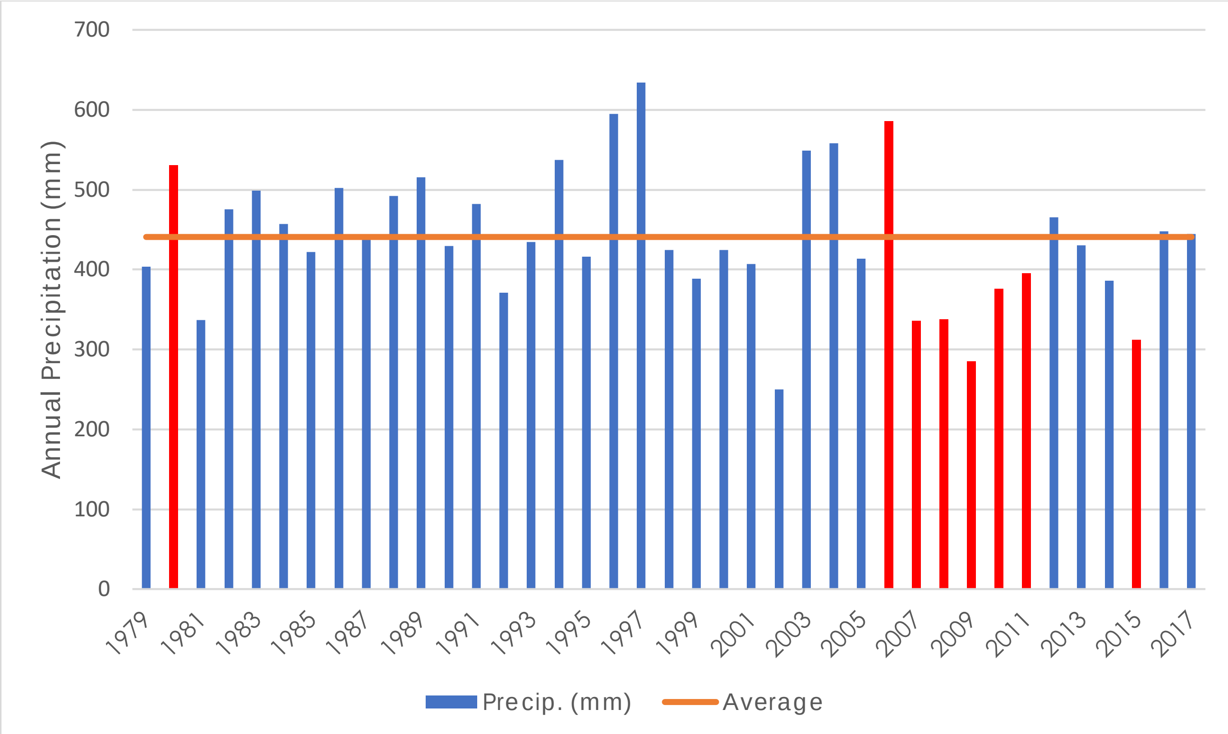


Figure 2.0 Historical Precipitation Data (Township 57 Range 21 W4M)

3.2 Database Searches

The following provincial databases were queried for records pertinent to the Study Area:

- Alberta Conservation Information Management System (ACIMS) on October 1, 2018 and again on January 6, 2019 (Government of Alberta, 2019e);
- Fisheries & Wildlife Management Information System (FWMIS) on October 1, 2018, and again on January 6, 2019 (Government of Alberta , 2019a)and
- Estimated Wetland Value by Section layer using ArcGIS Online map viewer (Government of Alberta, 2019d) was searched on October 01, 2018, to obtain a preliminary estimate of the area and value of wetlands within the section in which the Study Area is located.

3.3 Wetland Field Survey

Black Fly conducted the field survey on October 10, 2018. Data collection, wetland classification, and delineation of wetland boundaries follow the protocols outlined in the Alberta *Wetland Identification and Delineation Directive* (Government of Alberta, 2015b).

Observations of plant species within the wetland area and soil characteristics within the top 30cm of the soil profile were recorded. Photographs of the wetlands were taken, and UTM locations were recorded. Representative photographs of the wetlands are summarized in photo plates in Appendix B.

Wetlands were classified using the *Alberta Wetland Classification System (*AWCS) (Government of Alberta, 2015a). The AWCS categorizes wetlands according to their class (bog, fen, marsh, shallow open water, swamp), their vegetative form (ex. graminoid, shrubby, wooded deciduous), their type based on salinity (freshwater, slightly brackish, moderately brackish, brackish) and water permanence (temporary, seasonal, semi-permanent, permanent).

The wetland boundaries were delineated in the field based on hydrologic soil indicators such as mottling and gleying, as well as the composition of vegetation species and communities. A hand-held GPS unit was used to delinate the wetland boundaries. Following the site assessment, the final wetland boundaries were determined by comparing the field boundaries and preliminary historical boundaries created from the aerial photographs.

Upon completion of the field assessment, a shapefile of the assessed wetlands and the completed ABWRET-A form was submitted to AEP for the calculation of the actual value of the wetlands. The ABWRET-A was submitted on November 27, 2018 and results were obtained on January 04, 2019.

4.0 RESULTS

4.1 Historical Aerial Photograph Review

A summary of the historical photograph review and field-verified wetlands are presented in Table 2.0. During the historical photograph review, five wetlands were identified within the Study Area (lWetlands 1-5, respectively). During the field visit, the presence of these five wetlands was confirmed; no new wetlands were identified. Historical photos and delineations are provided in Appendix A (Figures 6.0-11.0).

Table 2.0 Summary of Historical Aerial Photograph Review

Year of Aerial Photograph	Presence of Water or Inundation	Comments
1980	Wetland 1 & 2	The property has a residence surrounded by trees in the northeast corner. The rest of the property doesn't appear to be treed. Wetlands 1 and 2 are holding water. The northern and southern portions of Wetland 2 do not seem to be connected. Wetlands 4 and 5 are visible but do not appear to be holding water. Wetland 3 is not visible. No development visible south of the Study Area.
2006	Wetland 1, 2, & 5	The residence and surrounding trees are still visible. The remainder of the property now appears to be patchy with tree/shrub cover, except in the southwest corner.

		Development is evident in the property south of the Study Area. Wetlands 1 and 5 are holding small amounts of water. Wetland 2 is separated into north and south areas which both have multiple pools of water. Wetlands 1 and 2 are visible, and Wetlands 4 & 5 are visible but appear to be connected. Wetland 3 is not visible.
2007	Wetland 2	The residence is still visible, and the trees throughout the property appear to be thicker. The southwest corner of the property still appears to be devoid of trees. There are small pools of water in Wetland 2, which is separated into north and south portions. Wetland 1 is also visible but doesn't appear to be holding water. Wetlands 3, 4 and 5 are not visible.
2008	Wetland 1 & 2	The residence and trees look the same as 2007. Wetlands 1 and 2 both contain open water. Wetland 2 is split into north and south portions. Wetland 3 is visible. Wetlands 4 and 5 appear to be connected.
2009	Wetland 1 & 2	The residence and trees look the same as 2007. Wetlands 1 and 2 both contain open water. Wetland 2 is split into north and south portions. Wetland 3 is visible. Wetlands 4 and 5 appear to be connected.
2010	Wetland 2	The imagery for 2009 and 2010 appear to be the same with slightly different resolution.
2011	Wetland 2 & 4	Wetlands 1, 2 and 4 are visible. The center of the image appears very dark, although the shrubs are still visible. It is unclear whether this area has been tilled or is wet.
2015	Wetland 2	The image is in color. Wetland 2 is holding water in approximately 9 different locations. The north and south portions of Wetland 2 appear to be connected. Wetlands 1, 2 and 4 are visible. Wetlands 3 and 5 are not apparent.

4.2 Database Searches

A query of the ACIMS database did not return any historical occurrences of rare or listed species within Study Area.

A search of the FWMIS databases did not identify any sensitive wildlife species or species of concern within a one-kilometer radius, centric to the Study Area.

The preliminary search of estimated wetland value using the Alberta Merged Wetland Inventory (Government of Alberta, 2019d) identified 97 hectares of D-value wetland within 29-57-21-W4M. The final wetland values assigned by Alberta Environment and Parks (AEP), received on January 04, 2019, are as follows:

- C-Values for Wetlands 1 and 2,
- D-Values for Wetlands 3 through 5, received by Black Fly on January 04, 2019 (Appendix D).

All database search records are included in Appendix C. ABWRET-A results return from AEP (ABWRET Tracking Number A181124) are included in Appendix D.

4.3 Field Observations of Wetlands

Black Fly conducted the field survey on October 10, 2018. A summary of the wetland areas and classification is provided in Table 3.0, and the final wetland boundary delineations are illustrated in Figure 3.0.

At the time of the field survey, the ground was covered by approximately 2-3" of snow. Assessment of vegetation species cover was determined based on identifiable features above the snow cover. No evidence of livestock was observed. Moreover, no indication of human traffic, either on foot or motorized, was observed. Plant species found within the upland areas of the property included yarrow (*Achillea millefolium*), dandelion (*Taraxacum officinale*) and grass species such as Kentucky blue grass (*Poa pratensis*) and timothy (*Phleum pretense*).

Identification and assessment of the vegetation within the wetlands was influenced by seasonality of the survey and presence of light snow cover. A combination of soil redox features and vegetation community indicators were used to establish wetland boundaries. Standing water was present only in Wetland 2; however, the deepest zone of the wetland was not accessible during the field assessment due to the presence of thin ice and unknown water depth presenting a safety hazard.

Individual wetland photo plates are presented in Appendix B, and locations of photo points are shown in Figure 4.0.

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS
Coordinate System: NAD 1983 10TM AEP Resource
Projection: Transverse Mercator
Datum: North American 1983
Revison Date: November 30, 2018
Drawn By: Nadine Clifton

0 20 40 80 120 160 Meters

N

Current Wetland Extent

Field Work: October 10, 2018

Project Name: Red Water Wetlands
Legal Land Description: SW-29-57-21 W4

Figure Number: 3.0

Prepared By: BLACK FLY ENVIRONMENTAL

Prepared For: TECKERA civil engineering consultants

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User

Coordinate System: NAD 1983 10TM AEP Resource
Projection: Transverse Mercator
Datum: North American 1983

Revison Date: November 27, 2018
Drawn By: Nadine Clifton

0 20 40 80 120 160 Meters

N

Photo Points

Field Work: October 10, 2018

Project Name: Red Water Wetlands
Legal Land Description: SW-29-57-21 W4

Figure Number: 4.0

Prepared By: BLACK FLY ENVIRONMENTAL

Prepared For: TECKERA civil engineering consultants

Wetland 1

Wetland 1 is located along the northern boundary on the western side of the Study Area (Appendix B, Photos 1-6). No water was present within the wetland at the time of assessment; however, it was evident that the wetland holds water at some point throughout the year, based on observed vegetation indicators. Vegetation zonation was not visible snow cover obscured the positive identification of shorter-statured vegetation communities.

Dominant species included awned sedge (*Carex atherodes*) and isolated patches of common cattail (*Thypha latifolia*) which were observed at the center of the wetland. Patches of willow (*Salix sp.*) were present within the wetland basin, as well as around the wetland edges in depressional areas intermixed with aspen cover. Other observed wetland species include slough grass (*Beckmannia syzigachne),* common plantain (*Plantago major*), dock species (*Rumex spp.)*, bluejoint (*Calamagrostis canadensis*) and tufted hair grass (*Deschampsia cespitosa*).

Canada thistle (*Cirsium arvense)* was observed in trace amounts along the linear disturbance which runs east-west across the north border of the Study Area. This noxious weed, as designated by the Alberta *Weed Control Act* (Government of Alberta, 2010) did not appear to be present in high densities and was not observed elsewhere in the Study Area. Note that the detection of weed species was difficult due to survey timing and snow cover.

Soil redox features were evident and including mottling and oxidized root channels along the edge of the wetland. The litter layer was thick and well-developed throughout the wetland area.

Wetland 2

Wetland 2 is located along the eastern side of the Study Area and is the largest and most well-defined wetland in the Study Area (Appendix B, Photos 7-18). Standing water was observed at various locations within the wetland; maximum depth measurements were not recorded due to safety hazards presented by thin ice. In addition, the ditch along the access road running north-south along the eastern boundary of the Study Area was plugged at the time of assessment. Water levels in the ditch were equal to levels in Wetland 2 in some areas, particularly along the southern portion.

A linear disturbance created a separation in deep water pools along the eastern side of the Study Area. Evidence of a beaver or muskrat traveling between pools was noted (disturbance can be seen on Figure 3, between photo points 7 and 8). A beaver lodge was observed along the eastern wetland boundary of Wetland 2 though it is unclear whether the beavers are still active in this area.

The northwestern reaches of Wetland 2 displayed vegetation zonation from wet meadow zone to shallow wetland zone. The northeastern reaches of Wetland 2 zonation also included a deep wetland zone, visible in Figure 3.0. Within the shallow wetland zone, pools of frozen water were visible with duck weed (*Lemna minor)* frozen in the ice. Vegetation in the shallow wetland zone was dominated by awned sedge (*Carex atherodes*). Other observed wetland species included small bottle sedge (*Carex* *utriculata),* common cattail, slough grass, and small-fruited bulrush (*Scirpus microcarpus).* The deep wetland zones of Wetland 2 were inaccessible due to unknown depth of water and ice coverage, which was deemed a safety concern. The dominant species within the deep wetland zone was common cattail, which grew in thick rings around areas of open water. The largest pools of water were observed in the northeast corner and southeast half of Wetland 2.

Wetland 2 is the largest wetland in the Study Area and contains patches of shrubby swamp throughout. These patches are mainly located along the periphery of the wetland with few isolated patches within the wetland basin; with the largest patch located at the center of the northern lobe.

Soil redox features were evident and included gleying and oxidized root channels. The depth to seepage was 18cm and water filled the bottom of the soil pit at 28cm.

Wetland 3

Wetland 3 is located in the center of the Study Area (Appendix B, Photos 19-24). It is a small, shallow depression; the observed change in vegetation community was subtle. The deepest portion of the wetland was a shallow wetland zone and was dominated by water sedge (*Carex aquatilis);* however, this zone comprised less than 10% of the total wetland area. The majority of the wetland was a wet meadow zone dominated by bluejoint, fowl blue grass (*Poa palustris*) and tufted hairgrass.

No soil redox features were observed in the upper 30 cm of the soil pit, but the litter layer was well developed throughout the wetland area.

Wetland 4

Wetland 4 is located along the western edge of the Study Area (Appendix B, Photos 25-30), immediately east of 44th street. At the time of assessment, it did not appear to be contiguous with Wetland 5. The dominant vegetation cover was water sedge; other observed wetland species include common cattail, small bottle sedge, and sweet coltsfoot (*Petasites sagittatus*). There was no water observed within the wetland at the time of assessment; however, snow covered approximately 60% of the wetland surface.

The A horizon extended beyond 30cm of the soil pit, and no redox features were observed within this horizon. The litter layer was thick and well developed throughout the wetland.

Wetland 5

Wetland 5 is located east of Wetland 4 (Appendix B, Photos 31-36). It is a low-lying area where several ruts and divots were observed, which ran east in a linear fashion. The wetland is narrow, and contained small patches of common cattail, small bottle sedge, and willow species. Some upland species were scattered throughout the wetland between the low-lying areas, including aster species and Kentucky blue grass.

The A horizon extended below the 30cm depth of the soil pit, and no redox features were observed within this horizon. The litter layer was patchy, and only appeared thick and well-developed within the patches of cattail and sedges.

Table 3.0 Summary of wetland characteristics observed in the Study Area (SW¼ -29-57-21-W4M).

Wetland ID	Wetland Area (ha)	AWCS	AEP Relative Wetland Value	Defining Species	Comments
Wetland 1	1.63	Marsh-Graminoid-Seasonal (M-G-III)	C	*Carex atherodes*	Trace amounts of Canada thistle
Wetland 2	8.85	Marsh-Graminoid-Semi-Permanent (M-G-IV)	C	*Typha latifolia*	Beaver activity, deep wetland zones and large pools of shallow open water
Wetland 3	0.10	Marsh-Graminoid-Temporary (M-G-II)	D	*Calamagrostis canadensis*	Small depressional area, few wetland species
Wetland 4	0.17	Marsh-Graminoid-Seasonal (M-G-III)	D	*Carex atherodes*	Depressional area along the east side of 44th st.
Wetland 5	0.22	Marsh-Graminoid-Temporary (M-G-II)	D	*Carex atherodes*	Small linear wetland composed of multiple small channels and divots

5.0 POTENTIAL IMPACTS

Potential effects to wetland resources include:

- Alterations to wetlands resulting in change of wetland type or permanence;
- Loss of habitat for plants and animals;
- Disruption of drainage patterns within the wetland resulting in flooding and an increased potential for sediment runoff; and,
- Increased abundance of noxious species in newly disturbed areas.

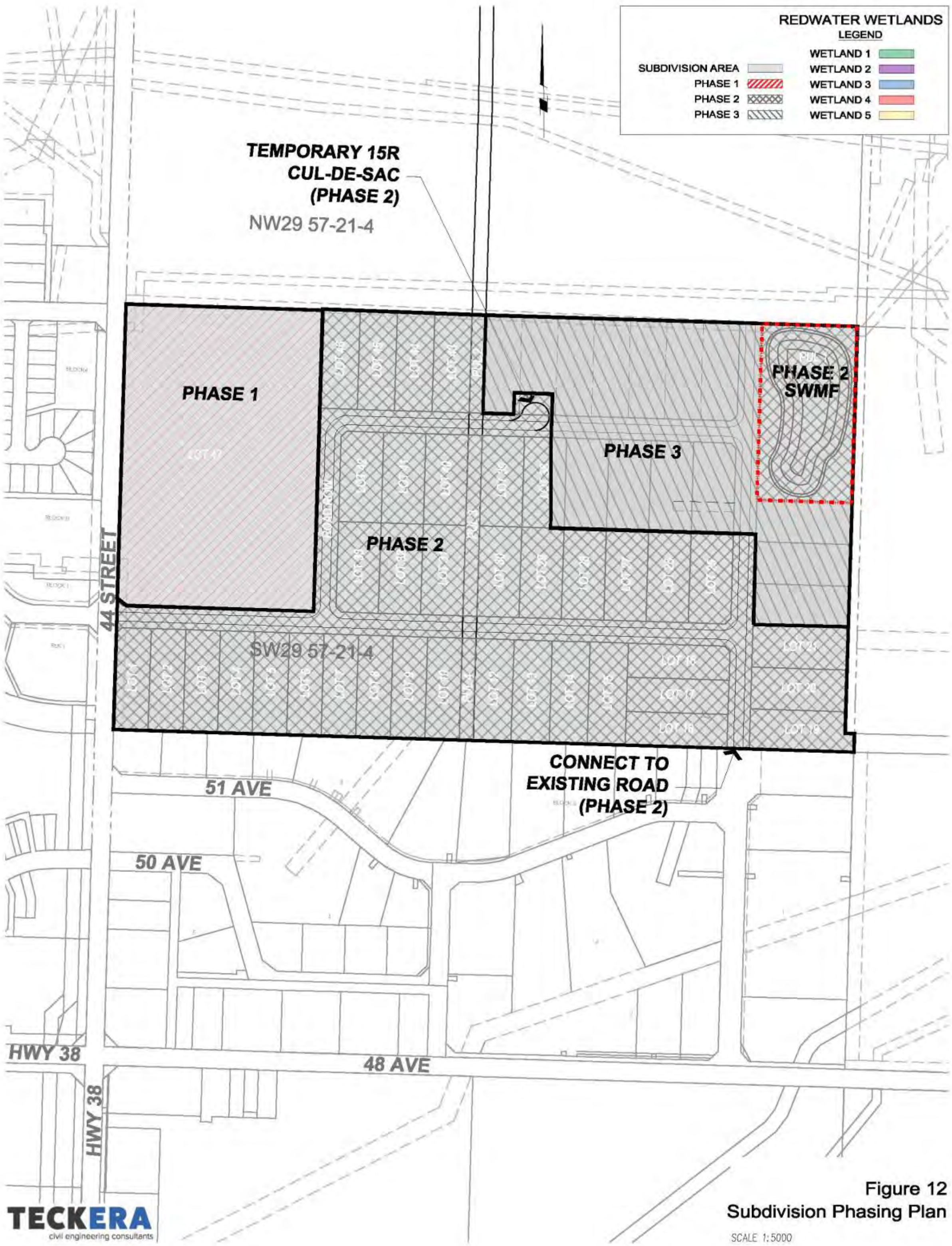
The Alberta *Wetland Mitigation Directive* outlines three main strategies to deal with potential impacts: avoidance, minimization, and replacement.

Avoidance – In this case, wetland avoidance is not practicable as the area is to be developed into an industrial park and the lands are zoned as such by the City of Redwater.

Minimization – Disturbance to the wetlands in the long term cannot be avoided; however, the existing wetlands will be incorporated into the stormwater management system located in Phase 2, as seen in Figure 5.0.

Replacement - Minimization of adverse effects to the wetlands is not possible for the proposed development, and a resulting permanent loss of wetland area will occur. In-lieu fee payments will be made to offset the permanent loss of wetland, as required under AEP policy.

Figure 5.0 Subdivision phasing plan for industrial park in SW ¼ 29-57-21-W4M



6.0 WETLAND AVOIDANCE & REPLACEMENT

Due to the nature of the development, avoidance of wetlands is not practicable. The industrial park requires the removal of the wetlands to accommodate road construction, paving, building erection, power and lighting facilities, etc. The Study Area is largely covered with wetlands; however, the parcel is adjacent to urban development within the Town of Redwater which is expected to have continued growth.

To minimize the impacts of development on the existing wetlands, the development plan has adopted a phased approach (Shown in Figure 5.0, above). Developing the property in three phases will allow for most wetlands to remain on the landscape until the later phases (phase 2 and phase 3) are required. In the short-term, this will minimize impacts to wetlands and allow for continued wetland function. In the long term, the existing wetlands will be incorporated into the storm water management design and construction.

At this time, only Phase 1 is being developed and therefore subject to permanent disturbance (i.e. removal). As such, an in-lieu payment is required of offset the permanent loss of wetlands within the

Phase 1 boundary, which will include Wetlands 4 &5, shown in Table 4.0 below.

Table 4.0 Wetland Areas and Compensation Ratios; Phased Approach

Wetland ID	Total Wetland Area (ha)	Compensation Ratio	Total Replacement (ha)
1	1.63	2	3.26
2	8.85	2	17.7
3	0.1	1	0.1
4	0.17	1	0.17
5	0.20	1	0.22
		Total Phase 1	0.37

The total wetland area impacted by Phase1 is 0.37 ha in relative wetland assessment value unit 2, valuated at $19,400/ha. The total amount of in-lieu payment fees is $7,178.00.

7.0 CLOSURE

We thank you for the opportunity to be of assistance. Should you have any questions, please contact either of the undersigned at 780.977.0646 for Jennifer Gosse, and 780.725.2227 for Nadine Clifton.

Thank you

Black Fly Environmental Ltd.

Prepared by:

Jennifer Gosse

Jennifer Gosse, P.Ag., P. Biol.
Environmental Specialist

Reviewed by:

Nadine Clifton, P.Ag., P.Biol
Environmental Scientist

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Regions of Alberta Soil Inventory Database:

http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/All/sag14652

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Merged Wetland Inventory: http://aep.alberta.ca/forms-maps-services/maps/resource-data-product-catalogue/biophysical.aspx

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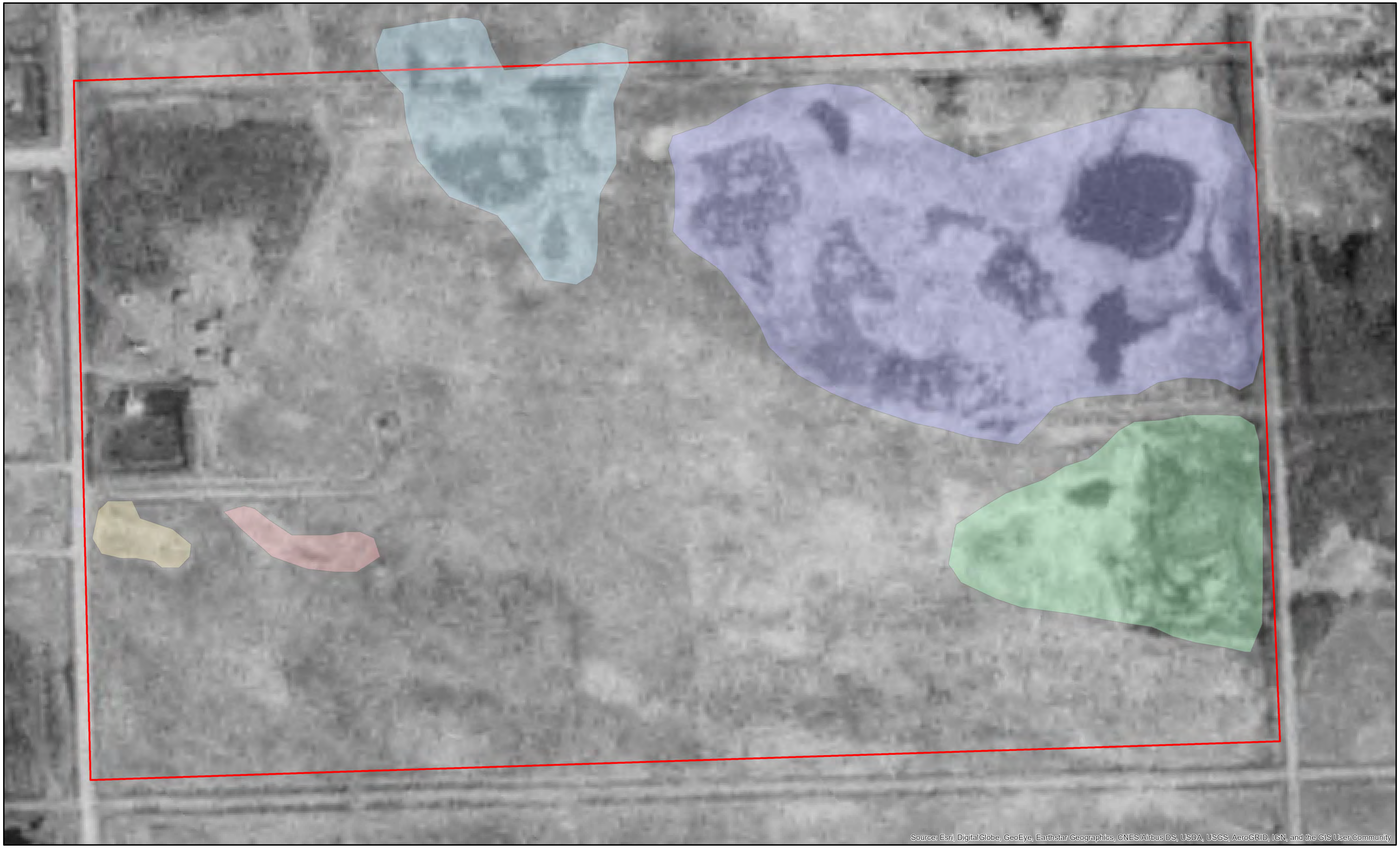
APPENDIX A - HISTORICAL AIR PHOTOS



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Projection: Transverse Mercator
Datum: North American 1983
Revison Date: November 30, 2018
Drawn By: Nadine Clifton

0 20 40 80 120 160 Meters

N

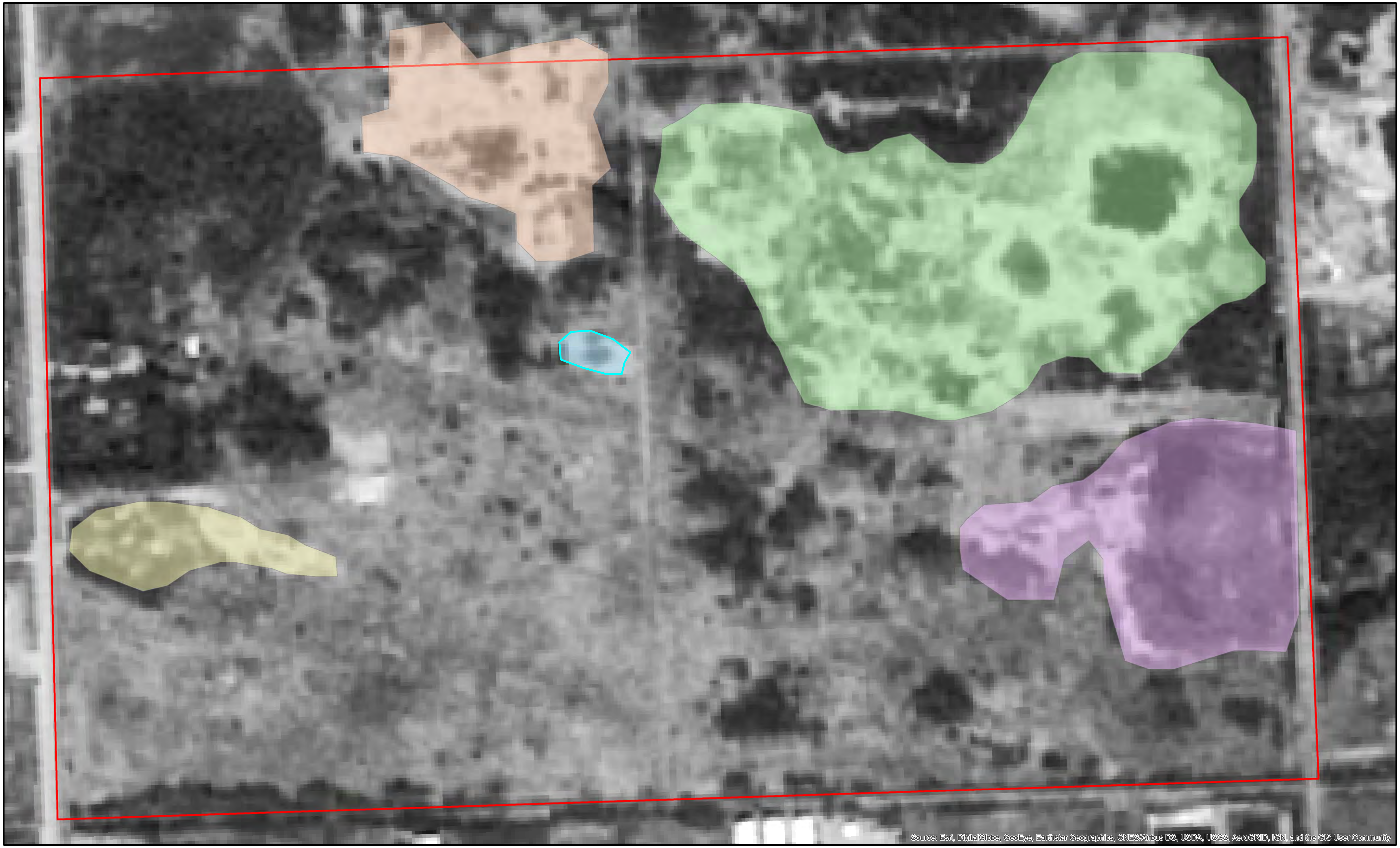
Historical Wetland Extent 1980

Project Name: Red Water Wetlands
Legal Land Description: SW-29-57-21 W4

Figure Number: 6.0

Prepared By: BLACK FLY ENVIRONMENTAL

Prepared For: TECKERA civil engineering consultants



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Services Date 2008
Coordinate System: NAD 1983 10TM AEP Resource
Projection: Transverse Mercator
Datum: North American 1983
Revison Date: November 30, 2018
Drawn By: Nadine Clifton

0 20 40 80 120 160 Meters

N

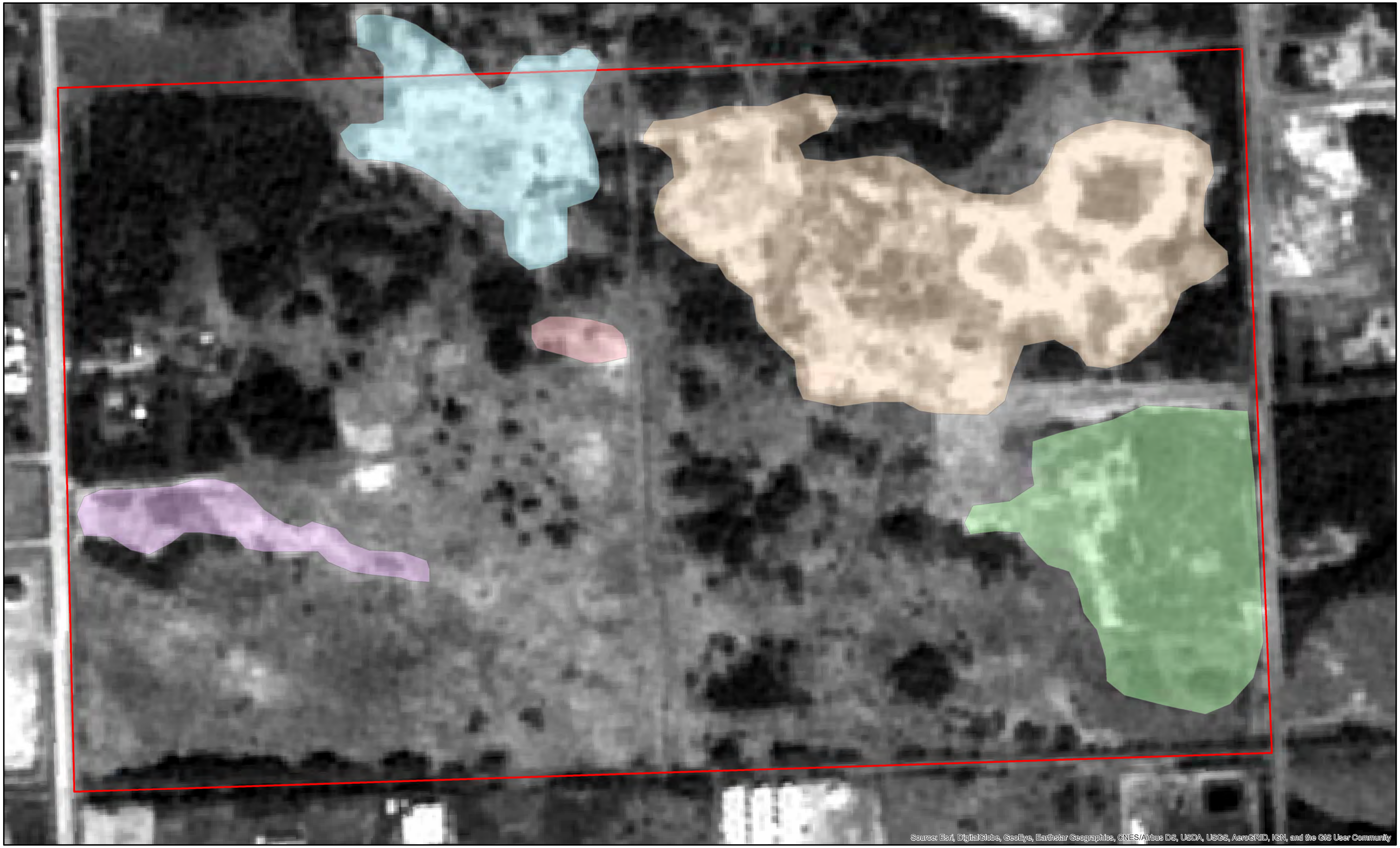
Historical Wetland Extent
2008

Project Name: Red Water Wetlands
Legal Land Description: SW-29-57-21 W4

Figure Number: 7.0

Prepared By: BLACK FLY ENVIRONMENTAL

Prepared For: TECKERA civil engineering consultants



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Coordinate System: NAD 1983 10TM AEP Resource
Projection: Transverse Mercator
Datum: North American 1983
Revison Date: November 30, 2018
Drawn By: Nadine Clifton

0 20 40 80 120 160 Meters

N

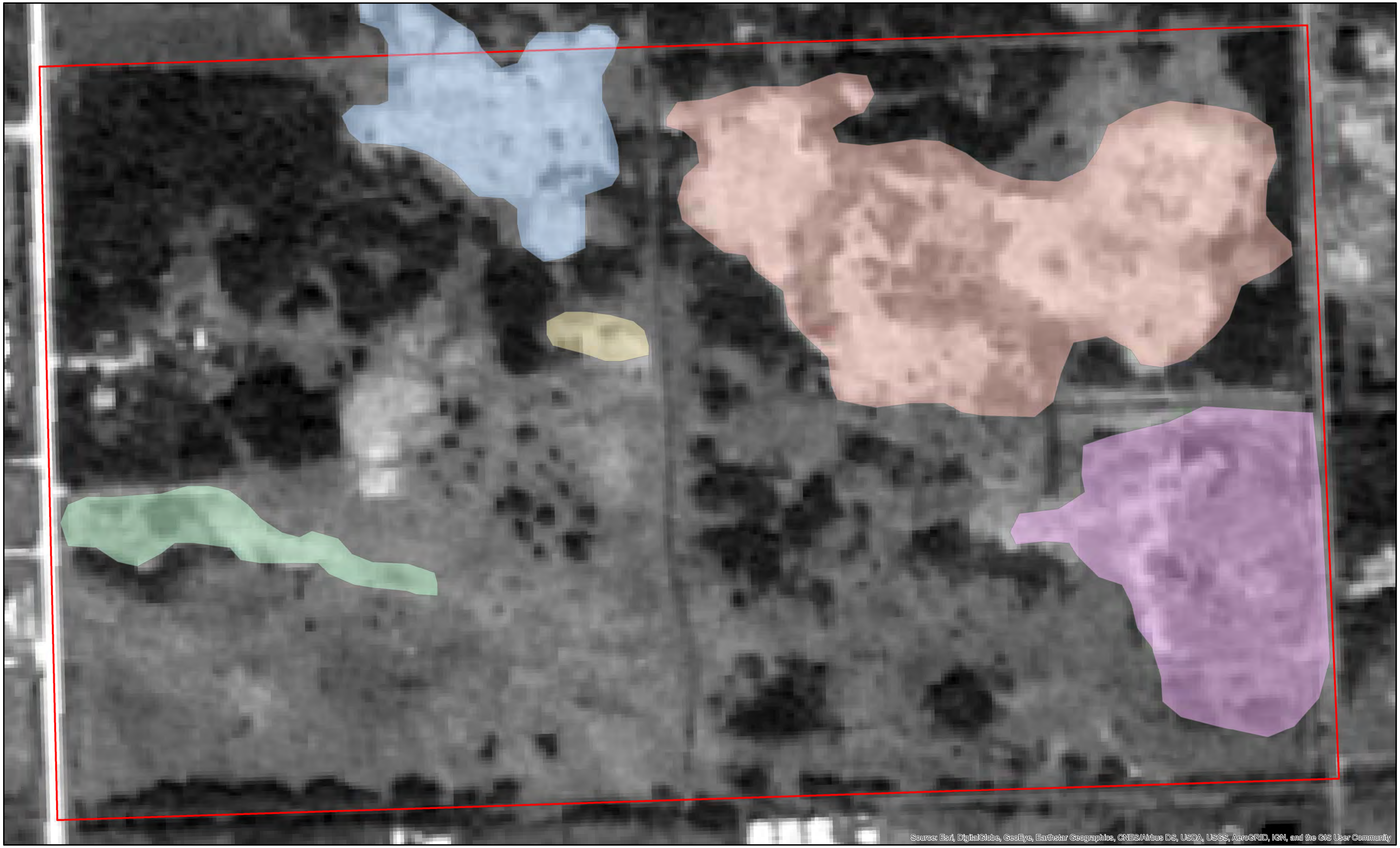
Historical Wetland Extent 2009

Project Name: Red Water Wetlands
Legal Land Description: SW-29-57-21 W4

Figure Number: 8.0

Prepared By: BLACK FLY ENVIRONMENTAL

Prepared For: TECKERA civil engineering consultants



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Coordinate System: NAD 1983 10TM AEP Resource
Projection: Transverse Mercator
Datum: North American 1983
Revison Date: November 30, 2018
Drawn By: Nadine Clifton

0 20 40 80 120 160 Meters

N

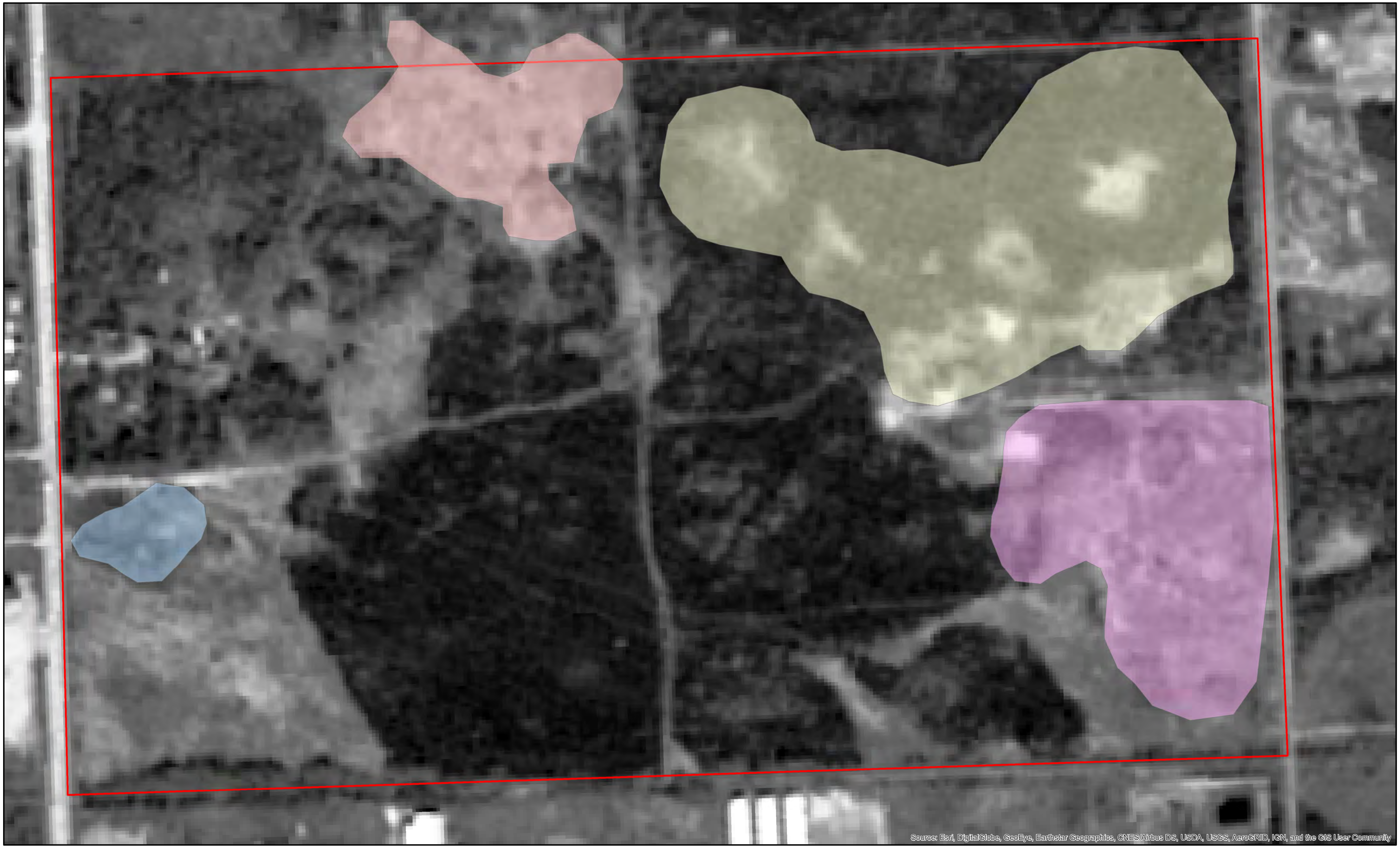
Historical Wetland Extent
2010

Project Name: Red Water Wetlands
Legal Land Description: SW-29-57-21 W4

Figure Number: 9.0

Prepared By: BLACK FLY ENVIRONMENTAL

Prepared For: TECKERA civil engineering consultants



Service Layer Credits: Abacus Data Graphics AbaData 2.0 Imagery
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Coordinate System: NAD 1983 10TM AEP Resource
Projection: Transverse Mercator
Datum: North American 1983
Revison Date: November 30, 2018
Drawn By: Nadine Clifton

0 20 40 80 120 160
Meters

N

Historical Wetland Extent
2011

Project Name: Red Water Wetlands Legal
Land Description: SW-29-57-21 W4

Figure Number: 10.0

Prepared By: BLACK FLY ENVIRONMENTAL

Prepared For: TECKERA civil engineering consultants

Service Layer Credits: Google Earth Imagery Date 8/2/2015

Coordinate System: NAD 1983 10TM AEP Resource
Projection: Transverse Mercator
Datum: North American 1983

Revison Date: November 27, 2018
Drawn By: Nadine Clifton

0 20 40 80 120 160
Meters

N

Historical Wetland Extent
2015

Project Name: Red Water Wetlands
Legal Land Description: SW-29-57-21 W4

Figure Number: 11.0

Prepared By: BLACK FLY ENVIRONMENTAL

Prepared For: TECKERA civil engineering consultants

APPENDIX B – PHOTO PLATES

Photo 1: Wetland 1 at Photo Point 1; looking North

Photo 2: Wetland 1 at Photo Point 1; looking East

Photo 3: Wetland 1 at Photo Point 1; looking South

Photo 4: Wetland 1 at Photo Point 1; looking West

Photo 5: Wetland 1 at Photo Point 1; looking Down

Photo 6: Soil pit in Wetland 1 at Photo Point 1

Photo 7: Wetland 2 at Photo Point 2; looking North

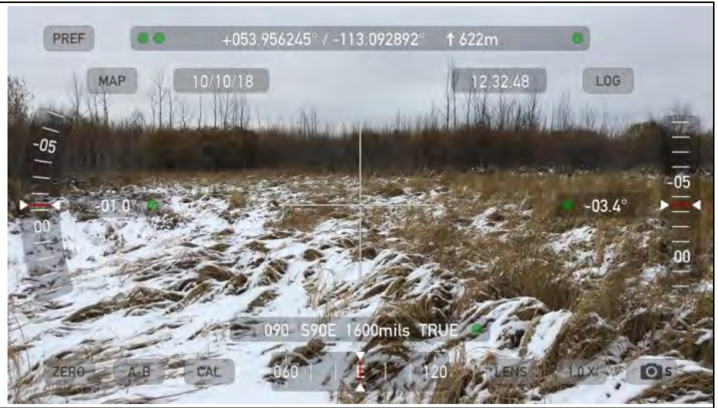


Photo 8: Wetland 2 at Photo Point 2; looking East

Photo 9: Wetland 2 at Photo Point 2; looking South

Photo 10: Wetland 2 at Photo Point 2; looking West

Photo 11: Wetland 2 at Photo Point 2; looking Down

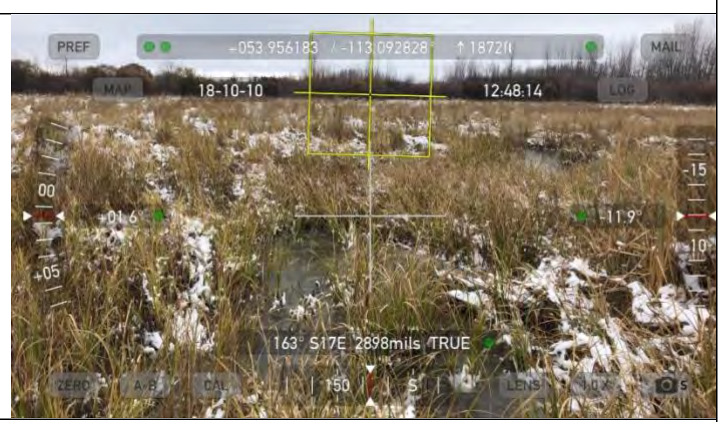


Photo 12: Wetland 2 at Photo Point 2; showing frozen water at surface

Photo 13: Wetland 2 at Photo Point 6 looking North

Photo 14: Wetland 2 at Photo Point 6 looking East

Photo 15: Wetland 2 at Photo Point 6 looking South

Photo 16: Wetland 2 at Photo Point 6 looking West

Photo 17: Wetland 2 at Photo Point 7 looking Northeast

Photo 18: Wetland 2 at Photo Point 8 looking South

Photo 19: Wetland 3 at Photo Point 3; looking North

Photo 20: Wetland 3 at Photo Point 3; looking East

Photo 21: Wetland 3 at Photo Point 3; looking South

Photo 22: Wetland 3 at Photo Point 3; looking West

Photo 23: Wetland 3 at Photo Point 3; looking Down

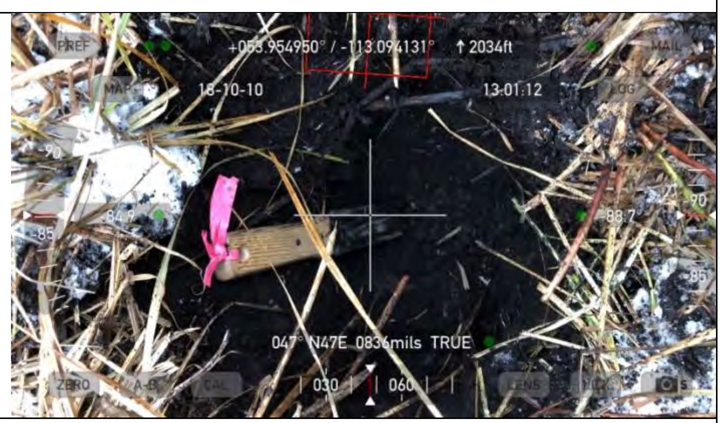


Photo 24: Soil pit in Wetland 3 at Photo Point 3

Photo 25: Wetland 4 at Photo Point 4; looking North

Photo 26: Wetland 4 at Photo Point 4; looking East

Photo 27: Wetland 4 at Photo Point 4; looking South

Photo 28: Wetland 4 at Photo Point 4; looking West towards 44st

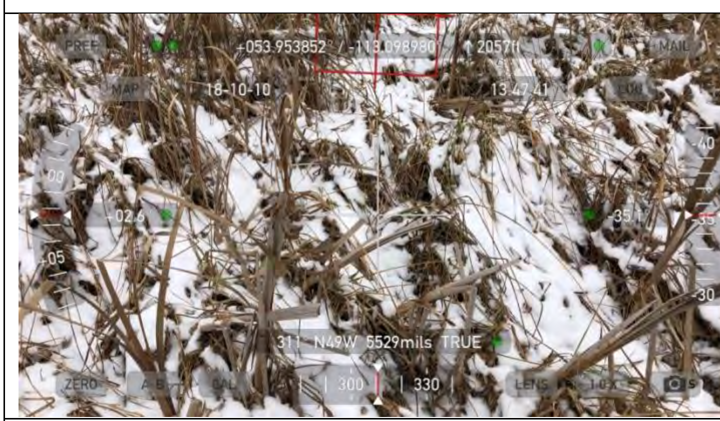


Photo 29: Wetland 4 at Photo Point 4; looking Down

Photo 30: Soil pit in Wetland 4 at Photo Point 4

Photo 31: Wetland 5 at Photo Point 5; looking North toward upland area

Photo 32: Wetland 5 at Photo Point 5; looking East toward upland area

Photo 33: Wetland 5 at Photo Point 5; looking South

Photo 34: Wetland 4 at Photo Point 4; looking West

Photo 35: Wetland 4 at Photo Point 4; looking Down

Photo 36: Soil pit in Wetland 4 at Photo Point 4

APPENDIX C – DATABASE SEARCH RESULTS

Search ACIMS Data

☰ MENU

Date: 6/1/2019
Requestor: Consultant
Reason for Request: Environmental Assessment
SEC: 29 **TWP:** 057 **RGE:** 21 **MER:** 4

Alberta Parks

Non-sensitive EOs: 0 (*Data Updated:October 2017*)

M-RR-TTT-SS	EO_ID	ECODE	S_RANK	SNAME	SCOMNAME	LAST_OBS_D

No Non-sensitive EOs Found: Next Steps - See FAQ

Sensitive EOs: 0 (*Data Updated:October 2017*)

M-RR-TTT	EO_ID	ECODE	S_RANK	SNAME	SCOMNAME	LAST_OBS_D

No Sensitive EOs Found: Next Steps - See FAQ

Protected Areas: 0 (*Data Updated:October 2017*)

M-RR-TTT-SS	PROTECTED AREA NAME	TYPE	IUCN

No Protected Areas Found

Crown Reservations/Notations: 0 (*Data Updated:October 2017*)

M-RR-TTT-SS	NAME	TYPE

No Crown Reservations/Notations Found

Alberta Environment and Parks

Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Created: 6-Jan-2019 15:17

Species present within the current extent :

Fish Inventory	Wildlife Inventory	Stocked Inventory
	No Species Found in Search Extent	No Species Found in Search Extent

Buffer Extent

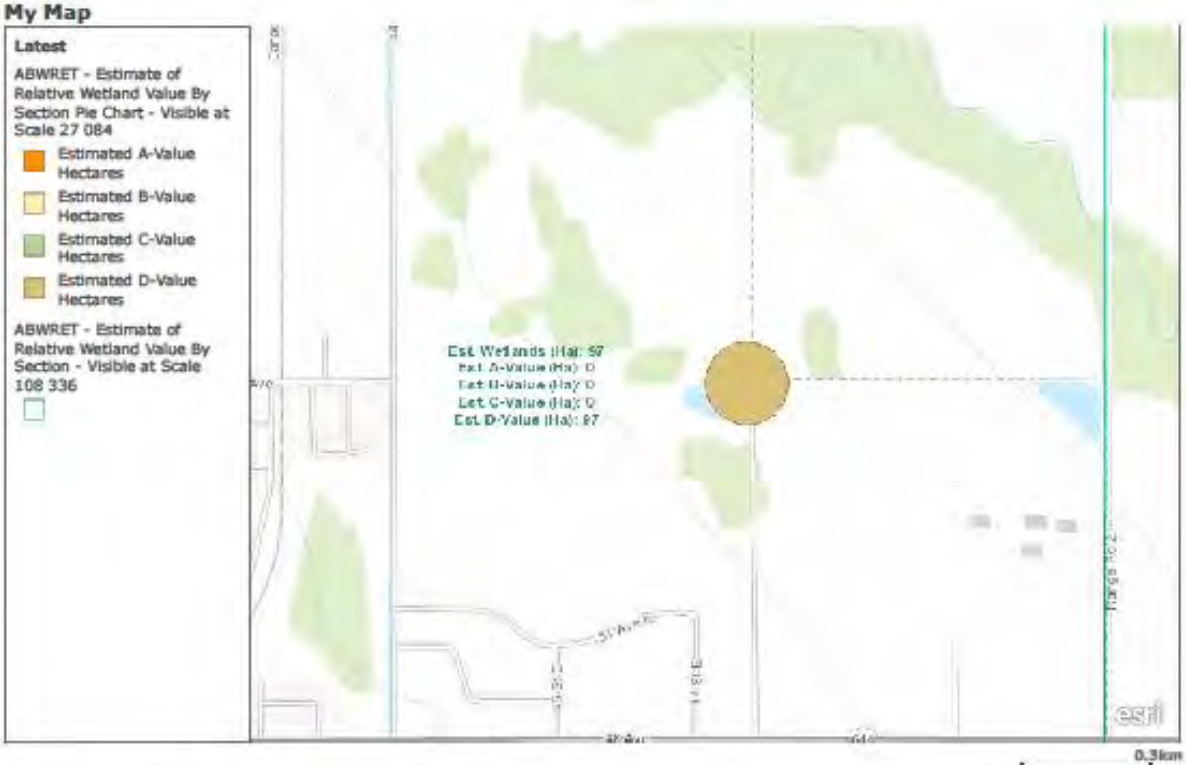
Centroid (X,Y):	Projection	Centroid: (Qtr Sec Twp Rng Mer)	Radius or Dimensions
625087, 5977838	10-TM AEP Forest	SW 29 57 21 4	1 kilometers

Contact Information

For contact information, please visit:

http://aep.alberta.ca/about-us/contact-us/fisheries-wildlife-management-area-contacts.aspx

My Map



Sturgeon County, Province of Alberta, Esri Canada, Esri, HERE, Garmin, USGS, METI/NASA, EPA, USDA, AAFC, NRCan | Copyright Government of Alberta

APPENDIX D – ABWRET-A RESULTS (ABWRET Tracking Number A181124)

Function (ABWRET-A Raw Score)	Wetland 1	Wetland 2	Wetland 3	Wetland 4	Wetland 5
Surface Water Storage (WS)	5.67	6.15	1.64	5.37	4.86
Stream Flow Support (SFS)	0.00	0.00	0.00	0.00	0.00
Streamwater Cooling (WC)	0.00	0.00	0.00	0.00	0.00
Sediment & Toxicant Retention & Stabilization (SR)	10.00	10.00	10.00	10.00	10.00
Phosphorus Retention (PR)	10.00	10.00	10.00	10.00	10.00
Nitrate Removal & Retention (NR)	10.00	10.00	10.00	10.00	10.00
Organic Nutrient Export (OE)	0.00	0.00	0.00	0.00	0.00
Fish Habitat (FH)	0.00	0.00	0.00	0.00	0.00
Aquatic Invertebrate Habitat (INV)	5.51	5.70	4.65	4.74	4.37
Amphibian Habitat (AM)	4.31	3.14	2.55	3.80	2.72
Waterbird Habitat (WB)	5.92	5.87	4.66	5.12	4.96
Songbird, Raptor, & Mammal Habitat (SBM)	3.42	4.98	2.15	2.50	2.72
Pollinator & Native Plant Habitat (PH)	3.96	4.38	2.88	3.30	3.33
Human Use & Recognition (HU)	1.60	2.24	1.61	1.41	1.52
Function (ABWRET-A Normalized Score)	Wetland 1	Wetland 2	Wetland 3	Wetland 4	Wetland 5
Surface Water Storage (WS)	0.76	0.85	0.06	0.71	0.62
Stream Flow Support (SFS)	0.00	0.00	0.00	0.00	0.00
Streamwater Cooling (WC)	0.00	0.00	0.00	0.00	0.00
Sediment & Toxicant Retention & Stabilization (SR)	1.00	1.00	1.00	1.00	1.00
Phosphorus Retention (PR)	1.00	1.00	1.00	1.00	1.00
Nitrate Removal & Retention (NR)	1.00	1.00	1.00	1.00	1.00
Organic Nutrient Export (OE)	0.00	0.00	0.00	0.00	0.00
Fish Habitat (FH)	0.00	0.00	0.00	0.00	0.00
Aquatic Invertebrate Habitat (INV)	0.56	0.59	0.45	0.46	0.41
Amphibian Habitat (AM)	0.61	0.42	0.32	0.53	0.35
Waterbird Habitat (WB)	0.50	0.49	0.34	0.40	0.38
Songbird, Raptor, & Mammal Habitat (SBM)	0.34	0.63	0.11	0.17	0.21
Pollinator & Native Plant Habitat (PH)	0.39	0.46	0.20	0.28	0.28
Human Use & Recognition (HU)	0.11	0.24	0.11	0.07	0.09
Normalized Score (ABWRET_A) Based on Wetlands in RWVAU	Wetland 1	Wetland 2	Wetland 3	Wetland 4	Wetland 5
Normalized Hydrological Health (HH)	0.76	0.85	0.06	0.71	0.62
Normalized Water Quality (WQ)	1.00	1.00	1.00	1.00	1.00
Normalized Ecological Health (EH)	0.61	0.63	0.45	0.53	0.41
Normalized Human Use (HU)	0.11	0.24	0.11	0.07	0.09
RWVAU #	2	2	2	2	2
Normalized Value Score (ABWRET_a)	0.72	0.77	0.46	0.68	0.62
Value Category (a, b, c, d)	c	c	d	d	d
Abundance Factor	0	0	0	0	0
Final Score (A, B, C, D)	C	C	D	D	D

Appendix E1

Traffic Impact Assessment

(McElhanney)

Our File: 2131-00400-13

September 14, 2020

0974200 Ltd.
6671 Elm Road
Lantzville, BC V0R 2H0

Attention: Bob Eakin

RE: Redwater Industrial Subdivision Traffic Impact Assessment

As requested, McElhanney Ltd. (McElhanney) has prepared the following Traffic Impact Assessment report for the Redwater Industrial Subdivision located near Highway 38 and 44 Street. The following report outlines the summary of the existing highway conditions, the proposed improvements and the traffic impacts with the development.

We trust this report will provide the necessary support for the roadside development application process. Should you have any questions, please do not hesitate to contact one of the undersigned.

Sincerely,
McElhanney Ltd.

Prepared by:	Reviewed by:
	Derek Yin
Elaine Lau, P.Eng., PTOE Senior Transportation Engineer eklau@mcelhanney.com | 780-809-3234	Derek Yin, PhD., P.Eng. Division Manager, Highways dyin@mcelhanney.com | 780-809-3210

1. Background Information

1.1 STUDY PURPOSE AND OBJECTIVE

0974200 Ltd. (the Developer) is proposing to develop a subdivision site for a range of industrial uses. The proposed development is located within the Town of Redwater, AB along 44th Street. The development location is highlighted in **Figure 1** .

The proposed development requires a Traffic Impact Assessment (TIA) for the intersections of Highway 38 / 44th Street and 44th Street / 54th Avenue as part of development approvals. McElhanney Ltd. (McElhanney) has been commissioned to prepare a traffic impact study for the proposed development. The objectives of this Traffic Impact Assessment are to examine the intersection performance with the proposed development and to recommend necessary road improvements that will maintain acceptable traffic operations at the highway access location for the next 20 years.

The TIA follows the guidelines and procedure as published by the Institute of Transportation Engineers (ITE) as well as Alberta Transportation's TIA Guidelines.

1.2 PROPOSED DEVELOPMENT

The site is located within the Town of Redwater, AB, adjacent to 44th Street on SW 29-57-21 W4M as shown in **Figure 1**. Per the site plan located in **Attachment A**, the proposed development will have one access located at the existing intersection of 44th Street and 54th Avenue. **Figure 2** outlines the layout of the proposed development. The development is expected to be completed in two phases as outlined in **Table 1**.

Table 1: Proposed Development by Phase

Phase	Land Use	Total Lot Size	Anticipated Full Build-Out Year
Phase 1	• Lot #1: Mechanic shop with 4 to 5 employees. • Lot #2: General contractor services site with laydown yard with 6 employees.	4.83 acres	2021
Phase 2	38 to 40 general industrial lots, with varied industrial uses based on the Town's Land Use Bylaw.	16.64 acres	2024

The following intersections are expected to be impacted by the development and were analyzed for the purpose of this assessment:

- Highway 38 / 44th Street
- 44th Street / 54th Avenue

.

Figure 1: Study Area

Figure 2: Proposed Development Plan Layout

2. Existing Infrastructure & Conditions

2.1 EXISTING HIGHWAY CONDITIONS

In the vicinity of the proposed development, Highway 38 is a paved two-lane undivided highway in the Level 3 service category with a posted speed of 50 km/h. The roadway has a rural cross-section with ditches lining both sides of the street. A small section of Highway 38 through the study area (the west leg of the intersection of Highway 38 and 44th Street) does have curb and gutter lining the street through the Town of Redwater. The intersection of Highway 38 and 44th Street is uncontrolled, illuminated and has a Type IIc intersection treatment (see **Figure 3**) with a dedicated eastbound right-turn lane. Land uses adjacent to the intersection are comprised of mixed uses and empty lots.

44th Street is a paved two-lane undivided collector roadway with a posted speed of 50 km/h in the vicinity of the proposed development. The roadway has a rural cross-section with ditches on both sides and illumination along the east side. The topography on 44th Street is relatively flat. Land uses adjacent to the 44th Street are general a mixed of residential, light industrial and open spaces.

The intersection of 44th Street / 54th Avenue is currently an uncontrolled T-intersection that provides local access to land uses (mostly residential) west of 44th Street. The intersection is characterized as a local rural intersection and has a Type 1a intersection treatment, with no ditches or curb and gutter. Illumination is provided at the intersection.

Figure 4 through **Figure 6** shows the study corridor and intersections.

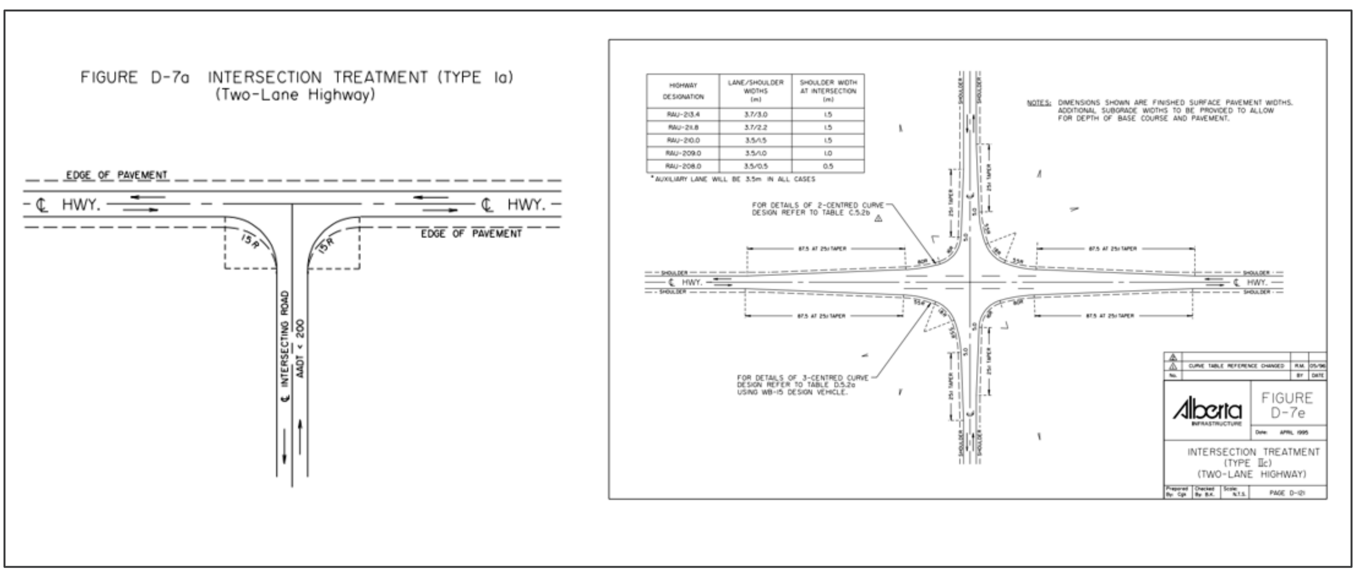


Figure 3: Alberta Transportation Type Ia and IIc Intersection Configuration – Two-Lane Highway

Figure 4: Highway 38 and 44th Street Intersection – Looking East (Image Source: Google Maps)

Figure 5: 44th Street – Looking North (Image Source: Google Maps)

Figure 6: 44th Street and 54th Avenue Intersection – Looking North (Image Source: Google Maps)

2.2 EXISTING TRAFFIC CONDITIONS

Traffic counts were conducted by McElhanney at the intersection of 44th Street and 54th Avenue on April 8, 2019. The peak hours were found to be from 10:15 – 11:15 for the AM peak and from 4:00 – 5:00 for the PM peak. 2019 traffic counts were also available for the Highway 38 / 44th Street intersection from Alberta Transportation Traffic Volume Data Map. The traffic count data can be found in **Attachment B**.

Based on the data, the daily vehicle composition of along Highway 38 and 44th Street is comprised mainly of passenger vehicles with approximately 5% to 11% trucks (single unit and heavy trucks), depending on the approach. The vehicle composition approaching each leg of the Highway 38 / 44th Street intersection is summarized in **Table 2**.

Table 2: 2019 Daily Vehicle Composition by Intersection Approach – Highway 38 / 44th Street Intersection

Vehicle Composition	Highway 38 (East Approach)	Highway 644 (West Approach)	44th Street (North Approach)	Highway 38 (South Approach)
Passenger Vehicle	93.2%	87.9%	93.7%	88.7%
Recreational Vehicle	0.3%	0.4%	0.6%	0.3%
Bus	0.3%	0.5%	0.3%	0.4%
Single Unit Truck	3.7%	4.0%	4.2%	3.8%
Tractor Trailer Unit	2.5%	7.1%	1.1%	6.8%

Figure 7 depicts the existing (2019) peak hour traffic volumes at the study locations. Current peak hour turn volumes at both study intersections are relatively low. The heaviest movement is observed in the northbound left-turn, which it accommodates between 70 to 90 vehicles per hour during peak conditions.

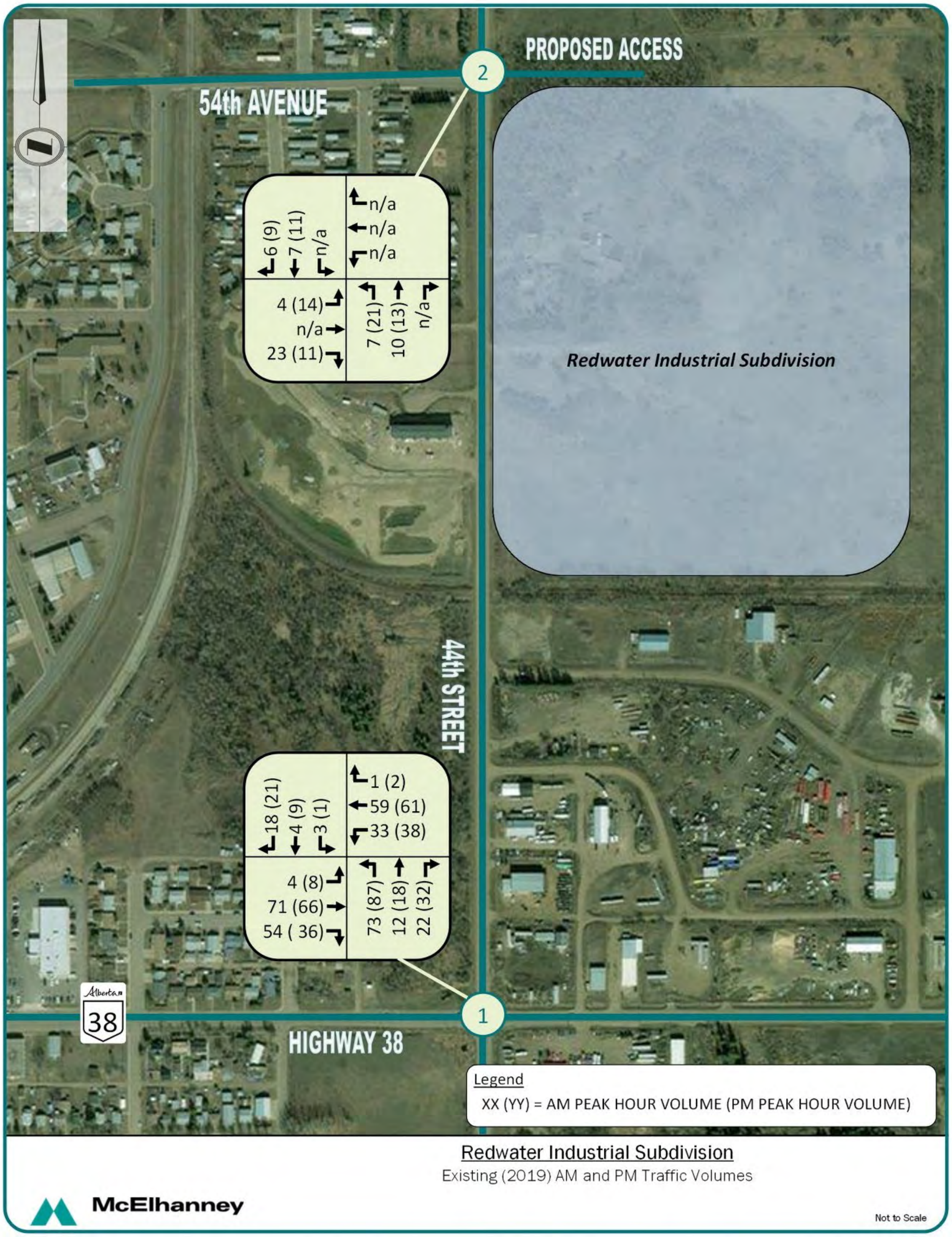


Figure 7: Existing (2019) AM and PM Peak Hour Intersection Volume

3. Traffic Projections

3.1 BACKGROUND TRAFFIC

Historic traffic data obtained from traffic count station ATR 997120 (Highway 38 and 44th Street intersection) indicates the background traffic has fluctuated along both roadways throughout the past 20 years. Growth along 44th Street increased steadily at an average annual linear rate of 4% between 2002 and 2010 and since 2010, traffic along 44th Street have decreased by an average rate of 4% per year. Overall, the average annual linear growth rate along 44th Street is approximately 0.6% over the past 20 years.

Highway 38 experienced steady growth between 2008 and 2009 (an average annual growth of 2% per year) and then almost a 15% decrease in traffic between 2008 and 2009. Traffic volumes on Highway 38 grew again from 2009 to 2017 at an average rate of 3% per year and experienced a significant decrease between 2017 to 2018 (over 20%). Overall, the average annual linear growth rate on Highway 38 is approximately -1.0% over the past 20 years.

Per the census data, the population of Redwater is declining at a rate of approximately 0.4% per year over the past 15 years from 2001 to 2016. Between 2011 and 2016, Redwater grew by 138 people, equivalent to an average growth rate of 1.4% per year.

With such fluctuations in the historical traffic data for each roadway, it is difficult to anticipate the growth rate in the coming years. Additionally, a residential development (Alluvium Residential Development) is currently planned on the west side of 44th Street which will also utilize the intersection of Highway 38 / 44th Street. Considering the fluctuating growth around Highway 38 and 44th Street, as well as the Alluvium Residential Development, a growth rate of 2.5% was utilized to forecast future traffic projections for this TIA. While this is an aggressive growth rate and is much higher than the average linear growth rate over the past 10 to 20 years (0% or less), it captures growth from other development in the area as well as local and regional traffic growth on Highway 38 and 44th Street.

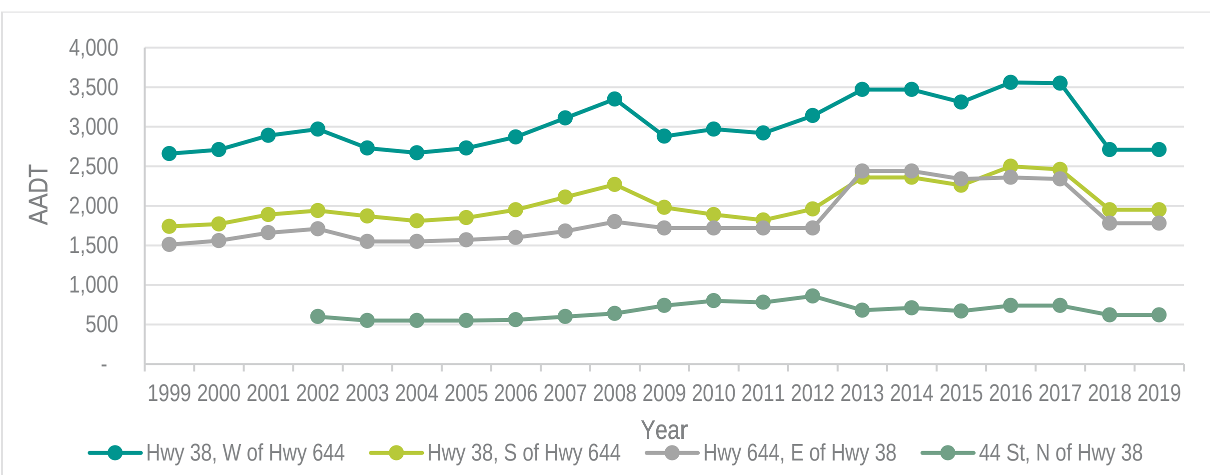


Figure 8: 20-Year Historic AADT, Alberta Transportation Count Site 997120 (Highway 38 and Highway 644)

The proposed development is expected to be completed in two phases, with the anticipated opening day of Phase 1 in 2021 and Phase 2 in 2024. In addition to the 2021 and 2024, future AM and PM peak background traffic volumes were projected for the 2044 horizon – 20 years beyond the completion of Phase 2. The peak background traffic volumes under the 2021, 2024 and 2044 horizon are illustrated in **Figure 9**, **Figure 10** and **Figure 11**, respectively.

Figure 9: 2021 Background Traffic Volumes

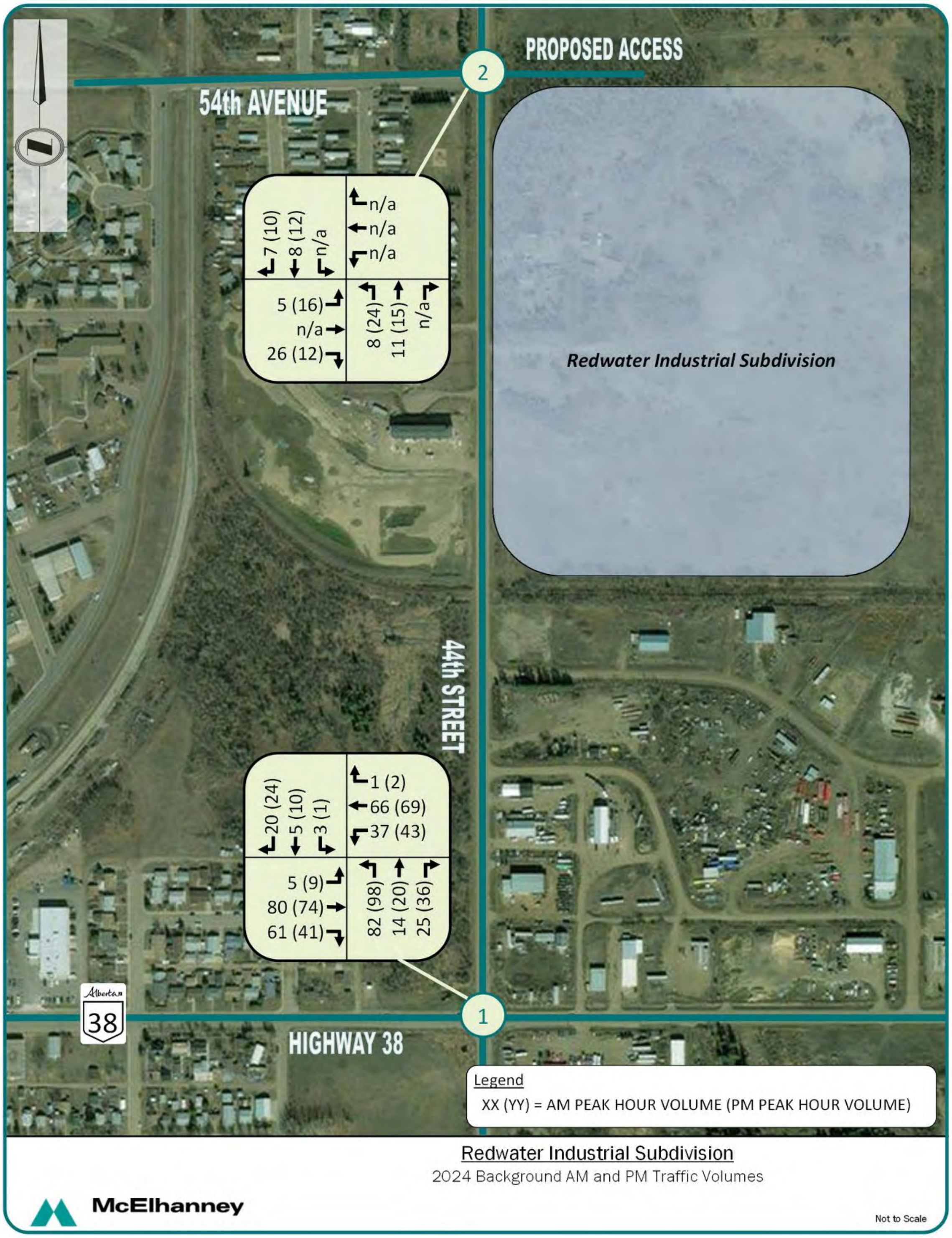


Figure 10: 2024 Background Traffic Volumes

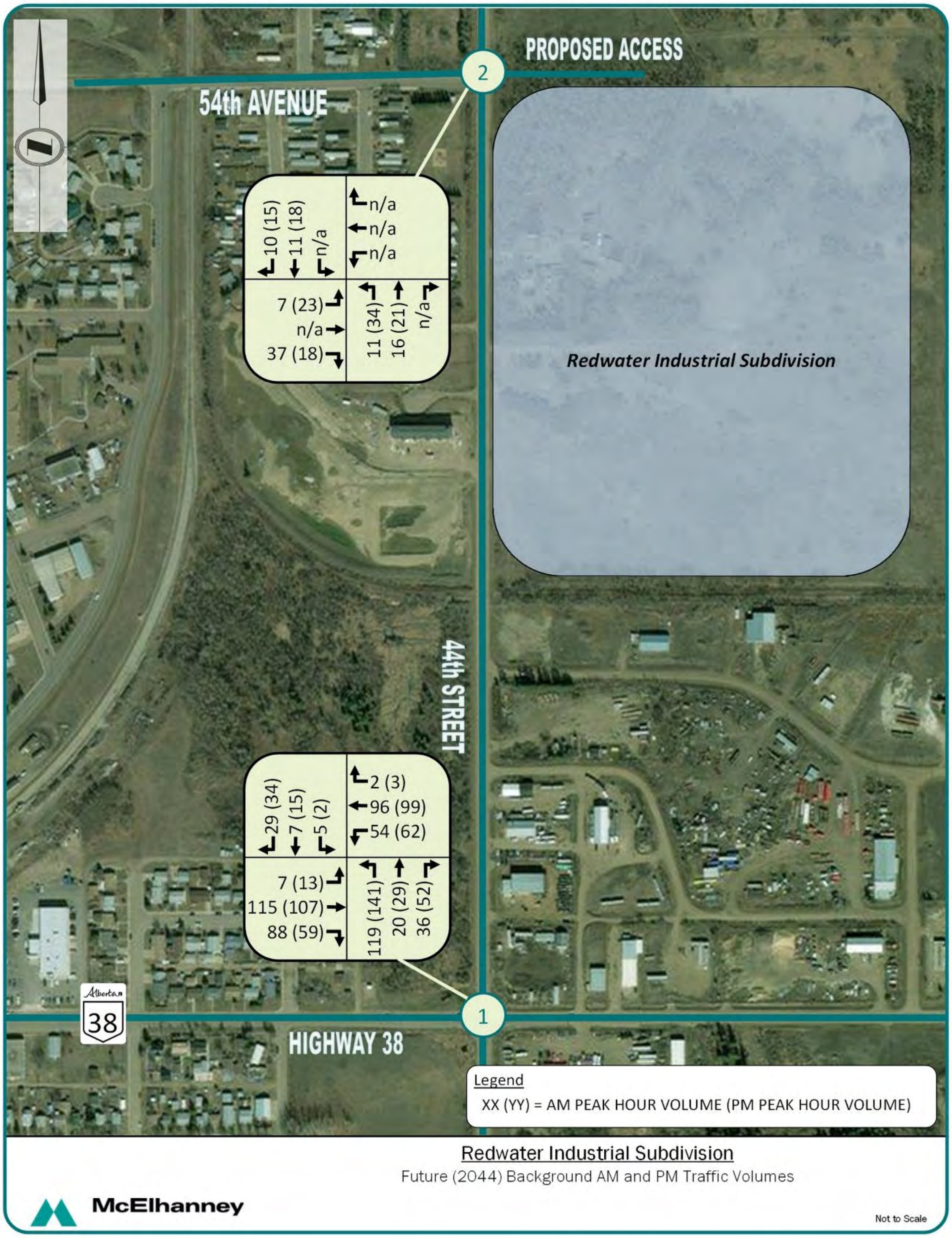


Figure 11: 20-Year Horizon (2044) Background Traffic Volumes

3.2 DEVELOPMENT TRAFFIC

3.2.1 Trip Generation

Peak hour trip generation estimates were developed using the Trip Generation, 10th Edition, 2017, Institute of Transportation Engineers (ITE). Phase 1 of the development is expected to consist of a mechanic shop with 4 to 5 employees and a general contractor service business with a laydown yard on approximately 4.8 acres of land. Phase 2 of the development is expected to consist of 38 to 40 lots on approximately 16.6 acres of land for general industrial uses as per the Town's Land Use Bylaw, which range from automotive repair shops to self-service storage facilities and veterinary clinics.

Land use code 942 (Automobile Care Center) and land use code 110 (General Light Industrial) was used for Phase 1. For the purpose of this assessment, the gross floor area (GFA) of the mechanic shop and contractor service business is assumed to be 7,000 ft^2 and 5,000 ft^2, respectively. Land use code 130 (Industrial Park) was used for Phase 2 as this phase of development includes a range of industrial uses distributed over several lots. According to the Town's land use bylaw, the maximum site coverage is 60%. Assuming that the building size coverage is 50% of the allowable site coverage, the total GFA from Phase 2 is approximately 75,794 ft^2.**Table 3** below presents the estimated trips generated by the development.

Table 3: Trip Generation Summary

Land Use Type	Gross Floor Area (ft^2)	Peak Hour	Trip Rate	In/Out Ratio		Trips		
				In %	Out %	In	Out	Total
PHASE 1 DEVELOPMENT								
942 Automobile Care Center (Mechanic Shop)	7,000	AM	2.25	66%	34%	10	6	16
		PM	T = 2.41(X) + 11.83	48%	52%	14	15	39
110 General Light Industrial	5,000	AM	Ln(T) = 0.74Ln(X) + 0.39	88%	12%	4	1	5
		PM	Ln(T) = 0.69Ln(X) + 0.43	13%	87%	1	4	5
Phase 1 Total AM Trips						14	7	21
Phase 1 Total PM Trips						15	19	34
PHASE 2 DEVELOPMENT								
130 Industrial Park	74,794	AM	0.40	81%	19%	24	6	30
		PM	0.40	21%	79%	6	24	30
TOTAL DEVELOPMENT								
Total Development AM Trips						38	13	51
Total Development PM Trips						21	43	64

Phase 1 of the development is expected to generate a total of 21 trips (14 in and 7 out) and 34 trips (15 in and 19 out) during the AM and PM peak hour, respectively. Phase 2 of the development will generate a total of 30 trips during both AM and PM peak hour. Overall, full build of the development will generate 51 trips and 64 trips during the AM and PM peak hour.

3.2.2 Trip Distribution

The trip distribution of traffic generated by the project development was estimated based on the surrounding infrastructure, specifically Highway 38 and the Town of Redwater. It is anticipated that the majority of vehicles accessing the site will be from out of town, and thus utilize Highway 38 to access the site. Based on the surrounding infrastructure, the following trip distribution was assumed:

- At the intersection of 44th Street / proposed site access, 70% of the traffic will come or go to the south, and 30% will come or go to the north.

- At the intersection of Highway 38 / 44th Street, 60% of the traffic will come or go to the west, 30% will come or go to the south and 10% will come or go from the east.

The site generated traffic volumes are presented in **Figure 12** and **Figure 13** for Phase 1 and Phase 2, respectively.

3.3 COMBINED TRAFFIC

The development trips estimated for the project development (**Table 3**) were added to the background traffic to determine traffic volumes for Opening Day Phase 1 (2021), Opening Day Phase 2 (2024) and future 20-year horizon (2044). The combined AM and PM peak hour traffic volumes under each horizon are presented in **Figure 14** through to **Figure 16**. It should be noted that the traffic volumes in the 2024 and 2044 horizon includes both Phase 1 and Phase 2 development traffic.

Figure 12: Site-Generated Traffic Volumes – Phase 1 (2021)

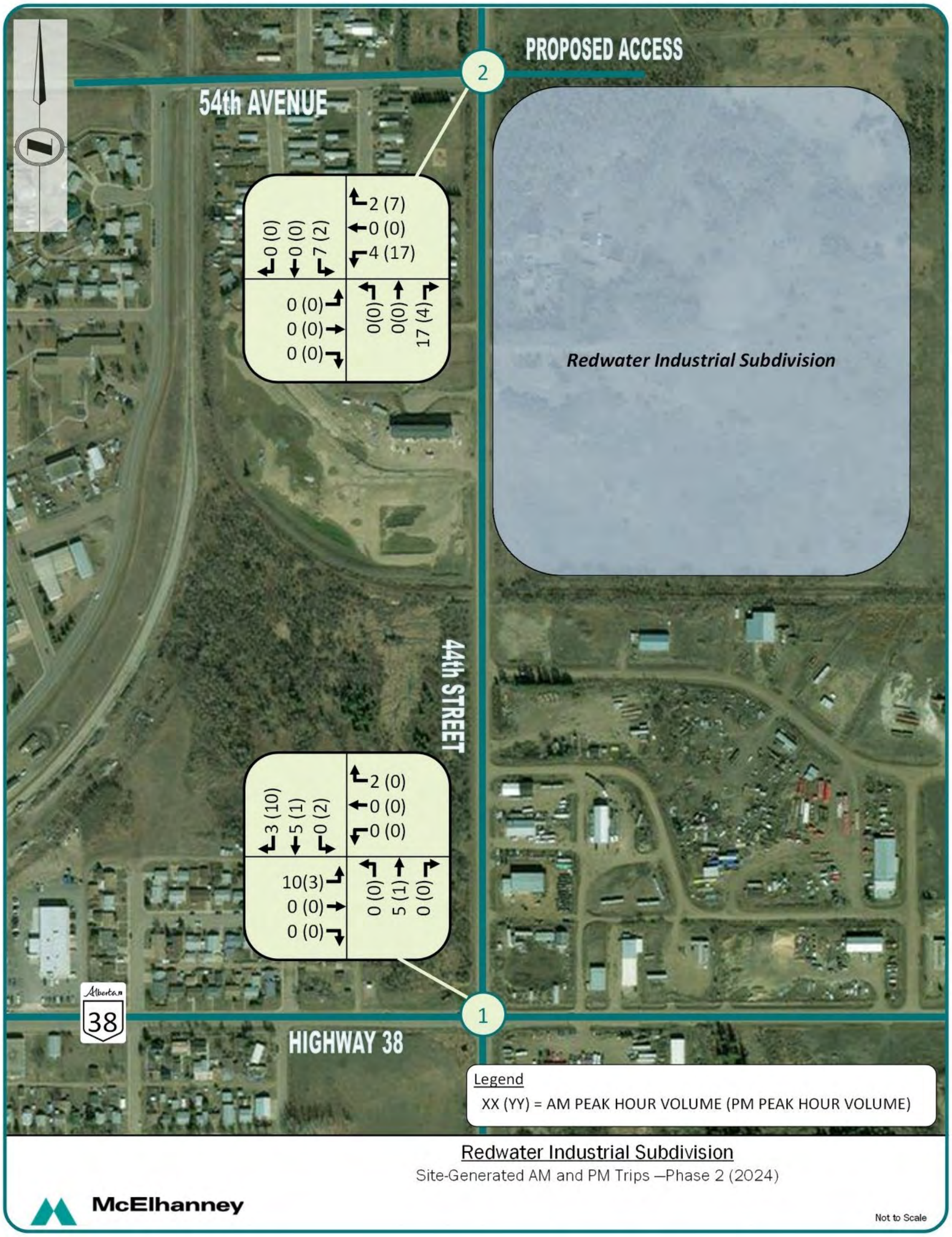


Figure 13: Site-Generated Traffic Volumes – Phase 2 (2024)

Figure 14: 2021 (Opening Day, Phase 1) Combined AM and PM Peak Hour Intersection Volume

Figure 15: 2024 (Opening Day, Phase 2) Combined AM and PM Peak Hour Intersection Volume

Figure 16: 20-Year Horizon (2044) Combined AM and PM Peak Hour Intersection Volume

4. Traffic & Warrant Analysis

4.1 CAPACITY ANALYSIS

Traffic operational analysis for the study intersections were conducted using Synchro 10 traffic software. The Level of Service (LOS) under two-way stop control (TWSC) on minor roads was analyzed for the following six scenarios:

- Opening Day, Phase 1 (2021) – Background and Combined Condition’
- Opening Day, Phase 2 (2024) – Background and Combined Condition; and
- Future Year (2044) – Background and Combined Condition

The analysis results for study intersections are presented in **Table 4** and **Table 5**. The analysis outputs are included in **Attachment C**.

Under both Opening Day, Phase 1 (2021) and Phase 2 (2024) horizon, the study intersections will operate under good level of service, with all approaches experiencing minimal delays and operating at LOS B or better during the AM and PM peak hour. With a linear background traffic growth of 2.5% per year, both intersections will continue to operate at acceptable levels of service in 2044, with all approaches operating at a LOS C or better. The northbound approach at the Highway 38 / 44th Street intersection will experience slightly longer delays in 2044, particularly in the PM peak, however, this approach will operate at a LOS C with the 95th percentile queues estimated to be under 20 meters and a volume-to-capacity (v/c) ratio of 0.44. Both intersections will have an overall intersection LOS A under the three planning horizons (2021, 2024 and 2044).

The **addition of the proposed development is expected to have minimal impacts to the operations of both study intersections** under the three planning horizons. Under the future (20-year) horizon, both intersections will continue to operate at a LOS A with the proposed development and background growth. All approaches will also operate at a LOS C or better, with relatively short 95th percentile queues and v/c ratios well below 1.0. These findings suggest that the current design of the Highway 38 / 44th Street intersection can accommodate the projected background growth and site-generated traffic without additional improvements. The 44th Street / 54th Avenue intersection will require an upgrade from the current T-intersection to a four-legged intersection to accommodate the proposed access. Additional warrant analysis was undertaken and described in the next subsections to determine whether other intersection treatments are required.

Table 4: AM and PM Peak Hour Intersection Performance Summary – Highway 38 / 44th Street Intersection

Horizon	Performance Measure	Eastbound L T	Eastbound R	Westbound L T R	Northbound L T R	Southbound L T R	Intersection LOS
Highway 38 / 44th Street - AM Peak Hour							
2021 Background	Average Delay (veh/s)	0.4	0.0	2.9	11.2	9.3	A
	95th Percentile Queue (m)	0.1	0.0	0.6	4.8	0.8	
	V/C Ratio	0.00	0.04	0.03	0.17	0.03	
	Approach LOS	A	A	A	B	A	
2021 Combined	Average Delay (veh/s)	0.9	0.0	2.9	11.5	9.6	A
	95th Percentile Queue (m)	0.2	0.0	0.6	5.1	1.0	
	V/C Ratio	0.01	0.04	0.03	0.19	0.04	
	Approach LOS	A	A	A	B	A	
2024 Background	Average Delay (veh/s)	0.4	0.0	2.9	11.5	9.4	A
	95th Percentile Queue (m)	0.1	0.0	0.7	5.3	0.8	
	V/C Ratio	0.00	0.04	0.03	0.19	0.04	
	Approach LOS	A	A	A	B	A	
2024 Combined	Average Delay (veh/s)	1.6	0.0	2.8	12.2	9.7	A
	95th Percentile Queue (m)	0.3	0.0	0.7	6.3	1.2	
	V/C Ratio	0.01	0.04	0.03	0.22	0.05	
	Approach LOS	A	A	A	B	A	
2044 Background	Average Delay (veh/s)	0.5	0.0	3.1	14.5	10.2	A
	95th Percentile Queue (m)	0.1	0.0	1.1	11.2	1.5	
	V/C Ratio	0.01	0.06	0.05	0.34	0.06	
	Approach LOS	A	A	A	B	B	
2044 Combined	Average Delay (veh/s)	1.3	0.0	3.0	15.8	10.5	A
	95th Percentile Queue (m)	0.4	0.0	1.1	13	1.9	
	V/C Ratio	0.02	0.06	0.05	0.37	0.08	
	Approach LOS	A	A	A	C	B	
Highway 38 / 44th Street - PM Peak Hour							
2021 Background	Average Delay (veh/s)	0.8	0.0	3.0	11.7	9.6	A
	95th Percentile Queue (m)	0.1	0.0	0.7	6.6	1.0	
	V/C Ratio	0.01	0.02	0.03	0.23	0.04	
	Approach LOS	A	A	A	B	A	
2021 Combined	Average Delay (veh/s)	1.4	0.0	3.0	12.2	9.7	A
	95th Percentile Queue (m)	0.2	0.0	0.7	7.2	1.5	
	V/C Ratio	0.01	0.02	0.03	0.24	0.06	
	Approach LOS	A	A	A	B	A	
2024 Background	Average Delay (veh/s)	0.9	0.0	3.1	12.2	9.7	A
	95th Percentile Queue (m)	0.2	0.0	0.8	7.5	1.1	
	V/C Ratio	0.01	0.03	0.03	0.25	0.05	
	Approach LOS	A	A	A	B	A	
2024 Combined	Average Delay (veh/s)	1.6	0.0	3.0	13.2	10.1	A
	95th Percentile Queue (m)	0.3	0.0	0.8	8.8	2.3	
	V/C Ratio	0.01	0.03	0.03	0.28	0.09	
	Approach LOS	A	A	A	B	B	
2044 Background	Average Delay (veh/s)	0.9	0.0	3.2	16.7	10.5	A
	95th Percentile Queue (m)	0.2	0.0	1.2	17.1	1.9	
	V/C Ratio	0.01	0.04	0.05	0.44	0.08	
	Approach LOS	A	A	A	C	B	
2044 Combined	Average Delay (veh/s)	1.4	0.0	3.2	19	11.1	A
	95th Percentile Queue (m)	0.4	0.0	1.2	20.5	3.4	
	V/C Ratio	0.02	0.04	0.05	0.49	0.13	
	Approach LOS	A	A	A	C	B	

Table 5: AM and PM Peak Hour Intersection Performance Summary – 44th Street / 54th Avenue Intersection

Horizon	Performance Measure	Eastbound			Westbound			Northbound			Southbound			Intersection LOS
		L	T	R	L	T	R	L	T	R	L	T	R	
44th Street / 54th Avenue - AM Peak Hour														
2021 Background	Average Delay (veh/s)		8.5			-			3.1			0.0		A
	95th Percentile Queue (m)		0.6			-			0.1			0.00		
	V/C Ratio		0.03			-			0.00			0.00		
	Approach LOS		A			-			A			A		
2021 Combined	Average Delay (veh/s)		8.5			8.9			1.9			1.5		A
	95th Percentile Queue (m)		0.6			0.2			0.1			0.1		
	V/C Ratio		0.03			0.01			0.00			0.00		
	Approach LOS		A			A			A			A		
2024 Background	Average Delay (veh/s)		8.5			-			3.1			0.0		A
	95th Percentile Queue (m)		0.7			-			0.1			0.00		
	V/C Ratio		0.03			-			0.01			0.00		
	Approach LOS		A			-			A			A		
2024 Combined	Average Delay (veh/s)		8.6			9.2			1.3			3.1		A
	95th Percentile Queue (m)		0.7			0.3			0.1			0.2		
	V/C Ratio		0.03			0.01			0.01			0.01		
	Approach LOS		A			A			A			A		
2044 Background	Average Delay (veh/s)		8.6			-			3			0.0		A
	95th Percentile Queue (m)		1.1			-			0.2			0.00		
	V/C Ratio		0.05			-			0.01			0.00		
	Approach LOS		A			-			A			A		
2044 Combined	Average Delay (veh/s)		8.7			9.3			1.5			2.5		A
	95th Percentile Queue (m)		1.1			0.4			0.2			0.2		
	V/C Ratio		0.05			0.02			0.01			0.01		
	Approach LOS		A			A			A			A		
44th Street / 54th Avenue - PM Peak Hour														
2021 Background	Average Delay (veh/s)		8.8			-			4.5			0.0		A
	95th Percentile Queue (m)		0.7			-			0.3			0.00		
	V/C Ratio		0.03			-			0.01			0.00		
	Approach LOS		A			-			A			A		
2021 Combined	Average Delay (veh/s)		8.9			9.1			3.5			1.3		A
	95th Percentile Queue (m)		0.7			0.5			0.3			0.1		
	V/C Ratio		0.03			0.02			0.01			0.00		
	Approach LOS		A			A			A			A		
2024 Background	Average Delay (veh/s)		8.9			-			4.6			0.0		A
	95th Percentile Queue (m)		0.7			-			0.4			0.00		
	V/C Ratio		0.03			-			0.02			0.00		
	Approach LOS		A			-			A			A		
2024 Combined	Average Delay (veh/s)		9.0			9.3			3.3			1.7		A
	95th Percentile Queue (m)		0.8			1.3			0.4			0.1		
	V/C Ratio		0.03			0.05			0.02			0.00		
	Approach LOS		A			A			A			A		
2044 Background	Average Delay (veh/s)		9.1			-			4.6			0.0		A
	95th Percentile Queue (m)		1.2			-			0.5			0.00		
	V/C Ratio		0.05			-			0.02			0.00		
	Approach LOS		A			-			A			A		
2044 Combined	Average Delay (veh/s)		9.3			9.6			3.7			1.2		A
	95th Percentile Queue (m)		1.2			1.4			0.5			0.1		
	V/C Ratio		0.05			0.06			0.02			0.00		
	Approach LOS		A			A			A			A		

4.2 INTERSECTION TREATMENT WARRANT ANALYSIS

Alberta Transportation's Highway Geometric Design Guide (HGDG) provides criteria for the selection of an appropriate at-grade intersection treatment on two-lane rural highways. According to *Figure D-7.4* of the HGDG, the proposed intersection treatment is a function of AADT on the main road and the intersecting road (as shown in **Figure 17**). The AADT for the intersecting approach was based on traffic data obtained from Alberta Transportation. Following this methodology, the intersection treatment for the intersection of 44th Street / 54th Avenue will warrant a Type II(c) intersection treatment at each time horizon. The existing intersection at Highway 38 / 44th Street warrants further detailed analysis to determine the appropriate intersection treatment.

Detailed intersection treatment analysis that was carried out for the Highway 38 / 44th Street intersection indicate that a Type II(c) treatment is warranted based on the percentage of left turns. The westbound left turn volume was used for this analysis as it is considered the heaviest left movement at the intersection. As shown in **Figure 18**, a Type II(c) treatment is warranted at each time horizon. The current intersection has an exclusive eastbound right-turn lane; however, a westbound right-turn lane is not warranted at any of the planning horizons based on the HGDG's right-turn warrant.

The AADT on Highway 38 (west of 44th Street) is projected to exceed 4,000 vehicles per day in 2044. According to the HGDG, the overall access management of the highway should be considered before intersection treatments are constructed. It is worth noting that most of the growth on Highway 38 is attributed to the background growth and not the proposed development. Overall, the detailed intersection treatment analysis indicates that the current intersection treatment (Type II(c)) at Highway 38 and 44th Street can support the projected traffic volumes (without and with development) under the 2044 horizon without further improvements.

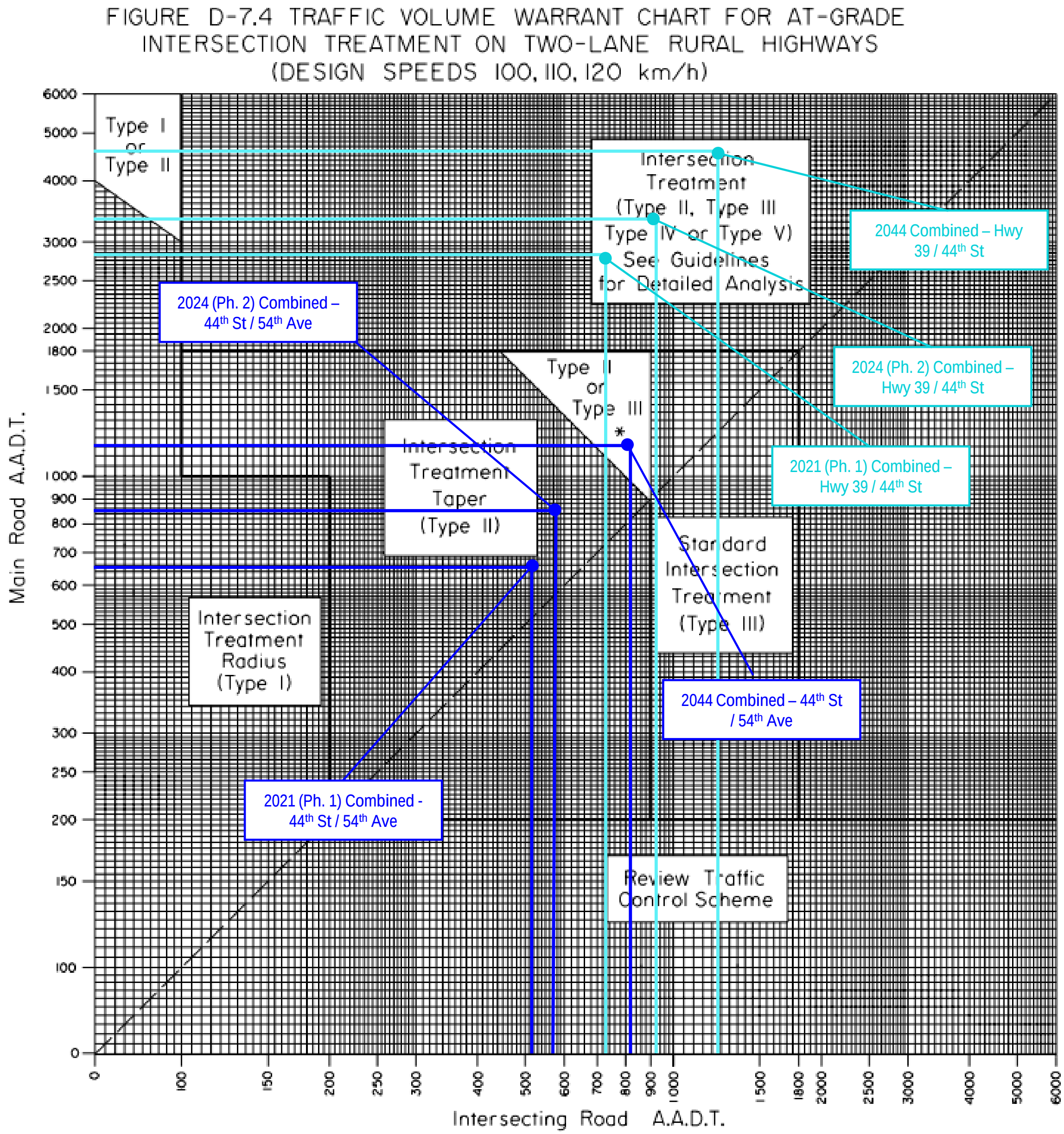


Figure 17: At-Grade Intersection Treatment Warrant – Two-Lane Rural Highways

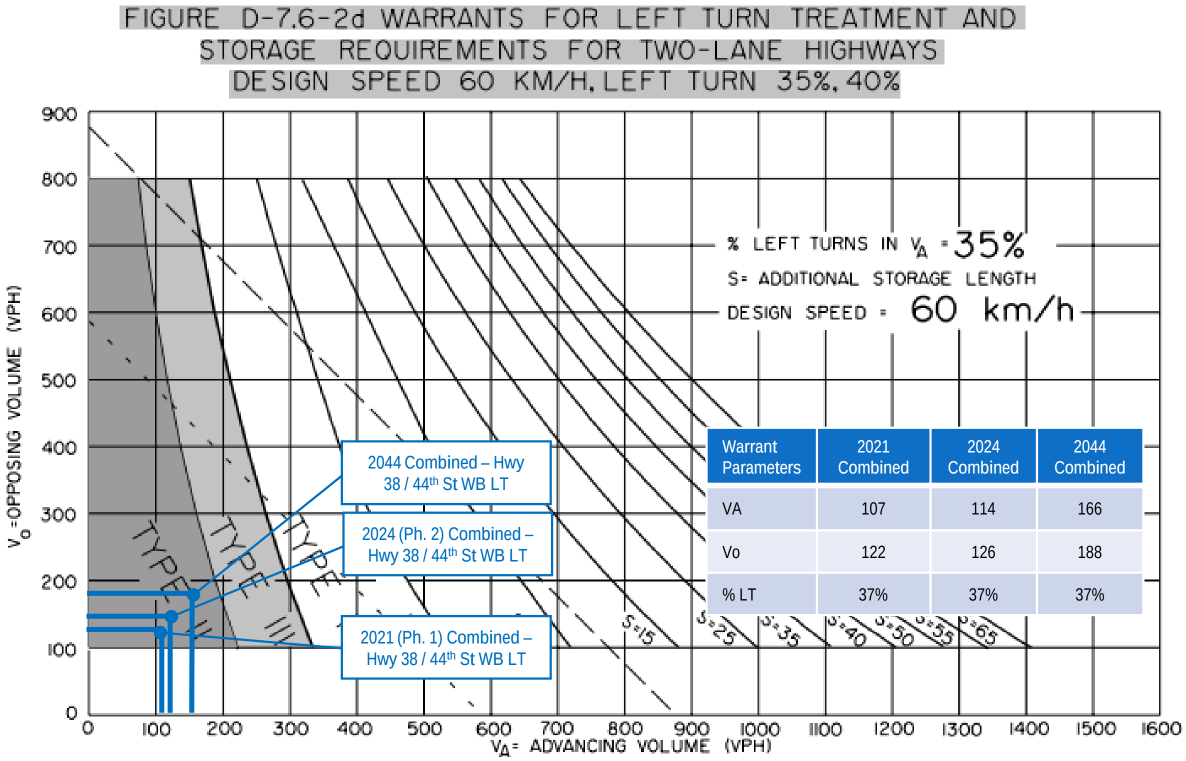


Figure 18: Left-Turn Warrant – Highway 38 / 44th Street

4.3 SIGHT DISTANCE

Intersection sight distance is defined as the sight distance available for drivers looking left and right along the main roadway from the point where vehicles are required to stop on an intersecting road before entering the intersection. The standard intersection sight distance requirement used in Alberta is based on the distance that is required for vehicles to turn left onto a major highway, without significantly interfering with vehicles approaching from the left at the design speed. This distance is adopted as a minimum for both directions for design purposes. According to the province's Highway Geometric Design Guide (see **Attachment D**), the minimum sight distance required along a main highway with a 60 km/h design speed for a WB-17 vehicle is 230 meters and 310 meters for a WB-21 vehicle.

Highway 38 and 44th Street are both flat and straight near the proposed intersection areas, with no horizontal or vertical curves located within the vicinity of either intersection. The sight distances in all directions is greater than 400 meters, exceeding the required 310 meters, meeting the intersection sight distance design criteria for both WB-17 and WB-21 vehicles.

4.4 SIGNAL WARRANT ANALYSIS

Traffic signal warrant was carried out for the Highway 38 / 44th Street intersection based on the Transportation Association of Canada's (TAC) Traffic Signal and Pedestrian Signal Head Warrant Handbook (June 2014). The analysis, provided in **Attachment D**, indicates that traffic signals are not warranted under Opening Day (Phase 1 and Phase 2) and 20-year conditions. Traffic signal warrant analysis was not carried out for the 44th Street / 54th Avenue intersection since traffic volumes are relatively lower than the Highway 38 / 44th Street intersection and will not be warranted for a traffic signal.

4.5 ILLUMINATION WARRANT ANALYSIS

Both study intersections are currently illuminated, however, an illumination warrant for both intersections was conducted to determine whether further illumination improvements are required based on the warrants outlined in the Transportation Association of Canada's (TAC) Illumination of Isolated Rural Intersections (2001) guide. The analysis (see **Attachment D**) indicates that illumination at the Highway 38 / 44th Street intersection is not warranted under the 2021 and 2024 horizon, but delineation lighting to illuminate cross street traffic is warranted under the 20-year (2044) horizon. Illumination is not warranted for the 44th Street / 54 Avenue intersection under the 2044 horizon due to lower vehicle volumes.

4.6 PEDESTRIAN WARRANT ANALYSIS

It is anticipated that there will be no regular pedestrian traffic at either of the study intersections due to the lack of amenities surrounding the development. Therefore, no pedestrian movement accommodation is warranted.

5. Conclusions & Recommendations

This study has examined the traffic impacts associated with the proposed Industrial Subdivision. The conclusions and recommendations are summarized below:

- The traffic from both phases of the proposed development have minimal impact to the level of service on Highway 38 and 44th Street. Both study intersections will continue to operate at a LOS A, with all approaches operating at a LOS C under the 2044 horizon during the peak hours.

- Intersection treatment warrant analysis indicate that a Type II(c) intersection treatment, which is aligned with the current intersection design for a two-lane highway is warranted for the intersection of Highway 38 / 44th Street for the 20-year horizon. No further improvements are required to support the proposed development.

- Intersection treatment warrant analysis indicate that a Type II(c) intersection treatment for a two-lane highway is warranted for the intersection of 44th Street / 54th Avenue to support the proposed site access. The design criteria should be confirmed through the preliminary and detail design stage.

- Sight distances at both intersections are adequate for the assumed design vehicle (WB-21).

- Illumination is not warranted at 44th Street / 54th Avenue intersection, however, delineation lighting to illuminate cross street traffic is warranted under the 20-year (2044) horizon for the Highway 38 / 44th Street intersection. Both intersections are currently illuminated, and no further improvements are required to support the proposed development.

- Traffic signals and pedestrian accommodation are not warranted at the study intersections.

6. Closing

This Report entitled “Redwater Industrial Subdivision Traffic Impact Assessment” was prepared by McElhanney Ltd. under the authorization of 0974200 Ltd. The analysis, report and recommendations put forward, reflect the Consultants’ best judgement with the available information. Any use of this information in a manner not intended, or with knowledge that situations have changed, shall not be the responsibility of McElhanney Ltd. or the undersigned.

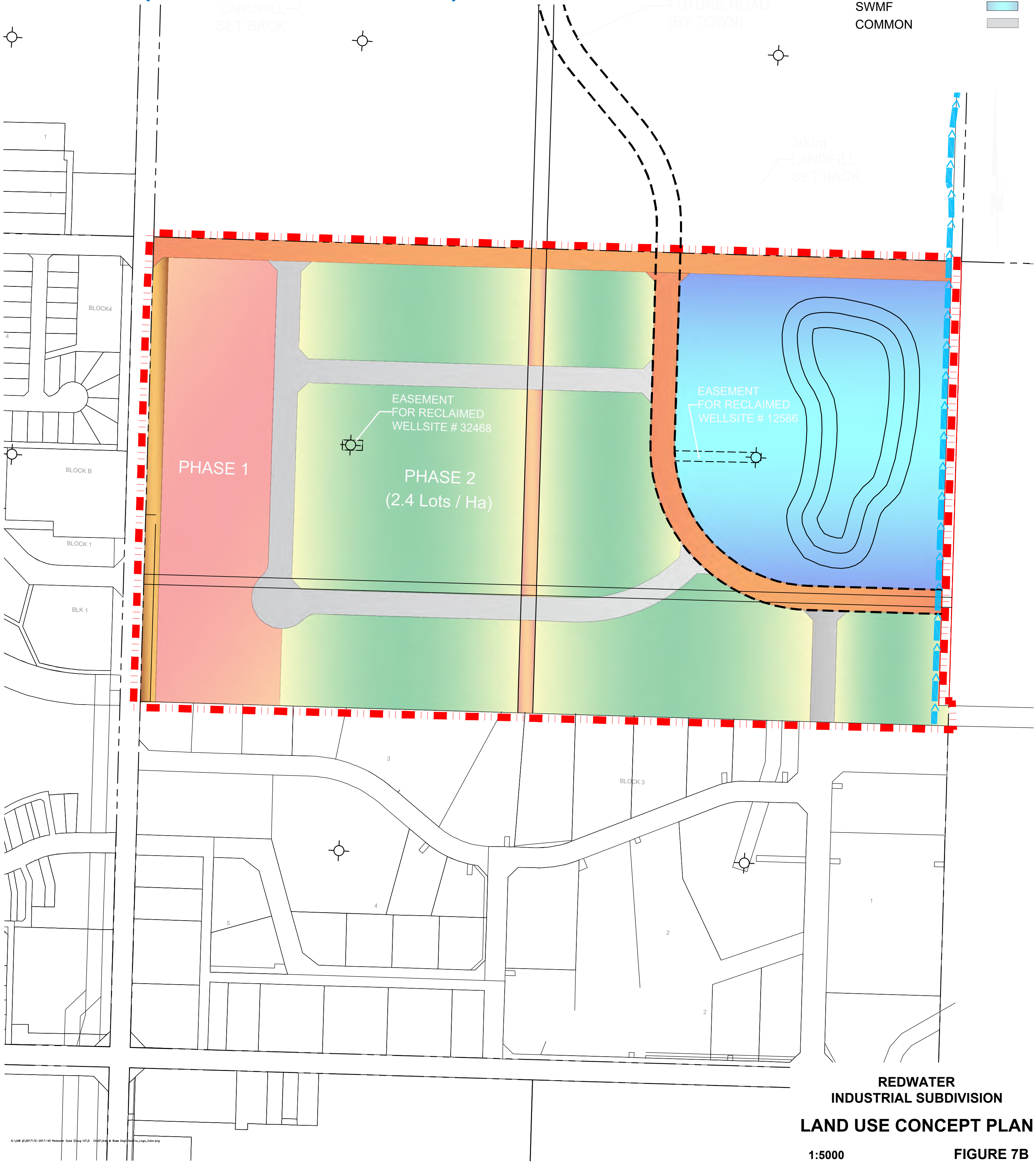
Attachment A – Proposed Development Plan

PROPOSED LOT LAYOUT FOR INDUSTRIAL SUBDIVISION REDWATER, ALBERTA

(WITHOUT LOT LINES)

LEGEND

- 54TH AVENUE CONT.
- ARTERIAL ROAD
- UR 1-3 (SAN LINE)
- 10.m BUFFER
- PHASE 1
- PHASE 2
- SWMF
- COMMON



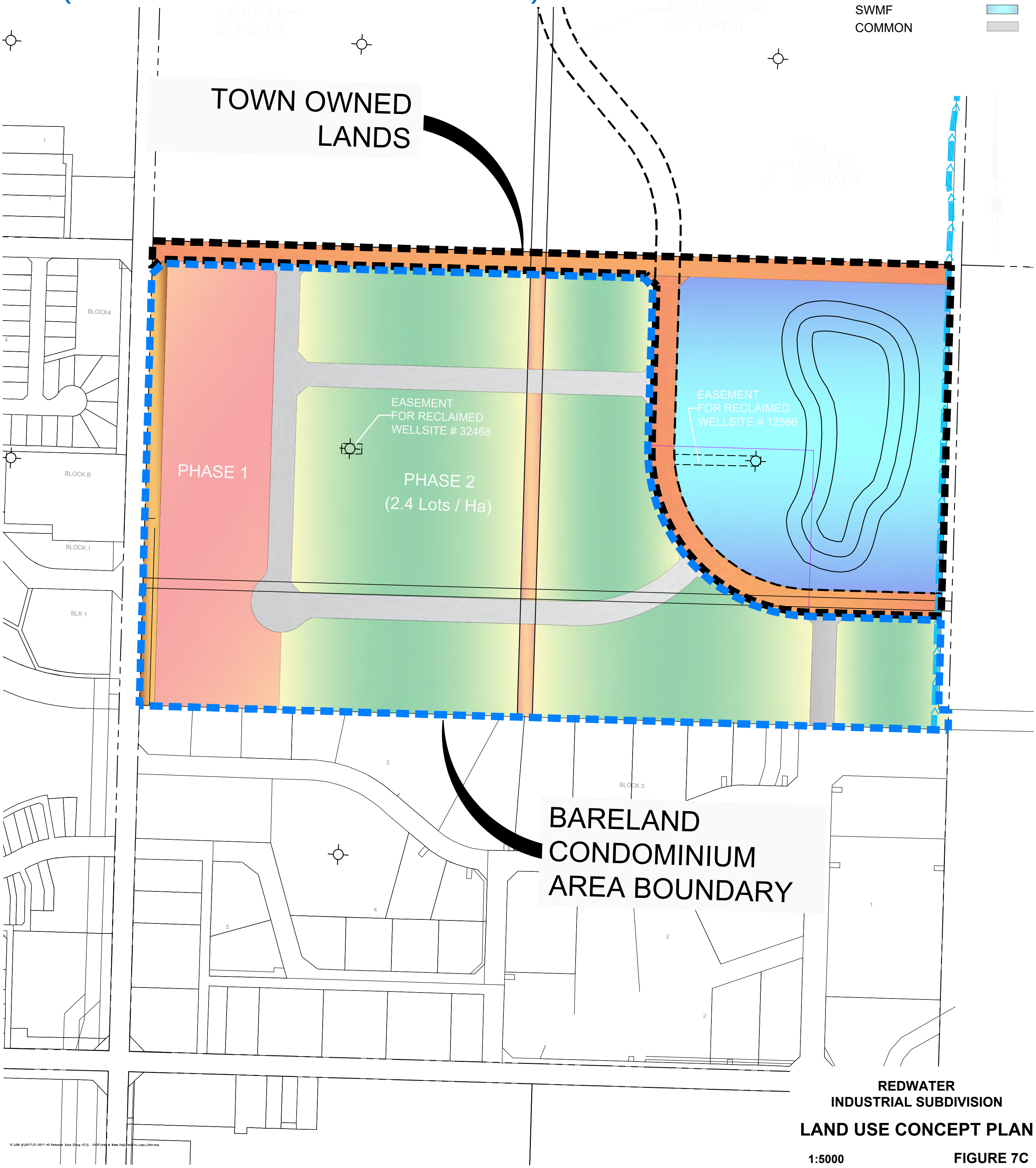
REDWATER INDUSTRIAL SUBDIVISION

LAND USE CONCEPT PLAN

1:5000 **FIGURE 7B**

PROPOSED LOT LAYOUT FOR INDUSTRIAL SUBDIVISION REDWATER, ALBERTA

(CONDO AREA VS TOWN LANDS)



REDWATER
INDUSTRIAL SUBDIVISION

LAND USE CONCEPT PLAN

1:5000

FIGURE 7C

Attachment B – Traffic Data

Turning Movement Summary Diagram

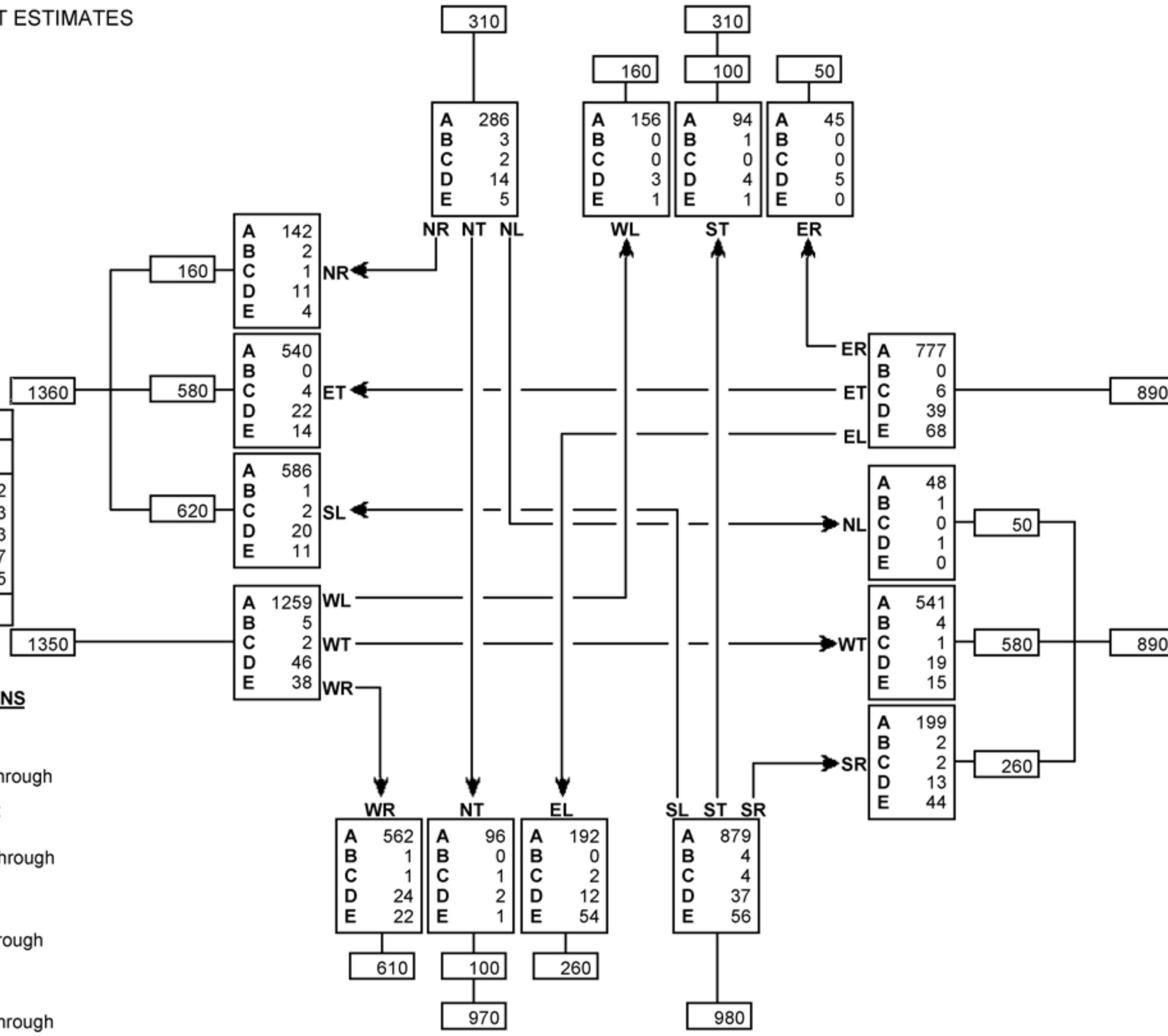
Reference No.: 997120

Intersection of:
38 & 644 AT REDWATER

2019 AADT / ASDT ESTIMATES

North On 44 St		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	581	93.7
B: Recreational Vehicle	4	0.6
C: Bus	2	0.3
D: Single Unit Truck	26	4.2
E: Tractor Trailer Unit	7	1.1
ASDT 730	AADT 620	

West On 38		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	2527	93.2
B: Recreational Vehicle	8	0.3
C: Bus	9	0.3
D: Single Unit Truck	99	3.7
E: Tractor Trailer Unit	67	2.5
ASDT 3210	AADT 2710	



East On 644		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	1565	87.9
B: Recreational Vehicle	7	0.4
C: Bus	9	0.5
D: Single Unit Truck	72	4.0
E: Tractor Trailer Unit	127	7.1
ASDT 2110	AADT 1780	

South On 38		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	1729	88.7
B: Recreational Vehicle	5	0.3
C: Bus	8	0.4
D: Single Unit Truck	75	3.8
E: Tractor Trailer Unit	133	6.8
ASDT 2310	AADT 1950	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Annual Average Daily Traffic
Average daily traffic expressed as vehicles per day fo period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day fo period of May 1 to September 30 (153 days)

Turning Movement Summary Diagram

Reference No.: 997120

Intersection of:
38 & 644 AT REDWATER

2019 a.m. 100th Highest Hour ESTIMATES

North On 44 St

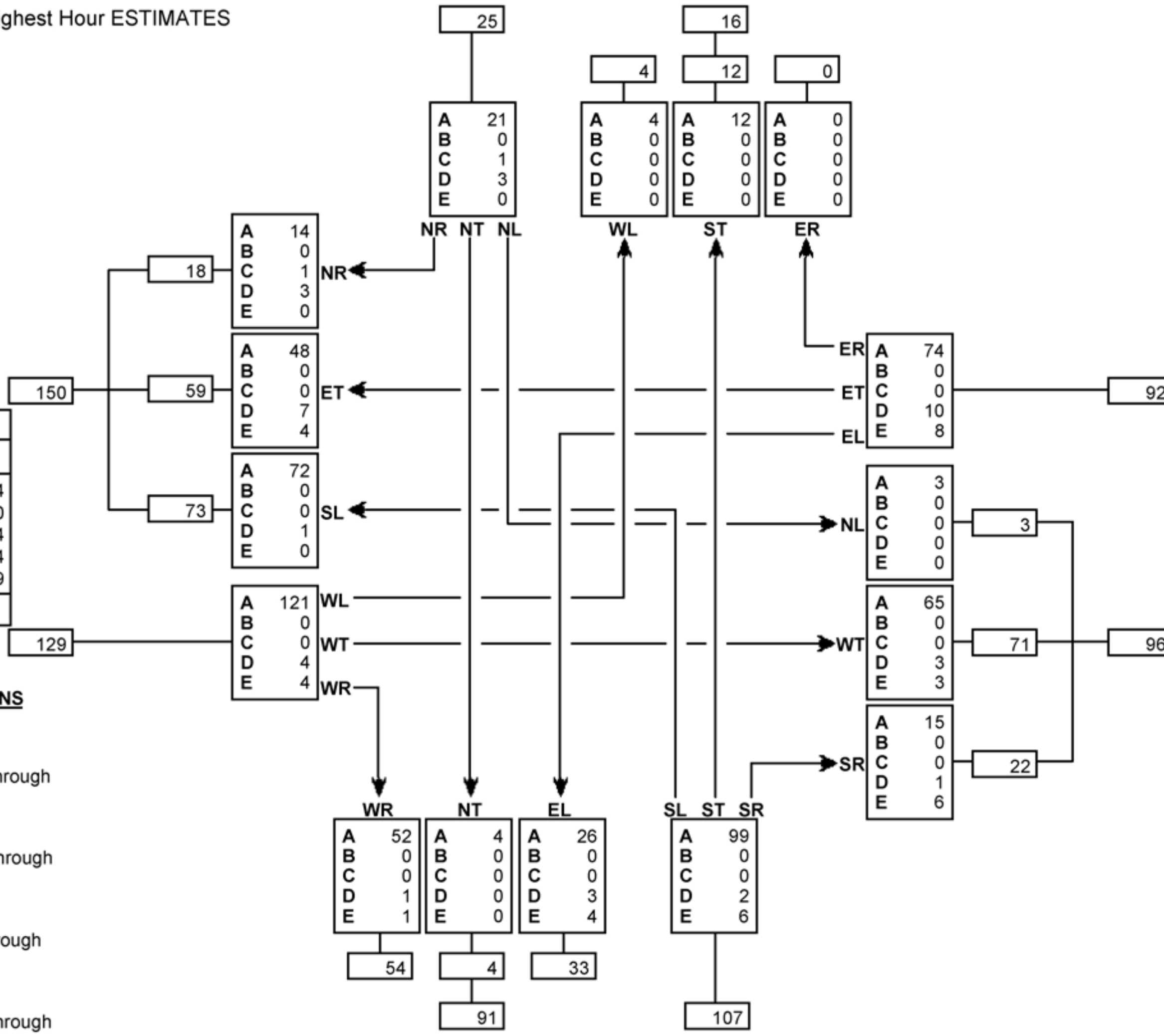
Vehicle Type	Vol	%
A: Passenger Vehicle	37	90.2
B: Recreational Vehicle	0	0.0
C: Bus	1	2.4
D: Single Unit Truck	3	7.3
E: Tractor Trailer Unit	0	0.0
Total	41	

West On 38

Vehicle Type	Vol	%
A: Passenger Vehicle	255	91.4
B: Recreational Vehicle	0	0.0
C: Bus	1	0.4
D: Single Unit Truck	15	5.4
E: Tractor Trailer Unit	8	2.9
Total	279	

East On 644

Vehicle Type	Vol	%
A: Passenger Vehicle	157	83.5
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	14	7.4
E: Tractor Trailer Unit	17	9.0
Total	188	



TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

South On 38

Vehicle Type	Vol	%
A: Passenger Vehicle	181	91.4
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	6	3.0
E: Tractor Trailer Unit	11	5.6
Total	198	

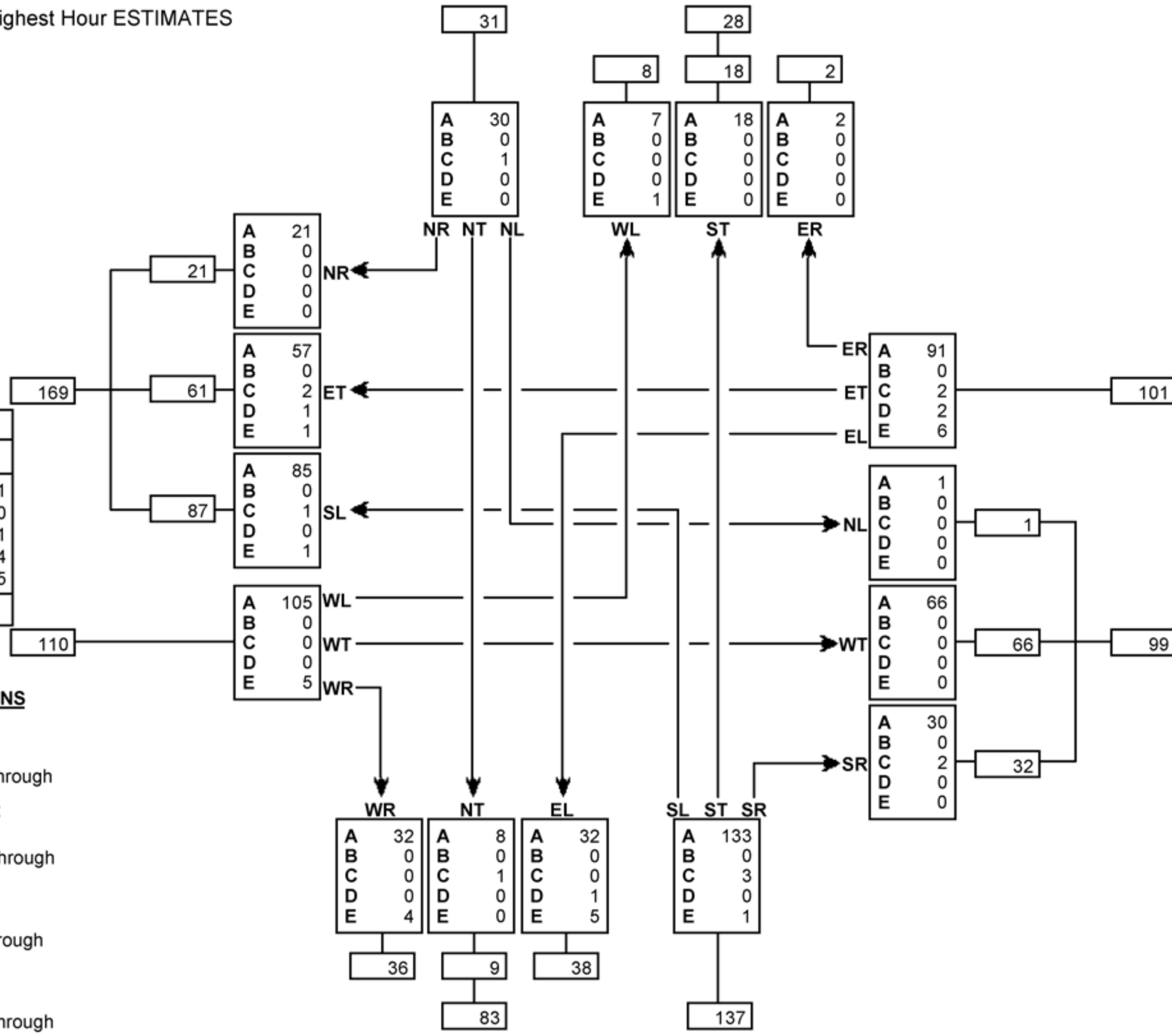
Turning Movement Summary Diagram

Reference No.: 997120

Intersection of:
38 & 644 AT REDWATER

2019 p.m. 100th Highest Hour ESTIMATES

North On 44 St		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	57	96.6
B: Recreational Vehicle	0	0.0
C: Bus	1	1.7
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	1	1.7
Total	59	



West On 38		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	268	96.1
B: Recreational Vehicle	0	0.0
C: Bus	3	1.1
D: Single Unit Truck	1	0.4
E: Tractor Trailer Unit	7	2.5
Total	279	

East On 644		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	188	94.0
B: Recreational Vehicle	0	0.0
C: Bus	4	2.0
D: Single Unit Truck	2	1.0
E: Tractor Trailer Unit	6	3.0
Total	200	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

South On 38		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	205	93.2
B: Recreational Vehicle	0	0.0
C: Bus	4	1.8
D: Single Unit Truck	1	0.5
E: Tractor Trailer Unit	10	4.5
Total	220	

McElhanney
Consulting Services Ltd.

DIRECTIONAL TRAFFIC COUNT SUMMARY

HIGHWAY: 38 **REFERENCE NO.:** 00997120 **INTERSECTION OF:** 38 & 644 AT REDWATER

LATITUDE (degrees): 53.948993 **LONGITUDE (degrees):** -113.099736 **LEGAL DESCRIPTION:**

DAY & DATE OF COUNT: THURSDAY, MAY 10, 2018 **COUNT DURATION:** 12 HOURS (7:00 AM TO 7:00 PM)

	APPROACHING INTERSECTION																														
	FROM THE EAST ON 644															FROM THE WEST ON 38															
INTERVAL	LEFT					THROUGH					RIGHT					LEFT					THROUGH					RIGHT					TOTALS
7:00-7:15 AM	1				1	4			1		1					2					10					10			1		31
7:15 - 7:30	3		1			6					3					7					16		1			10		1			48
7:30 - 7:45	3					3			1		1					3					10				1	9					31
7:45 - 8:00	7			1		12										2					4			1		5			1		33
8:00 - 8:15	5				2	9		1			2					2					6			2	1	6				1	37
8:15 - 8:30	3					13			1		1										9					10					37
8:30 - 8:45	1					7										2					3					5			1		19
8:45 - 9:00	1				1	7			1		1					1					8					7					27
9:00 - 9:15	4					12			4							3					3					9					35
9:15 - 9:30	3				1	10										4					3			1	2	11			3		38
9:30 - 9:45	4		1			7					2					3					3			1		11					32
9:45 - 10:00	5				1	10				2											4					6			1		29
10:00 - 10:15	3			1		5					1					1					13	1		1		5			1		32
10:15 - 10:30	6			1	2	11					2					1					7			1		6	1		2	1	41
10:30 - 10:45	1					11										3					6					7					28
10:45 - 11:00				1		11					2					3					8	1		1	2	6			1		36
11:00 - 11:15	2			1	1	10			1	1											13					8					37
11:15 - 11:30	6					8			2	2											8			1		8					35
11:30 - 11:45	6			1	2	6										1					9			1	2	9					37
11:45-12:00 PM	5					11			2							2					17					13			1	1	52
12:00 - 12:15	3					19					1					2					13					7					45
12:15 - 12:30	4				1	10			1		1					2					11					11				1	42
12:30 - 12:45	1					10				1	2					5					10				1	14			1	2	47
12:45 - 1:00	4			1	4	4										1					17			2	2	11				1	47
1:00 - 1:15	3				1	11					1					3					13			1	1	11				1	46
1:15 - 1:30	3				2	11					1					2					13					10				1	43
1:30 - 1:45	4				2	10			1	1	2					3					10					9			1		43
1:45 - 2:00	4			1	2	10					1			1		2					11					8					40
2:00 - 2:15	7				3	10					3			1		4					15					7					50
2:15 - 2:30	4				1	12															8					7					32
2:30 - 2:45	3			2	2	7					1			1		1					9					10			1		37
2:45 - 3:00	2				2	11			1	1						3					11	1				6					38
3:00 - 3:15	9				1	11										2					12					10					45
3:15 - 3:30	4				1	11			1	1									1		10			1		11					41
3:30 - 3:45	4				3	9				2	1					1					10				1	5				2	38
3:45 - 4:00	3				1	12			1							2					8					8			1		36
4:00 - 4:15	4			1	1	16		1	1							2					18					10					54
4:15 - 4:30	7				1	6				1						1					10					2				1	29
4:30 - 4:45	9				2	16		1			2					1					11					8				1	51
4:45 - 5:00	7					10										2				1	17					7				1	45
5:00 - 5:15	3				1	8										3					19					9			1		44
5:15 - 5:30	3				1	12					1					1					10					13					41
5:30 - 5:45	4					7										6					11			1		9					38
5:45 - 6:00	1				1	8										3					7					7					27
6:00 - 6:15					1	5										2			1		9			1		10					29
6:15 - 6:30						7					1										5					9					22
6:30 - 6:45	3				3	6										1					2					3					18
6:45-7:00 PM	2				1	4															3					4				1	15
VEH CLASS	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	
TOTALS	174		2	11	49	446		3	19	12	34			3		95			2	1	463	3	1	16	13	397	1	1	17	15	1778
	EL					ET					ER					WL					WT					WR					

LOCATION DIAGRAM ENCLOSED (Y/N): YES
WEATHER CONDITIONS: OVERCAST, RAIN
RECORDER(S): JOSHUA TOPLIFFE
ROAD SURFACE CONDTIONS: WET
COMMENTS:

VEHICLE CLASSES

A: PASSENGER VEHICLES **B:** RECREATION VEHICLES **C:** BUSES
D: SINGLE UNIT TRUCKS **E:** TRACTOR TRAILER COMBINATIONS

McElhanney
Consulting Services Ltd.

DIRECTIONAL TRAFFIC COUNT SUMMARY

HIGHWAY: 38 **REFERENCE NO.:** 00997120 **INTERSECTION OF:** 38 & 644 AT REDWATER

LATITUDE (degrees): 53.948993 **LONGITUDE (degrees):** -113.099736 **LEGAL DESCRIPTION:**

DAY & DATE OF COUNT: THURSDAY, MAY 10, 2018 **COUNT DURATION:** 12 HOURS (7:00 AM TO 7:00 PM)

	APPROACHING INTERSECTION																															
	FROM THE NORTH ON 44 ST															FROM THE SOUTH ON 38																GRAND
INTERVAL	LEFT					THROUGH					RIGHT					LEFT					THROUGH					RIGHT					TOTALS	TOTALS
7:00-7:15 AM	1					3					2					5		1	1		3					1					17	48
7:15 - 7:30	1					6					3					8					1					6					25	73
7:30 - 7:45	2					7			1		1					3			1		2					1					18	49
7:45 - 8:00	2					1					1					5			1	1	1					6					18	51
8:00 - 8:15	1					3					5					7					2					2				1	21	58
8:15 - 8:30	1			1		4										13					2					1					22	59
8:30 - 8:45						1					3			1		4										5				1	15	34
8:45 - 9:00						4					2					16			1		1					6			2	1	33	60
9:00 - 9:15	1										1					7				2	1					3				1	16	51
9:15 - 9:30						1					2					5										3			2	1	14	52
9:30 - 9:45	2					2					2					8			1						1	3				1	20	52
9:45 - 10:00	1									1	4					4					3			1		1					15	44
10:00 - 10:15	1					2					4					8					2					1					18	50
10:15 - 10:30	1					1										5			1		1					3			1		13	54
10:30 - 10:45	1					1					2					6			2		2			1							15	43
10:45 - 11:00											4					6			1		1					2				1	15	51
11:00 - 11:15	1										2					8					1					2				2	16	53
11:15 - 11:30	1					1					1					10					1					2			1		17	52
11:30 - 11:45											1		1	1		16			1		2					1					23	60
11:45-12:00 PM						2					6			1		18					5					6				2	40	92
12:00 - 12:15	2										1					11					2					1					17	62
12:15 - 12:30	1					1					5			1		14			1	1						4				1	29	71
12:30 - 12:45	1					4			1		2					11	1		1		1					2	1			2	27	74
12:45 - 1:00						2					5					7			1	1	1					1			1	1	20	67
1:00 - 1:15	1					2					3					11			1	1	1					2				1	23	69
1:15 - 1:30	1					2					3					10					1					3					20	63
1:30 - 1:45	1					1					2			1		9					2					2				1	19	62
1:45 - 2:00	2					1					2					8			1		2					3				1	20	60
2:00 - 2:15	2					1					1			1		9			2		2			1		3					22	72
2:15 - 2:30	3										5					5					4					3				1	21	53
2:30 - 2:45						1									1	13					1					2				1	19	56
2:45 - 3:00	2					2					2					6					1					3					16	54
3:00 - 3:15	1					3					1	1				14					2					3			2		27	72
3:15 - 3:30						1					3					13			2		5					6				1	31	72
3:30 - 3:45	1					1					3			1	1	12										2				3	24	62
3:45 - 4:00	1										3					6					3					3				3	19	55
4:00 - 4:15						3					4					16		1		1	1					3					29	83
4:15 - 4:30						1					2					14					4					6		2			29	58
4:30 - 4:45						2		1			10					24					6					11					54	105
4:45 - 5:00	1					1					2					18					4					5					31	76
5:00 - 5:15						1						1				34					9					6				3	54	98
5:15 - 5:30	3					2					2					17					8			1		4				1	38	79
5:30 - 5:45	1					5					1			1		25				1	4					4					42	80
5:45 - 6:00	1					3					3			1		20					1	1				5			1	1	37	64
6:00 - 6:15											3					17					4					5				1	30	59
6:15 - 6:30											4					14				1	1					2					22	44
6:30 - 6:45						1					2				1	13					3					5	1				26	44
6:45-7:00 PM		1				1					2					13				1	1									1	20	35
VEH CLASS	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E		
TOTALS	42	1		1		81		1	2	1	122	2	1	9	3	546	1	2	19	10	105	1		4	1	154	2	2	10	34	1157	2935
	NL					NT					NR					SL					ST					SR						

LOCATION DIAGRAM ENCLOSED (Y/N): YES
WEATHER CONDITIONS: OVERCAST, RAIN
RECORDER(S): JOSHUA TOPLIFFE
ROAD SURFACE CONDTIONS: WET
COMMENTS:

VEHICLE CLASSES

A: PASSENGER VEHICLES **B:** RECREATION VEHICLES **C:** BUSES
D: SINGLE UNIT TRUCKS **E:** TRACTOR TRAILER COMBINATIONS

McElhanney
Consulting Services Ltd.

TURNING MOVEMENT SUMMARY DIAGRAM

INTERSECTION OF: **44 STREET & 54 AVENUE, REDWATER**

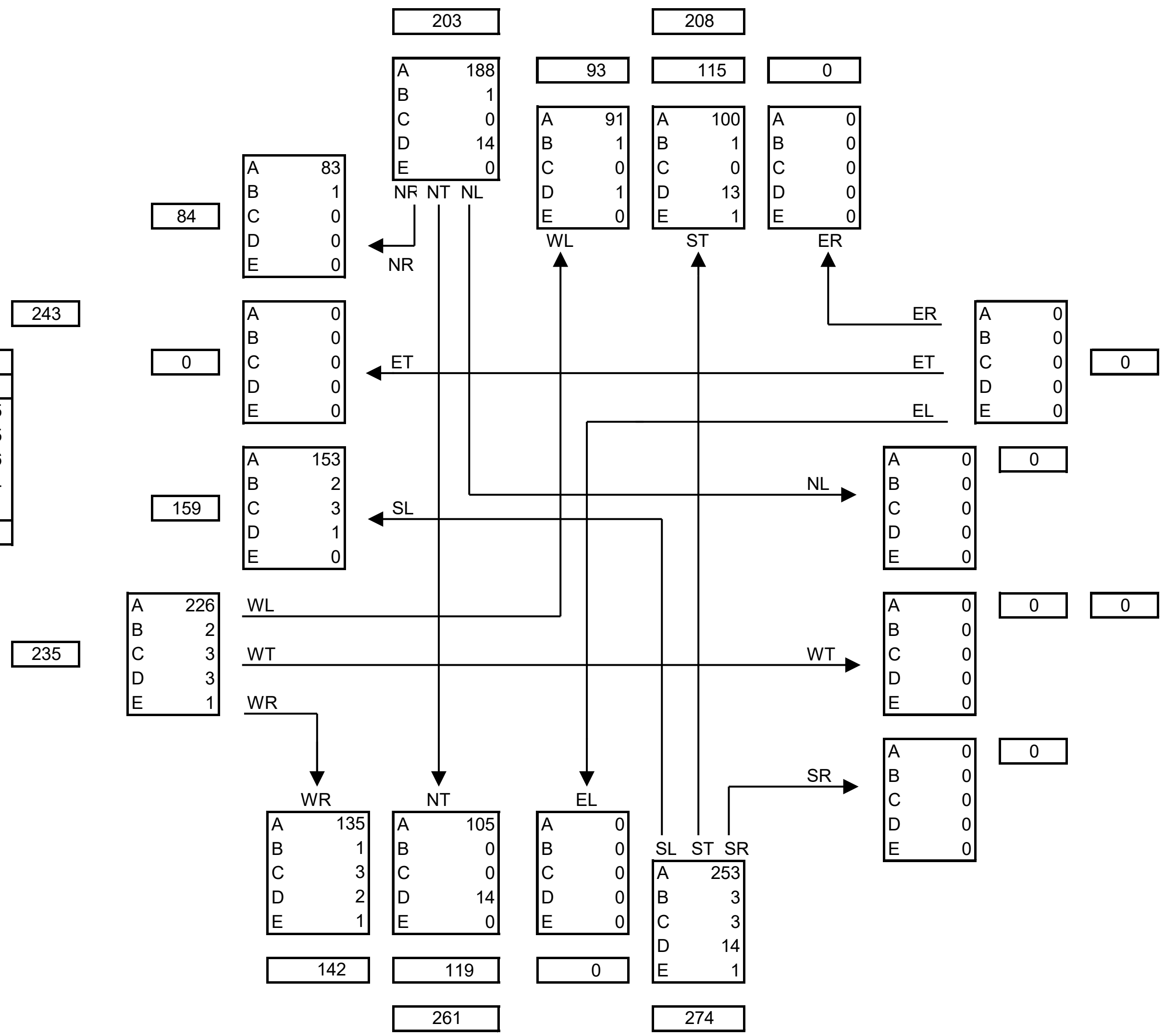
DAY & DATE OF COUNT: **MONDAY, APRIL 08, 2019**
COUNT DURATION: **12 HOURS (7:00 AM TO 7:00 PM)**

OBSERVED 12 HOURS TRAFFIC VOLUMES

NORTH ON 44 STREET		
VEH TYPE	VOL	%
A: PASSENGER VEHICLES	379	92.21
B: RECREATION VEHICLES	3	0.73
C: BUSES	0	0.00
D: SINGLE UNIT TRUCKS	28	6.81
E: TRACTOR TRAILER COMB.	1	0.24
TOTAL	411	

WEST ON 54 AVENUE		
VEH TYPE	VOL	%
A: PASSENGER VEHICLES	462	96.65
B: RECREATION VEHICLES	5	1.05
C: BUSES	6	1.26
D: SINGLE UNIT TRUCKS	4	0.84
E: TRACTOR TRAILER COMB.	1	0.21
TOTAL	478	

EAST ON		
VEH TYPE	VOL	%
A: PASSENGER VEHICLES	0	0.00
B: RECREATION VEHICLES	0	0.00
C: BUSES	0	0.00
D: SINGLE UNIT TRUCKS	0	0.00
E: TRACTOR TRAILER COMB.	0	0.00
TOTAL	0	



SOUTH ON 44 STREET		
VEH TYPE	VOL	%
A: PASSENGER VEHICLES	493	92.15
B: RECREATION VEHICLES	4	0.75
C: BUSES	6	1.12
D: SINGLE UNIT TRUCKS	30	5.61
E: TRACTOR TRAILER COMB.	2	0.37
TOTAL	535	

TURNING MOVEMENT ABBREVIATIONS
NL : TRAFFIC FROM NORTH TURNING LEFT
NT : TRAFFIC FROM NORTH PROCEEDING THROUGH
NR : TRAFFIC FROM NORTH TURNING RIGHT
SL : TRAFFIC FROM SOUTH TURNING LEFT
ST : TRAFFIC FROM SOUTH PROCEEDING THROUGH
SR : TRAFFIC FROM SOUTH TURNING RIGHT
EL : TRAFFIC FROM EAST TURNING LEFT
ET : TRAFFIC FROM EAST PROCEEDING THROUGH
ER : TRAFFIC FROM EAST TURNING RIGHT
WL : TRAFFIC FROM WEST TURNING LEFT
WT : TRAFFIC FROM WEST PROCEEDING THROUGH
WR : TRAFFIC FROM WEST TURNING RIGHT

McElhanney
Consulting Services Ltd.

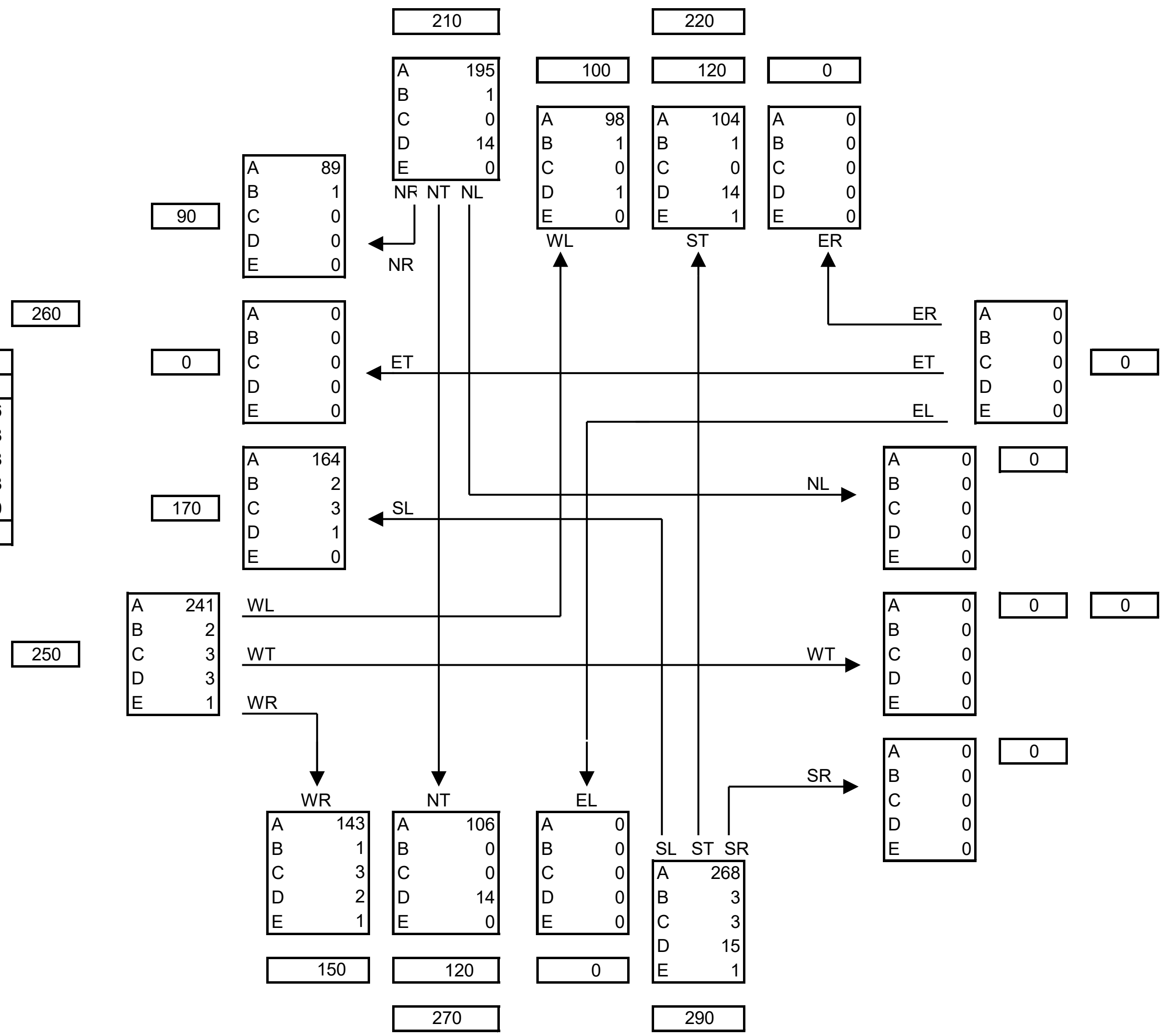
TURNING MOVEMENT SUMMARY DIAGRAM

INTERSECTION OF: 44 STREET & 54 AVENUE, REDWATER

2019 AADT & ASDT ESTIMATES

NORTH ON 44 STREET		
VEH TYPE	VOL	%
A: PASSENGER VEHICLES	397	92.33
B: RECREATION VEHICLES	3	0.70
C: BUSES	0	0.00
D: SINGLE UNIT TRUCKS	29	6.74
E: TRACTOR TRAILER COMB.	1	0.23
ASDT 470	AADT	430

WEST ON 54 AVENUE		
	VOL	%
A: PASSENGER VEHICLES	494	96.86
B: RECREATION VEHICLES	5	0.98
C: BUSES	6	1.18
D: SINGLE UNIT TRUCKS	4	0.78
E: TRACTOR TRAILER COMB.	1	0.20
ASDT 560	AADT	510



EAST ON		
VEH TYPE	VOL	%
A: PASSENGER VEHICLES	0	0.00
B: RECREATION VEHICLES	0	0.00
C: BUSES	0	0.00
D: SINGLE UNIT TRUCKS	0	0.00
E: TRACTOR TRAILER COMB.	0	0.00
ASDT 0	AADT	0

TURNING MOVEMENT ABBREVIATIONS

NL : TRAFFIC FROM NORTH TURNING LEFT
NT : TRAFFIC FROM NORTH PROCEEDING THROUGH
NR : TRAFFIC FROM NORTH TURNING RIGHT
SL : TRAFFIC FROM SOUTH TURNING LEFT
ST : TRAFFIC FROM SOUTH PROCEEDING THROUGH
SR : TRAFFIC FROM SOUTH TURNING RIGHT
EL : TRAFFIC FROM EAST TURNING LEFT
ET : TRAFFIC FROM EAST PROCEEDING THROUGH
ER : TRAFFIC FROM EAST TURNING RIGHT
WL : TRAFFIC FROM WEST TURNING LEFT
WT : TRAFFIC FROM WEST PROCEEDING THROUGH
WR : TRAFFIC FROM WEST TURNING RIGHT

AADT: AVERAGE ANNUAL DAILY TRAFFIC
AVERAGE TWO-WAY DAILY TRAFFIC VOLUME FOR THE PERIOD OF JANUARY 1ST TO DECEMBER 31ST

ASDT: AVERAGE ANNUAL DAILY TRAFFIC
AVERAGE TWO-WAY DAILY TRAFFIC VOLUME FOR THE PERIOD OF MAY 1ST TO SEPTEMBER 30TH

SOUTH ON 44 STREET		
VEH TYPE	VOL	%
A: PASSENGER VEHICLES	517	92.32
B: RECREATION VEHICLES	4	0.71
C: BUSES	6	1.07
D: SINGLE UNIT TRUCKS	31	5.54
E: TRACTOR TRAILER COMB.	2	0.36
ASDT 620	AADT	560

McElhanney
Consulting Services Ltd.

TURNING MOVEMENT SUMMARY DIAGRAM

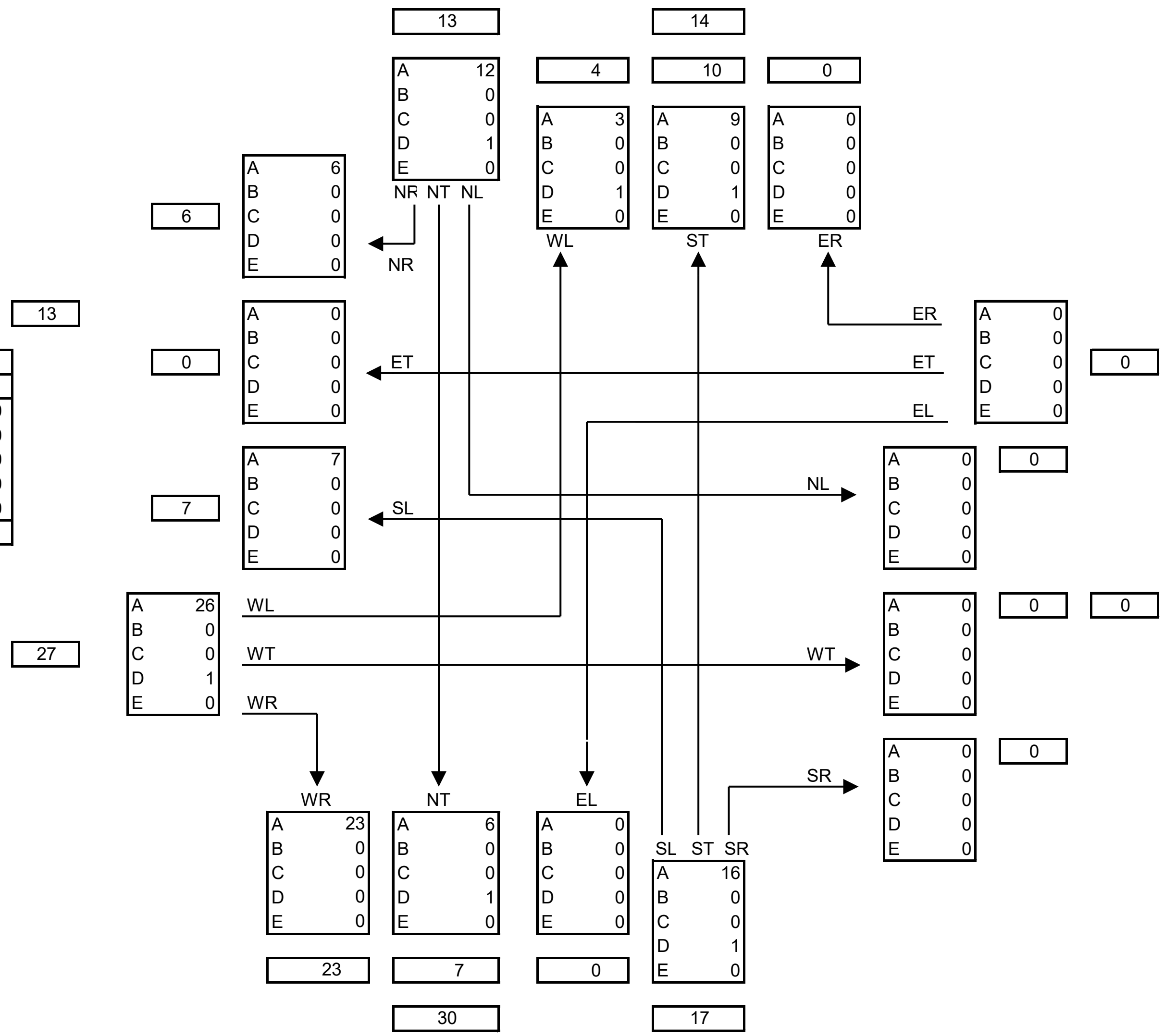
INTERSECTION OF: 44 STREET & 54 AVENUE, REDWATER

2019 AM 100TH HIGHEST HOUR TRAFFIC VOLUMES

NORTH ON 44 STREET		
VEH TYPE	VOL	%
A: PASSENGER VEHICLES	24	88.9
B: RECREATION VEHICLES	0	0.00
C: BUSES	0	0.00
D: SINGLE UNIT TRUCKS	3	11.11
E: TRACTOR TRAILER COMB.	0	0.00
TOTAL	27	

WEST ON 54 AVENUE		
	VOL	%
A: PASSENGER VEHICLES	39	97.50
B: RECREATION VEHICLES	0	0.00
C: BUSES	0	0.00
D: SINGLE UNIT TRUCKS	1	2.50
E: TRACTOR TRAILER COMB.	0	0.00
TOTAL	40	

EAST ON		
VEH TYPE	VOL	%
A: PASSENGER VEHICLES	0	0.00
B: RECREATION VEHICLES	0	0.00
C: BUSES	0	0.00
D: SINGLE UNIT TRUCKS	0	0.00
E: TRACTOR TRAILER COMB.	0	0.00
TOTAL	0	



SOUTH ON 44 STREET		
VEH TYPE	VOL	%
A: PASSENGER VEHICLES	45	95.74
B: RECREATION VEHICLES	0	0.00
C: BUSES	0	0.00
D: SINGLE UNIT TRUCKS	2	4.26
E: TRACTOR TRAILER COMB.	0	0.00
TOTAL	47	

TURNING MOVEMENT ABBREVIATIONS

- NL : TRAFFIC FROM NORTH TURNING LEFT
- NT : TRAFFIC FROM NORTH PROCEEDING THROUGH
- NR : TRAFFIC FROM NORTH TURNING RIGHT
- SL : TRAFFIC FROM SOUTH TURNING LEFT
- ST : TRAFFIC FROM SOUTH PROCEEDING THROUGH
- SR : TRAFFIC FROM SOUTH TURNING RIGHT
- EL : TRAFFIC FROM EAST TURNING LEFT
- ET : TRAFFIC FROM EAST PROCEEDING THROUGH
- ER : TRAFFIC FROM EAST TURNING RIGHT
- WL : TRAFFIC FROM WEST TURNING LEFT
- WT : TRAFFIC FROM WEST PROCEEDING THROUGH
- WR : TRAFFIC FROM WEST TURNING RIGHT

McElhanney
Consulting Services Ltd.

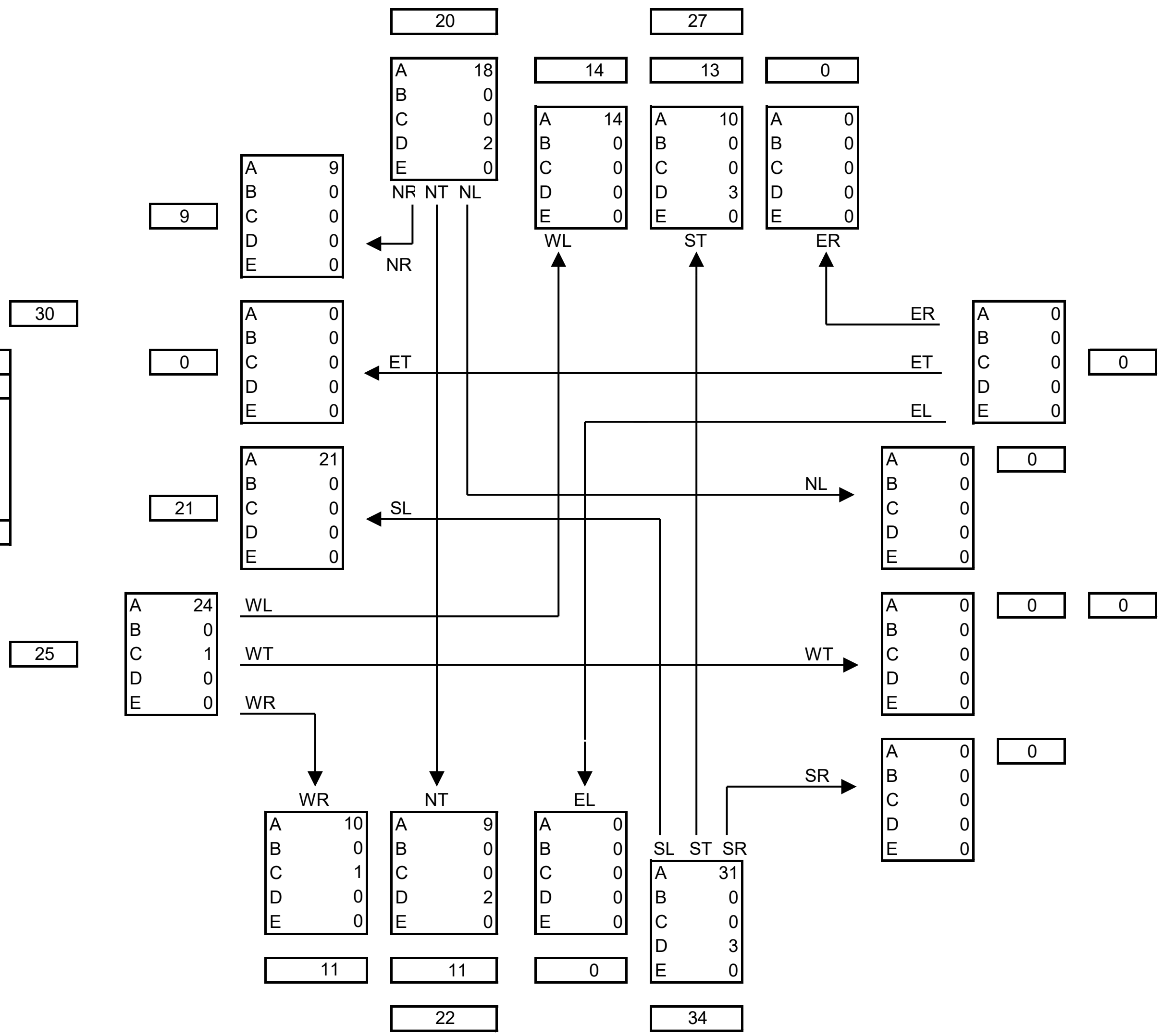
TURNING MOVEMENT SUMMARY DIAGRAM

INTERSECTION OF: 44 STREET & 54 AVENUE, REDWATER

2019 PM 100TH HIGHEST HOUR TRAFFIC VOLUMES

NORTH ON	44 STREET	
VEH TYPE	VOL	%
A: PASSENGER VEHICLES	42	89.36
B: RECREATION VEHICLES	0	0.00
C: BUSES	0	0.00
D: SINGLE UNIT TRUCKS	5	10.64
E: TRACTOR TRAILER COMB.	0	0.00
TOTAL	47	

WEST ON	54 AVENUE	
	VOL	%
A: PASSENGER VEHICLES	54	98.18
B: RECREATION VEHICLES	0	0.00
C: BUSES	1	1.82
D: SINGLE UNIT TRUCKS	0	0.00
E: TRACTOR TRAILER COMB.	0	0.00
TOTAL	55	



EAST ON		
VEH TYPE	VOL	%
A: PASSENGER VEHICLES	0	0.00
B: RECREATION VEHICLES	0	0.00
C: BUSES	0	0.00
D: SINGLE UNIT TRUCKS	0	0.00
E: TRACTOR TRAILER COMB.	0	0.00
TOTAL	0	

SOUTH ON	44 STREET	
VEH TYPE	VOL	%
A: PASSENGER VEHICLES	50	89.3
B: RECREATION VEHICLES	0	0.00
C: BUSES	1	1.79
D: SINGLE UNIT TRUCKS	5	8.93
E: TRACTOR TRAILER COMB.	0	0.00
TOTAL	56	

TURNING MOVEMENT ABBREVIATIONS

- NL : TRAFFIC FROM NORTH TURNING LEFT
- NT : TRAFFIC FROM NORTH PROCEEDING THROUGH
- NR : TRAFFIC FROM NORTH TURNING RIGHT
- SL : TRAFFIC FROM SOUTH TURNING LEFT
- ST : TRAFFIC FROM SOUTH PROCEEDING THROUGH
- SR : TRAFFIC FROM SOUTH TURNING RIGHT
- EL : TRAFFIC FROM EAST TURNING LEFT
- ET : TRAFFIC FROM EAST PROCEEDING THROUGH
- ER : TRAFFIC FROM EAST TURNING RIGHT
- WL : TRAFFIC FROM WEST TURNING LEFT
- WT : TRAFFIC FROM WEST PROCEEDING THROUGH
- WR : TRAFFIC FROM WEST TURNING RIGHT

Attachment C – Synchro Traffic Analysis Outputs

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	75	57	35	62	1	77	13	23	3	4	19
Future Volume (Veh/h)	4	75	57	35	62	1	77	13	23	3	4	19
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	82	62	38	67	1	84	14	25	3	4	21
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	68			144			256	234	82	266	296	68
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	68			144			256	234	82	266	296	68
tC, single (s)	4.1			4.2			7.1	6.5	6.5	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.5	3.5	4.0	3.3
p0 queue free %	100			97			87	98	97	100	99	98
cM capacity (veh/h)	1546			1379			667	650	913	646	601	1002

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	86	62	106	123	28
Volume Left	4	0	38	84	3
Volume Right	0	62	1	25	21
cSH	1546	1700	1379	703	868
Volume to Capacity	0.00	0.04	0.03	0.17	0.03
Queue Length 95th (m)	0.1	0.0	0.6	4.8	0.8
Control Delay (s)	0.4	0.0	2.9	11.2	9.3
Lane LOS	A		A	B	A
Approach Delay (s)	0.2		2.9	11.2	9.3
Approach LOS				B	A

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	31.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	0	23	0	0	0	7	10	0	0	7	6
Future Volume (Veh/h)	4	0	23	0	0	0	7	10	0	0	7	6
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	0	25	0	0	0	8	11	0	0	8	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	38	38	12	64	42	11	15			11		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	38	38	12	64	42	11	15			11		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	98	100	100	100	100			100		
cM capacity (veh/h)	968	853	1075	911	850	1076	1616			1621		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	29	0	19	15
Volume Left	4	0	8	0
Volume Right	25	0	0	7
cSH	1059	1700	1616	1621
Volume to Capacity	0.03	0.00	0.00	0.00
Queue Length 95th (m)	0.6	0.0	0.1	0.0
Control Delay (s)	8.5	0.0	3.1	0.0
Lane LOS	A	A	A	
Approach Delay (s)	8.5	0.0	3.1	0.0
Approach LOS	A	A		

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	16.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	75	57	35	62	2	77	16	23	4	6	22
Future Volume (Veh/h)	10	75	57	35	62	2	77	16	23	4	6	22
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	82	62	38	67	2	84	17	25	4	7	24
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	69			144			276	249	82	282	310	68
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	69			144			276	249	82	282	310	68
tC, single (s)	4.1			4.2			7.1	6.5	6.5	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.5	3.5	4.0	3.3
p0 queue free %	99			97			87	97	97	99	99	98
cM capacity (veh/h)	1538			1379			641	633	913	624	585	998

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	93	62	107	126	35
Volume Left	11	0	38	84	4
Volume Right	0	62	2	25	24
cSH	1538	1700	1379	680	825
Volume to Capacity	0.01	0.04	0.03	0.19	0.04
Queue Length 95th (m)	0.2	0.0	0.6	5.1	1.0
Control Delay (s)	0.9	0.0	2.9	11.5	9.6
Lane LOS	A		A	B	A
Approach Delay (s)	0.6		2.9	11.5	9.6
Approach LOS				B	A

Intersection Summary			
Average Delay	5.1		
Intersection Capacity Utilization	31.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	0	23	5	0	2	7	11	10	4	7	6
Future Volume (Veh/h)	4	0	23	5	0	2	7	11	10	4	7	6
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	0	25	5	0	2	8	12	11	4	8	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	55	58	12	78	56	18	15			23		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	55	58	12	78	56	18	15			23		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	98	99	100	100	100			100		
cM capacity (veh/h)	941	830	1075	887	832	1064	1616			1599		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	29	7	31	19
Volume Left	4	5	8	4
Volume Right	25	2	11	7
cSH	1054	931	1616	1599
Volume to Capacity	0.03	0.01	0.00	0.00
Queue Length 95th (m)	0.6	0.2	0.1	0.1
Control Delay (s)	8.5	8.9	1.9	1.5
Lane LOS	A	A	A	A
Approach Delay (s)	8.5	8.9	1.9	1.5
Approach LOS	A	A		

Intersection Summary			
Average Delay	4.6		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	69	38	40	64	2	91	19	34	1	9	22
Future Volume (Veh/h)	8	69	38	40	64	2	91	19	34	1	9	22
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	75	41	43	70	2	99	21	37	1	10	24
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	72			116			279	251	75	298	291	71
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	72			116			279	251	75	298	291	71
tC, single (s)	4.1			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			97			84	97	96	100	98	98
cM capacity (veh/h)	1534			1407			633	632	992	601	600	997

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	84	41	115	157	35
Volume Left	9	0	43	99	1
Volume Right	0	41	2	37	24
cSH	1534	1700	1407	692	826
Volume to Capacity	0.01	0.02	0.03	0.23	0.04
Queue Length 95th (m)	0.1	0.0	0.7	6.6	1.0
Control Delay (s)	0.8	0.0	3.0	11.7	9.6
Lane LOS	A		A	B	A
Approach Delay (s)	0.6		3.0	11.7	9.6
Approach LOS				B	A

Intersection Summary			
Average Delay	6.0		
Intersection Capacity Utilization	33.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	0	12	0	0	0	22	14	0	0	12	9
Future Volume (Veh/h)	15	0	12	0	0	0	22	14	0	0	12	9
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	0	13	0	0	0	24	15	0	0	13	10
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	81	81	18	94	86	15	23			15		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	81	81	18	94	86	15	23			15		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	100	100	100	99			100		
cM capacity (veh/h)	901	801	1066	873	796	1070	1605			1616		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	29	0	39	23
Volume Left	16	0	24	0
Volume Right	13	0	0	10
cSH	968	1700	1605	1616
Volume to Capacity	0.03	0.00	0.01	0.00
Queue Length 95th (m)	0.7	0.0	0.3	0.0
Control Delay (s)	8.8	0.0	4.5	0.0
Lane LOS	A	A	A	
Approach Delay (s)	8.8	0.0	4.5	0.0
Approach LOS	A	A		

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	18.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	69	38	40	64	3	91	22	34	2	13	30
Future Volume (Veh/h)	15	69	38	40	64	3	91	22	34	2	13	30
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	75	41	43	70	3	99	24	37	2	14	33
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	73			116			304	266	75	314	306	72
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	73			116			304	266	75	314	306	72
tC, single (s)	4.1			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			97			83	96	96	100	98	97
cM capacity (veh/h)	1533			1407			598	615	992	580	585	994

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	91	41	116	160	49
Volume Left	16	0	43	99	2
Volume Right	0	41	3	37	33
cSH	1533	1700	1407	661	809
Volume to Capacity	0.01	0.02	0.03	0.24	0.06
Queue Length 95th (m)	0.2	0.0	0.7	7.2	1.5
Control Delay (s)	1.4	0.0	3.0	12.2	9.7
Lane LOS	A		A	B	A
Approach Delay (s)	0.9		3.0	12.2	9.7
Approach LOS				B	A

Intersection Summary			
Average Delay	6.3		
Intersection Capacity Utilization	34.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	0	12	13	0	6	22	14	11	5	12	9
Future Volume (Veh/h)	15	0	12	13	0	6	22	14	11	5	12	9
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	0	13	14	0	7	24	15	12	5	13	10
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	104	103	18	110	102	21	23			27		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	104	103	18	110	102	21	23			27		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	98	100	99	99			100		
cM capacity (veh/h)	863	777	1066	848	778	1059	1605			1593		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	29	21	51	28
Volume Left	16	14	24	5
Volume Right	13	7	12	10
cSH	944	909	1605	1593
Volume to Capacity	0.03	0.02	0.01	0.00
Queue Length 95th (m)	0.7	0.5	0.3	0.1
Control Delay (s)	8.9	9.1	3.5	1.3
Lane LOS	A	A	A	A
Approach Delay (s)	8.9	9.1	3.5	1.3
Approach LOS	A	A		

Intersection Summary			
Average Delay	5.1		
Intersection Capacity Utilization	15.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	80	61	37	66	1	82	14	25	3	5	20
Future Volume (Veh/h)	5	80	61	37	66	1	82	14	25	3	5	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	87	66	40	72	1	89	15	27	3	5	22
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	73			153			274	250	87	284	316	72
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	73			153			274	250	87	284	316	72
tC, single (s)	4.1			4.2			7.1	6.5	6.5	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.5	3.5	4.0	3.3
p0 queue free %	100			97			86	98	97	100	99	98
cM capacity (veh/h)	1540			1369			647	635	907	625	584	995

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	92	66	113	131	30
Volume Left	5	0	40	89	3
Volume Right	0	66	1	27	22
cSH	1540	1700	1369	686	846
Volume to Capacity	0.00	0.04	0.03	0.19	0.04
Queue Length 95th (m)	0.1	0.0	0.7	5.3	0.8
Control Delay (s)	0.4	0.0	2.9	11.5	9.4
Lane LOS	A		A	B	A
Approach Delay (s)	0.2		2.9	11.5	9.4
Approach LOS				B	A

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	32.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	26	0	0	0	8	11	0	0	8	7
Future Volume (Veh/h)	5	0	26	0	0	0	8	11	0	0	8	7
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	28	0	0	0	9	12	0	0	9	8
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	43	43	13	71	47	12	17			12		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	43	43	13	71	47	12	17			12		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	97	100	100	100	99			100		
cM capacity (veh/h)	961	848	1073	897	844	1074	1613			1620		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	33	0	21	17
Volume Left	5	0	9	0
Volume Right	28	0	0	8
cSH	1054	1700	1613	1620
Volume to Capacity	0.03	0.00	0.01	0.00
Queue Length 95th (m)	0.7	0.0	0.1	0.0
Control Delay (s)	8.5	0.0	3.1	0.0
Lane LOS	A	A	A	
Approach Delay (s)	8.5	0.0	3.1	0.0
Approach LOS	A	A		

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	17.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	80	61	37	66	4	82	21	25	4	7	26
Future Volume (Veh/h)	20	80	61	37	66	4	82	21	25	4	7	26
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	87	66	40	72	4	89	23	27	4	8	28
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	76			153			317	287	87	324	351	74
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	76			153			317	287	87	324	351	74
tC, single (s)	4.1			4.2			7.1	6.5	6.5	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.5	3.5	4.0	3.3
p0 queue free %	99			97			85	96	97	99	99	97
cM capacity (veh/h)	1529			1369			594	597	907	575	550	990

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	109	66	116	139	40
Volume Left	22	0	40	89	4
Volume Right	0	66	4	27	28
cSH	1529	1700	1369	638	804
Volume to Capacity	0.01	0.04	0.03	0.22	0.05
Queue Length 95th (m)	0.3	0.0	0.7	6.3	1.2
Control Delay (s)	1.6	0.0	2.8	12.2	9.7
Lane LOS	A		A	B	A
Approach Delay (s)	1.0		2.8	12.2	9.7
Approach LOS				B	A

Intersection Summary			
Average Delay	5.5		
Intersection Capacity Utilization	32.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	26	9	0	2	8	11	27	11	8	7
Future Volume (Veh/h)	5	0	26	9	0	2	8	11	27	11	8	7
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	28	10	0	2	9	12	29	12	9	8
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	84	96	13	110	86	26	17			41		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	84	96	13	110	86	26	17			41		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	97	99	100	100	99			99		
cM capacity (veh/h)	897	787	1073	840	798	1052	1613			1575		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	33	12	50	29
Volume Left	5	10	9	12
Volume Right	28	2	29	8
cSH	1042	869	1613	1575
Volume to Capacity	0.03	0.01	0.01	0.01
Queue Length 95th (m)	0.7	0.3	0.1	0.2
Control Delay (s)	8.6	9.2	1.3	3.1
Lane LOS	A	A	A	A
Approach Delay (s)	8.6	9.2	1.3	3.1
Approach LOS	A	A		

Intersection Summary			
Average Delay	4.4		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	74	41	43	69	2	98	20	36	1	10	24
Future Volume (Veh/h)	9	74	41	43	69	2	98	20	36	1	10	24
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	10	80	45	47	75	2	107	22	39	1	11	26
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	77			125			302	271	80	320	315	76
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	77			125			302	271	80	320	315	76
tC, single (s)	4.1			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			97			82	96	96	100	98	97
cM capacity (veh/h)	1528			1396			607	613	986	577	580	991

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	90	45	124	168	38
Volume Left	10	0	47	107	1
Volume Right	0	45	2	39	26
cSH	1528	1700	1396	668	809
Volume to Capacity	0.01	0.03	0.03	0.25	0.05
Queue Length 95th (m)	0.2	0.0	0.8	7.5	1.1
Control Delay (s)	0.9	0.0	3.1	12.2	9.7
Lane LOS	A		A	B	A
Approach Delay (s)	0.6		3.1	12.2	9.7
Approach LOS				B	A

Intersection Summary			
Average Delay	6.2		
Intersection Capacity Utilization	34.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	16	0	12	0	0	0	24	15	0	0	12	10
Future Volume (Veh/h)	16	0	12	0	0	0	24	15	0	0	12	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	0	13	0	0	0	26	16	0	0	13	11
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	86	86	18	100	92	16	24			16		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	86	86	18	100	92	16	24			16		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	100	100	100	98			100		
cM capacity (veh/h)	893	794	1066	865	789	1069	1604			1615		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	30	0	42	24
Volume Left	17	0	26	0
Volume Right	13	0	0	11
cSH	960	1700	1604	1615
Volume to Capacity	0.03	0.00	0.02	0.00
Queue Length 95th (m)	0.7	0.0	0.4	0.0
Control Delay (s)	8.9	0.0	4.6	0.0
Lane LOS	A	A	A	
Approach Delay (s)	8.9	0.0	4.6	0.0
Approach LOS	A	A		

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	18.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	74	41	43	69	4	98	25	36	4	19	42
Future Volume (Veh/h)	18	74	41	43	69	4	98	25	36	4	19	42
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	20	80	45	47	75	4	107	27	39	4	21	46
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	79			125			348	293	80	344	336	77
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	79			125			348	293	80	344	336	77
tC, single (s)	4.1			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			97			80	95	96	99	96	95
cM capacity (veh/h)	1526			1396			544	591	986	548	559	987

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	100	45	126	173	71
Volume Left	20	0	47	107	4
Volume Right	0	45	4	39	46
cSH	1526	1700	1396	614	776
Volume to Capacity	0.01	0.03	0.03	0.28	0.09
Queue Length 95th (m)	0.3	0.0	0.8	8.8	2.3
Control Delay (s)	1.6	0.0	3.0	13.2	10.1
Lane LOS	A		A	B	B
Approach Delay (s)	1.1		3.0	13.2	10.1
Approach LOS				B	B

Intersection Summary			
Average Delay	6.9		
Intersection Capacity Utilization	35.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Volume (veh/h)	16	0	12	30	0	13	24	15	15	6	12	10
Future Volume (Veh/h)	16	0	12	30	0	13	24	15	15	6	12	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	0	13	33	0	14	26	16	16	7	13	11
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	122	116	18	122	114	24	24			32		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	122	116	18	122	114	24	24			32		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	96	100	99	98			100		
cM capacity (veh/h)	832	762	1066	832	764	1055	1604			1587		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	30	47	58	31
Volume Left	17	33	26	7
Volume Right	13	14	16	11
cSH	920	888	1604	1587
Volume to Capacity	0.03	0.05	0.02	0.00
Queue Length 95th (m)	0.8	1.3	0.4	0.1
Control Delay (s)	9.0	9.3	3.3	1.7
Lane LOS	A	A	A	A
Approach Delay (s)	9.0	9.3	3.3	1.7
Approach LOS	A	A		

Intersection Summary				
Average Delay		5.7		
Intersection Capacity Utilization		15.8%	ICU Level of Service	A
Analysis Period (min)		15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	7	115	88	54	96	2	119	20	36	5	7	29
Future Volume (Veh/h)	7	115	88	54	96	2	119	20	36	5	7	29
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	125	96	59	104	2	129	22	39	5	8	32
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	106			221			400	365	125	414	460	105
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	106			221			400	365	125	414	460	105
tC, single (s)	4.1			4.2			7.1	6.5	6.5	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.5	3.5	4.0	3.3
p0 queue free %	99			95			75	96	95	99	98	97
cM capacity (veh/h)	1498			1291			517	538	863	491	476	955

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	133	96	165	190	45
Volume Left	8	0	59	129	5
Volume Right	0	96	2	39	32
cSH	1498	1700	1291	566	744
Volume to Capacity	0.01	0.06	0.05	0.34	0.06
Queue Length 95th (m)	0.1	0.0	1.1	11.2	1.5
Control Delay (s)	0.5	0.0	3.1	14.5	10.2
Lane LOS	A		A	B	B
Approach Delay (s)	0.3		3.1	14.5	10.2
Approach LOS				B	B

Intersection Summary			
Average Delay	6.0		
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Volume (veh/h)	7	0	37	0	0	0	11	16	0	0	11	10
Future Volume (Veh/h)	7	0	37	0	0	0	11	16	0	0	11	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	0	40	0	0	0	12	17	0	0	12	11
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	58	58	18	98	64	17	23			17		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	58	58	18	98	64	17	23			17		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	96	100	100	100	99			100		
cM capacity (veh/h)	937	830	1067	850	824	1068	1605			1613		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	48	0	29	23
Volume Left	8	0	12	0
Volume Right	40	0	0	11
cSH	1043	1700	1605	1613
Volume to Capacity	0.05	0.00	0.01	0.00
Queue Length 95th (m)	1.1	0.0	0.2	0.0
Control Delay (s)	8.6	0.0	3.0	0.0
Lane LOS	A	A	A	
Approach Delay (s)	8.6	0.0	3.0	0.0
Approach LOS	A	A		

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	18.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	115	88	54	96	4	119	27	36	6	9	35
Future Volume (Veh/h)	22	115	88	54	96	4	119	27	36	6	9	35
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	24	125	96	59	104	4	129	29	39	7	10	38
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	108			221			440	399	125	450	493	106
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	108			221			440	399	125	450	493	106
tC, single (s)	4.1			4.2			7.1	6.5	6.5	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.5	3.5	4.0	3.3
p0 queue free %	98			95			73	94	95	98	98	96
cM capacity (veh/h)	1489			1291			478	508	863	453	449	951

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	149	96	167	197	55
Volume Left	24	0	59	129	7
Volume Right	0	96	4	39	38
cSH	1489	1700	1291	529	708
Volume to Capacity	0.02	0.06	0.05	0.37	0.08
Queue Length 95th (m)	0.4	0.0	1.1	13.0	1.9
Control Delay (s)	1.3	0.0	3.0	15.8	10.5
Lane LOS	A		A	C	B
Approach Delay (s)	0.8		3.0	15.8	10.5
Approach LOS				C	B

Intersection Summary			
Average Delay	6.6		
Intersection Capacity Utilization	38.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Volume (veh/h)	7	0	37	9	0	4	11	16	27	11	11	10
Future Volume (Veh/h)	7	0	37	9	0	4	11	16	27	11	11	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	0	40	10	0	4	12	17	29	12	12	11
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	101	112	18	137	102	32	23			46		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	101	112	18	137	102	32	23			46		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	96	99	100	100	99			99		
cM capacity (veh/h)	871	771	1067	796	779	1045	1605			1568		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	48	14	58	35
Volume Left	8	10	12	12
Volume Right	40	4	29	11
cSH	1029	854	1605	1568
Volume to Capacity	0.05	0.02	0.01	0.01
Queue Length 95th (m)	1.1	0.4	0.2	0.2
Control Delay (s)	8.7	9.3	1.5	2.5
Lane LOS	A	A	A	A
Approach Delay (s)	8.7	9.3	1.5	2.5
Approach LOS	A	A		

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	13.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	107	59	62	99	3	141	29	52	2	15	34
Future Volume (Veh/h)	13	107	59	62	99	3	141	29	52	2	15	34
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	116	64	67	108	3	153	32	57	2	16	37
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	111			180			432	389	116	460	452	110
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	111			180			432	389	116	460	452	110
tC, single (s)	4.1			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			95			68	94	94	100	97	96
cM capacity (veh/h)	1485			1332			479	517	942	440	476	950

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	130	64	178	242	55
Volume Left	14	0	67	153	2
Volume Right	0	64	3	57	37
cSH	1485	1700	1332	547	713
Volume to Capacity	0.01	0.04	0.05	0.44	0.08
Queue Length 95th (m)	0.2	0.0	1.2	17.1	1.9
Control Delay (s)	0.9	0.0	3.2	16.7	10.5
Lane LOS	A		A	C	B
Approach Delay (s)	0.6		3.2	16.7	10.5
Approach LOS				C	B

Intersection Summary			
Average Delay	7.9		
Intersection Capacity Utilization	41.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	23	0	18	0	0	0	34	21	0	0	18	15
Future Volume (Veh/h)	23	0	18	0	0	0	34	21	0	0	18	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	25	0	20	0	0	0	37	23	0	0	20	16
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	125	125	28	145	133	23	36			23		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	125	125	28	145	133	23	36			23		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	100	98	100	100	100	98			100		
cM capacity (veh/h)	838	751	1053	798	744	1060	1588			1605		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	45	0	60	36
Volume Left	25	0	37	0
Volume Right	20	0	0	16
cSH	922	1700	1588	1605
Volume to Capacity	0.05	0.00	0.02	0.00
Queue Length 95th (m)	1.2	0.0	0.5	0.0
Control Delay (s)	9.1	0.0	4.6	0.0
Lane LOS	A	A	A	
Approach Delay (s)	9.1	0.0	4.6	0.0
Approach LOS	A	A		

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	19.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	107	59	62	99	5	141	34	52	5	24	52
Future Volume (Veh/h)	22	107	59	62	99	5	141	34	52	5	24	52
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	24	116	64	67	108	5	153	37	57	5	26	57
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	113			180			478	411	116	484	472	110
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	113			180			478	411	116	484	472	110
tC, single (s)	4.1			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			95			64	93	94	99	94	94
cM capacity (veh/h)	1483			1332			426	497	942	417	459	946

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	140	64	180	247	88
Volume Left	24	0	67	153	5
Volume Right	0	64	5	57	57
cSH	1483	1700	1332	500	683
Volume to Capacity	0.02	0.04	0.05	0.49	0.13
Queue Length 95th (m)	0.4	0.0	1.2	20.5	3.4
Control Delay (s)	1.4	0.0	3.2	19.0	11.1
Lane LOS	A		A	C	B
Approach Delay (s)	1.0		3.2	19.0	11.1
Approach LOS				C	B

Intersection Summary			
Average Delay	9.0		
Intersection Capacity Utilization	41.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	23	0	18	30	0	13	34	21	15	6	18	15
Future Volume (Veh/h)	23	0	18	30	0	13	34	21	15	6	18	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	25	0	20	33	0	14	37	23	16	7	20	16
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	161	155	28	167	155	31	36			39		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	161	155	28	167	155	31	36			39		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	100	98	96	100	99	98			100		
cM capacity (veh/h)	781	720	1053	768	720	1046	1588			1577		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	45	47	76	43
Volume Left	25	33	37	7
Volume Right	20	14	16	16
cSH	882	834	1588	1577
Volume to Capacity	0.05	0.06	0.02	0.00
Queue Length 95th (m)	1.2	1.4	0.5	0.1
Control Delay (s)	9.3	9.6	3.7	1.2
Lane LOS	A	A	A	A
Approach Delay (s)	9.3	9.6	3.7	1.2
Approach LOS	A	A		

Intersection Summary			
Average Delay	5.7		
Intersection Capacity Utilization	19.6%	ICU Level of Service	A
Analysis Period (min)	15		

Attachment D – Warrant Analysis

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

44th Street	Main Road	**Date**	September 10, 2020
54 Avenue	Minor Road	**Other**	i.e. source of intersection information
Red Water	City/Town		2044 Combined traffic

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	0		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	0		5		OK	
Channelization Factor					OK	0
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	50				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Posted Speed Category =	D	0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**6**

OPERATIONAL FACTORS

	Value	Rating	Weight	Comments	Check	Score
Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	1154	1	10	Either Use the two AADT inputs **OR** the Descriptive Signalization	OK	10
AADT on Minor Road (2-way)	829	1	20	Warrant (Unused values should be set to Zero) Refer to Table	OK	20
Signalization Warrant	Descriptive	0	30	1(B) for description and rating values for signalization warrant.	OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	3	5	Refer to Table 1(B) for ratings.	OK	15
Operating Speed or Posted Speed on Major Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
					Operational Factors Subtotal	**45**

ENVIRONMENTAL FACTOR

	Value	Rating	Weight	Comments	Check	Score
Lighted Developments within 150 m radius of intersection	2	2	5	Maximum of 4 quadrants	OK	10
					Environmental Factor Subtotal	**10**

COLLISION HISTORY

	Value	Rating	Weight	Comments	Check	Score
Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)		0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
					Collision History Subtotal	**0**

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY	
Geometric Factors Subtotal	6
Operational Factor Subtotal	45
Environmental Factor Subtotal	10
Collision History Subtotal	0
TOTAL POINTS	**61**

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Hwy 38:10	Main Road	Date	September 10, 2020
Hwy 644 (44 Street)	Minor Road	Other	i.e. source of intersection information
Red Water	City/Town		2018 /2019 traffic

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	0		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	0		5		OK	
Channelization Factor					OK	0
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	50				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Posted Speed Category =	D	0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
				Geometric Factors Subtotal		**6**

OPERATIONAL FACTORS

	Value	Rating	Weight	Comments	Check	Score
Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	2710	2	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	20
AADT on Minor Road (2-way)	1200	2	20		OK	40
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	4	5	Refer to Table 1(B) for ratings.	OK	20
Operating Speed or Posted Speed on Major Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
				Operational Factors Subtotal		**80**

ENVIRONMENTAL FACTOR

	Value	Rating	Weight	Comments	Check	Score
Lighted Developments within 150 m radius of intersection	2	2	5	Maximum of 4 quadrants	OK	10
				Environmental Factor Subtotal		**10**

COLLISION HISTORY

	Value	Rating	Weight	Comments	Check	Score
Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)		0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
				Collision History Subtotal		**0**

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY	
Geometric Factors Subtotal	6
Operational Factor Subtotal	80
Environmental Factor Subtotal	10
Collision History Subtotal	0
TOTAL POINTS	**96**

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Hwy 38:10	Main Road	**Date**	September 10, 2020
Hwy 644 (44 Street)	Minor Road	**Other**	i.e. source of intersection information
Red Water	City/Town		2024 Combined traffic

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	0		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	0		5		OK	
Channelization Factor					OK	0
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	50				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Posted Speed Category =	D	0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**6**

OPERATIONAL FACTORS

	Value	Rating	Weight	Comments	Check	Score
Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	3195	3	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	30
AADT on Minor Road (2-way)	1484	2	20		OK	40
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	4	5	Refer to Table 1(B) for ratings.	OK	20
Operating Speed or Posted Speed on Major Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
					Operational Factors Subtotal	**90**

ENVIRONMENTAL FACTOR

	Value	Rating	Weight	Comments	Check	Score
Lighted Developments within 150 m radius of intersection	2	2	5	Maximum of 4 quadrants	OK	10
					Environmental Factor Subtotal	**10**

COLLISION HISTORY

	Value	Rating	Weight	Comments	Check	Score
Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)		0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
					Collision History Subtotal	**0**

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY	
Geometric Factors Subtotal	6
Operational Factor Subtotal	90
Environmental Factor Subtotal	10
Collision History Subtotal	0
TOTAL POINTS	**106**

Illumination of Isolated Rural Intersections

LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Hwy 38:10	Main Road	Date	September 10, 2020
Hwy 644 (44 Street)	Minor Road	Other	i.e. source of intersection information
Red Water	City/Town		2044 Combined traffic

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	0		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	0		5		OK	
Channelization Factor					OK	0
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	50				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Posted Speed Category =	D	0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**6**

OPERATIONAL FACTORS

	Value	Rating	Weight	Comments	Check	Score
Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	4404	3	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	30
AADT on Minor Road (2-way)	2084	4	20		OK	80
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	4	5	Refer to Table 1(B) for ratings.	OK	20
Operating Speed or Posted Speed on Major Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
					Operational Factors Subtotal	**130**

ENVIRONMENTAL FACTOR

	Value	Rating	Weight	Comments	Check	Score
Lighted Developments within 150 m radius of intersection	2	2	5	Maximum of 4 quadrants	OK	10
					Environmental Factor Subtotal	**10**

COLLISION HISTORY

	Value	Rating	Weight	Comments	Check	Score
Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)		0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
					Collision History Subtotal	**0**

Check Intersection Signalization:
Intersection is not Signalized

ILLUMINATION WARRANTED
DELINEATION LIGHTING TO ILLUMINATE PEDESTRIANS OR CROSS STREET TRAFFIC

SUMMARY	
Geometric Factors Subtotal	6
Operational Factor Subtotal	130
Environmental Factor Subtotal	10
Collision History Subtotal	0
TOTAL POINTS	**146**

Alberta Transportation - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Hwy 38 & Hwy 644	Direction (EW or NS)	EW	Road Authority:	Alberta Transportation
Side Street (name)	44 Street	Direction (EW or NS)	NS	City:	Red Water
Quadrant / Int #	4	Comments	2018/2019 background traffic	Analysis Date:	2020 Sep 09, Wed
	CHECK SHEET			Count Date:	2018 May 10, Thu
				Date Entry Format:	2019-07-03

for Warrant Calculation Results, please hit 'Page Down'

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Hwy 38 & Hwy 644	WB		1			1			3,000	2			
Hwy 38 & Hwy 644	EB				1				3,000	1			
44 Street	NB				1				3,000	1			
44 Street	SB				1				3,000	1			

	Saturation Flow Rates (if not default) (vphpl)	Default Saturation Flow Rates (vphpl)
Left Turn	1,800	1,650
Through	1,900	1,800
Right Turn	1,600	1,500

Are the 44 Street NB right turns significantly impeded by through movements? (y/n)	n
Are the 44 Street SB right turns significantly impeded by through movements? (y/n)	n
Are the Hwy 38 & Hwy 644 WB right turns significantly impeded by through movements? (y/n)	n
Are the Hwy 38 & Hwy 644 EB right turns significantly impeded by through movements? (y/n)	n

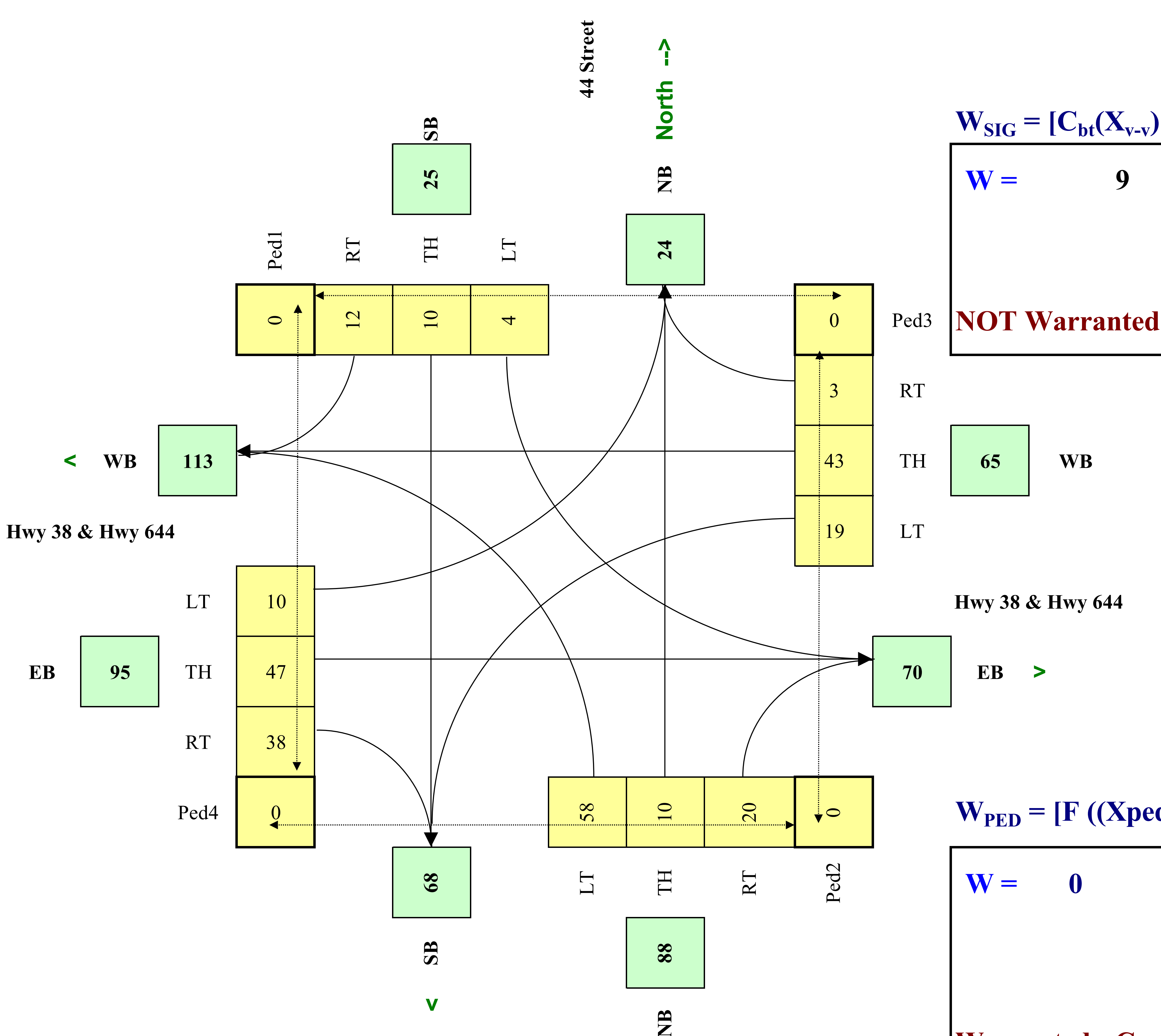
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	2,100
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Hwy 38 & Hwy 644	EW	60	8.0%	n	0.0
44 Street	NS	60	8.0%	n	0.0

Set Peak Hours

Traffic Input	NB LT	NB Th	NB RT	SB LT	SB Th	SB RT	WB LT	WB Th	WB RT	EB LT	EB Th	EB RT	Ped1 NS W Side	Ped2 NS E Side	Ped3 EW N Side	Ped4 EW S Side
7:15 - 8:15	26	6	16	6	18	10	22	32	6	14	42	33	0	0	0	0
8:15 - 9:15	43	4	20	3	9	7	10	45	2	6	23	32	0	0	0	0
11:45 - 12:45	56	10	13	3	3	12	14	54	4	11	52	51	0	0	0	0
12:45 - 13:45	51	3	16	3	10	16	24	38	4	9	59	45	0	0	0	0
16:00 - 17:00	74	15	27	1	8	18	32	52	2	7	56	30	0	0	0	0
17:00 - 18:00	97	24	25	5	11	9	14	35	1	13	48	39	0	0	0	0
Total (6-hour peak)	**347**	**62**	**117**	**21**	**59**	**72**	**116**	**256**	**19**	**60**	**280**	**230**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**58**	**10**	**20**	**4**	**10**	**12**	**19**	**43**	**3**	**10**	**47**	**38**	**0**	**0**	**0**	**0**
Actual Pedestrian Crossing Distance (m)													10.0	10.0	10.0	10.0

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v-v}) / K_1 + (F (X_{v-p}) L) / K_2] \times C_i$

W =	9	9	0
		Veh	Ped

NOT Warranted

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

Traffic Signal Warrant Spreadsheet - v2.0 © 2014 Transportation Association of Canada

Alberta Transportation - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Hwy 38 & Hwy 644	Direction (EW or NS)	EW	Road Authority:	Alberta Transportation
Side Street (name)	44 Street	Direction (EW or NS)	NS	City:	Red Water
Quadrant / Int #	4	Comments	2021 Combined traffic (Phase 1)	Analysis Date:	2020 Sep 09, Wed
	CHECK SHEET			Count Date:	2018 May 10, Thu
				Date Entry Format:	2019-07-03

for Warrant Calculation Results, please hit 'Page Down'

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Hwy 38 & Hwy 644	WB		1			1			3,000	2			
Hwy 38 & Hwy 644	EB				1				3,000	1			
44 Street	NB				1				3,000	1			
44 Street	SB				1				3,000	1			

	Saturation Flow Rates (if not default) (vphpl)	Default Saturation Flow Rates (vphpl)
Left Turn	1,800	1,650
Through	1,900	1,800
Right Turn	1,600	1,500

Are the 44 Street NB right turns significantly impeded by through movements? (y/n)	n
Are the 44 Street SB right turns significantly impeded by through movements? (y/n)	n
Are the Hwy 38 & Hwy 644 WB right turns significantly impeded by through movements? (y/n)	n
Are the Hwy 38 & Hwy 644 EB right turns significantly impeded by through movements? (y/n)	n

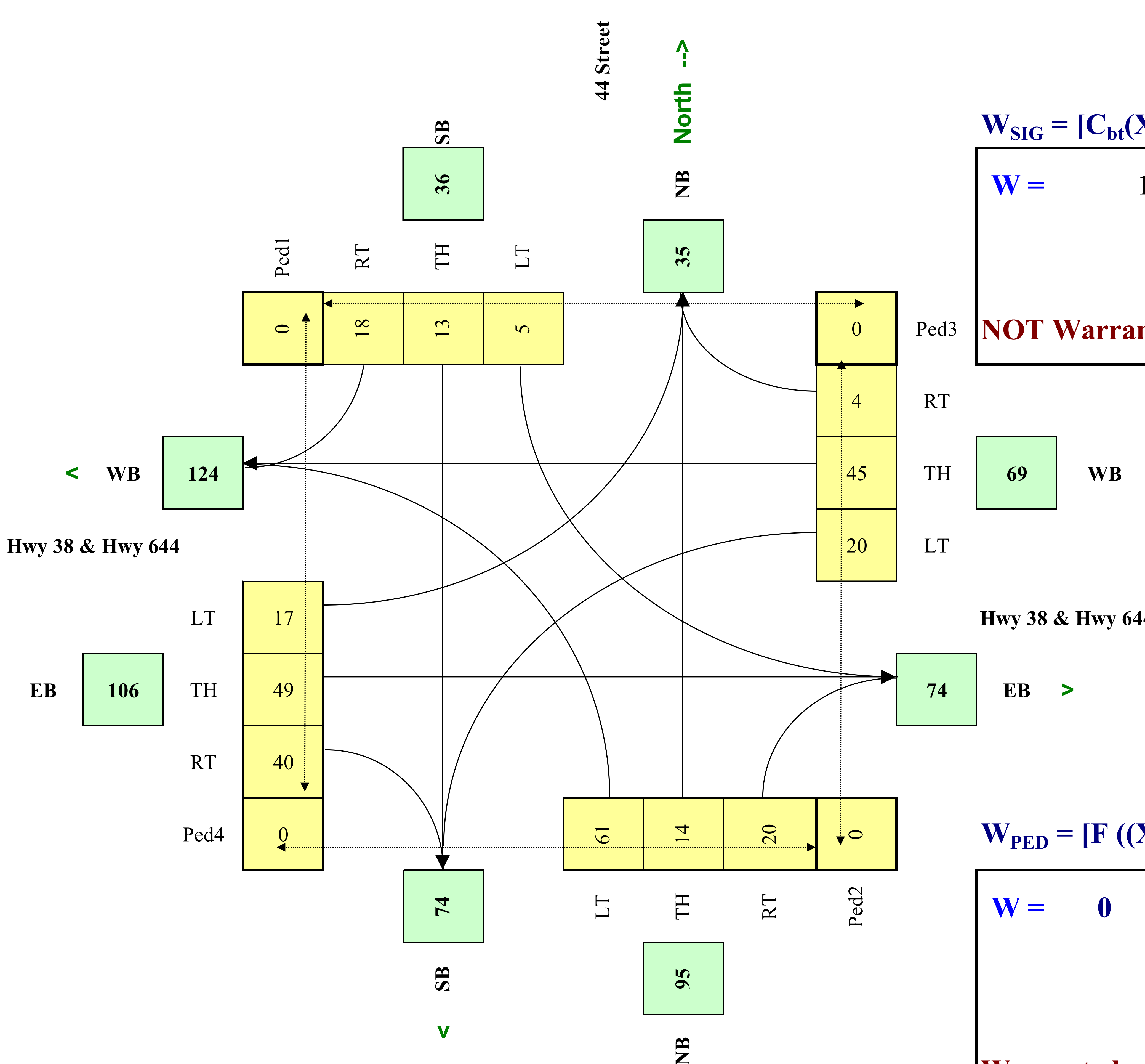
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	2,100
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Hwy 38 & Hwy 644	EW	60	8.0%	n	0.0
44 Street	NS	60	8.0%	n	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:15 - 8:15	27	9	17	7	20	13	23	34	7	21	44	35	0	0	0	0
8:15 - 9:15	45	7	21	4	11	10	11	47	3	12	24	34	0	0	0	0
11:45 - 12:45	59	14	14	4	6	18	15	57	5	18	55	54	0	0	0	0
12:45 - 13:45	54	6	17	4	13	22	25	40	5	16	62	47	0	0	0	0
16:00 - 17:00	78	19	28	2	12	27	34	55	3	14	59	32	0	0	0	0
17:00 - 18:00	102	28	26	7	16	17	15	37	2	20	50	41	0	0	0	0
Total (6-hour peak)	**364**	**83**	**123**	**28**	**78**	**108**	**122**	**269**	**26**	**100**	**294**	**242**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**61**	**14**	**20**	**5**	**13**	**18**	**20**	**45**	**4**	**17**	**49**	**40**	**0**	**0**	**0**	**0**
Actual Pedestrian Crossing Distance (m)													10.0	10.0	10.0	10.0

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v\text{-}v}) / K_1 + (F (X_{v\text{-}p}) L) / K_2] \times C_i$

W =	12	12	0
		Veh	Ped

NOT Warranted

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

Alberta Transportation - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Hwy 38 & Hwy 644	Direction (EW or NS)	EW	Road Authority:	Alberta Transportation
Side Street (name)	44 Street	Direction (EW or NS)	NS	City:	Red Water
Quadrant / Int #	4	Comments	2024 Combined traffic (Phase 1 & Phase 2)	Analysis Date:	2020 Sep 09, Wed
	CHECK SHEET			Count Date:	2018 May 10, Thu
				Date Entry Format:	2019-07-03

for Warrant Calculation Results, please hit 'Page Down'

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Hwy 38 & Hwy 644	WB		1			1			3,000	2			
Hwy 38 & Hwy 644	EB				1				3,000	1			
44 Street	NB				1				3,000	1			
44 Street	SB				1				3,000	1			

Saturation Flow Rates (if not default) (vphpl)		Default Saturation Flow Rates (vphpl)
Left Turn	1,800	1,650
Through	1,900	1,800
Right Turn	1,600	1,500

Are the 44 Street NB right turns significantly impeded by through movements? (y/n)	n
Are the 44 Street SB right turns significantly impeded by through movements? (y/n)	n
Are the Hwy 38 & Hwy 644 WB right turns significantly impeded by through movements? (y/n)	n
Are the Hwy 38 & Hwy 644 EB right turns significantly impeded by through movements? (y/n)	n

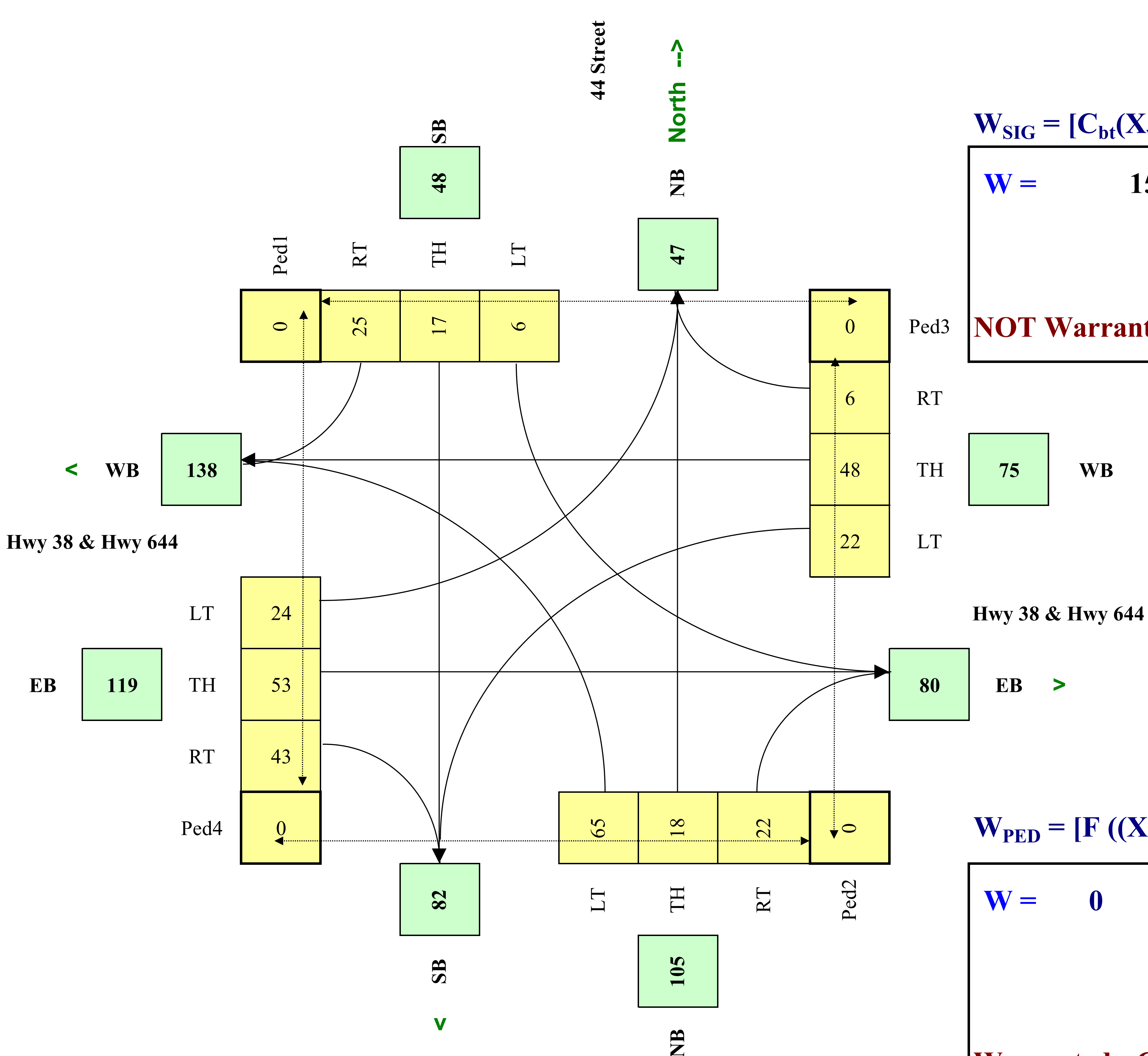
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	2,100
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Hwy 38 & Hwy 644	EW	60	8.0%	n	0.0
44 Street	NS	60	8.0%	n	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:15 - 8:15	29	15	18	8	23	17	25	36	9	32	47	37	0	0	0	0
8:15 - 9:15	48	12	23	4	13	13	11	51	5	23	26	36	0	0	0	0
11:45 - 12:45	63	17	15	5	9	25	16	61	7	25	59	57	0	0	0	0
12:45 - 13:45	57	10	18	5	17	30	27	43	7	23	66	51	0	0	0	0
16:00 - 17:00	83	21	30	4	18	38	36	59	4	17	63	34	0	0	0	0
17:00 - 18:00	109	31	28	9	21	28	16	39	3	23	54	44	0	0	0	0
Total (6-hour peak)	**390**	**107**	**132**	**35**	**102**	**152**	**131**	**288**	**34**	**142**	**315**	**259**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**65**	**18**	**22**	**6**	**17**	**25**	**22**	**48**	**6**	**24**	**53**	**43**	**0**	**0**	**0**	**0**
Actual Pedestrian Crossing Distance (m)													10.0	10.0	10.0	10.0

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v-v}) / K_1 + (F (X_{v-p}) L) / K_2] \times C_i$

W =	15	15	0
		Veh	Ped

NOT Warranted

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

Alberta Transportation - Traffic Signal & Pedestrian Signal Head Warrant Analysis

Main Street (name)	Hwy 38 & Hwy 644	Direction (EW or NS)	EW	Road Authority:	Alberta Transportation
Side Street (name)	44 Street	Direction (EW or NS)	NS	City:	Red Water
Quadrant / Int #	4	Comments	2044 Combined traffic Comprehensive annual linear growth rate 2.5%	Analysis Date:	2020 Sep 09, Wed
CHECK SHEET				Count Date:	2018 May 10, Thu
				Date Entry Format:	2019-07-03

for Warrant Calculation Results, please hit 'Page Down'

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	RT Channelization (y/n)	UpStream Signal (m)	# of Thru Lanes	LT Phase Type	RTOR Allowed (y/n)	Actuated Thru Phase
Hwy 38 & Hwy 644	WB		1			1			3,000	2			
Hwy 38 & Hwy 644	EB				1				3,000	1			
44 Street	NB				1				3,000	1			
44 Street	SB				1				3,000	1			

Saturation Flow Rates (if not default) (vphpl)		Default Saturation Flow Rates (vphpl)
Left Turn	1,800	1,650
Through	1,900	1,800
Right Turn	1,600	1,500

Are the 44 Street NB right turns significantly impeded by through movements? (y/n)	n
Are the 44 Street SB right turns significantly impeded by through movements? (y/n)	n
Are the Hwy 38 & Hwy 644 WB right turns significantly impeded by through movements? (y/n)	n
Are the Hwy 38 & Hwy 644 EB right turns significantly impeded by through movements? (y/n)	n

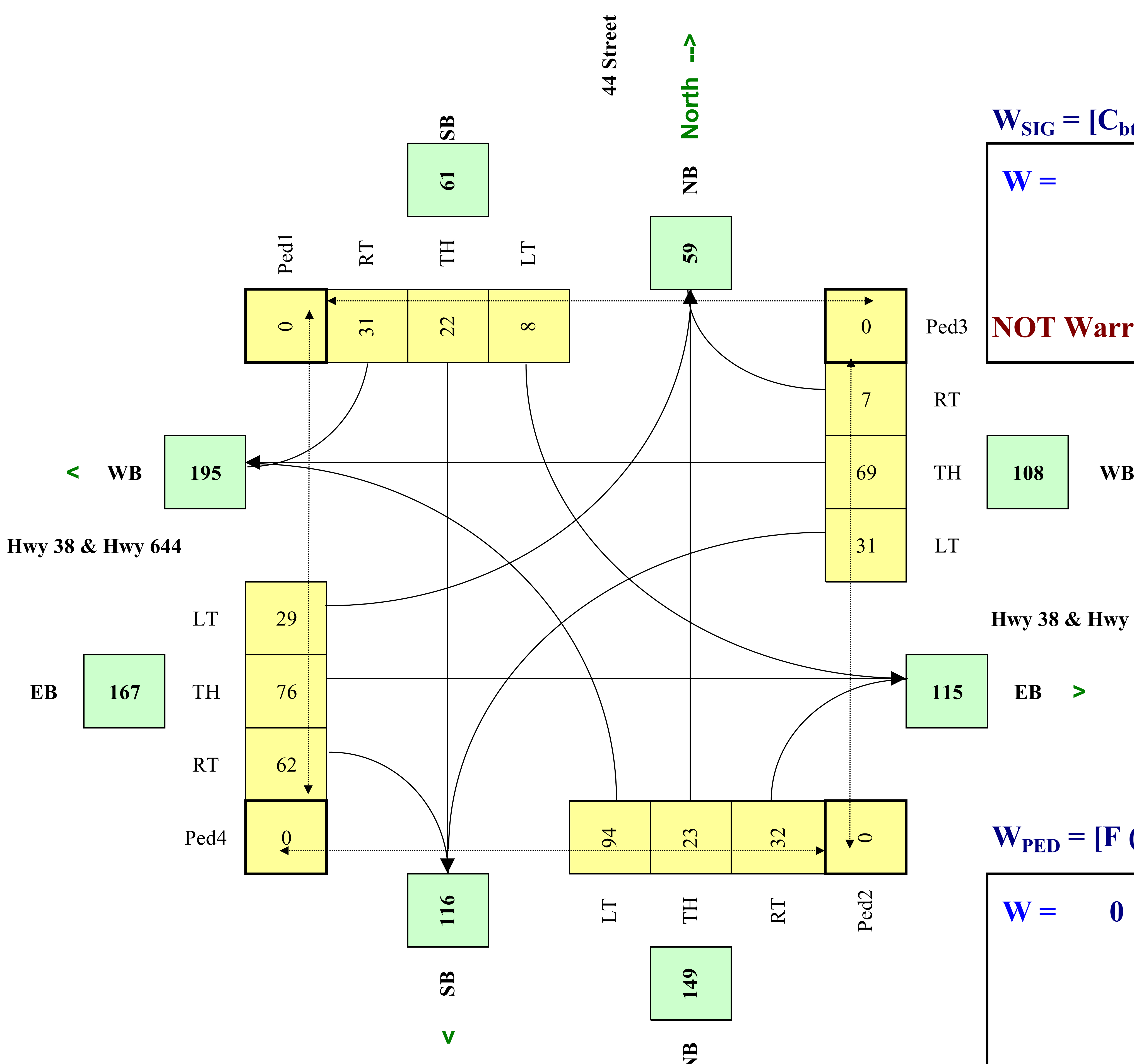
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	2,100
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Hwy 38 & Hwy 644	EW	60	8.0%	n	0.0
44 Street	NS	60	8.0%	n	0.0

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:15 - 8:15	42	18	26	11	32	22	36	52	12	39	68	54	0	0	0	0
8:15 - 9:15	70	14	33	6	17	17	16	73	6	26	37	52	0	0	0	0
11:45 - 12:45	91	22	21	7	11	31	23	88	9	30	85	83	0	0	0	0
12:45 - 13:45	83	11	26	7	22	38	39	62	9	27	96	73	0	0	0	0
16:00 - 17:00	120	29	44	5	22	47	52	85	5	20	91	49	0	0	0	0
17:00 - 18:00	158	43	41	11	27	33	23	57	3	30	78	63	0	0	0	0
Total (6-hour peak)	**564**	**138**	**190**	**46**	**131**	**188**	**189**	**416**	**43**	**172**	**455**	**374**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**94**	**23**	**32**	**8**	**22**	**31**	**31**	**69**	**7**	**29**	**76**	**62**	**0**	**0**	**0**	**0**
Actual Pedestrian Crossing Distance (m)													10.0	10.0	10.0	10.0

Average 6-hour Peak Turning Movements



$W_{SIG} = [C_{bt}(X_{v-v}) / K_1 + (F (X_{v-p}) L) / K_2] \times C_i$

W =	30	30	0
		Veh	Ped

NOT Warranted

RESET SHEET

$W_{PED} = [F ((Xped_m)d_m/K_2) + (Xped_s)d_s/K_3)]$

W = 0

Warranted - Complex Intersection

Traffic Signal Warrant Spreadsheet - v2.0 © 2014 Transportation Association of Canada

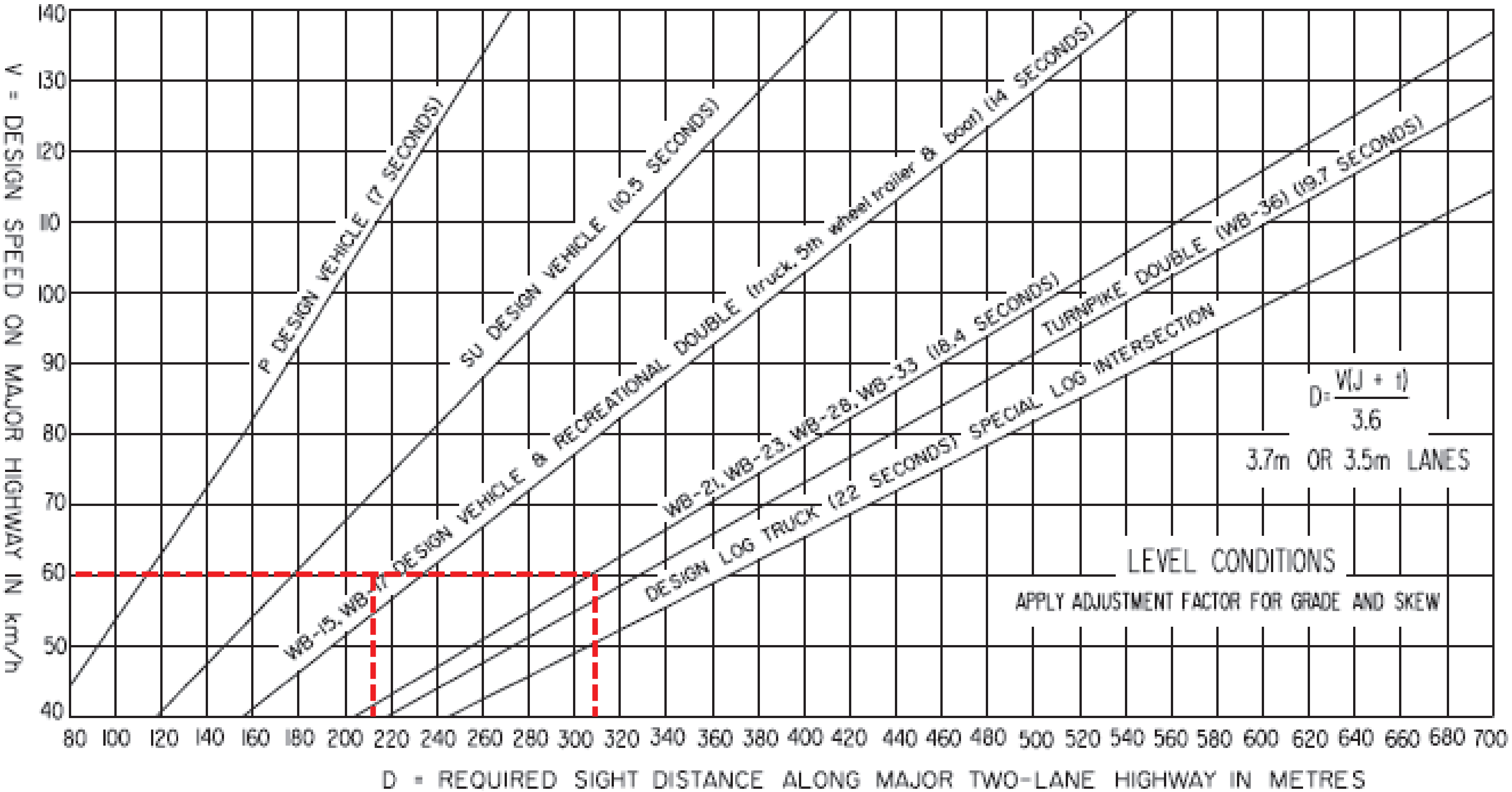


FIGURE D-4.2.2.2 SIGHT DISTANCES FOR LEFT TURN ONTO HIGHWAY*

* INTERSECTION SIGHT DISTANCE (I.S.D.)

- THE I.S.D.'s SHOWN IN THIS FIGURE ARE BASED ON THE DISTANCE TRAVELLED AT DESIGN SPEED DURING A CRITICAL TIME (SHOWN ON THE FIGURE IN SECONDS). THE CRITICAL TIME INCLUDES THE TIME TAKEN FOR THE MANOEUVRE (LEFT TURN FROM THE MINOR ROAD) PLUS 2 SECONDS FOR PERCEPTION/REACTION TIME.

- THE INTERSECTION SIGHT DISTANCE AVAILABLE IS TO BE DETERMINED USING AN EYE HEIGHT (BASED ON THE DESIGN VEHICLE) LOCATED AT THE JUNCTION AND AN OBJECT HEIGHT OF 1.3m (REPRESENTING THE ROOF OF A PASSENGER VEHICLE) ON THE THROUGH ALIGNMENT. THE EYE HEIGHTS TO BE USED ARE SHOWN IN FIGURE D-5a.

NOTES:

1. To determine the sight distance requirements at an intersection, the designer should select the longest vehicle or vehicle with the greatest I.S.D. need, that uses the intersection on a regular basis, i.e., daily. Because of the various eye heights, the I.S.D. available for several design vehicles may have to be checked.

2. The usefulness of intersection sight distances in excess of 500m has been debated and will be the subject of future research into gap acceptance by large trucks on rural highways in Alberta. Changes to this table may be made based on that research.

Contact
Elaine Lau, P.Eng., PTOE
780-809-3234
eklau@mcelhanney.com

McElhanney

CANADA BEST MANAGED COMPANIES

Appendix E2

Traffic Impact Assessment Amendment

(D&A Paulichuk Consulting Ltd.)

TRAFFIC IMPACT ASSESSMENT UPDATE/AMENDMENT

REDWATER INDUSTRIAL SUBDIVISION

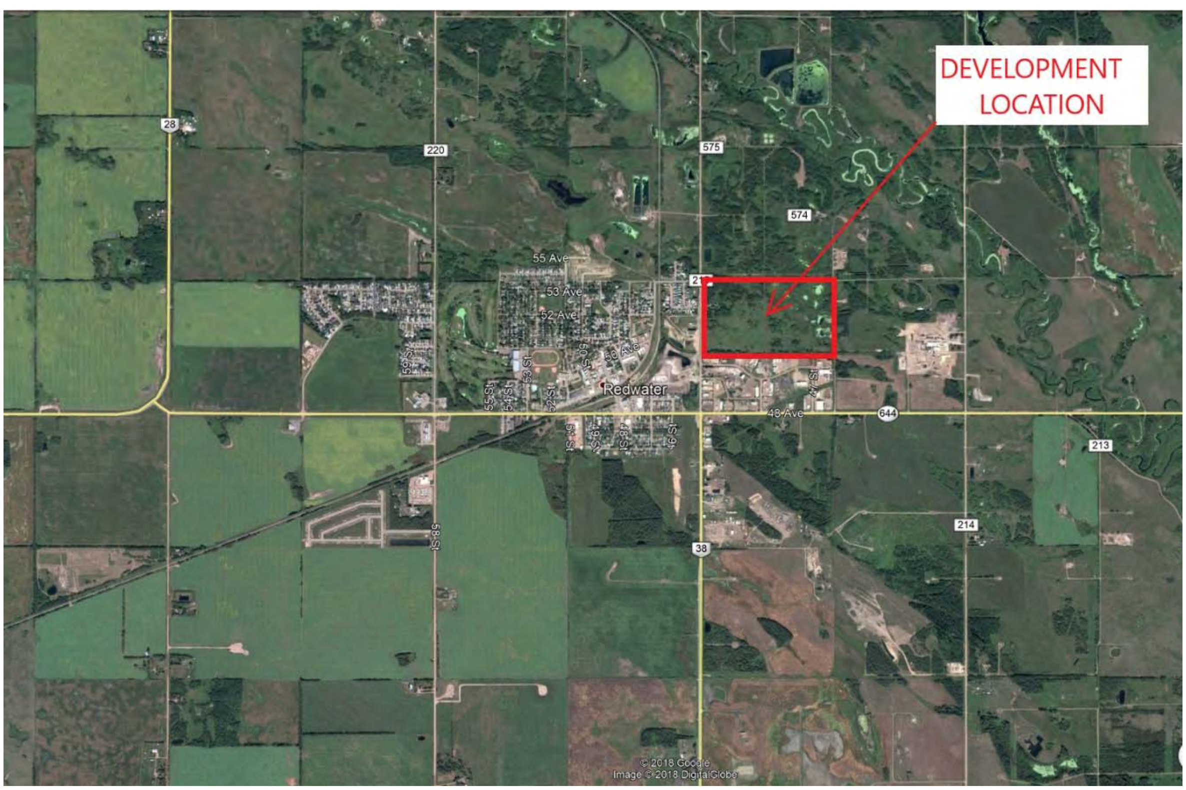
44th Street, Highway 38:10 & Highway 644
SW 29-57-21-W4M
Town of Redwater

D&A PAULICHUK CONSULTING LTD.

Dec. 30, 2020

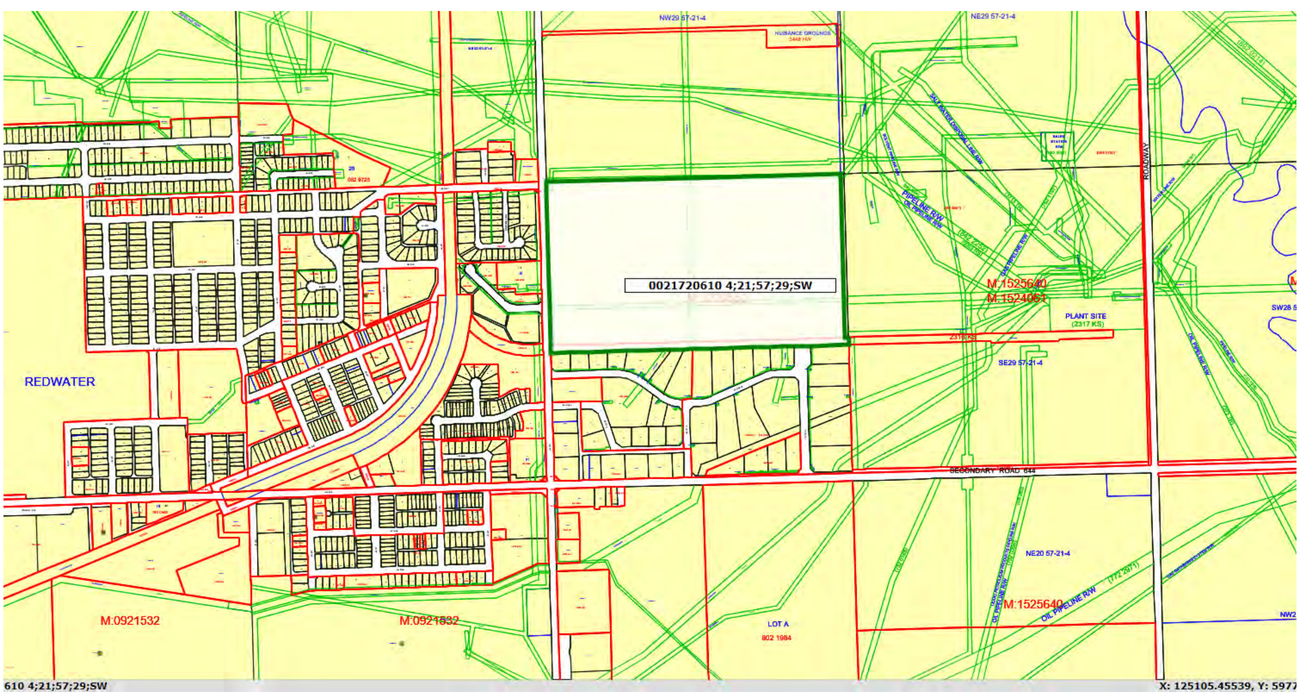
LOCATION PLAN L-1

LOCATION PLAN L-2

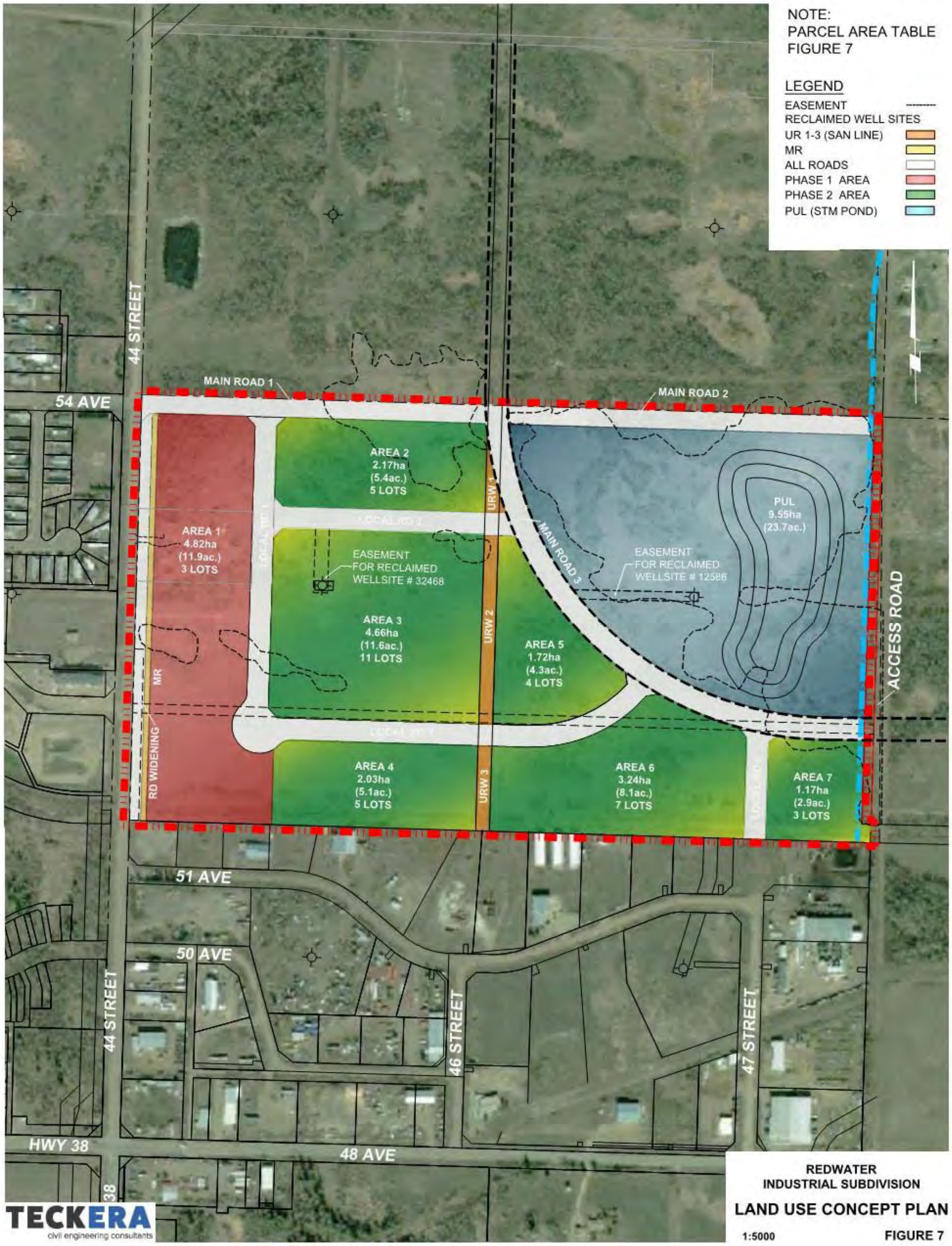


LOCATION PLAN L-3

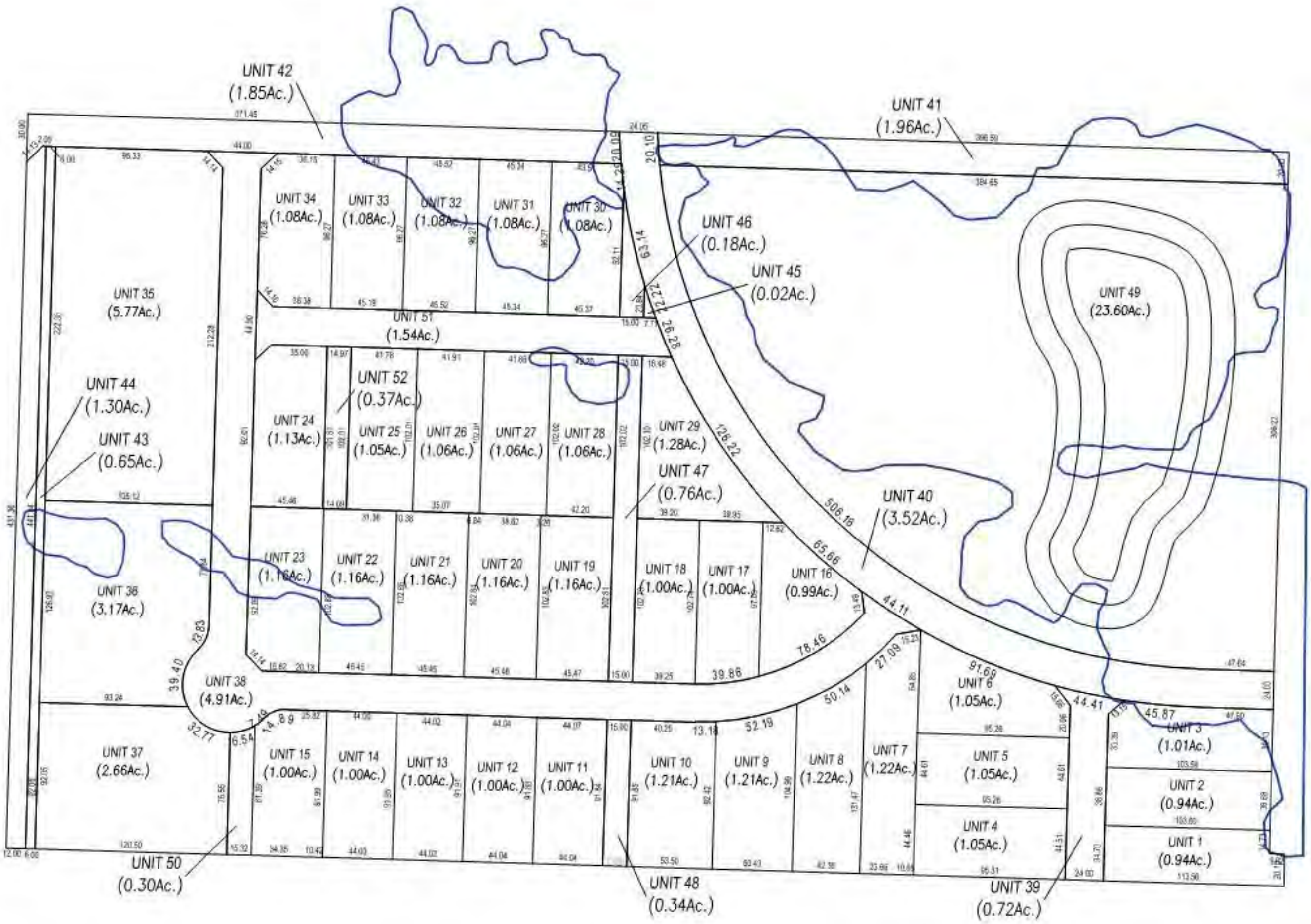
SPIN PLAN SP-1



DEVELOPMENT PLAN



DEVELOPMENT PLAN 2



Parcel Area Table			
Parcel #	Area m²	Hectares (ha.)	Acre (ac.)
UNIT 1	3800.00m²	0.38ha.	0.94ac.
UNIT 2	3800.00m²	0.38ha.	0.94ac.
UNIT 3	4087.72m²	0.41ha.	1.01ac.
UNIT 4	4238.98m²	0.42ha.	1.05ac.
UNIT 5	4250.00m²	0.42ha.	1.05ac.
UNIT 6	4238.19m²	0.42ha.	1.05ac.
UNIT 7	4925.96m²	0.49ha.	1.22ac.
UNIT 8	4942.80m²	0.49ha.	1.22ac.
UNIT 9	4904.73m²	0.49ha.	1.21ac.
UNIT 10	4912.36m²	0.49ha.	1.21ac.
UNIT 11	4046.86m²	0.40ha.	1.00ac.
UNIT 12	4046.86m²	0.40ha.	1.00ac.
UNIT 13	4046.86m²	0.40ha.	1.00ac.
UNIT 14	4046.86m²	0.40ha.	1.00ac.
UNIT 15	4046.86m²	0.40ha.	1.00ac.
UNIT 16	4025.38m²	0.40ha.	0.99ac.
UNIT 17	4030.00m²	0.40ha.	1.00ac.
UNIT 18	4030.00m²	0.40ha.	1.00ac.

Parcel Area Table			
Parcel #	Area m²	Hectares (ha.)	Acre (ac.)
UNIT 19	4675.00m²	0.47ha.	1.16ac.
UNIT 20	4675.00m²	0.47ha.	1.16ac.
UNIT 21	4675.00m²	0.47ha.	1.16ac.
UNIT 22	4675.00m²	0.47ha.	1.16ac.
UNIT 23	4682.26m²	0.47ha.	1.16ac.
UNIT 24	4561.58m²	0.46ha.	1.13ac.
UNIT 25	4259.80m²	0.43ha.	1.05ac.
UNIT 26	4275.57m²	0.43ha.	1.06ac.
UNIT 27	4272.82m²	0.43ha.	1.06ac.
UNIT 28	4305.67m²	0.43ha.	1.06ac.
UNIT 29	5182.04m²	0.52ha.	1.28ac.
UNIT 30	4361.10m²	0.44ha.	1.08ac.
UNIT 31	4364.47m²	0.44ha.	1.08ac.
UNIT 32	4382.05m²	0.44ha.	1.08ac.
UNIT 33	4361.77m²	0.44ha.	1.08ac.
UNIT 34	4355.37m²	0.44ha.	1.08ac.
UNIT 35	23343.89m²	2.33ha.	5.77ac.
UNIT 36	12824.68m²	1.28ha.	3.17ac.

Parcel Area Table			
Parcel #	Area m²	Hectares (ha.)	Acre (ac.)
UNIT 37	10778.40m²	1.08ha.	2.66ac.
UNIT 38	19876.15m²	1.99ha.	4.91ac.
UNIT 39	2902.00m²	0.29ha.	0.72ac.
UNIT 40	14229.26m²	1.42ha.	3.52ac.
UNIT 41	7914.45m²	0.79ha.	1.96ac.
UNIT 42	7496.30m²	0.75ha.	1.85ac.
UNIT 43	2648.06m²	0.26ha.	0.65ac.
UNIT 44	5246.26m²	0.52ha.	1.30ac.
UNIT 45	77.87m²	0.01ha.	0.02ac.
UNIT 46	716.12m²	0.07ha.	0.18ac.
UNIT 47	3072.49m²	0.31ha.	0.76ac.
UNIT 48	1377.66m²	0.14ha.	0.34ac.
UNIT 49	95514.77m²	9.55ha.	23.60ac.
UNIT 50	1208.44m²	0.12ha.	0.30ac.
UNIT 51	6238.44m²	0.62ha.	1.54ac.
UNIT 52	1510.19m²	0.15ha.	0.37ac.

TABLE OF CONTENTS

1. INTRODUCTION & METHODOLGY

This report is a Traffic Impact Assessment (TIA) Update and Amendment to the Traffic Impact Assessment prepared by McElhanney for this development site dated September 14, 2020. The parcel is approximately 400m x 800m for 32.0 ha (79.1 acres) in size. See Location and Development Plans before this report.

This report amendment has been prepared to determine the impact of the proposed development on traffic using Highway 38:10 East-West (48th Avenue), Highway 38:10 South-North (44th Street), Highway 644:02 (48th Avenue) and 44 Street Local Road in the Town of Redwater. Since a TIA for the site has recently been prepared, the scope of work in this case is to address the comments provided by Alberta Transportation on the review of the last TIA as follows:

- Include residential subdivision to the west of 44 Street, known as Alluvium Redwater Subdivision.
- Include traffic generated from undeveloped lots within the Industrial Subdivision directly south of the proposed development.
- Consider all the approved and discretionary uses allowed on these parcels under the land use policy and assume that a reasonable percentage of the lots will choose these less common development options.
- Address an additional public road connection to Highway 644:02 (48th Avenue) from 46th Street
- Complete intersectional analysis of the following intersections and accurately project what improvements are warranted:

    - Highway 38:10, Highway 644:02 and 44th Street intersection
    - Highway 644:02 and 47th Street intersection
    - 44th Street & Proposed Subdivision Access/54th Avenue

- Address Roundabout versus Signalization at junction of Highway 38:10, Highway 644:02 and 44th Street intersection

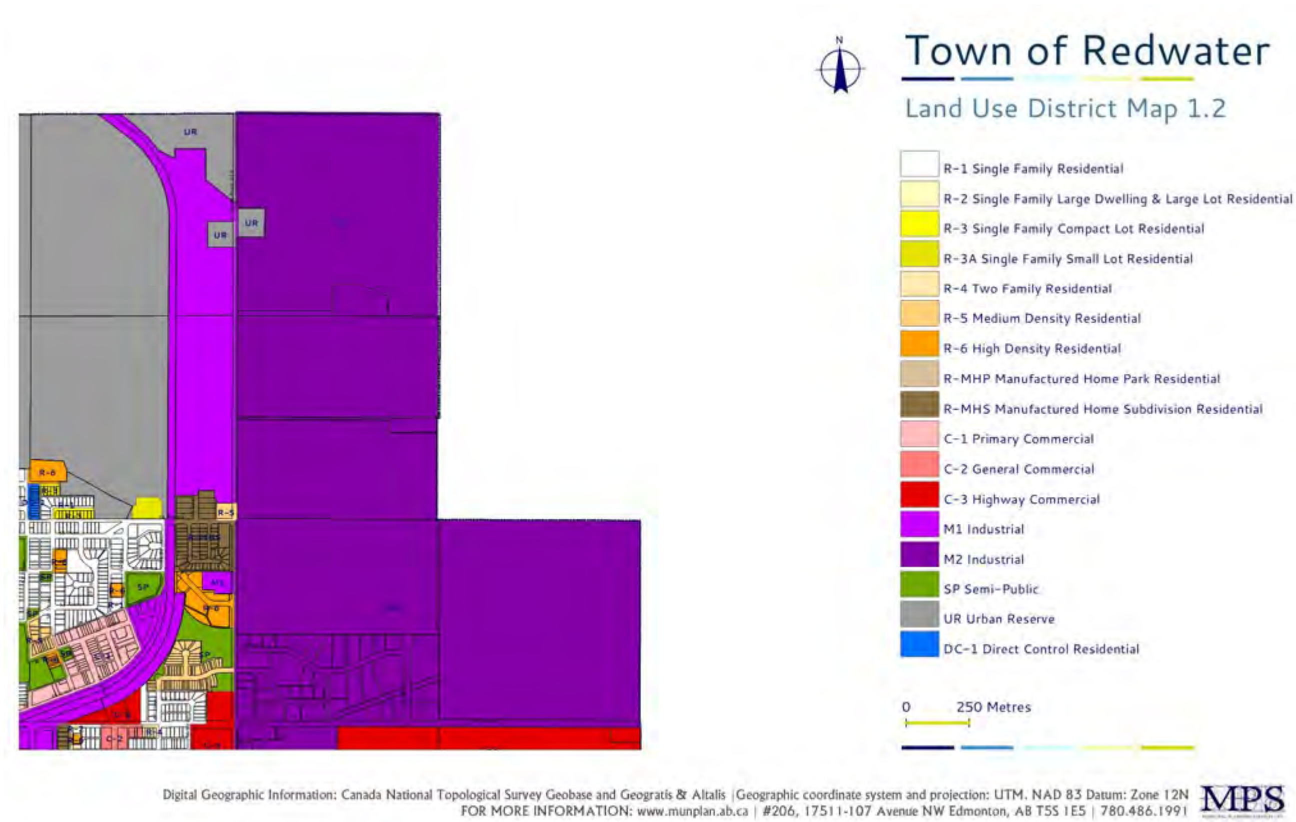
This report update/amendment is based on information provided by the developers of the site, site observations from Mr. Darcy Paulichuk, P. Eng., traffic volume data from Alberta Transportation, intersectional analysis procedures and standards documented in Alberta Infrastructure and Transportation's "Highway Geometric Design Guide", 1999, and Alberta Infrastructure and Transportation's "Traffic Impact Assessment Guideline", 2005.

This report has been prepared for the developers of the site for purposes of gaining approval from municipal and provincial governments for the development of this site.

2. PROPOSED DEVELOPMENT

2.1 Development Details

The proposed development is an Industrial Park Subdivision under the Town of Redwater's Land Use District defined as "Industrial (M2) District) as shown below:



The Permitted and Discretionary Uses for this land use are as follows:

<u>Permitted Uses</u>

(1) Automotive and equipment repair shops, heavy
(2) Automotive and equipment repair shops, light
(3) Automotive and recreational vehicles sales/rental establishments, heavy
(4) Automotive and recreational vehicles sales/rental establishments, light
(5) Business support services establishments
(6) Cannabis production and distribution facilities
(7) Drive-in businesses, but only if they are drive-through vehicle service establishments
(8) Equipment rental establishments

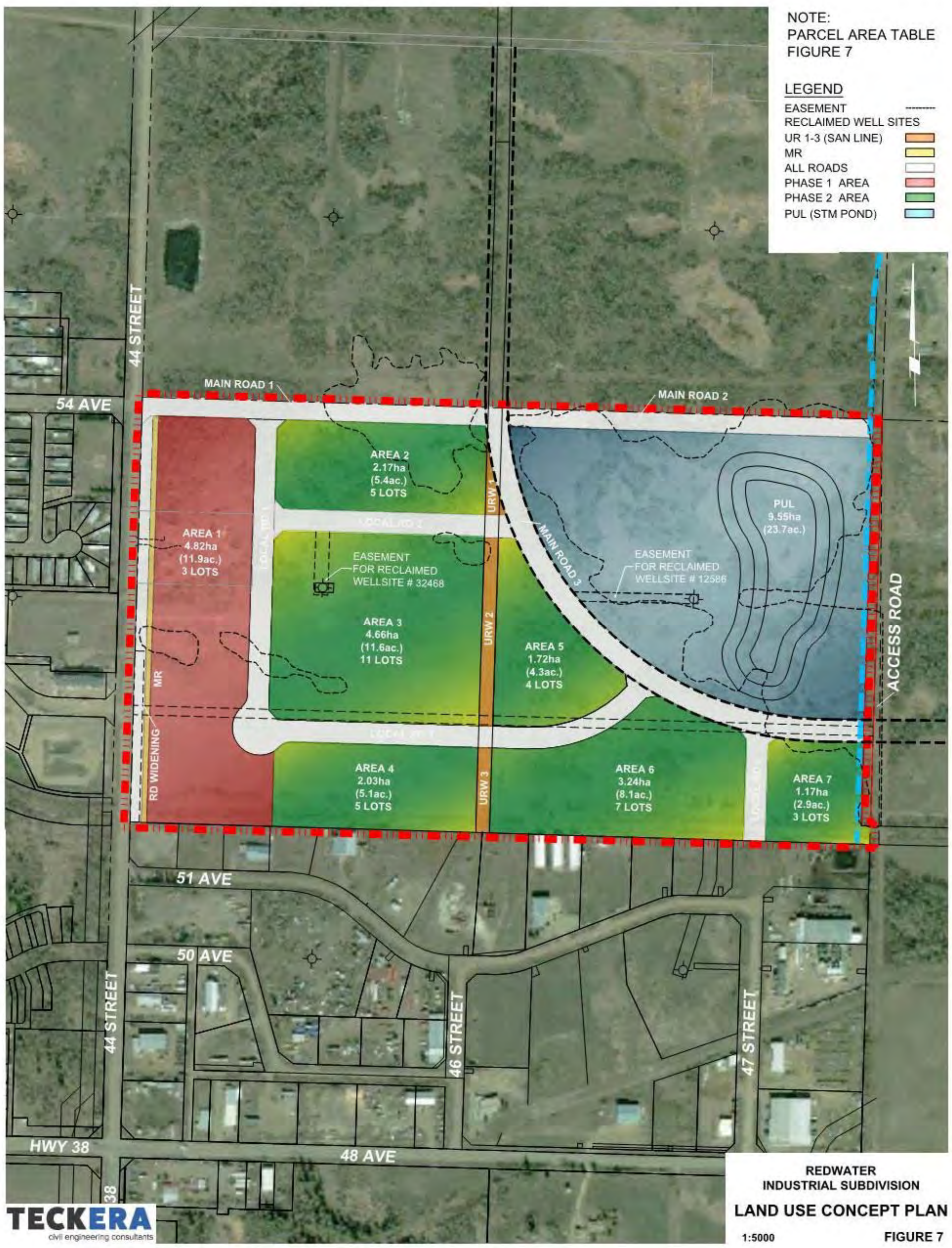
(9) Extensive agriculture
(10) Fleet services
(11) General contractor services
(12) Greenhouses and plant nurseries
(13) Industrial hemp production and distribution facilities
(14) Industrial vehicle and equipment sales/rental establishments
(15) Light industrial uses
(16) Limited contractor services
(17) Outdoor storage
(18) Public parks
(19) Public uses
(20) Public utilities
(21) Recycling depots
(22) Sea cans
(23) Self-service storage facilities
(24) Service stations
(25) Solar energy collection systems
(26) Trucking and cartage establishments
(27) Truck and recreational vehicle sales/rental establishments
(28) Veterinary clinics
(29) Wind energy conversion systems, micro
(30) Buildings and uses accessory to permitted uses

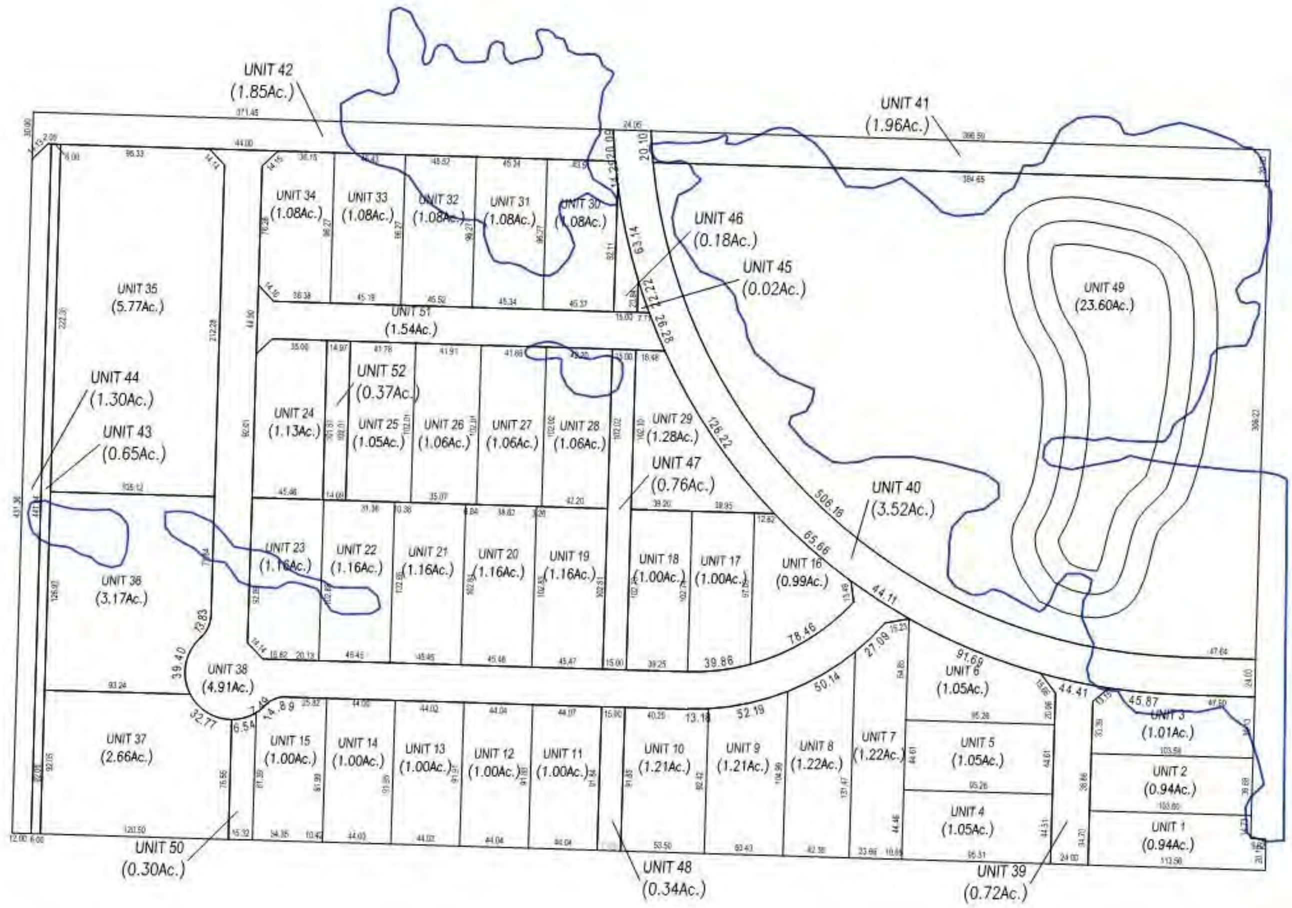
Discretionary Uses

(1) Agricultural industry
(2) Amusement establishments, outdoor
(3) Animal hospitals
(4) Auctioneering establishments
(5) Eating and drinking establishments
(6) Heavy industrial uses
(7) Heavy petrochemical industrial uses
(8) Large animal veterinary clinics
(9) Large wind energy conversion systems
(10) Major utility services
(11) Recreational vehicle campgrounds, seasonal
(12) Recreational vehicle campgrounds, workcamp
(13) Recreational vehicle storage
(14) Small animal breeding and boarding establishments
(15) Small radio communications towers
(16) Wind energy conversion systems, small
(17) Surveillance suites

(18) Staging area
(19) Wireless communications facilities
(20) Workcamps
(21) Workcamps, short term
(22) Other uses which, in the opinion of the Development Authority, are similar to the above mentioned permitted and discretionary uses
(23) Buildings and uses accessory to discretionary uses

The conceptual layout for the Proposed Development is shown below:





Parcel Area Table			
Parcel #	Area m²	Hectares (ha.)	Acre (ac.)
UNIT 1	3800.00m²	0.38ha.	0.94ac.
UNIT 2	3800.00m²	0.38ha.	0.94ac.
UNIT 3	4087.72m²	0.41ha.	1.01ac.
UNIT 4	4238.98m²	0.42ha.	1.05ac.
UNIT 5	4250.00m²	0.42ha.	1.05ac.
UNIT 6	4238.19m²	0.42ha.	1.05ac.
UNIT 7	4925.96m²	0.49ha.	1.22ac.
UNIT 8	4942.80m²	0.49ha.	1.22ac.
UNIT 9	4904.73m²	0.49ha.	1.21ac.
UNIT 10	4912.36m²	0.49ha.	1.21ac.
UNIT 11	4046.86m²	0.40ha.	1.00ac.
UNIT 12	4046.86m²	0.40ha.	1.00ac.
UNIT 13	4046.86m²	0.40ha.	1.00ac.
UNIT 14	4046.86m²	0.40ha.	1.00ac.
UNIT 15	4046.86m²	0.40ha.	1.00ac.
UNIT 16	4025.38m²	0.40ha.	0.99ac.
UNIT 17	4030.00m²	0.40ha.	1.00ac.
UNIT 18	4030.00m²	0.40ha.	1.00ac.

Parcel Area Table			
Parcel #	Area m²	Hectares (ha.)	Acre (ac.)
UNIT 19	4675.00m²	0.47ha.	1.16ac.
UNIT 20	4675.00m²	0.47ha.	1.16ac.
UNIT 21	4675.00m²	0.47ha.	1.16ac.
UNIT 22	4675.00m²	0.47ha.	1.16ac.
UNIT 23	4682.26m²	0.47ha.	1.16ac.
UNIT 24	4561.58m²	0.46ha.	1.13ac.
UNIT 25	4259.80m²	0.43ha.	1.05ac.
UNIT 26	4275.57m²	0.43ha.	1.06ac.
UNIT 27	4272.82m²	0.43ha.	1.06ac.
UNIT 28	4305.67m²	0.43ha.	1.06ac.
UNIT 29	5182.04m²	0.52ha.	1.28ac.
UNIT 30	4361.10m²	0.44ha.	1.08ac.
UNIT 31	4364.47m²	0.44ha.	1.08ac.
UNIT 32	4382.05m²	0.44ha.	1.08ac.
UNIT 33	4361.77m²	0.44ha.	1.08ac.
UNIT 34	4355.37m²	0.44ha.	1.08ac.
UNIT 35	23343.89m²	2.33ha.	5.77ac.
UNIT 36	12824.68m²	1.28ha.	3.17ac.

Parcel Area Table			
Parcel #	Area m²	Hectares (ha.)	Acre (ac.)
UNIT 37	10778.40m²	1.08ha.	2.66ac.
UNIT 38	19876.15m²	1.99ha.	4.91ac.
UNIT 39	2902.00m²	0.29ha.	0.72ac.
UNIT 40	14229.26m²	1.42ha.	3.52ac.
UNIT 41	7914.45m²	0.79ha.	1.96ac.
UNIT 42	7496.30m²	0.75ha.	1.85ac.
UNIT 43	2648.06m²	0.26ha.	0.65ac.
UNIT 44	5246.26m²	0.52ha.	1.30ac.
UNIT 45	77.87m²	0.01ha.	0.02ac.
UNIT 46	716.12m²	0.07ha.	0.18ac.
UNIT 47	3072.49m²	0.31ha.	0.76ac.
UNIT 48	1377.66m²	0.14ha.	0.34ac.
UNIT 49	95514.77m²	9.55ha.	23.60ac.
UNIT 50	1208.44m²	0.12ha.	0.30ac.
UNIT 51	6238.44m²	0.62ha.	1.54ac.
UNIT 52	1510.19m²	0.15ha.	0.37ac.

The proposed layout creates a new access onto 44th Street to the west at 54th Avenue and a secondary access to the south through the existing industrial subdivision onto Highway 644:02 (48th Avenue) at 47 Street.

The anticipated phasing of the development is shown below:

2.2 Land Use & Trip Generation Types

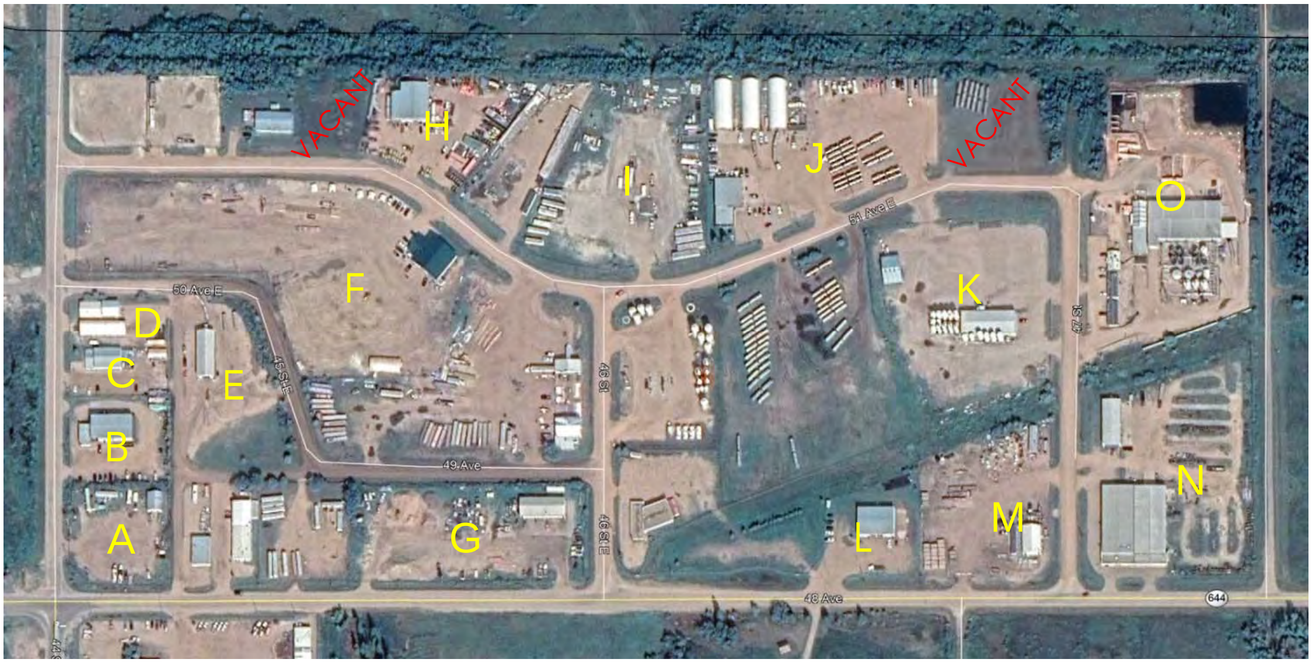
The proposed development can be separated into several land uses as allowed under the Town's Land Use Bylaw. To properly project future traffic volumes, a variety of land uses for the development lots will need to be considered when calculating trip generation rates.

2.2.1 Lot to Building Ratios

It is first important to note that Institute of Transportation (ITE) land uses provide trip generation rates for areas of building gross floor area. For this reason, the building area to lot size ratios must determined to project the size of potential building per development lot.

Industrial type lots tend to have a large area for working, storage of materials/equipment and open space. The area taken up for buildings is relatively low and hence building size is often directly related to traffic generation.

Below is an air photo of the existing industrial park type development in the area. This is likely the best representation of what will continue to development in this area of Redwater.



Area A: Lot Size: 5,250 m2 (56,500 ft2), Building(s) Size: 250 m2 (2,700 ft2)
(approx. 5% of Lot Size)

Area B, Pyramid – Electrical & Instrumental Services
Lot Size: 4,125 m2 (44,400 ft2), Building Size: 536 m2 (5,770 ft2)
(approx. 13% of Lot Size)

Area C, Quinn Pumps – Mechanical Supply & Service
Lot Size: 2,450 m2 (26,370 ft2), Building Size: 312 m2 (3,360 ft2)
(approx. 13% of Lot Size)

Area D: Lot Size: 2,450 m2 (26,370 ft2), Building(s) Size: 590 m2 (6,350 ft2)
(approx. 24% of Lot Size)

Area E: Lot Size: 8,400 m2 (90,420 ft2), Building(s) Size: 360 m2 (3,875 ft2)
(approx. 4.5% of Lot Size)

Area F: Lot Size: 40,600 m2 (437,000 ft2), Building(s) Size: 1,100 m2 (11,840 ft2)
(approx. 3% of Lot Size)

Area G: Lot Size: 10,075 m2 (108,450 ft2), Building(s) Size: 415 m2 (4,470 ft2)
(approx. 4% of Lot Size)

Area H: Lot Size: 6,660 m2 (71,690 ft2), Building(s) Size: 625 m2 (6,730 ft2)
(approx. 9.5% of Lot Size)

Area I: Lot Size: 6,660 m2 (71,690 ft2), Building(s) Size: 0 m2 (0 ft2)
(approx. 0% of Lot Size)

Area J: Lot Size: 13,125 m2 (141,280 ft2), Building(s) Size: 500 m2 (5,380 ft2)
(approx. 4% of Lot Size)

Area K: Lot Size: 13,625 m2 (146,660 ft2), Building(s) Size: 680 m2 (7,320 ft2)
(approx. 5% of Lot Size)

Area L: Lot Size: 9,000 m2 (96,880 ft2), Building(s) Size: 600 m2 (6,460 ft2)
(approx. 6.7% of Lot Size)

Area M: Lot Size: 8,180 m2 (88,050 ft2), Building(s) Size: 260 m2 (2,800 ft2)
(approx. 3.2% of Lot Size)

Area N: Lot Size: 16,100 m2 (173,300 ft2), Building(s) Size: 2,930 m2 (31,540 ft2)
(approx. 18% of Lot Size)

Area O: Lot Size: 21,100 m2 (227,130 ft2), Building(s) Size: 1,920 m2 (20,670 ft2)
(approx. 9.1% of Lot Size)

For the purposes of this report, a gross building area of 3 - 5% of the lot area will be used for projecting traffic (3% for large lots and 5% for small lots).

2.2.2 Land Uses for Traffic Projection

The land uses anticipated to be used in this development and their equivalent ITE land use are assumed as follows:

• Automotive and Equipment Repair Shops	ITE 942, Automotive Care Center
• Small Manufacturing Facilities	ITE 140, Manufacturing
• Equipment Rental Establishments	ITE 811, Construction Equipment Rental
• General Contractor Services	ITE 180, Specialty Trade Contractor
• Light Industrial Services	ITE 110, General Light Industrial
• Self-Service Storage Facilities	ITE 151, Mini-Warehouse
• Agricultural Industry	ITE 810, Tractor Supply Store
• Major Utility Service	ITE 170, Utility
• Building Supply Store	ITE 812, Building Materials & Lumber Store

The above land uses are broken up into the following percentage and area of use for the development lot area.

The total lot area available for development is 195,431.89m2. For Phase 1, 46,946.97m2 will be developed and for Phase 2, 148,484.92m2 will be developed.

PHASE 1

Lot 35: Automotive and Equipment Repair Shop: 23,343.89m2 lot → 700m2 building
Building: 7,540 ft2 (approx. 3% of Lot Size)

Lots 36 & 37: General Contractor Services: 23,603m2 lots → 708m2 buildings
Building: 7,621 ft2 (approx. 3% for 2 Lots)

PHASE 2

Lots 1 – 34 (Lots are assumed to be consolidated when larger area needed)

25% Light Industrial Services: 37,121m2 lot → 1,856m2 building
Building: 20,000 ft2 (approx. 5% of Lot Size)

15% General Contractor Services: 22,272m2 lot → 1,114m2 building
Building: 12,000 ft2 (approx. 5% of Lot Size)

10% Automotive and Equipment Repair Shop: 14,850m2 lot → 743m2 building
Building: 8,000 ft2 (approx. 5% of Lot Size)

10% Self-Service Storage Facilities: 14,850m2 lot → 743m2 building
Building: 8,000 ft2 (approx. 5% of Lot Size)

10% Equipment Rental Establishments: 14,850m2 lot → 743m2 building
Building: 8,000 ft2 (approx. 5% of Lot Size)

10% Major Utility Service: 14,850m2 lot → 743m2 building
Building: 8,000 ft2 (approx. 5% of Lot Size)

10% Building Supply Store: 14,850m2 lot → 743m2 building
Building: 8,000 ft2 (approx. 5% of Lot Size)

5% Agricultural Industry: 7,425m2 lot → 371m2 building
Building: 4,000 ft2 (approx. 5% of Lot Size)

5% Small Manufacturing Facilities:
7,425m2 lot → 371m2 building
Building: 4,000 ft2 (approx. 5% of Lot Size)

The total building floor area is projected to occupy 88,302 ft2 in total on the 2,103,680 ft2 of total lot space (4.2%).

It is important to note that the Institute of Transportation Engineers (ITE) Trip Generation Manual provides trip generation rates for several land use types, however much of data was collected in large urban centres which generate their own primary trips. In this case, Redwater has a population of only 2,200 and is significantly lower than the U.S. cities with 100,000's to 1,000,000's of people for which the ITE trip generation rate is based on. This is especially true for land uses such as the sales and supply developments. The traffic is likely to come from existing residents in or around the Redwater area. For this reason, some of the trip generation rates are reduced by 25% to 50%.

2.3 Trip Generation Determination

Trip Generation calculations are made as follows:

Units	X	Peak Hour of Adjacent Street Traffic	X	Internal Trip Reduction (100% - internal	X	Total Trips 100% or Primary Trips % or Pass-By Trips %
		X		In % or Out %	=	Total Trips or Primary Trips or Pass-By Trips

The following table presents the estimated trip generation calculations. Peak Hour of Adjacent Street Traffic values are used for generation rates. All data in the following tables are taken from the 10th Edition of Institute of Transportation Engineers Trip Generation Manual. Future development is estimated and based on the pattern of existing development.

In this site case, the land use projected for the new development are not anticipated to have pass-by trips but only primary trips. Pass-by trips tend to occur for mostly pure commercial developments.

TABLE 2.3 – 1: TRIP GENERATION - Daily

LAND USE	**ITE** **Land Use**	NO.	Reduction from Large Urban to Small Urban	Primary Trip %	Pass-By Trip %	Daily				
						Rate	In (Total) (Primary Trips) (Pass-By Trips)		Out (Total) (Primary Trips) (Pass-By Trips)	
Automotive & Equipment Repair Shop	942 Automotive Care Center	7,540 ft²	50%	100%	0%	26.8*	50% 50% 50%	51 51 0	50% 50% 50%	51 51 0
General Contractor Services	180 Speciality Trade Contractor	7,621 ft²	75%	100%	0%	10.22	50% 50% 50%	29 29 0	50% 50% 50%	29 29 0
TOTAL – Phase 1 Year 2025							80 / 80/ 0		80 / 80 / 0	
							160 / 160 / 0			
Light Industrial Services	110 General Light Industrial	20,000 ft²	75%	100%	0%	4.96	50% 50% 50%	38 38 0	50% 50% 50%	38 38 0
General Contractor Services	180 Speciality Trade Contractor	12,000 ft²	75%	100%	0%	10.22	50% 50% 50%	46 46 0	50% 50% 50%	46 46 0
Automotive & Equipment Repair Shop	942 Automotive Care Center	8,000 ft²	50%	100%	0%	26.8*	50% 50% 50%	54 54 0	50% 50% 50%	54 54 0
Self-Service Storage Facilities	151 Mini-Warehouse	8,000 ft²	100%	100%	0%	1.51	50% 50% 50%	6 6 0	50% 50% 50%	6 6 0
Equipment Rental Establishments	811 Construction Equipment Rental	8,000 ft²	75%	100%	0%	10.0**	50% 50% 50%	30 30 0	50% 50% 50%	30 30 0

Major Utility Service	170 Utility	8,000 ft^2	75%	100%	0%	13.24	50% 50% 50%	40 40 0	50% 50% 50%	40 40 0
Building Supply Store	812 Building Materials & Lumber Store	8,000 ft^2	75%	100%	0%	18.05	50% 50% 50%	54 54 0	50% 50% 50%	54 54 0
Agricultural Industry	810 Tractor Supply Store	4,000 ft^2	75%	100%	0%	24.0**	50% 50% 50%	36 36 0	50% 50% 50%	36 36 0
Manufacturing Industry	140 Manufacturing	4,000 ft^2	100%	100%	0%	3.93	50% 50% 50%	8 8 0	50% 50% 50%	8 8 0
TOTAL – Phase 2 Year 2045							312 / 312/ 0		312 / 312 / 0	
							624 / 624 / 0			
TOTAL							392 / 392 / 0		392 / 392 / 0	
							784 / 784 / 0			

*Note: A Daily Rate for this Land Use was not available in the ITE Manual. Therefore, the Peak Hour of Adjacent Street Traffic between 7 – 9am and 4 – 6 pm were averaged and multiplied by 10 for the Daily Rate.
**Note: A Daily Rate for this Land Use and the Peak Hour of Adjacent Street Traffic between 7 – 9am were not available in the ITE Manual. Therefore, the Peak Hour of Adjacent Street Traffic between 4 – 6 pm was multiplied by 10 for the Daily Rate.

TABLE 2.3 – 2: TRIP GENERATION – Peak Hours

Land Use	Units	Reduction from Large Urban to Small Urban	AM Peak Hour							PM Peak Hour						
			Rate	Primary Trip %	Pass-By Trip %	In (Total) (Primary Trips) (Pass-By Trips)		Out (Total) (Primary Trips) (Pass-By Trips)		Rate	Primary Trip %	Pass-By Trip %	In (Total) (Primary Trips) (Pass-By Trips)		Out (Total) (Primary Trips) (Pass-By Trips)	
Automotive & Equipment Repair Shop (ITE 942)	7,540 ft²	50%	2.25	100%	0%	66%	6 6 0	34%	3 3 0	3.11	100%	0%	48%	6 6 0	52%	6 6 0
General Contractor Services (ITE 180)	7,621 ft2	75%	1.66	100%	0%	73%	7 7 0	27%	3 3 0	1.97	100%	0%	32%	4 4 0	68%	8 8 0
TOTAL – Phase 1 Year 2025							13 13 0		6 6 0					10 10 0		14 14 0
Light Industrial Services (ITE 110)	20,000 ft²	75%	0.70	100%	0%	88%	10 10 0	12%	3 3 0	0.63	100%	0%	13%	2 2 0	87%	10 10 0
General Contractor Services (ITE 180)	12,000 ft²	75%	1.66	100%	0%	73%	11 11 0	27%	4 4 0	1.97	100%	0%	32%	6 6 0	68%	12 12 0
Automotive & Equipment Repair Shop (ITE 942)	8,000 ft²	50%	2.25	100%	0%	66%	6 6 0	34%	3 3 0	3.11	100%	0%	48%	6 6 0	52%	7 7 0
Self-Service Storage Facilities (ITE 151)	8,000 ft²	100%	0.10	100%	0%	60%	1 1 0	40%	0 0 0	0.17	100%	0%	47%	1 1 0	53%	1 1 0
Equipment Rental Establishments (ITE 811)	8,000 ft²	75%	0.99*	100%	0%	72%	5 5 0	28%	2 2 0	0.99	100%	0%	28%	2 2 0	72%	5 5 0
Major Utility Service (ITE 170)	8,000 ft²	75%	2.31	100%	0%	80%	11 11 0	20%	4 4 0	2.27	100%	0%	20%	3 3 0	80%	11 11 0

Land Use	Units	Reduction from Large Urban to Small Urban	AM Peak Hour							PM Peak Hour						
			Rate	Primary Trip %	Pass-By Trip %	In (Total) (Primary Trips) (Pass-By Trips)		Out (Total) (Primary Trips) (Pass-By Trips)		Rate	Primary Trip %	Pass-By Trip %	In (Total) (Primary Trips) (Pass-By Trips)		Out (Total) (Primary Trips) (Pass-By Trips)	
Building Supply Store (ITE 812)	8,000 ft²	75%	1.57	100%	0%	63%	6 6 0	37%	4 4 0	2.06	100%	0%	47%	6 6 0	53%	7 7 0
Agricultural Industry (ITE 810)	4,000 ft²	75%	1.40*	100%	0%	53%	3 3 0	47%	2 2 0	1.40	100%	0%	47%	2 2 0	53%	3 3 0
Manufacturing Industry (ITE 140)	4,000 ft²	100%	0.62	100%	0%	77%	2 2 0	23%	1 1 0	0.67	100%	0%	31%	1 1 0	69%	2 2 0
TOTAL – Phase 2 Year 2045						55 55 0		23 23 0					29 29 0		58 58 0	
Total						68 68 0		29 29 0					39 39 0		72 72 0	
						97 97 0							111 111 0			

*Note: Using the same rate as Peak Hour of Adjacent Street Traffic between 4 – 6 pm since no Peak Hour of Adjacent Street Traffic between 7 – 9am rate available in ITE Manual.

2.4 Trip Distribution

The anticipated trip distribution for the proposed developmnet will first occur from one access point at the north west corner of the property at the junction of 54th Avenue & 44th Street for Phase 1. The anticipated trip distribution percentages for Phase 1 is shown below.

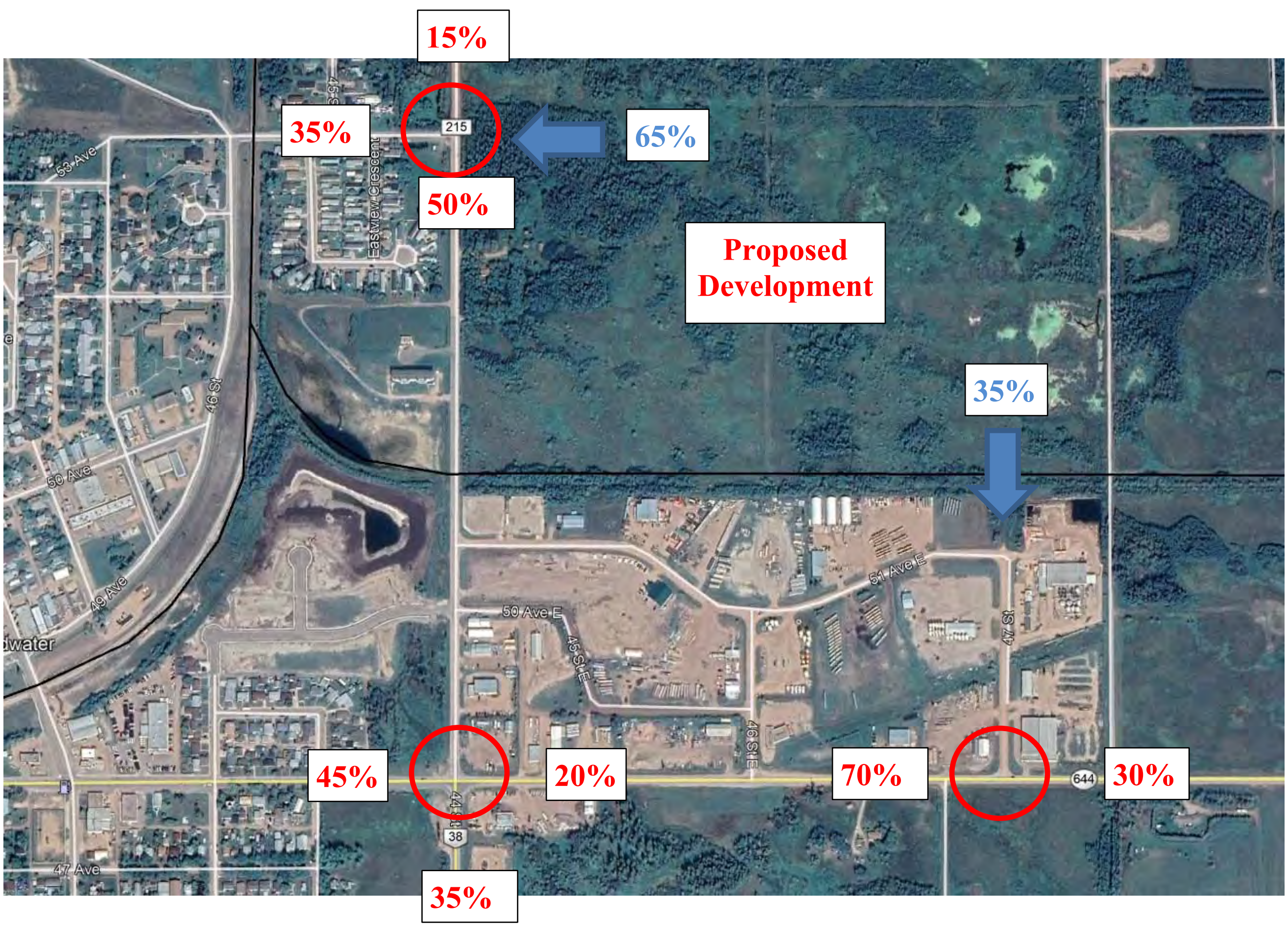
Figure 2.4.1 – Phase1 Only - 2025

In Phase 1, the traffic to the north along 44th Street from the development access is anticipated to be low as existing development to the north is low and the local roadway is not as developed as Highway 829 to the east. Traffic will likely utilize existing paved roadways and highways to the south. However, traffic will likely use 54th Avenue to the west, as this route is a shorter distance to the Redwater downtown area. This traffic is not expected to be large or heavy vehicles, just passenger vehicles running errands or going for lunch.

For Phase 2, slightly more traffic may go north from the north west corner of the development property. Most traffic still proceeds south to the junction of Highway 38 & Highway 644. Due to the location of the Alberta Industrial Heartland area, much of the proposed development is anticipated to service this area and its future growth.

A new access will be made to the south existing industrial park at 47th Street which connects to Highway 644 (48th Avenue). A portion of traffic from this intersection is anticipated to go east on Highway 644 and then north on Highway 829. The traffic on the west leg of this intersection is split 50% to the west and 50% to the south.

Figure 2.4.2 – Phase 1 & 2 – Year 2030 & 2040



2.5 New Development Traffic

The detailed breakdown of the traffic for Development trips are shown below.

Figure 2.5.1 - NEW DEVELOPMENT TRIPS – Phase 1, Year 2025

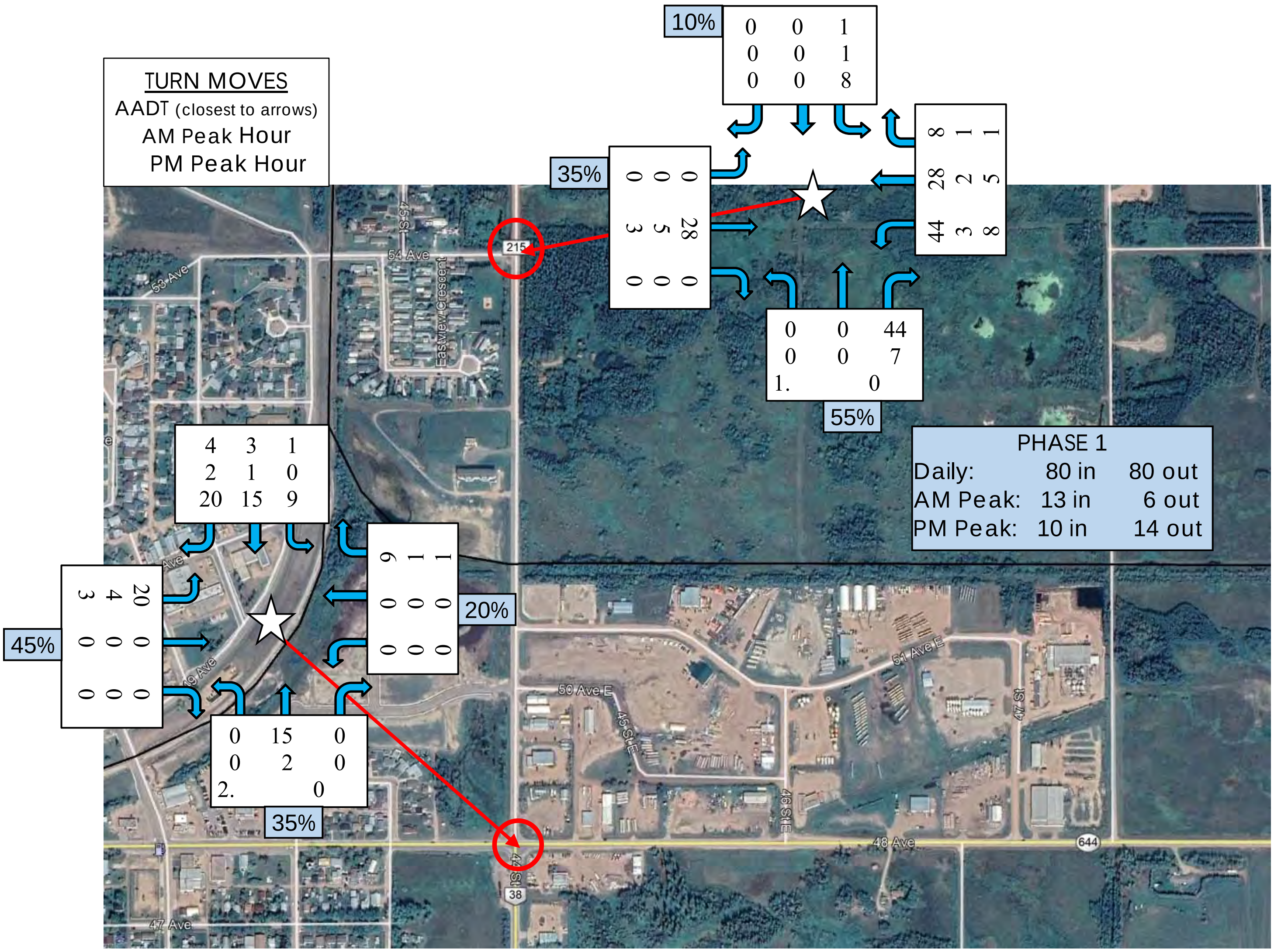


Figure 2.5.2 - NEW DEVELOPMENT TRIPS – Phase 1 & 2 (50%), Year 2035

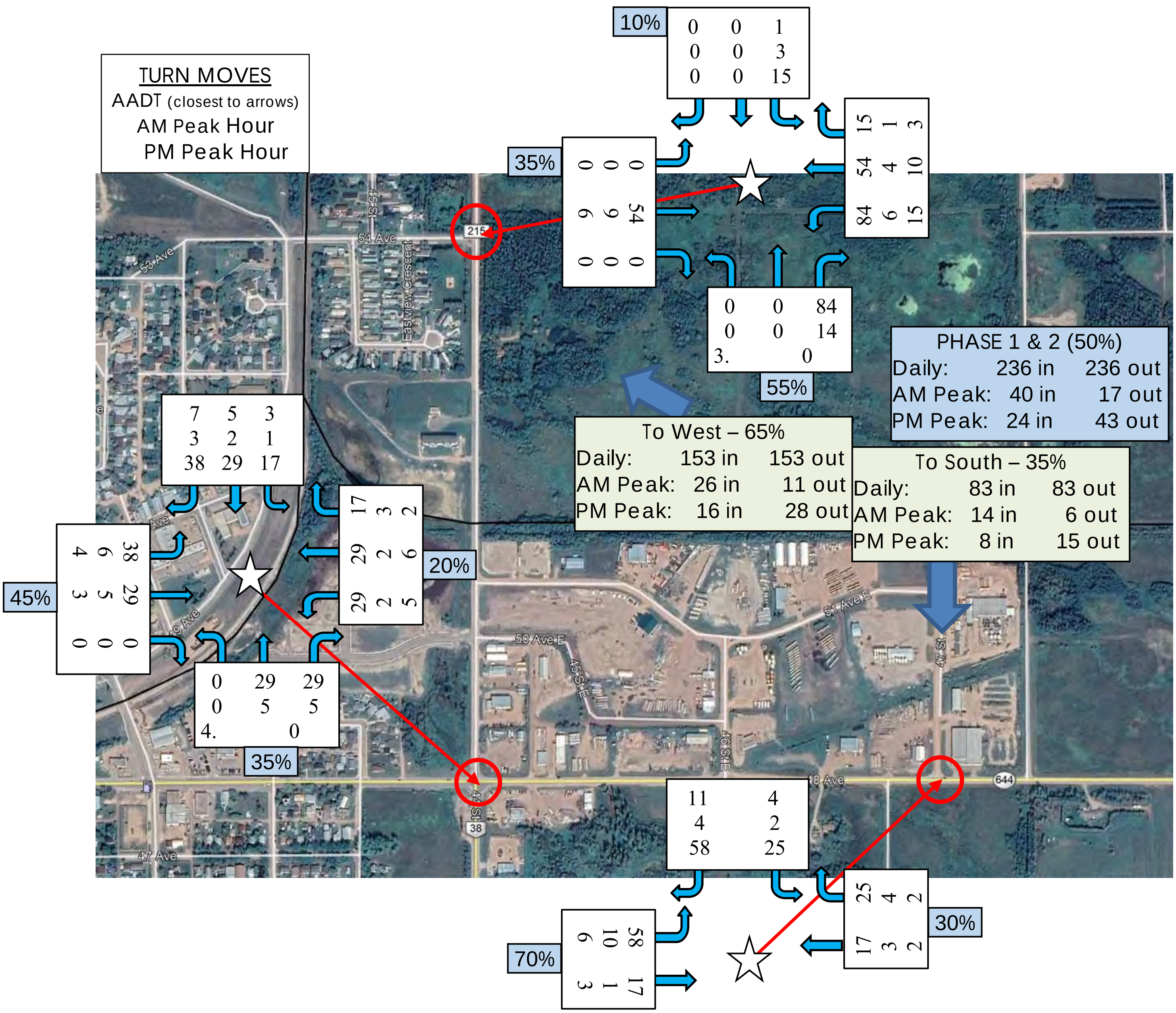
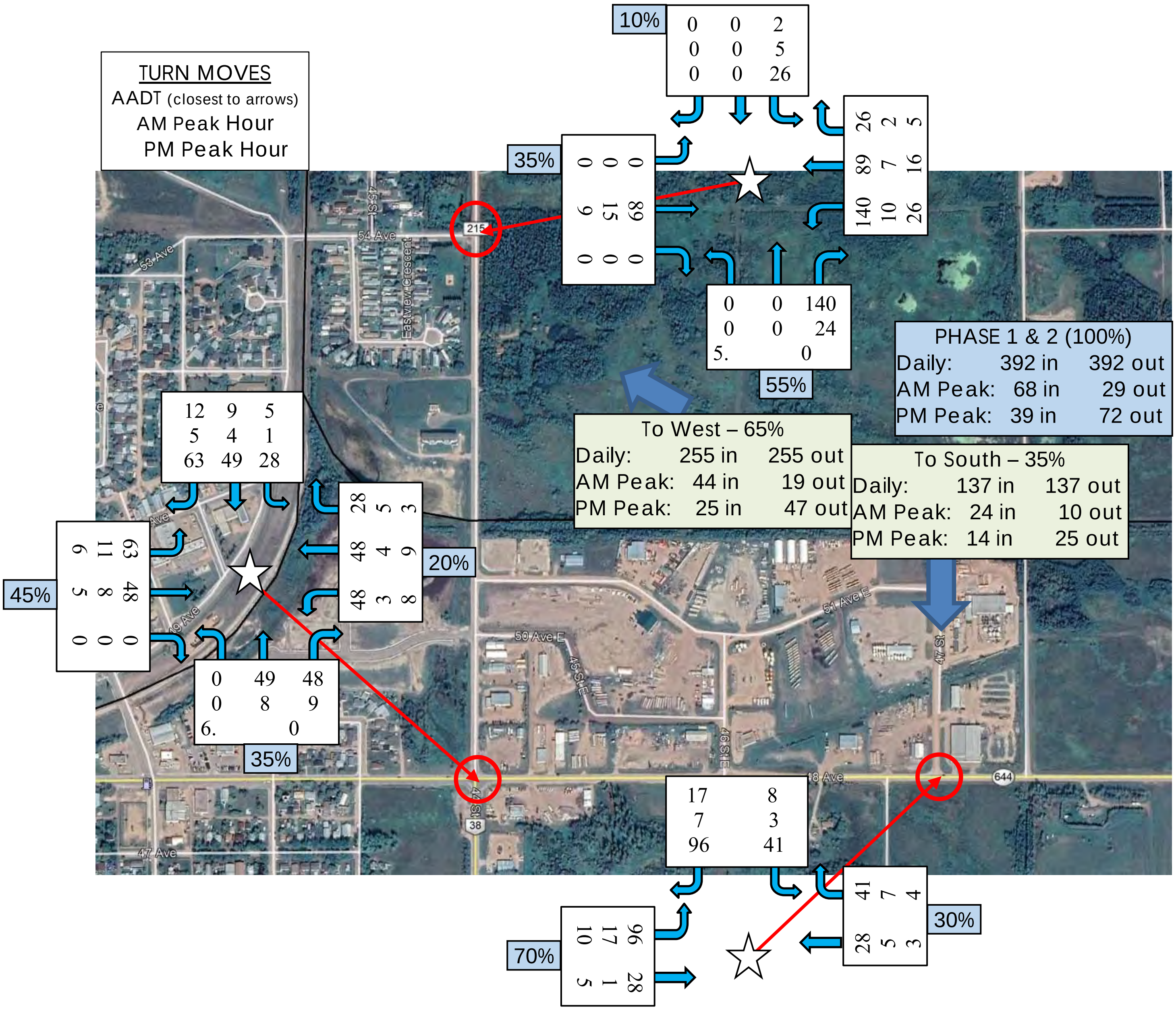


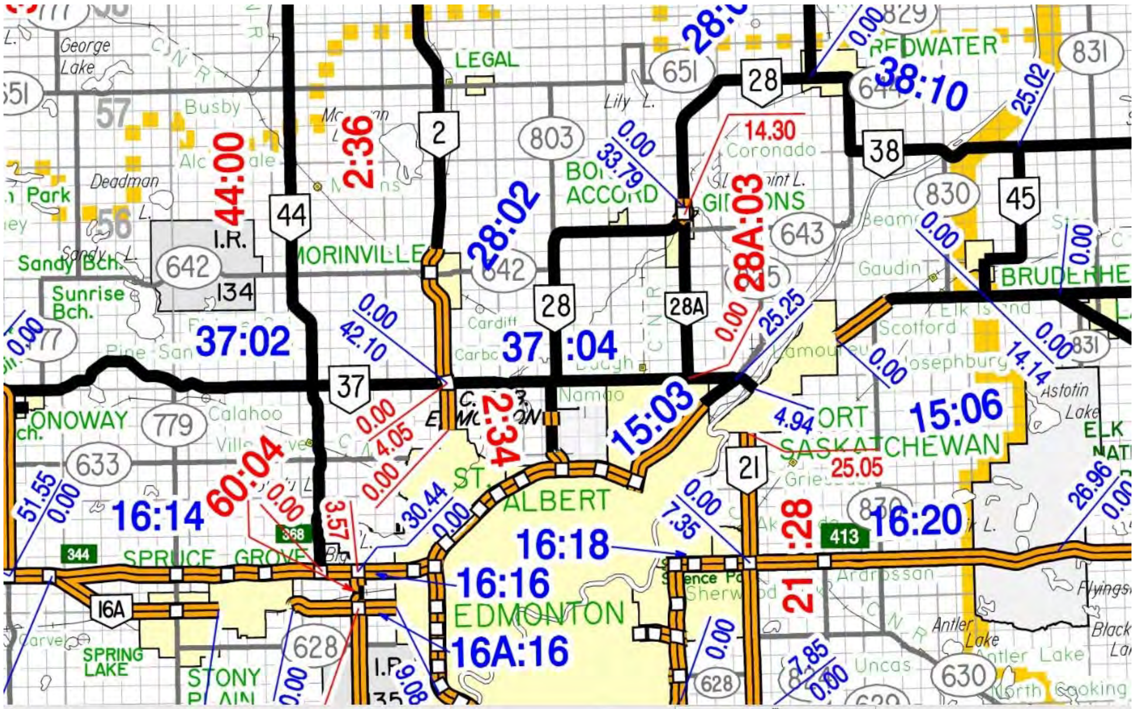
Figure 2.5.2 - NEW DEVELOPMENT TRIPS – Phase 1 & 2 (100%), Year 2045



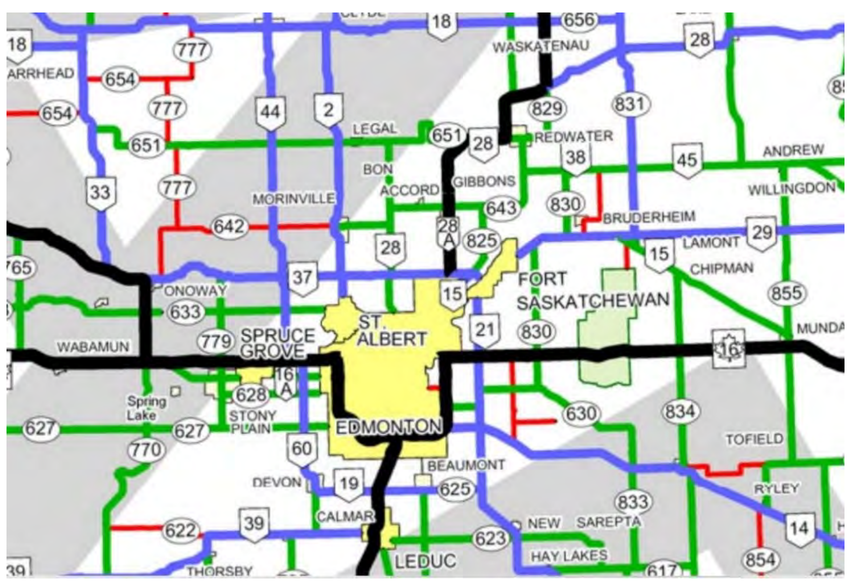
3. EXISTING CONDITIONS

3.1 Physical Properties – Hwy. 38:10 & Hwy. 644:02

Highway 38:10 traverses between the Hwy. 28 to Hwy. 644:02/Hwy. 38:10.



Hwy. 38:10 & Hwy. 644:02 are classified as a Level 3 roadways in accordance with Alberta Transportation's "Provincial Highway Service Classification System". Level 3 roadways typically carry traffic from major generators such as communities and/or resource and developments but with overall shorter travel distances. These roadways provide the connection between Level 4 and Level 2 roadways, and generally serve traffic of an intra regional or inter county nature.

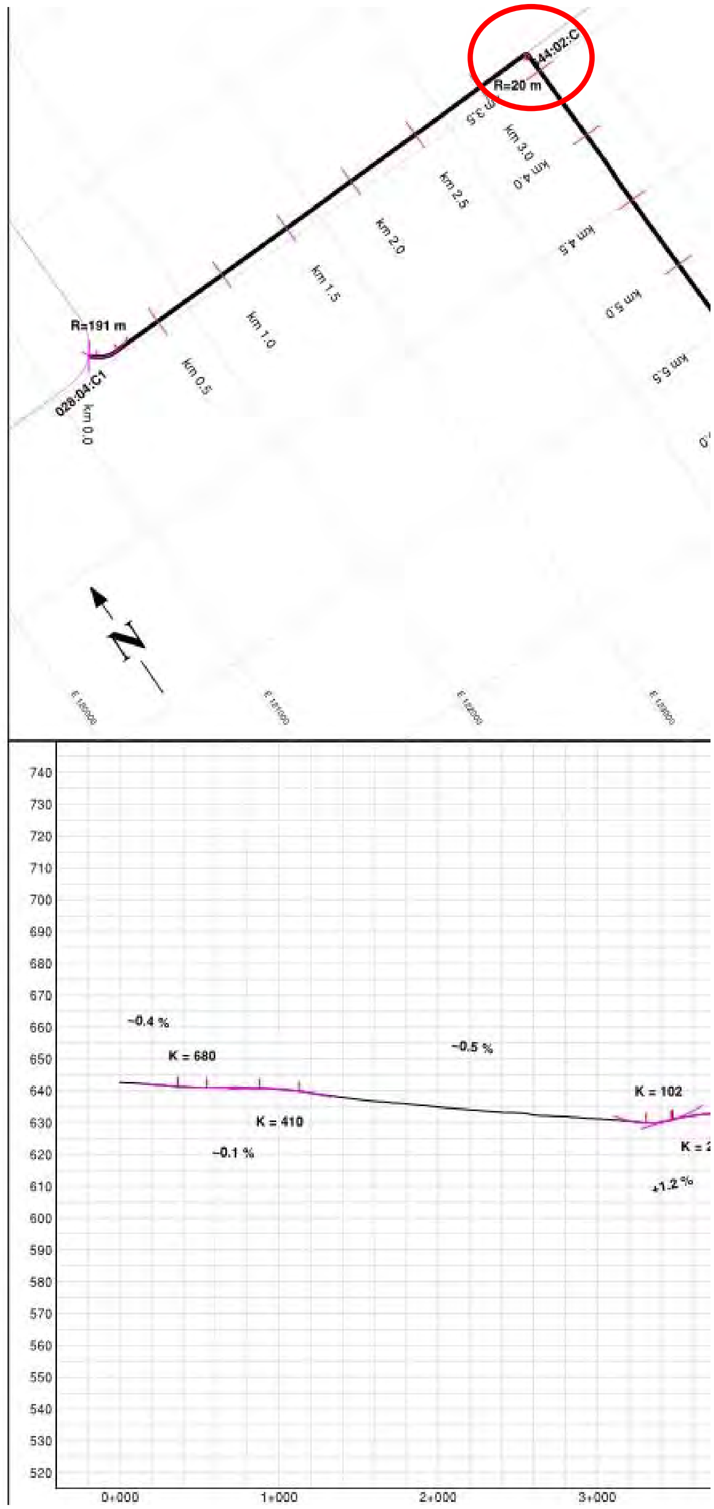


The intersection of Hwy. 38:10/Hwy. 644:02/44th Street and Hwy. 38:10 exists at approximately km 3.38.

Hwy. 38:10 traverses through a right angle from the west to the south.

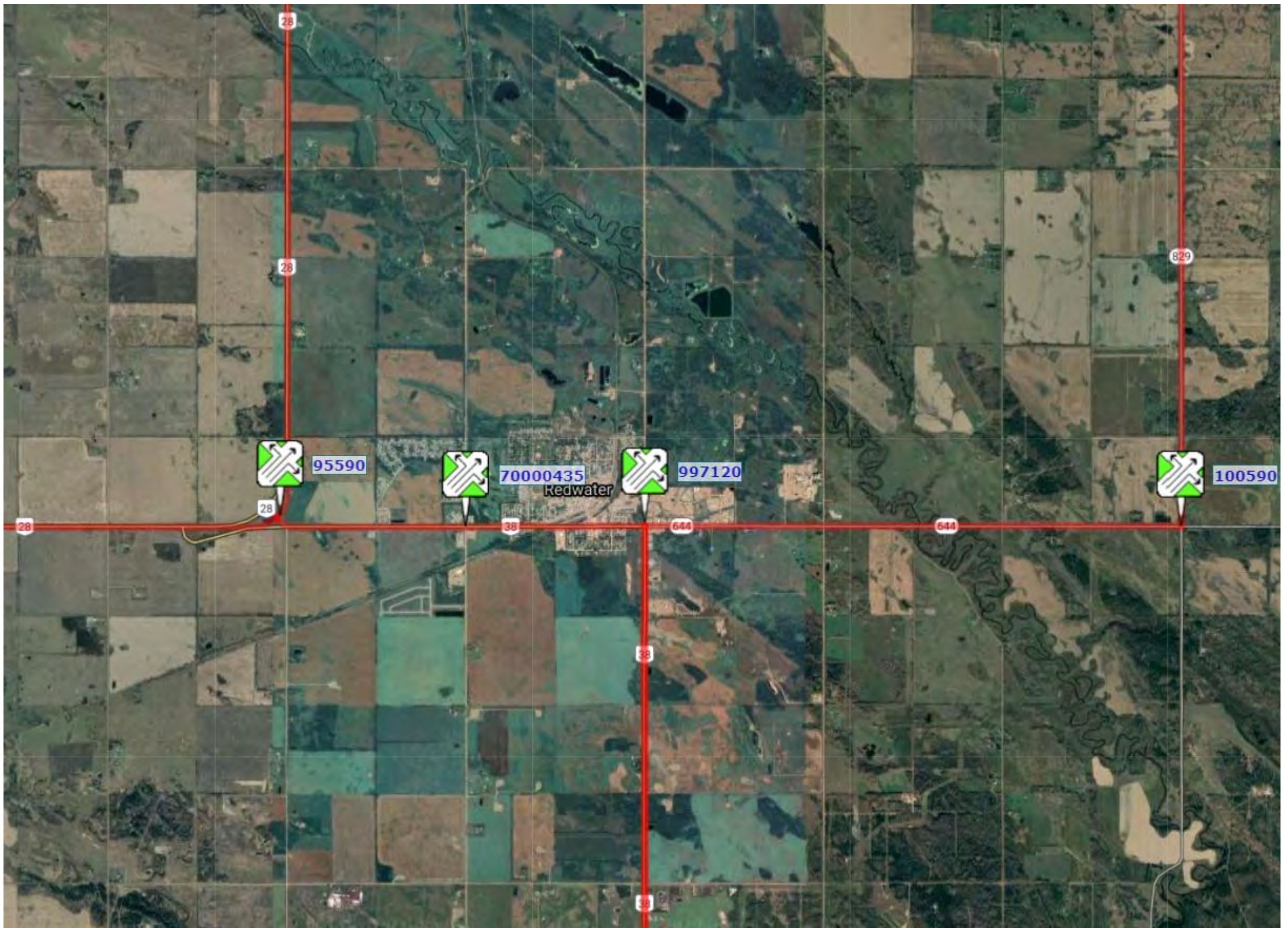
The intersection is with a flat vertical sag curve.

Available sight distance is >500m in all directions.



3.2 Traffic Properties – Hwy. 38:10 & Hwy. 644:02

Existing Alberta Transportation intersectional traffic count locations are shown in the map below:



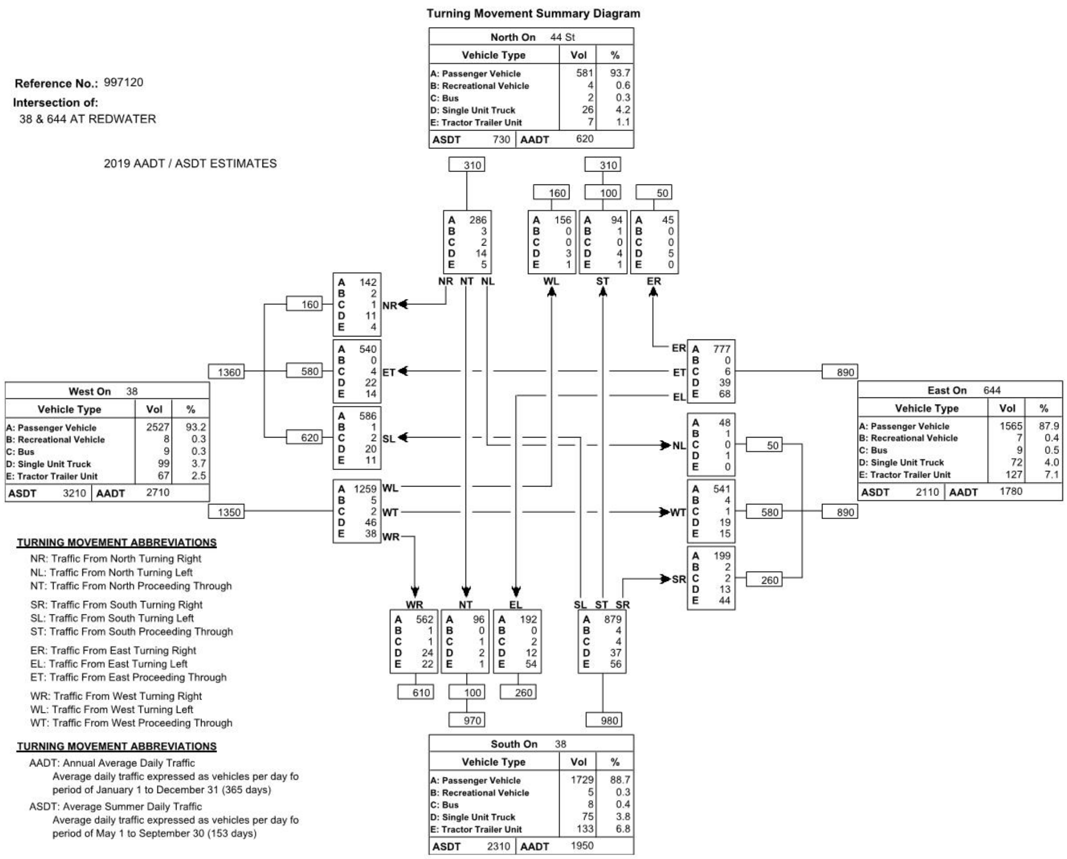
The AT website http://www.transportation.alberta.ca/mapping/ has traffic counts available that are relevant for comparison purposes for this assessment. There is a specific traffic count available for the intersection of Hwy. 38:10 and Hwy. 644:02. Details are shown below.

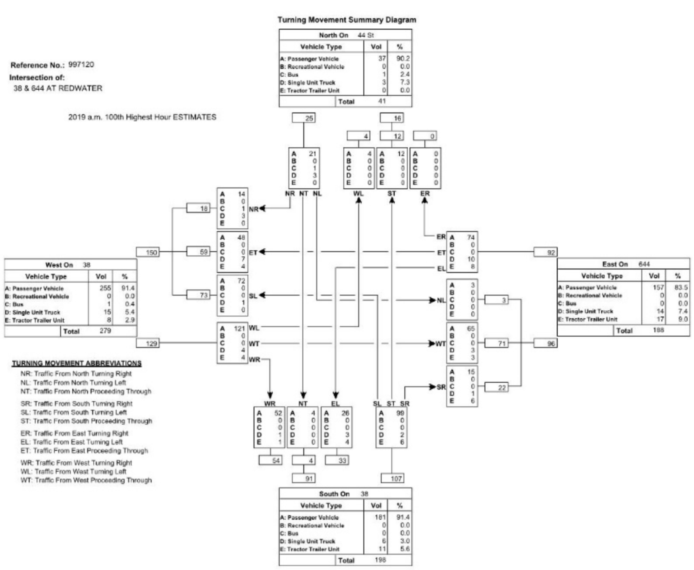
Table-3.2a: 2019 AADT from Alberta Highways Traffic Volume History

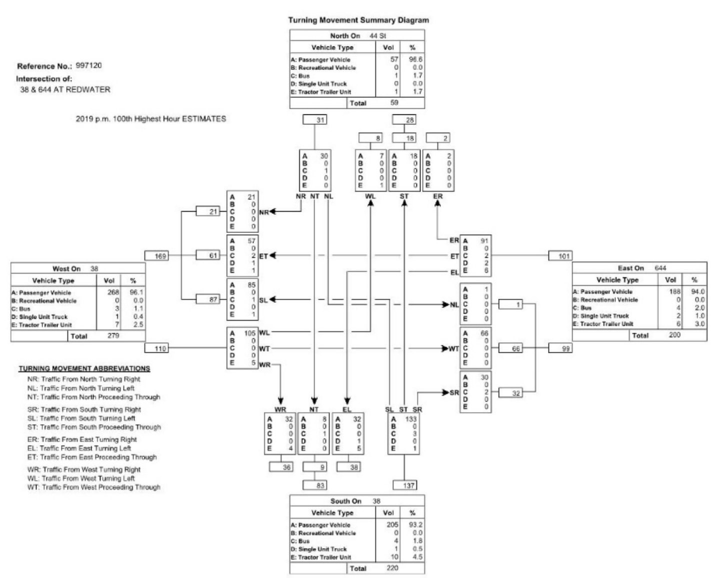
Intersection Leg	2019 AADT 38:10 West	2019 AADT 38:10 South	2019 AADT 644:02 East	2019 AADT 44th Street North
38 & 644 at Redwater (997120)	2710	1950	1780	620

Table-3.2b: 2019 AADT from Alberta Highways Traffic Volume History

Intersection Leg	2019 AADT 644:02 West	2019 AADT 38:10 South
644 & 829 E of Redwater (100590)	1140	1080


Turning Movement Summary Diagram
North On 44 St
Vehicle Type | Vol | %
A: Passenger Vehicle | 581 | 93.7
B: Recreational Vehicle | 4 | 0.6
C: Bus | 2 | 0.3
D: Single Unit Truck | 26 | 4.2
E: Tractor Trailer Unit | 7 | 1.1
ASDT 730 AADT 620
Reference No.: 997120
Intersection of:
38 & 644 AT REDWATER
2019 AADT / ASDT ESTIMATES
West On 38
Vehicle Type | Vol | %
A: Passenger Vehicle | 2527 | 93.2
B: Recreational Vehicle | 8 | 0.3
C: Bus | 9 | 0.3
D: Single Unit Truck | 99 | 3.7
E: Tractor Trailer Unit | 67 | 2.5
ASDT 3210 AADT 2710
East On 644
Vehicle Type | Vol | %
A: Passenger Vehicle | 1565 | 87.9
B: Recreational Vehicle | 7 | 0.4
C: Bus | 9 | 0.5
D: Single Unit Truck | 72 | 4.0
E: Tractor Trailer Unit | 127 | 7.1
ASDT 2110 AADT 1780
South On 38
Vehicle Type | Vol | %
A: Passenger Vehicle | 1729 | 88.7
B: Recreational Vehicle | 5 | 0.3
C: Bus | 8 | 0.4
D: Single Unit Truck | 75 | 3.8
E: Tractor Trailer Unit | 133 | 6.8
ASDT 2310 AADT 1950
TURNING MOVEMENT ABBREVIATIONS
NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through
SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through
ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through
WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through
TURNING MOVEMENT ABBREVIATIONS
AADT: Annual Average Daily Traffic
Average daily traffic expressed as vehicles per day fo
period of January 1 to December 31 (365 days)
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day fo
period of May 1 to September 30 (153 days)


Turning Movement Summary Diagram
Reference No.: 997120
Intersection of:
38 & 644 AT REDWATER
2019 a.m. 100th Highest Hour ESTIMATES
TURNING MOVEMENT ABBREVIATIONS


Turning Movement Summary Diagram
Reference No.: 997120
Intersection of:
38 & 644 AT REDWATER
2019 p.m. 100th Highest Hour ESTIMATES
TURNING MOVEMENT ABBREVIATIONS

3.3 Site Observations – Hwy. 38:10 & Hwy. 644:02

The details of the intersection site are as follows:

Highway 38:10, Hwy. 644:02 & 44th Street

- Highway 38:10 is two-laned and is paved. Posted Speed is 50 kph. The west leg of the Hwy. 38:10 was constructed as an urban cross section with curb and gutter, where the south leg was constructed as a rural cross section with 4:1 sideslopes and ditches. Steel pole street lighting exists along both west & south legs of Hwy. 38:10.
- Highway 644:02 is two-laned and paved. It has a posted speed of 70 kph at the east limit of the exiting industrial subdivision, east of 47th Street. The posted speed reduces to 50 kph just east of 46th Avenue. Steel pole street lighting exists along Hwy. 644:02.
- 44th Street is two-laned and is paved. Posted Speed is 50 kph. There are no painted lines on the road. Street lighting mounted on the wood power poles exists along 44th Street.
- For intersection treatment, there is only an exclusive right turn lane on Hwy. 38:10 from EB to SB. This lane also allows for a very short left turn bypass for EB traffic. Turn lane is approximately 100m with 50m taper.
- Stop conditions exist for NB and SB directions.

Some photos from this site are shown below:

Viewing east on Hwy. 38 West towards the intersection with Hwy. 644/44th Street. Intersection has exclusive right turn lane for turning to the south.

Hwy. 38:10 South – Viewing North at Hwy. 644/44th Street intersection.

Hwy. 644:02 – Viewing West at Hwy. 38 Intersection

44th Street – Viewing South at Hwy. 38 Intersection

44th Street – Viewing North at 54th Avenue Intersection.
Development Access to be to the right.

Highway 644:02 – Viewing East at 47th Avenue Intersection

3.4 Highway Traffic Projections – Hwy. 38:10, Hwy. 644:02, Local Roads

The following historical traffic data for Highway 38:10 is available from the Alberta Transportation's website for the west leg of the Hwy. 38:10 and Hwy. 644:02 intersection and indicates a growth of 0.09% from 1998 to 2019 (21 years), 0.10% from 2004 to 2019 (15 years), -0.06% from 2009 to 2019 (10 years) and -4.38% from 2014 to 2019 (5 years).

Historical Traffic Volumes – Hwy. 38:10, W. of Hwy. 644

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AADT	3350	2880	2970	2920	3140	3430	3470	3310	3560	3500	2710	2710

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
AADT	2660	2660	2710	2890	2970	2730	2670	2730	2870	3110

Using the above data, a growth rate of 1.0% will be used for used for Hwy. 38:10 West non-compounded annually.

The following historical traffic data is also available from the Alberta Transportation's website for the south leg of the Hwy. 38:10 and Hwy. 644:02 intersection and indicates a growth of 0.57% from 1998 to 2019 (21 years), 0.52% from 2004 to 2019 (15 years), -0.15% from 2009 to 2019 (10 years) and -3.47% from 2014 to 2019 (5 years).

Historical Traffic Volumes – Hwy. 38:10, S. of Hwy. 644

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AADT	2270	1980	1890	1820	1960	2290	2360	2260	2500	2460	1950	1950

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
AADT	1740	1740	1770	1890	1940	1870	1810	1850	1950	2110

Using the above data, a growth rate of 1.0% will be used for used for Hwy. 38:10 South non-compounded annually.

The following historical traffic data is also available from the Alberta Transportation's website for the east leg of the Hwy. 38:10 and Hwy. 644:02 intersection and indicates a growth of 0.85% from 1998 to 2019 (21 years), 0.99% from 2004 to 2019 (15 years), 0.35% from 2009 to 2019 (10 years) and -5.41% from 2014 to 2019 (5 years).

Historical Traffic Volumes – Hwy. 644:02, E. of Hwy. 38

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AADT	1800	1720	1720	1720	1720	2440	2440	2340	2360	2340	1780	1780

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
AADT	1510	1510	1560	1660	1710	1550	1550	1570	1600	1680

Using the above data, a growth rate of 1.0% will be used for used for Hwy. 644:02 non-compounded annually.

The following historical traffic data is also available from the Alberta Transportation's website for the north leg of the Hwy. 38:10 and Hwy. 644:02 intersection and indicates a growth of 0.20% from 2002 to 2019 (17 years), 0.85% from 2004 to 2019 (15 years), -1.62% from 2009 to 2019 (10 years) and -2.54% from 2014 to 2019 (5 years).

Historical Traffic Volumes – 44th Street, N. of Hwy. 38

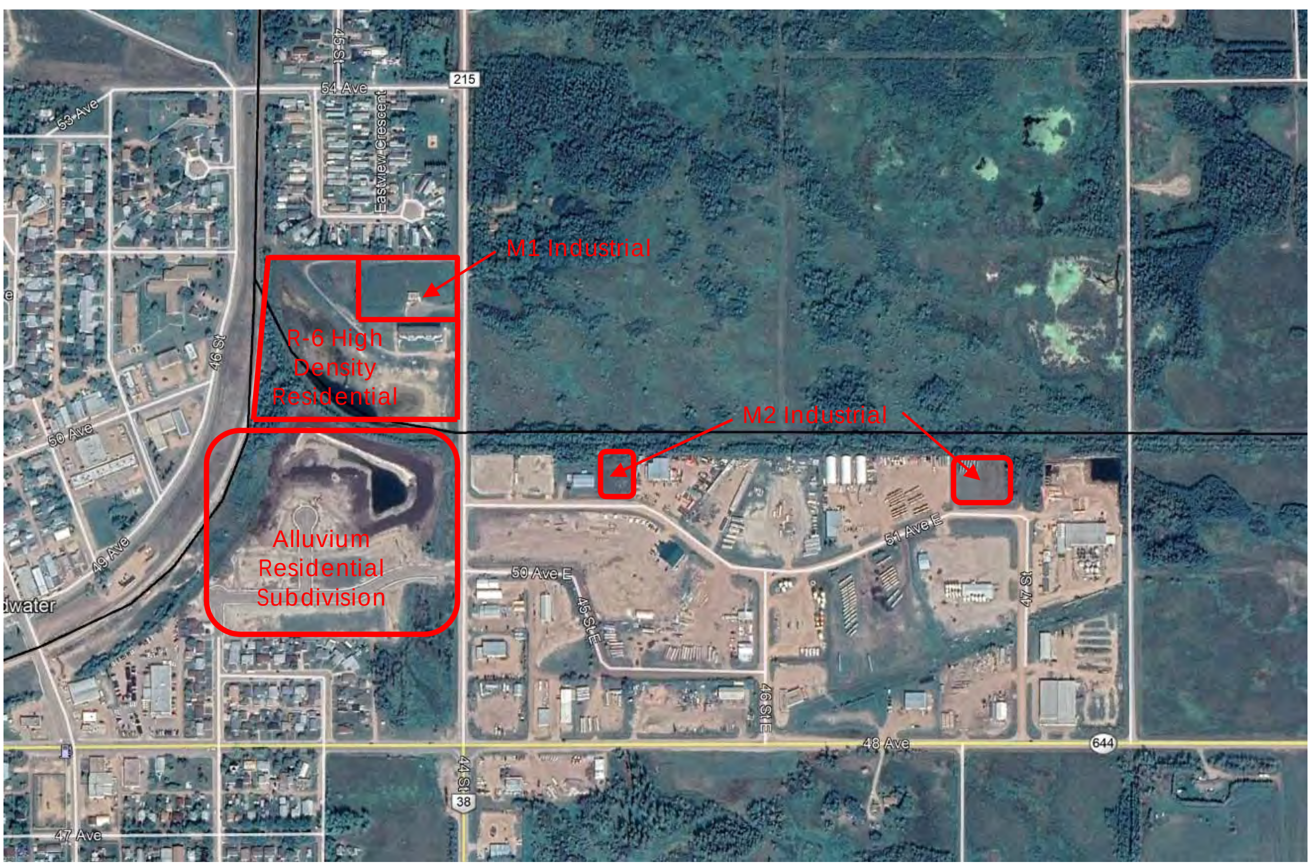
Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AADT	640	740	800	780	860	680	710	670	740	740	620	620

Year	2002	2003	2004	2005	2006	2007
AADT	600	550	550	550	560	600

Using the above data, a growth rate of 1.0% will be used for used for 44th Street non-compounded annually.

3.5 Other Background Traffic Generation

There are three additional areas that new traffic can generate in the future along 44th Street and Hwy. 644:02 outside the development area as follows:



The traffic generation provided in the Traffic Impact Assessment for the Alluvium Residential Subdivision (SE 30-57-21-W4) prepared by the WSP Group in July 16, 2015, is shown below:

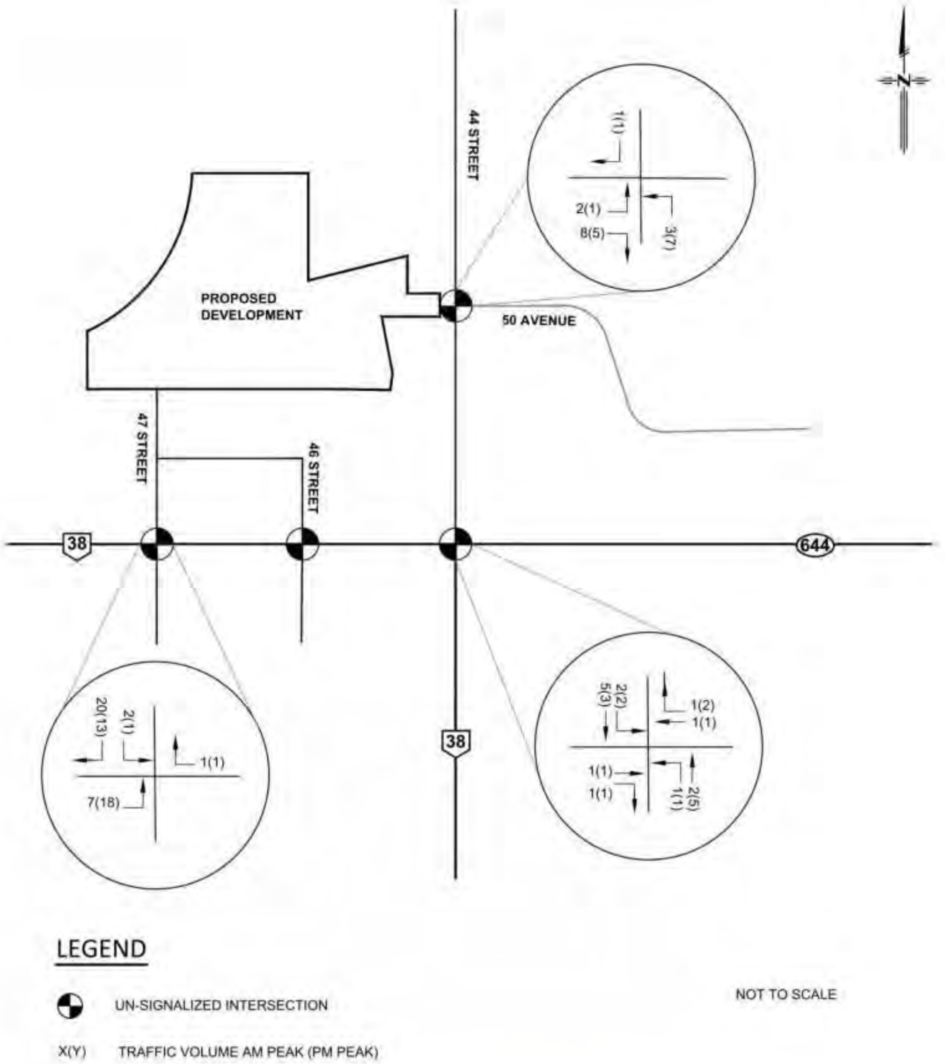
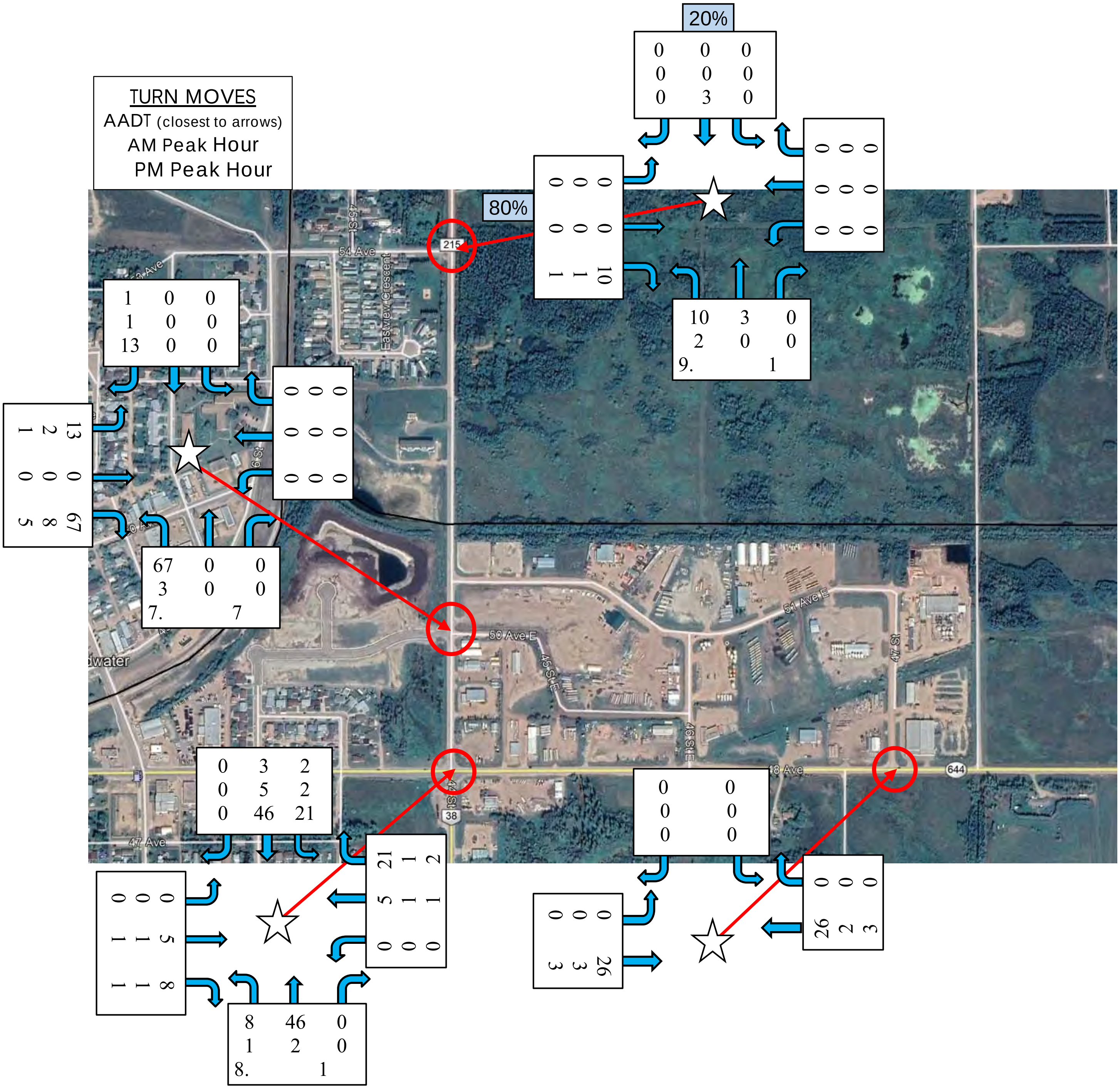


Figure 7. Trip Assignment

Figure 3.5.1 - ALLUVIUM SUBDIVISION TRIPS – 100%, Year 2025



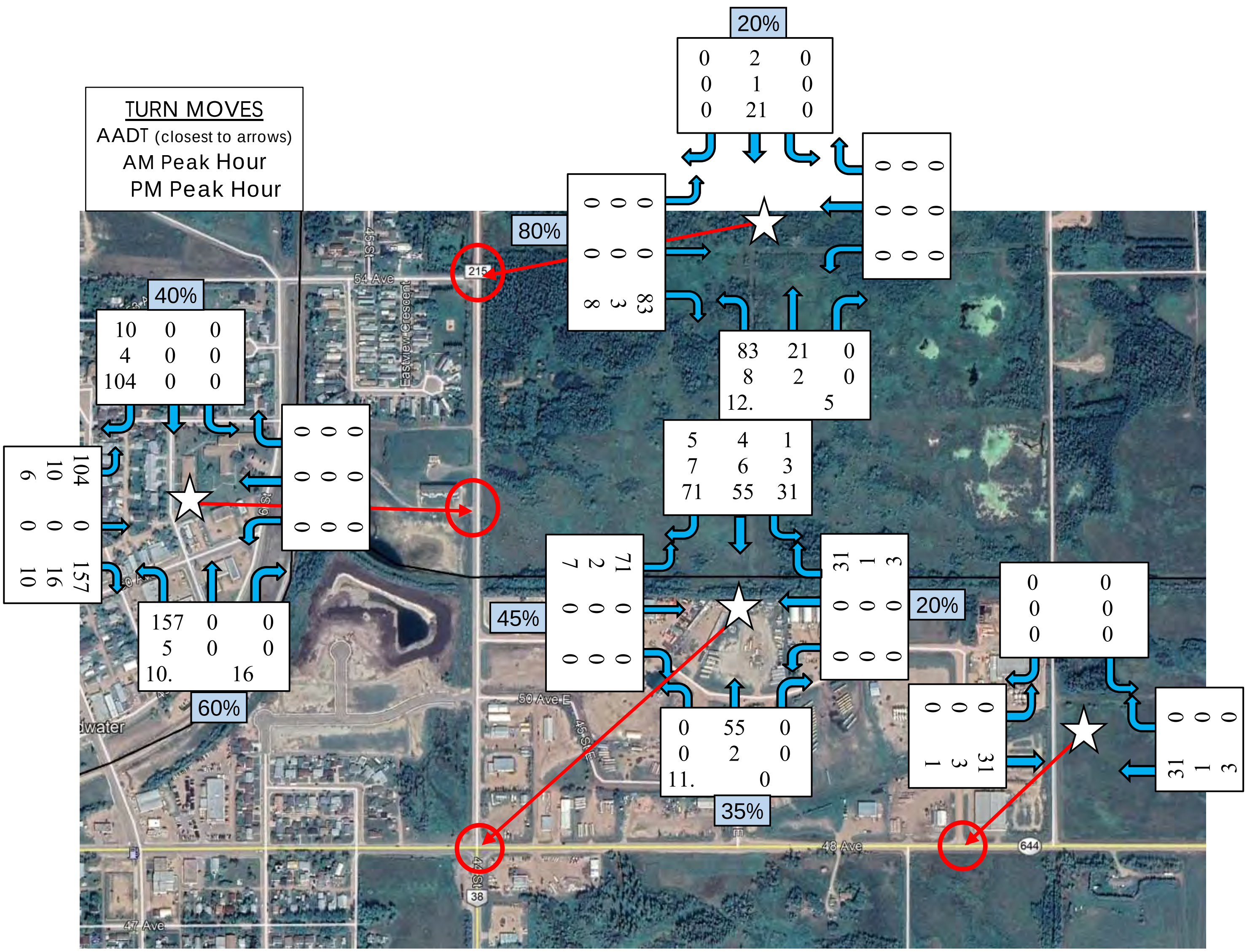
For the R-6 High Density area, the following is estimated for future traffic generation:

Daily:	96 units x 5.44 trips/day	= 522 trips (50% In, 50% Out)
AM Peak Hour:	96 units x 0.36 trips/hour	= 35 trips (26% In, 74% Out)
PM Peak Hour:	96 units x 0.44 trips/hour	= 42 trips (61% In, 39% Out)

The distribution of this traffic is estimated to travel 40% to the north and 60% to the south, fully developed in 10 years.

For the M-1 Industrial area, a truck fill water station is already located at this site. No further development is anticipated.

Figure 3.5.2 - R-6 HIGH DENSITY AREAVISION TRIPS – 100%, Year 2025

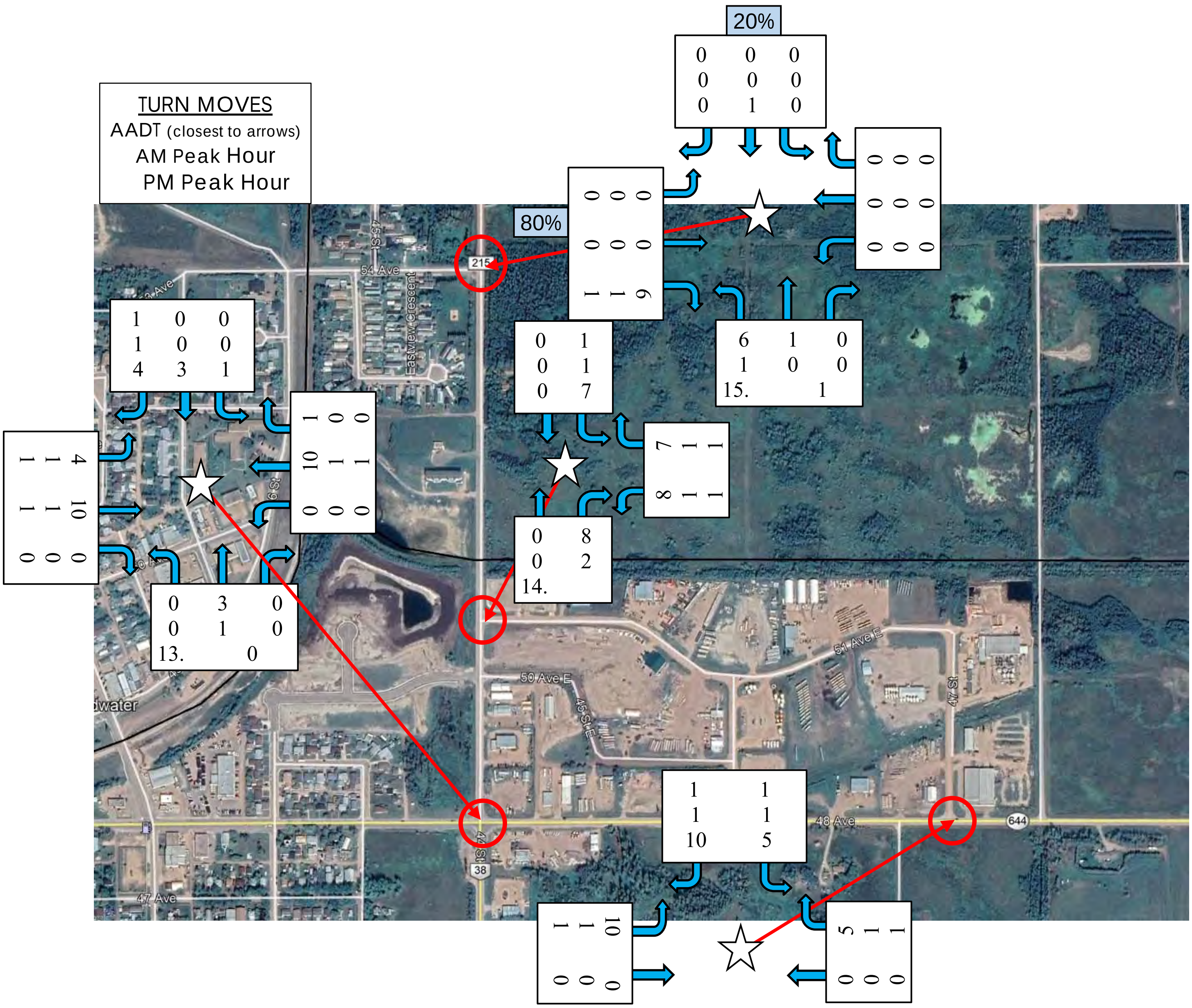


For the M-2 Industrial vacant lots, following is estimated for future traffic generation:

Daily:	8,000 ft2 x 75% x 4.96 trips/day	=	30 trips (50% In, 50% Out)
AM Peak Hour:	8,000 ft2 x 75% x 0.70 trips/hour	=	5 trips (88% In, 12% Out)
PM Peak Hour:	8,000 ft2 x 75% x 0.63 trips/hour	=	4 trips (13% In, 87% Out)

This traffic is anticipated to follow the same distribution patterns as the proposed development.

Figure 3.5.3 - M-2 INDUSTRIAL VACANT LOT TRIPS – 100%, Year 2025



3.6 Total Background Traffic

The turning movements for all background traffic + future traffic from other nearby developments in the area are shown below:

Figure 3.6.1 - TOTAL BACKGROUND TRIPS – Phase 1, Year 2025

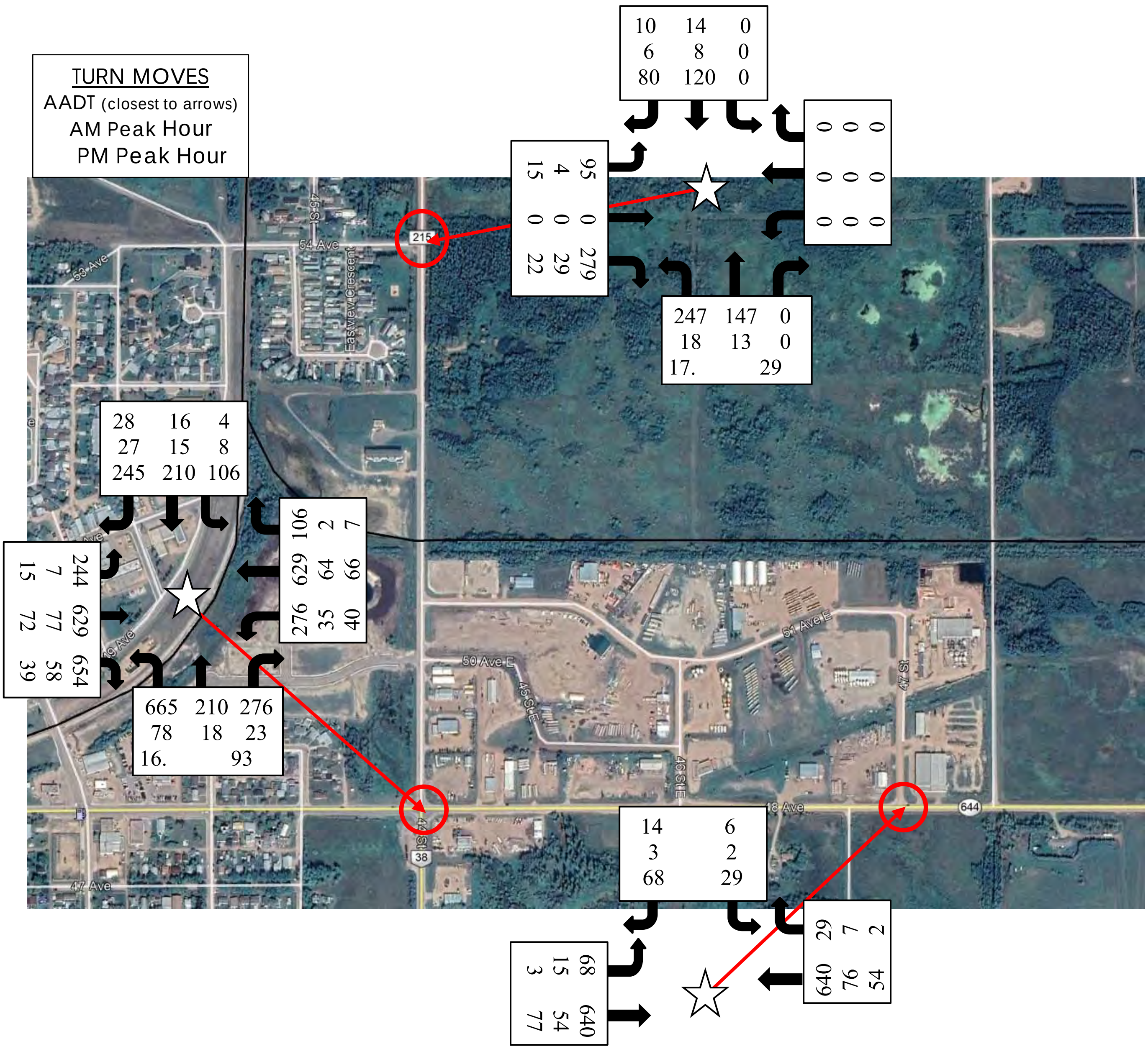


Figure 3.6.2 - TOTAL BACKGROUND TRIPS – Phase 1 & 2 (50%), Year 2035

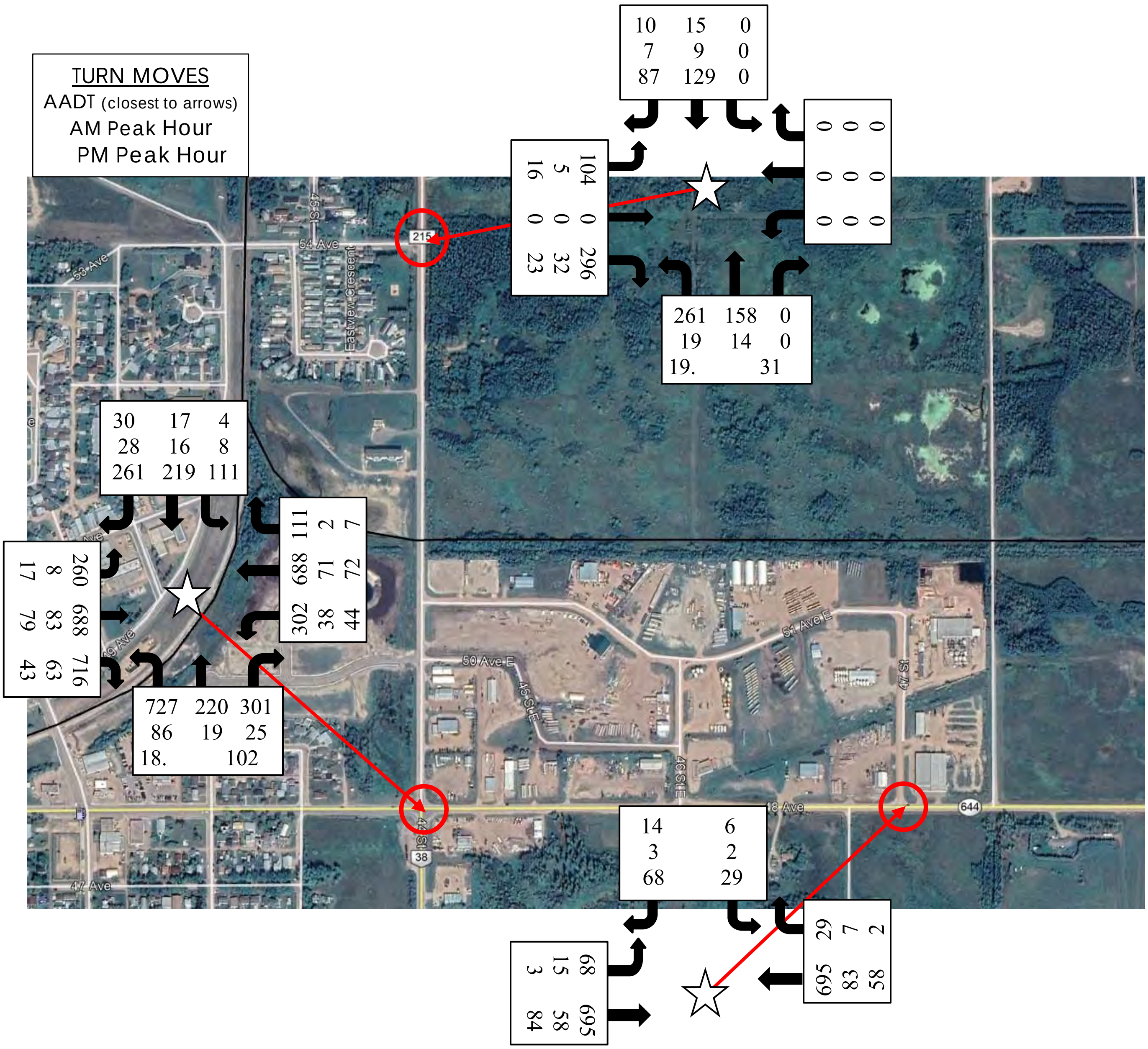
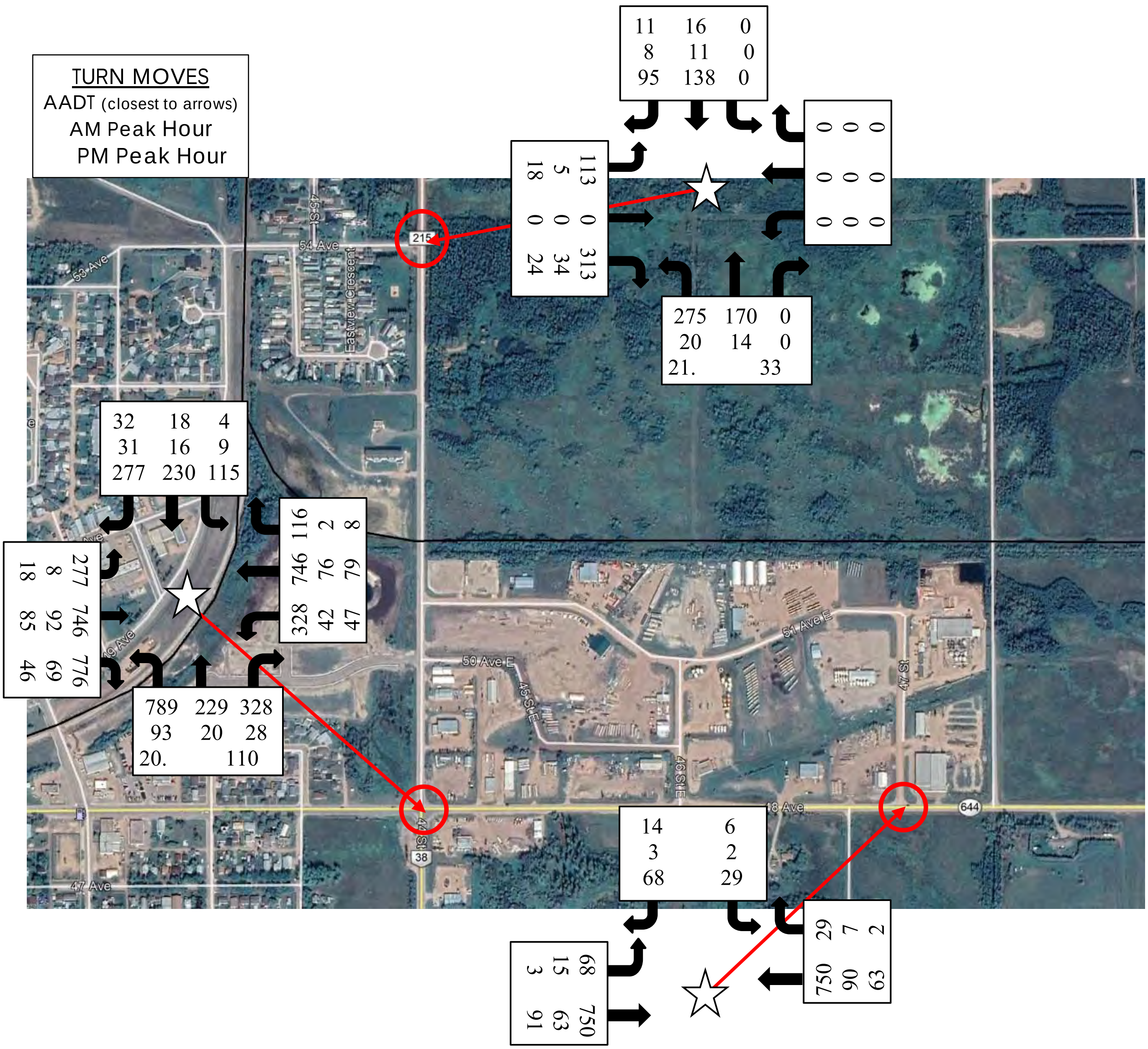


Figure 3.6.3 - TOTAL BACKGROUND TRIPS – Phase 1 & 2 (100%), Year 2045



For the 44th Street and 54th Avenue intersection existing traffic turning movements, the values from the TIA prepared by McElhanney was used. Daily volumes were calculated using the average of the AM and PM Peak Hours and multiplied by 10.

For the Hwy. 644:02 & 54th Street existing traffic turning movements, the following was used to estimate traffic:

Daily: 43,760 ft2 x 75% x 4.96 trips/day = 164 trips (50% In, 50% Out)
AM Peak Hour: 43,760 ft2 x 75% x 0.70 trips/hour = 23 trips (88% In, 12% Out)
PM Peak Hour: 43,760 ft2 x 75% x 0.63 trips/hour = 21 trips (13% In, 87% Out)

A distribution split of 70% to and from the west, and 30% to and from the east was assumed to estimate the turning movement diagram.

3.7 Combined Traffic Projections

The following tables show the estimated combined traffic volumes at the intersection of Highway 38:10, Highway 644:02 and 44th Street.

Combined Traffic Forecast, Daily Volumes

Year	Hwy. 38:10 West Leg Combined	Hwy. 38:10 South Leg Combined	Hwy. 644:02 East Leg Combined	44th Street North Leg Combined
2025	3106	2321	2040	1209
2035	3474	2601	2351	1350
2045	3833	2874	2627	1524

Combined Traffic Forecast, Peak Hour Volumes

Year	Hwy. 38:10 West Leg Combined am/pm	Hwy. 38:10 South Leg Combined am/pm	Hwy. 644:02 East Leg Combined am/pm	44th Street North Leg Combined am/pm
2025	317 / 321	230 / 257	210 / 225	87 /115
2035	355 / 363	261 / 291	245 / 265	101 / 131
2045	397 / 402	292 / 323	279 / 299	120/ 154

The Combined AADT Turning Movements for Years 2025, 2035 and 2045 are shown below:

Figure 3.7.1 - COMBINED TRIPS – Phase 1, Year 2025

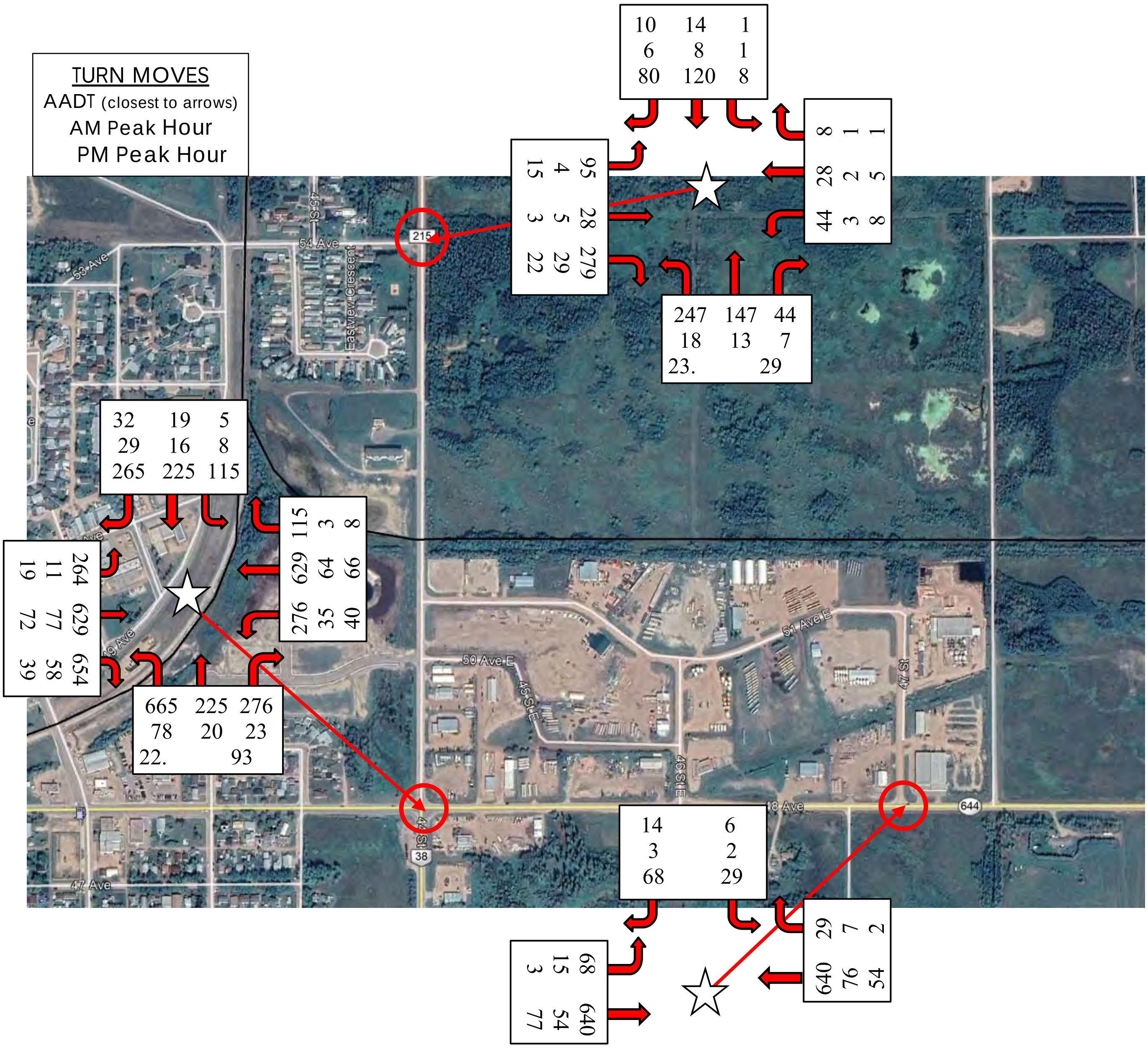


Figure 3.7.2 - COMBINED TRIPS – Phase 1 & 2 (50%), Year 2035

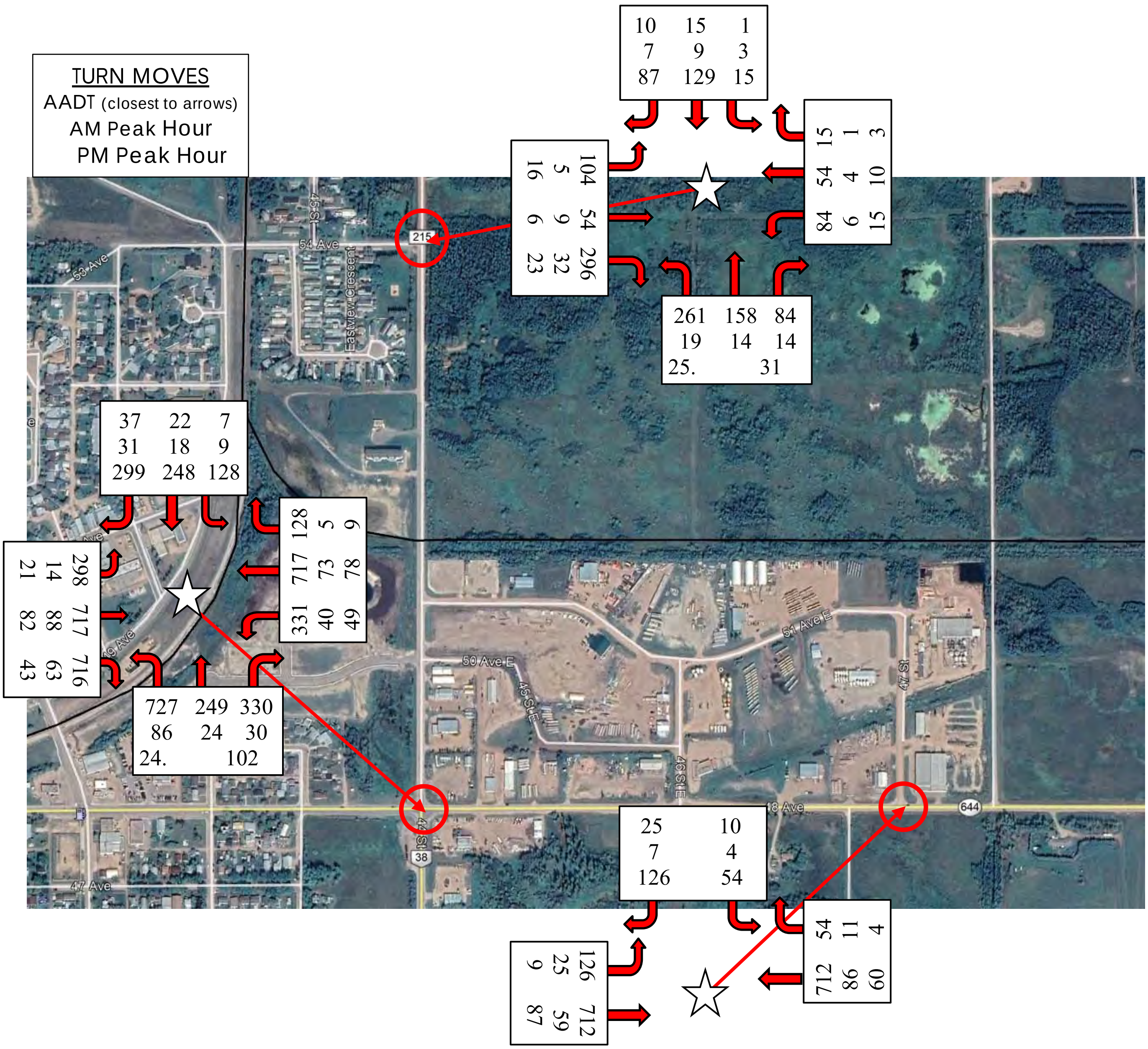
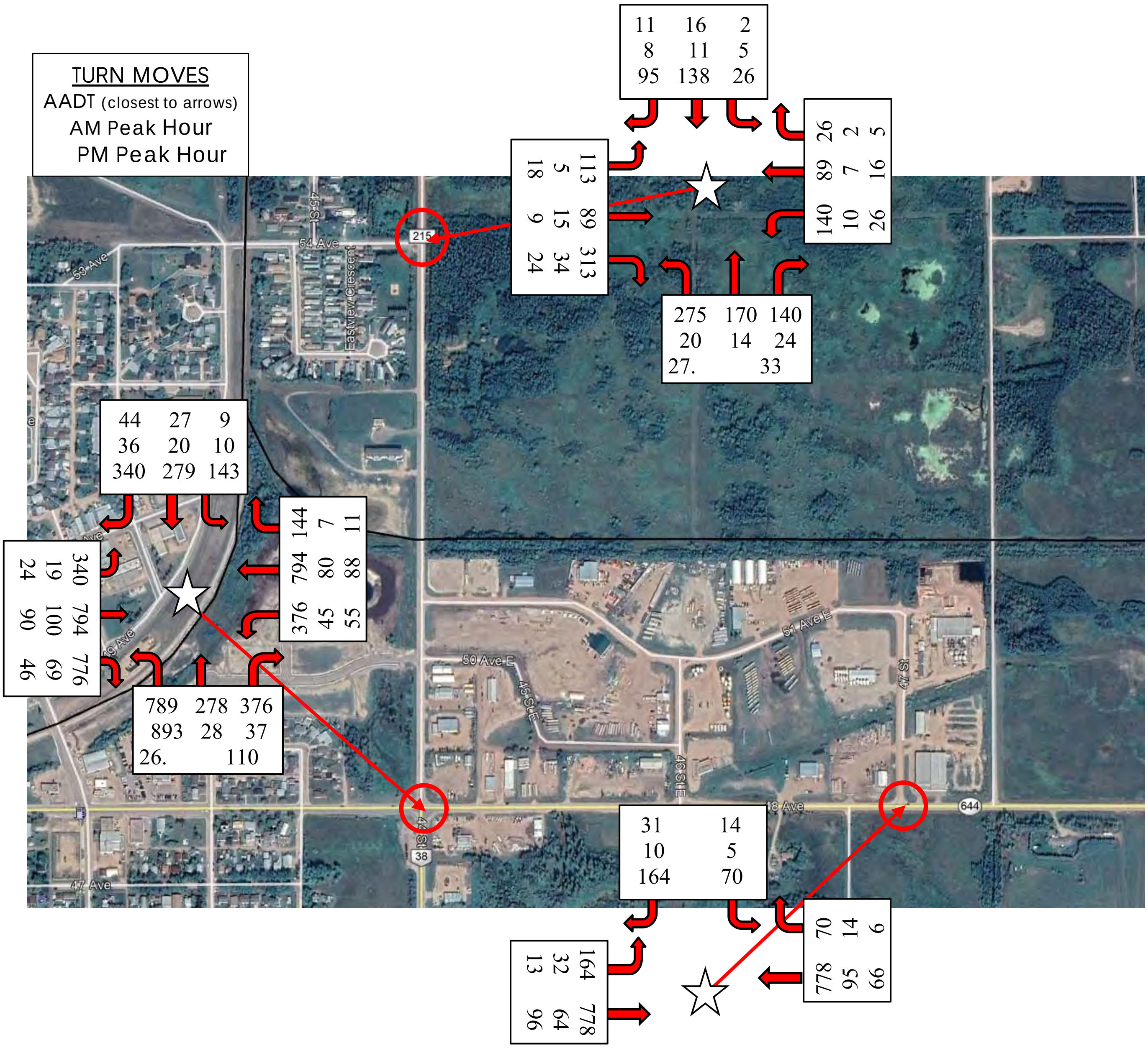


Figure 3.7.3 - COMBINED TRIPS – Phase 1 & 2 (100%), Year 2045



4. TRAFFIC ANALYSIS – Hwy. 38 :10, Hwy. 644 :02 & 44th Street

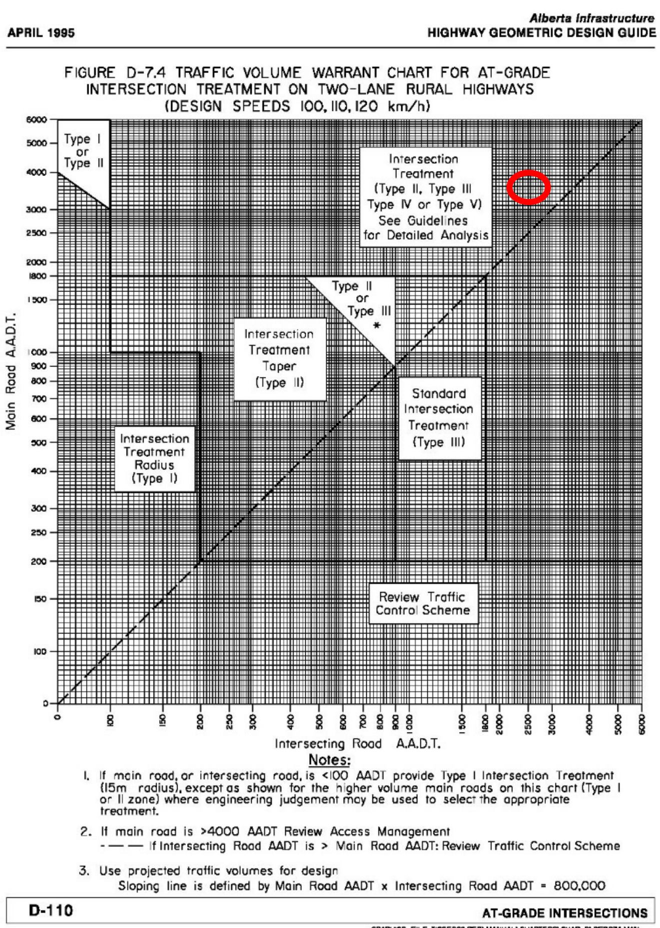
4.1 Design Speed

The posted speed on Highway 38:10 and 44th Street at this location is 50 km/hr and therefore a design speed of 60 km/h will be used for the analysis and the results assessed upon this.

The posted speed on Highway 644:02 at this location is 50 km/hr up to 46th Street and 70 km/hr east of 46th Street. A design speed of 60 km/h and 80 km/hr respectively will be used for the analysis and the results assessed upon this.

4.2 Determination Based on Traffic Volume Warrant Chart

The 2025, 2035 and 2045 AADT values for the Hwy. 38:10, Hwy. 644:02 and 44th Street intersection indicates from referencing Figure D-7.4, "Traffic Volume Warrant Chart for At-Grade Intersection Treatment on Two-Lane Rural Highways (Design Speeds 100/110/120 km/h)" (using the west & south legs), that a Detailed Analysis is required.



4.3 Detailed Analysis

Right Turn

In accordance with Alberta Transportation's "Highway Geometric Design Guide" (Section D.7.7), an exclusive right turn lane is warranted on an undivided highway when all three of the following conditions are met:

- Main (or though) road AADT ≥ 1,800
- Intersecting road AADT ≥ 900
- Right turn daily traffic volume ≥ 360 for the movement in question.

The following table indicates the status of these requirements for right turns from Highway 38:10 west to Highway 38:10 south.

Table 4.3.1 - Right Turn Warrant – East Bound

Condition	Existing Year 2021	Stage 1 Year 2025	Stage 1 & Stage 2 (50%) Year 2035	Stage 1 & Stage 2 (100%) Year 2045
	(Condition Met)	**(Condition Met)**	**(Condition Met)**	**(Condition Met)**
Main Road (Hwy. 38:10 W)	2761	3106	3474	3833
AADT ≥ 1800	(Yes)	(Yes)	(Yes)	(Yes)
Intersecting Road (Hwy. 38:10 S)	1987	2321	2601	2874
AADT ≥ 900	(Yes)	(Yes)	(Yes)	(Yes)
Right turn daily traffic ≥ 360	621	654	716	776
	(Yes)	(Yes)	(Yes)	(Yes)
For movement in question	(Yes)	(Yes)	(Yes)	(Yes)

Based on the projected volumes, an exclusive right turn lane is required for the eastbound direction for the next 24 years with the existing traffic in 2021 and added traffic from the proposed development.

The following table indicates the status of these requirements for right turns from Highway 644:02 west to 44th Street north.

Table 4.3.2 - Right Turn Warrant – West Bound

Condition	Existing Year 2021	Stage 1 Year 2025	Stage 1 & Stage 2 (50%) Year 2035	Stage 1 & Stage 2 (100%) Year 2045
	(Condition Met)	(Condition Met)	(Condition Met)	(Condition Met)
Main Road (Hwy. 644:02 E)	1814	2040	2351	2627
AADT ≥ 1800	(Yes)	(Yes)	(Yes)	(Yes)
Intersecting Road (44th Street N)	632	1209	1350	1524
AADT ≥ 900	(No)	(Yes)	(Yes)	(Yes)
Right turn daily traffic ≥ 360	51	115	128	144
	(No)	(No)	(No)	(No)
For movement in question	(No)	(No)	(No)	(No)

Based on the projected volumes, <u>an exclusive right turn lane is not required</u> for the westbound direction for the next 24 years with the existing traffic in 2021 and added traffic from the proposed development.

<u>Left Turn</u>

<u>Eastbound</u>

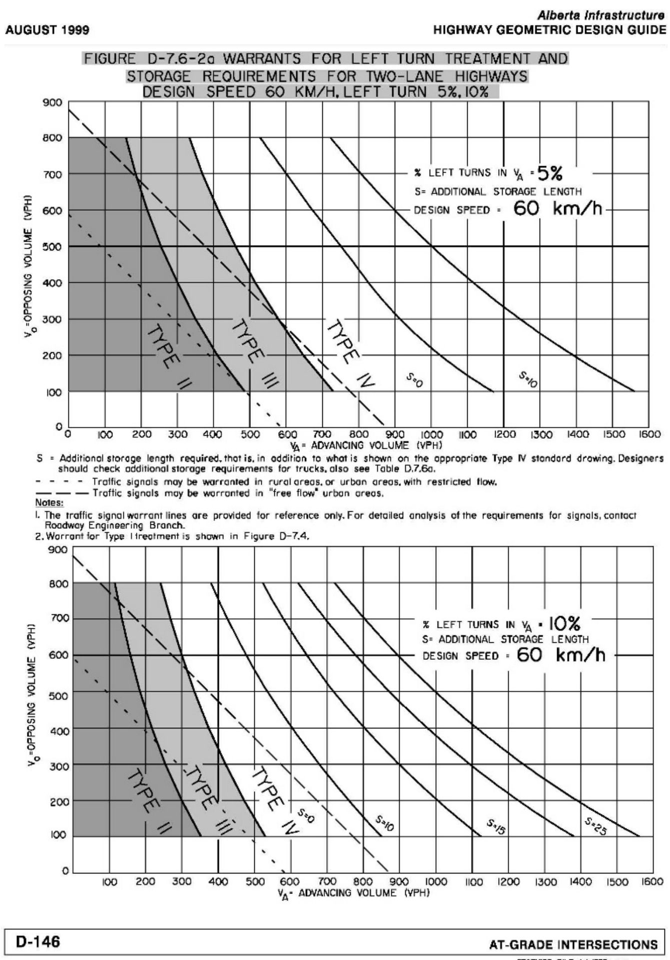
The Highway Geometric Design Guide Section D.7.6 gives graphical guidelines for determining left turn warrant. The graphs use peak (100th highest) hour volumes and factor in percent turning and design speed to identify the required treatment for the intersection. The following table shows the treatments needed for current and projected traffic volumes.

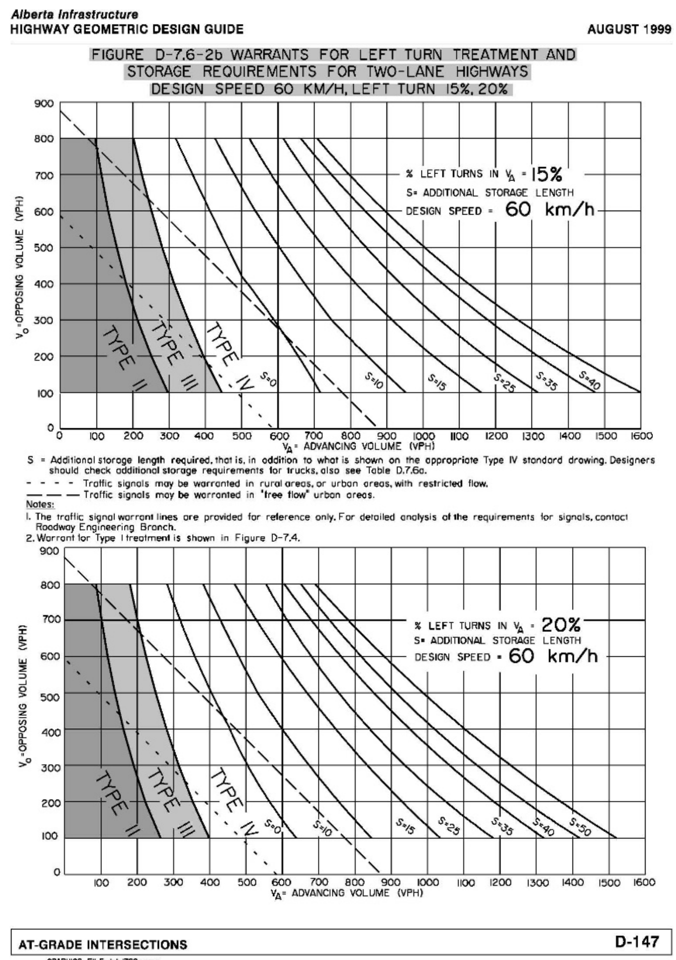
Table 4.3.3 - Required Treatment Type – Hwy. 38 to 44th Street EB, AM PEAK

	Existing Year 2021	Stage 1 Year 2025	Stage 1 & Stage 2 (50%) Year 2035	Stage 1 & Stage 2 (100%) Year 2045
Peak 100th Hour – AM Peak Hr				
% Left Turns	3.1%	7.5%	8.5%	15.0%
V_a = Advancing Volume (VPH)	131	146	165	160
V_0 = Opposing Volume (VPH)	94	102	118	154
Vl = Left turning Volume (VPH)	4	11	14	24
Design Speed	60 km/hr	60 km/hr	60 km/hr	60 km/hr
Required Treatment Type	**Type II**	**Type II**	**Type II**	**Type II**

Table 4.3.4 - Required Treatment Type – Hwy. 38 to 44th Street EB, PM PEAK

	Existing Year 2021	Stage 1 Year 2025	Stage 1 & Stage 2 (50%) Year 2035	Stage 1 & Stage 2 (100%) Year 2045
Peak 100th Hour – PM Peak Hr				
% Left Turns	6.9%	14.6%	14.4%	10.1%
V_a = Advancing Volume (VPH)	116	130	146	188
V_0 = Opposing Volume (VPH)	103	114	136	132
Vl = Left turning Volume (VPH)	8	19	21	19
Design Speed	60 km/hr	60 km/hr	60 km/hr	60 km/hr
Required Treatment Type	**Type II**	**Type II**	**Type II**	**Type II**





Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

Main Rd: Hwy. 38:10 West Leg **Minor Rd:** 44th Street North Leg **Direction:** EB **Period:** AM Peak **Year of Analysis:** 2021 **Date of Analysis:** Dec. 28, 2020

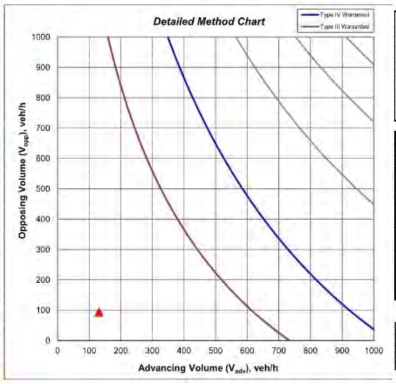
INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	2,761
Minor (intersecting) Road A.A.D.T	1,987
Left turn volume (V_{LT}), veh/h:	4
Advancing volume (V_{adv}), veh/h:	131
Opposing volume (V_{opp}), veh/h:	94
Left turn truck volume, trucks/h:	1
Right turn volume (V_{RT}), veh/day:	51

OUTPUT	Value
Percent left-turns in advancing volume:	3.1%
Percent trucks in left turn volume:	25.0%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.0%
Calculated conflicts per hour, veh/h:	0.1
Use Detailed Method	
Type II	

Additonal Storage Not Requied		
	base storage requirement	-
	- standard storage length	-
	+ additional truck storage	-
	= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

Main Rd: Hwy. 38:10 West Leg **Minor Rd:** 44th Street North Leg **Direction:** EB **Period:** PM Peak **Year of Analysis:** 2021 **Date of Analysis:** Dec. 28, 2020

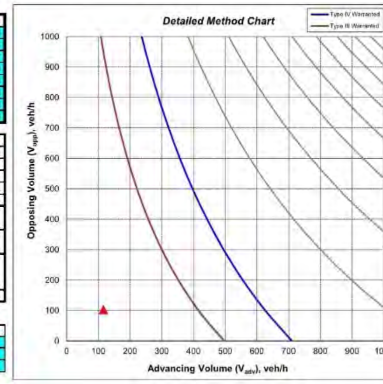
INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	3,474
Minor (intersecting) Road A.A.D.T	2,601
Left turn volume (V_{LT}), veh/h:	8
Advancing volume (V_{adv}), veh/h:	116
Opposing volume (V_{opp}), veh/h:	103
Left turn truck volume, trucks/h:	2
Right turn volume (V_{RT}), veh/day:	128

OUTPUT	Value
Percent left-turns in advancing volume:	6.9%
Percent trucks in left turn volume:	25.0%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.1%
Calculated conflicts per hour, veh/h:	0.1
Use Detailed Method	
Type II	

Additonal Storage Not Requied		
	base storage requirement	-
	- standard storage length	-
	+ additional truck storage	-
	= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

Main Rd: Hwy. 38:10 West Leg **Minor Rd:** 44th Street North Leg **Direction:** EB **Period:** AM Peak **Year of Analysis:** 2025 - Stage 1 **Date of Analysis:** Dec. 28, 2020

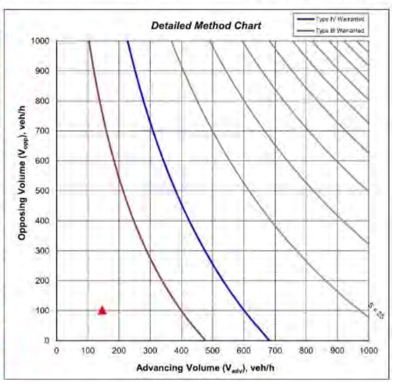
INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	3,106
Minor (intersecting) Road A.A.D.T	2,321
Left turn volume (V_{LT}), veh/h:	11
Advancing volume (V_{adv}), veh/h:	146
Opposing volume (V_{opp}), veh/h:	102
Left turn truck volume, trucks/h:	3
Right turn volume (V_{RT}), veh/day:	110

OUTPUT	Value
Percent left-turns in advancing volume:	7.5%
Percent trucks in left turn volume:	27.3%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.1%
Calculated conflicts per hour, veh/h:	0.2
Use Detailed Method	
Type II	

Additonal Storage Not Requied		
	base storage requirement	-
	- standard storage length	-
	+ additional truck storage	-
	= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

Main Rd: Hwy. 38:10 West Leg **Minor Rd:** 44th Street North Leg **Direction:** EB **Period:** PM Peak **Year of Analysis:** 2025 Stage 1 **Date of Analysis:** Dec. 28, 2020

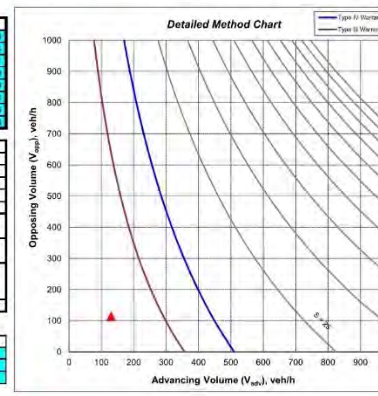
INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	3,474
Minor (intersecting) Road A.A.D.T	2,601
Left turn volume (V_{LT}), veh/h:	19
Advancing volume (V_{adv}), veh/h:	130
Opposing volume (V_{opp}), veh/h:	114
Left turn truck volume, trucks/h:	6
Right turn volume (V_{RT}), veh/day:	128

OUTPUT	Value
Percent left-turns in advancing volume:	14.6%
Percent trucks in left turn volume:	31.6%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.2%
Calculated conflicts per hour, veh/h:	0.2
Use Detailed Method	
Type II	

Additonal Storage Not Requied		
	base storage requirement	-
	- standard storage length	-
	+ additional truck storage	-
	= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

Main Rd: Hwy. 38:10 West Leg **Minor Rd:** 44th Street North Leg **Direction:** EB **Period:** AM Peak **Year of Analysis:** 2035 Stage 1&2(50% **Date of Analysis:** Dec. 28, 2020

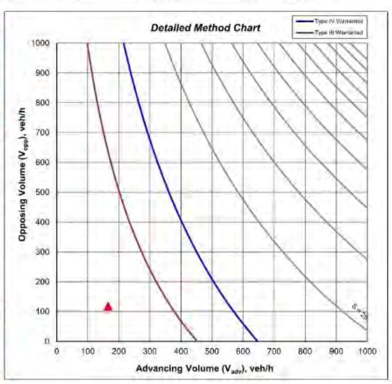
INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	3,474
Minor (intersecting) Road A.A.D.T	2,601
Left turn volume (V_{LT}), veh/h:	14
Advancing volume (V_{adv}), veh/h:	165
Opposing volume (V_{opp}), veh/h:	118
Left turn truck volume, trucks/h:	5
Right turn volume (V_{RT}), veh/day:	128

OUTPUT	Value
Percent left-turns in advancing volume:	8.5%
Percent trucks in left turn volume:	35.7%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.2%
Calculated conflicts per hour, veh/h:	0.3
Use Detailed Method	
Type II	

Additonal Storage Not Requied		
	base storage requirement	-
	- standard storage length	-
	+ additional truck storage	-
	= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

Main Rd: Hwy. 38:10 West Leg **Minor Rd:** 44th Street North Leg **Direction:** EB **Period:** PM Peak **Year of Analysis:** 2035 Stage 1&2(50%) **Date of Analysis:** Dec. 28, 2020

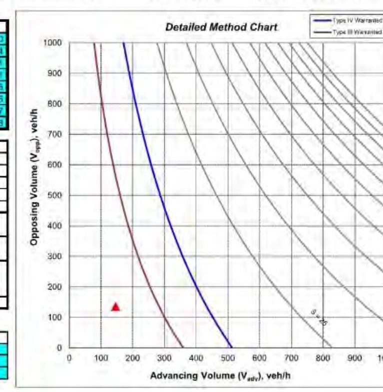
INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	3,474
Minor (intersecting) Road A.A.D.T	2,601
Left turn volume (V_{LT}), veh/h:	21
Advancing volume (V_{adv}), veh/h:	146
Opposing volume (V_{opp}), veh/h:	136
Left turn truck volume, trucks/h:	7
Right turn volume (V_{RT}), veh/day:	128

OUTPUT	Value
Percent left-turns in advancing volume:	14.4%
Percent trucks in left turn volume:	33.3%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.2%
Calculated conflicts per hour, veh/h:	0.4
Use Detailed Method	
Type II	

Additonal Storage Not Requied		
	base storage requirement	-
	- standard storage length	-
	+ additional truck storage	-
	= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

Main Rd: Hwy. 38:10 West Leg **Minor Rd:** 44th Street North Leg **Direction:** EB **Period:** AM Peak **Year of Analysis:** 2045 Stage 1&2(100% **Date of Analysis:** Dec. 28, 2020

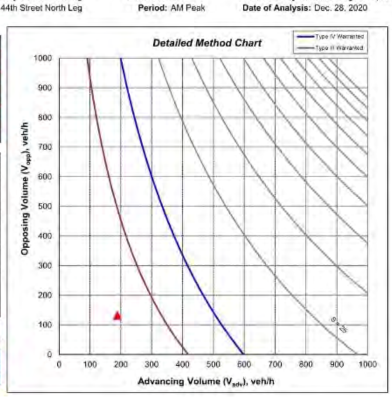
INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	3,833
Minor (intersecting) Road A.A.D.T	2,874
Left turn volume (V_{LT}), veh/h:	19
Advancing volume (V_{adv}), veh/h:	188
Opposing volume (V_{opp}), veh/h:	132
Left turn truck volume, trucks/h:	8
Right turn volume (V_{RT}), veh/day:	144

OUTPUT	Value
Percent left-turns in advancing volume:	10.1%
Percent trucks in left turn volume:	42.1%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.3%
Calculated conflicts per hour, veh/h:	0.6
Use Detailed Method	
Type II	

Additonal Storage Not Requied		
	base storage requirement	-
	- standard storage length	-
	+ additional truck storage	-
	= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

Main Rd: Hwy. 38:10 West Leg **Minor Rd:** 44th Street North Leg **Direction:** EB **Period:** PM Peak **Year of Analysis:** 2045 Stage 1&2(100% **Date of Analysis:** Dec. 28, 2020

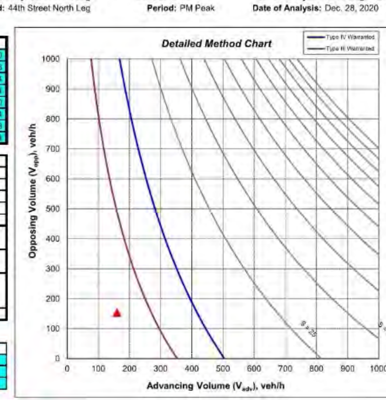
INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	3,833
Minor (intersecting) Road A.A.D.T	2,874
Left turn volume (V_{LT}), veh/h:	24
Advancing volume (V_{adv}), veh/h:	160
Opposing volume (V_{opp}), veh/h:	154
Left turn truck volume, trucks/h:	23
Right turn volume (V_{RT}), veh/day:	144

OUTPUT	Value
Percent left-turns in advancing volume:	15.0%
Percent trucks in left turn volume:	95.8%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.3%
Calculated conflicts per hour, veh/h:	0.5
Use Detailed Method	
Type II	

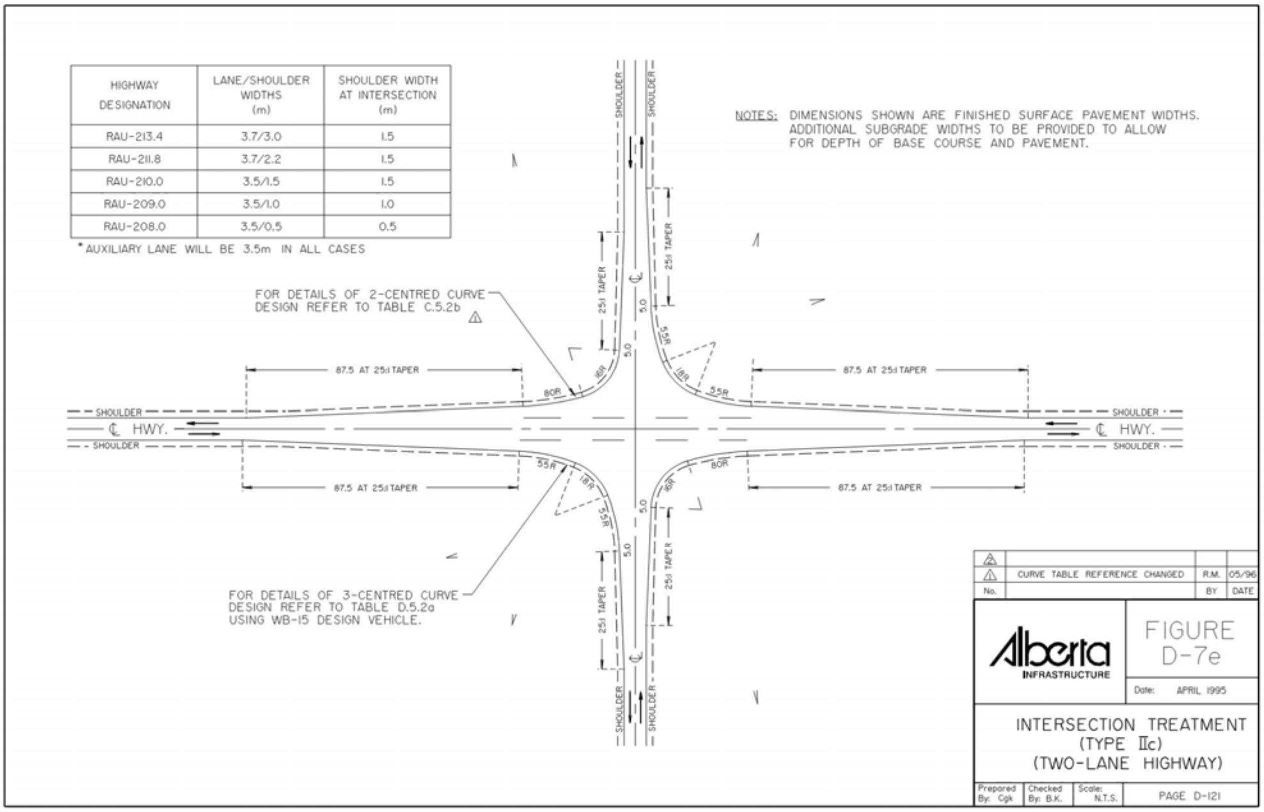
Additonal Storage Not Requied		
	base storage requirement	-
	- standard storage length	-
	+ additional truck storage	-
	= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



For the Eastbound direction of the intersection, a Type II intersection treatment is warranted for the next 24 years as shown below:



Westbound

Table 4.3.5 - Required Treatment Type – Hwy. 38 to 44th Street WB, AM PEAK

	Existing Year 2021	Stage 1 Year 2025	Stage 1 & Stage 2 (50%) Year 2035	Stage 1 & Stage 2 (100%) Year 2045
Peak 100th Hour – AM Peak Hr				
% Left Turns	36.2%	34.3%	33.9%	34.1%
V_a = Advancing Volume (VPH)	94	102	118	132
V_0 = Opposing Volume (VPH)	131	146	165	188
Vl = Left turning Volume (VPH)	34	35	40	45
Design Speed	60 km/hr	60 km/hr	60 km/hr	60 km/hr
Required Treatment Type	**Type II w/ Exclusive Rt Turn Lane**	**Type II w/ Exclusive Rt Turn Lane**	**Type II w/ Exclusive Rt Turn Lane**	**Type II w/ Exclusive Rt Turn Lane**

Table 4.3.6 - Required Treatment Type – Hwy. 38 to 44th Street WB, PM PEAK

	Existing Year 2021	Stage 1 Year 2025	Stage 1 & Stage 2 (50%) Year 2035	Stage 1 & Stage 2 (100%) Year 2045
Peak 100th Hour – PM Peak Hr				
% Left Turns	37.9%	35.1%	36.0%	35.7%
V_a = Advancing Volume (VPH)	103	114	136	154
V_0 = Opposing Volume (VPH)	116	130	146	160
Vl = Left turning Volume (VPH)	39	40	49	55
Design Speed	60 km/hr	60 km/hr	60 km/hr	60 km/hr
Required Treatment Type	**Type II w/ Exclusive Rt Turn Lane**	**Type II w/ Exclusive Rt Turn Lane**	**Type II w/ Exclusive Rt Turn Lane**	**Type II w/ Exclusive Rt Turn Lane**

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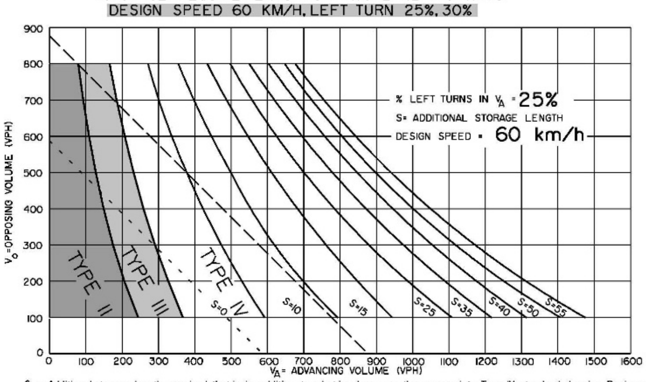
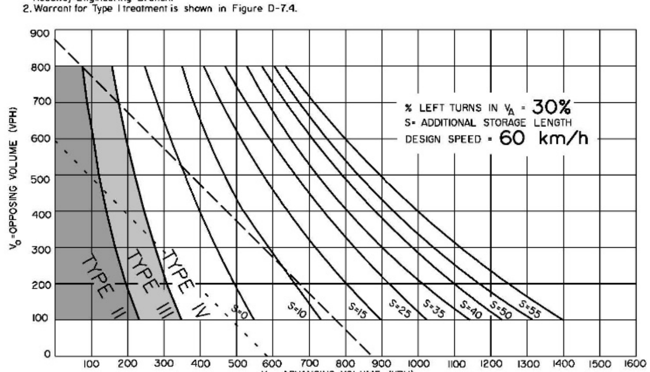
FIGURE D-7.6-2c WARRANTS FOR LEFT TURN TREATMENT AND STORAGE REQUIREMENTS FOR TWO-LANE HIGHWAYS DESIGN SPEED 60 KM/H, LEFT TURN 25%, 30%



S = Additional storage length required, that is, in addition to what is shown on the appropriate Type IV standard drawing. Designers should check additional storage requirements for trucks, also see Table D.7.6a.
- - - - Traffic signals may be warranted in rural areas, or urban areas, with restricted flow.
— — — Traffic signals may be warranted in "free flow" urban areas.

Notes:
1. The traffic signal warrant lines are provided for reference only. For detailed analysis of the requirements for signals, contact Roadway Engineering Branch.
2. Warrant for Type I treatment is shown in Figure D-7.4.

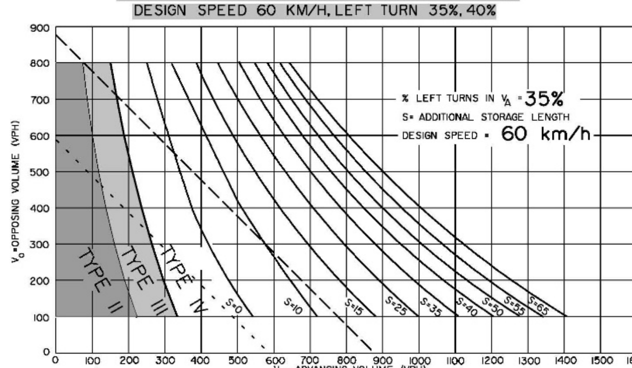


D-148 — AT-GRADE INTERSECTIONS

GRAPHICS FILE: debd762a.man

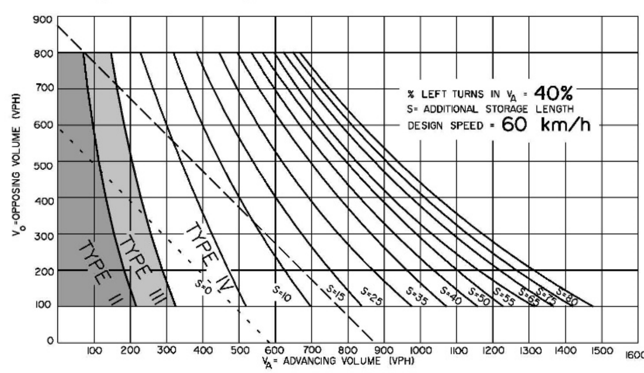
Alberta Infrastructure HIGHWAY GEOMETRIC DESIGN GUIDE — AUGUST 1999

FIGURE D-7.6-2d WARRANTS FOR LEFT TURN TREATMENT AND STORAGE REQUIREMENTS FOR TWO-LANE HIGHWAYS DESIGN SPEED 60 KM/H, LEFT TURN 35%, 40%



S = Additional storage length required, that is, in addition to what is shown on the appropriate Type IV standard drawing. Designers should check additional storage requirements for trucks, also see Table D.7.6a.
- - - - Traffic signals may be warranted in rural areas, or urban areas, with restricted flow.
— — — Traffic signals may be warranted in "free flow" urban areas.

Notes:
1. The traffic signal warrant lines are provided for reference only. For detailed analysis of the requirements for signals, contact Roadway Engineering Branch.
2. Warrant for Type I treatment is shown in Figure D-7.4.



AT-GRADE INTERSECTIONS — D-149

GRAPHICS FILE: debd762a.man

Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

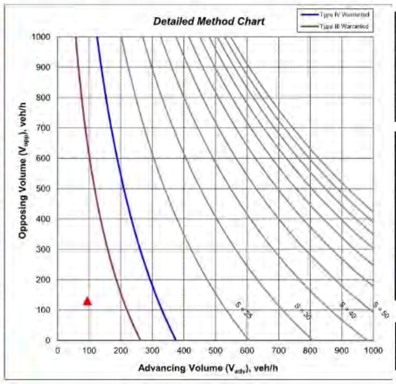
Main Rd: Hwy. 38:10 West Leg **Direction:** WB **Year of Analysis:** 2021 Existing
Minor Rd: 44th Street North Leg **Period:** AM Peak **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	2,761
Minor (intersecting) Road A.A.D.T	1,987
Left turn volume (V_{LT}), veh/h:	34
Advancing volume (V_{adv}), veh/h:	94
Opposing volume (V_{opp}), veh/h:	131
Left turn truck volume, trucks/h:	22
Right turn volume (V_{RT}), veh/day:	621

OUTPUT	Value
Percent left-turns in advancing volume:	36.2%
Percent trucks in left turn volume:	64.7%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.2%
Calculated conflicts per hour, veh/h:	0.2
Use Detailed Method	
Type II	**RT Lane warranted**
Additonal Storage Not Requied — *base storage requirement*	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

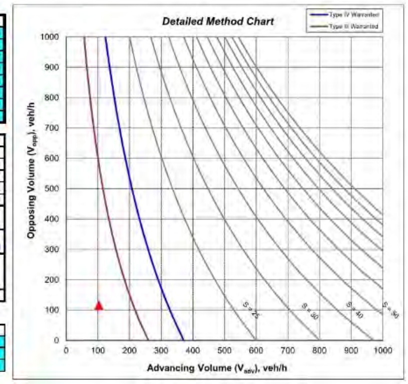
Main Rd: Hwy. 38:10 West Leg **Direction:** WB **Year of Analysis:** 2021 Existing
Minor Rd: 44th Street North Leg **Period:** PM Peak **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	2,761
Minor (intersecting) Road A.A.D.T	1,987
Left turn volume (V_{LT}), veh/h:	39
Advancing volume (V_{adv}), veh/h:	103
Opposing volume (V_{opp}), veh/h:	116
Left turn truck volume, trucks/h:	22
Right turn volume (V_{RT}), veh/day:	621

OUTPUT	Value
Percent left-turns in advancing volume:	37.9%
Percent trucks in left turn volume:	56.4%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.2%
Calculated conflicts per hour, veh/h:	0.2
Use Detailed Method	
Type II	**RT Lane warranted**
Additonal Storage Not Requied — *base storage requirement*	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

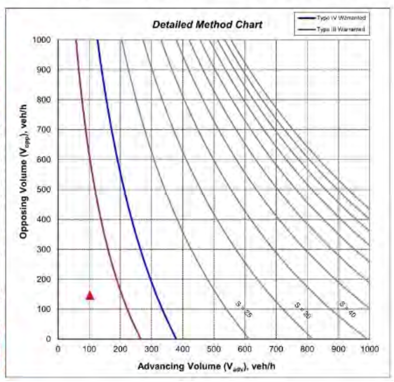
Main Rd: Hwy. 38:10 West Leg **Direction:** WB **Year of Analysis:** 2025 Stage 1
Minor Rd: 44th Street North Leg **Period:** AM Peak **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	3,106
Minor (intersecting) Road A.A.D.T	2,321
Left turn volume (V_{LT}), veh/h:	35
Advancing volume (V_{adv}), veh/h:	102
Opposing volume (V_{opp}), veh/h:	146
Left turn truck volume, trucks/h:	22
Right turn volume (V_{RT}), veh/day:	654

OUTPUT	Value
Percent left-turns in advancing volume:	34.3%
Percent trucks in left turn volume:	62.9%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.2%
Calculated conflicts per hour, veh/h:	0.2
Use Detailed Method	
Type II	**RT Lane warranted**
Additonal Storage Not Requied — *base storage requirement*	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

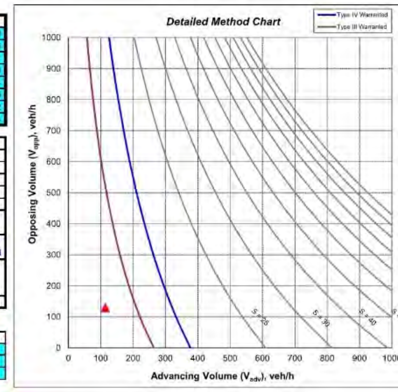
Main Rd: Hwy. 38:10 West Leg **Direction:** WB **Year of Analysis:** 2025 Stage 1
Minor Rd: 44th Street North Leg **Period:** PM Peak **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	3,106
Minor (intersecting) Road A.A.D.T	2,321
Left turn volume (V_{LT}), veh/h:	40
Advancing volume (V_{adv}), veh/h:	114
Opposing volume (V_{opp}), veh/h:	130
Left turn truck volume, trucks/h:	22
Right turn volume (V_{RT}), veh/day:	654

OUTPUT	Value
Percent left-turns in advancing volume:	35.1%
Percent trucks in left turn volume:	55.0%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.3%
Calculated conflicts per hour, veh/h:	0.3
Use Detailed Method	
Type II	**RT Lane warranted**
Additonal Storage Not Requied — *base storage requirement*	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

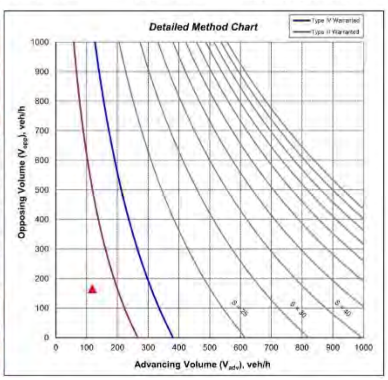
Main Rd: Hwy. 38:10 West Leg **Direction:** WB **Year of Analysis:** 2035 Stage 1&2(50%
Minor Rd: 44th Street North Leg **Period:** AM Peak **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	3,474
Minor (intersecting) Road A.A.D.T	2,601
Left turn volume (V_{LT}), veh/h:	40
Advancing volume (V_{adv}), veh/h:	118
Opposing volume (V_{opp}), veh/h:	165
Left turn truck volume, trucks/h:	18
Right turn volume (V_{RT}), veh/day:	716

OUTPUT	Value
Percent left-turns in advancing volume:	33.9%
Percent trucks in left turn volume:	45.0%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.3%
Calculated conflicts per hour, veh/h:	0.4
Use Detailed Method	
Type II	**RT Lane warranted**
Additonal Storage Not Requied — *base storage requirement*	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

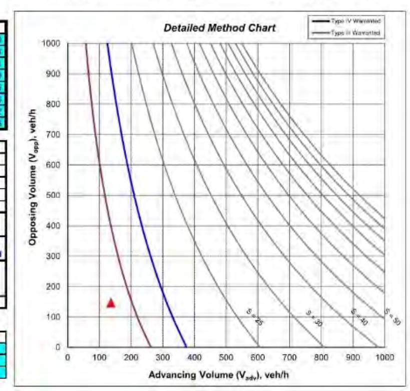
Main Rd: Hwy. 38:10 West Leg **Direction:** WB **Year of Analysis:** 2035 Stage 1&2(50%
Minor Rd: 44th Street North Leg **Period:** PM Peak **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	3,474
Minor (intersecting) Road A.A.D.T	2,601
Left turn volume (V_{LT}), veh/h:	49
Advancing volume (V_{adv}), veh/h:	136
Opposing volume (V_{opp}), veh/h:	146
Left turn truck volume, trucks/h:	22
Right turn volume (V_{RT}), veh/day:	716

OUTPUT	Value
Percent left-turns in advancing volume:	36.0%
Percent trucks in left turn volume:	44.9%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.4%
Calculated conflicts per hour, veh/h:	0.6
Use Detailed Method	
Type II	**RT Lane warranted**
Additonal Storage Not Requied — *base storage requirement*	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

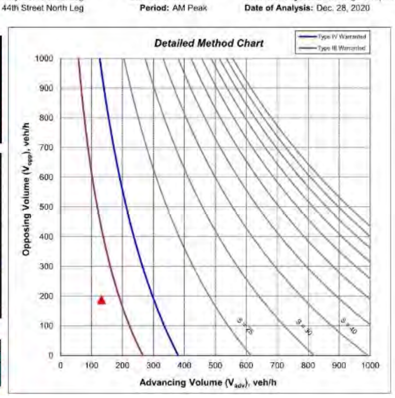
Main Rd: Hwy. 38:10 West Leg **Direction:** WB **Year of Analysis:** 2045 Stage 1&2(100%
Minor Rd: 44th Street North Leg **Period:** AM Peak **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	3,833
Minor (intersecting) Road A.A.D.T	2,874
Left turn volume (V_{LT}), veh/h:	45
Advancing volume (V_{adv}), veh/h:	132
Opposing volume (V_{opp}), veh/h:	188
Left turn truck volume, trucks/h:	20
Right turn volume (V_{RT}), veh/day:	776

OUTPUT	Value
Percent left-turns in advancing volume:	34.1%
Percent trucks in left turn volume:	44.4%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.4%
Calculated conflicts per hour, veh/h:	0.5
Use Detailed Method	
Type II	**RT Lane warranted**
Additonal Storage Not Requied — *base storage requirement*	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

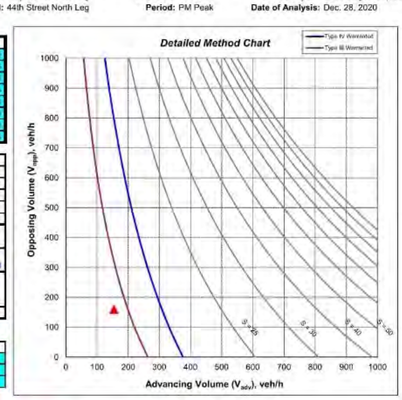
Main Rd: Hwy. 38:10 West Leg **Direction:** WB **Year of Analysis:** 2045 Stage 1&2(100%
Minor Rd: 44th Street North Leg **Period:** PM Peak **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85th percentile speed, km/h:	60
Main Road A.A.D.T.	3,833
Minor (intersecting) Road A.A.D.T	2,874
Left turn volume (V_{LT}), veh/h:	55
Advancing volume (V_{adv}), veh/h:	154
Opposing volume (V_{opp}), veh/h:	160
Left turn truck volume, trucks/h:	20
Right turn volume (V_{RT}), veh/day:	776

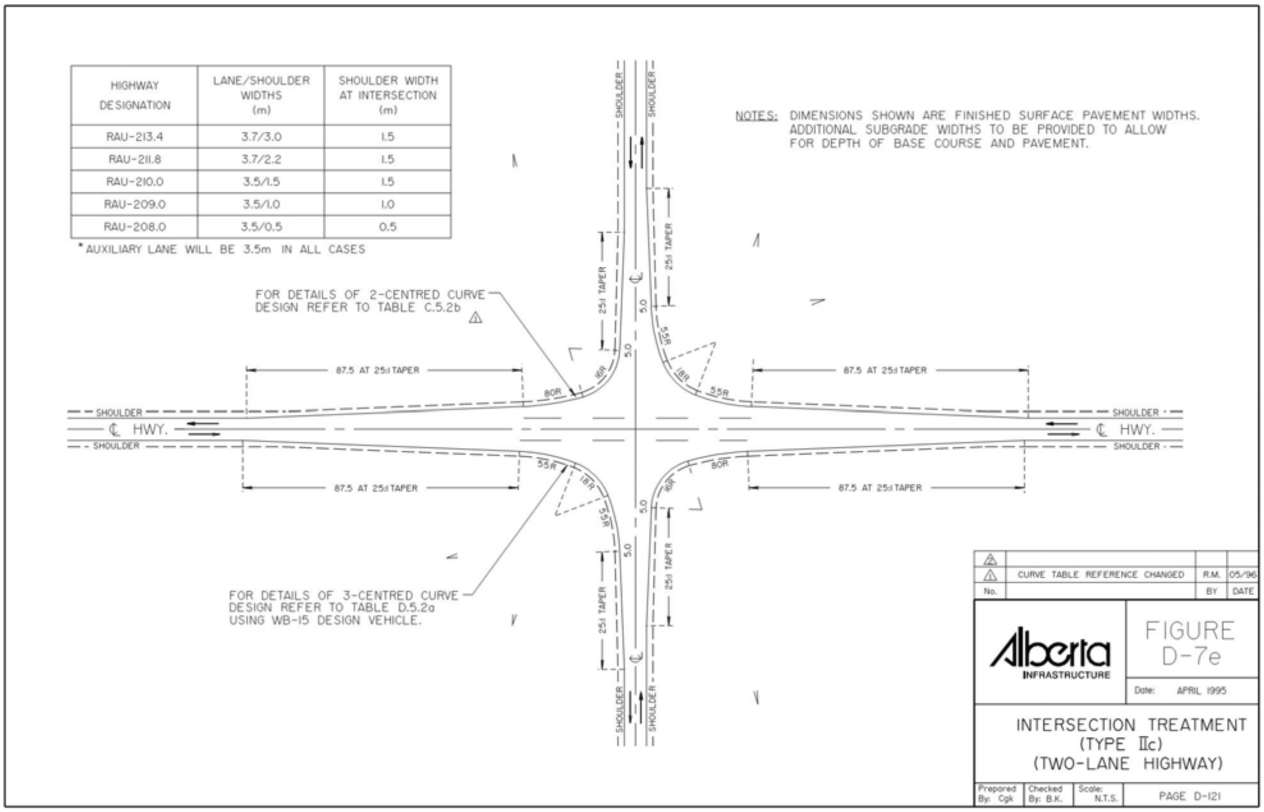
OUTPUT	Value
Percent left-turns in advancing volume:	35.7%
Percent trucks in left turn volume:	36.4%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.5%
Calculated conflicts per hour, veh/h:	0.8
Use Detailed Method	
Type II	**RT Lane warranted**
Additonal Storage Not Requied — *base storage requirement*	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



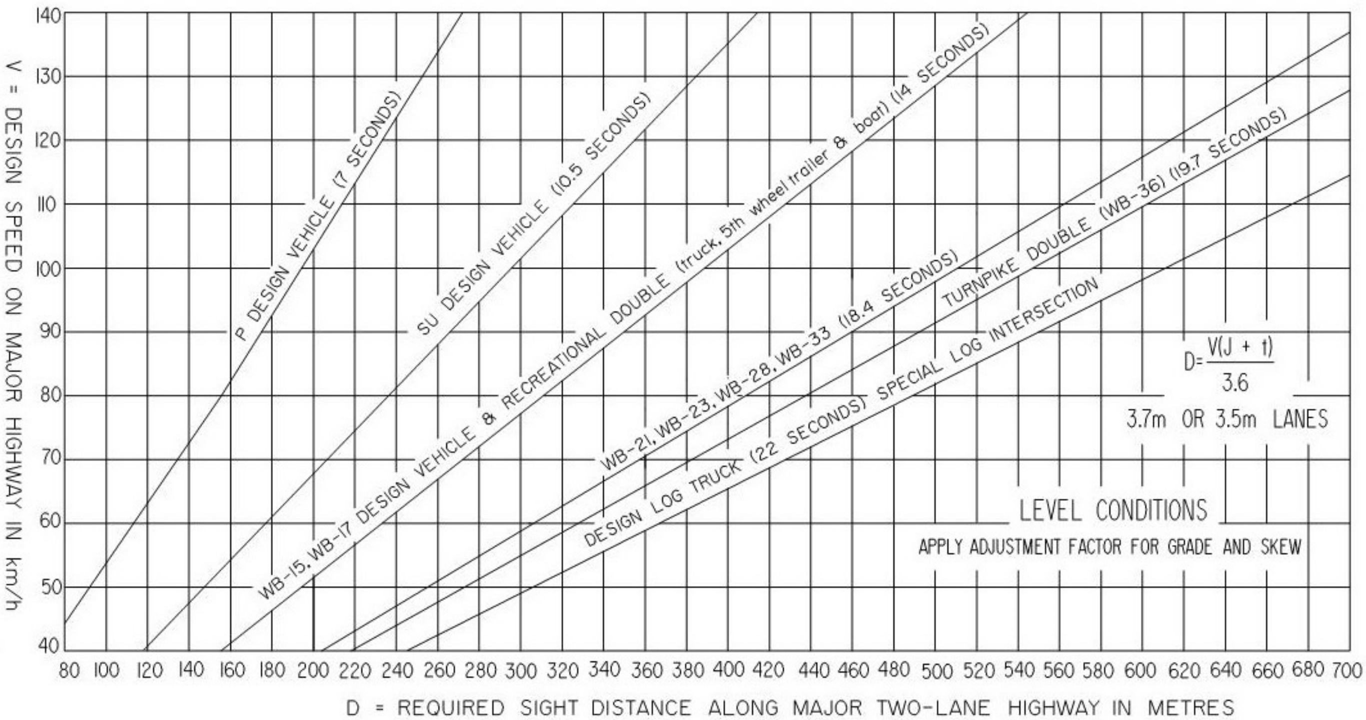
For the Westbound direction of the intersection, a Type II intersection treatment is warranted for the next 24 years as shown below:



4.4 Intersectional Sight Distance

In accordance with section D.4, “Sight Distances at Intersections”, the sight distance for left turning vehicles from the approach, without interfering with vehicles nearing the intersection, is used for determination of minimum sight distance requirements. Using Fig. D-4.2.2.2 below, the required sight distances for various vehicle types with an 80 km/hr design speed are as follows:

Vehicle Type	Required Sight Distance – 60 km/hr.
Passenger Vehicle (P)	112 m
Single Unit or Bus (SU)	178 m
Semi-Trailer Combination (WB15)	232 m
Semi-Trailer Combination (WB21, WB23, WB28, WB33)	305 m



The site distance is greater than 310 metres in both directions on Hwy. 38:10/Hwy. 644:02 at the Hwy. 38/44th Street intersection.

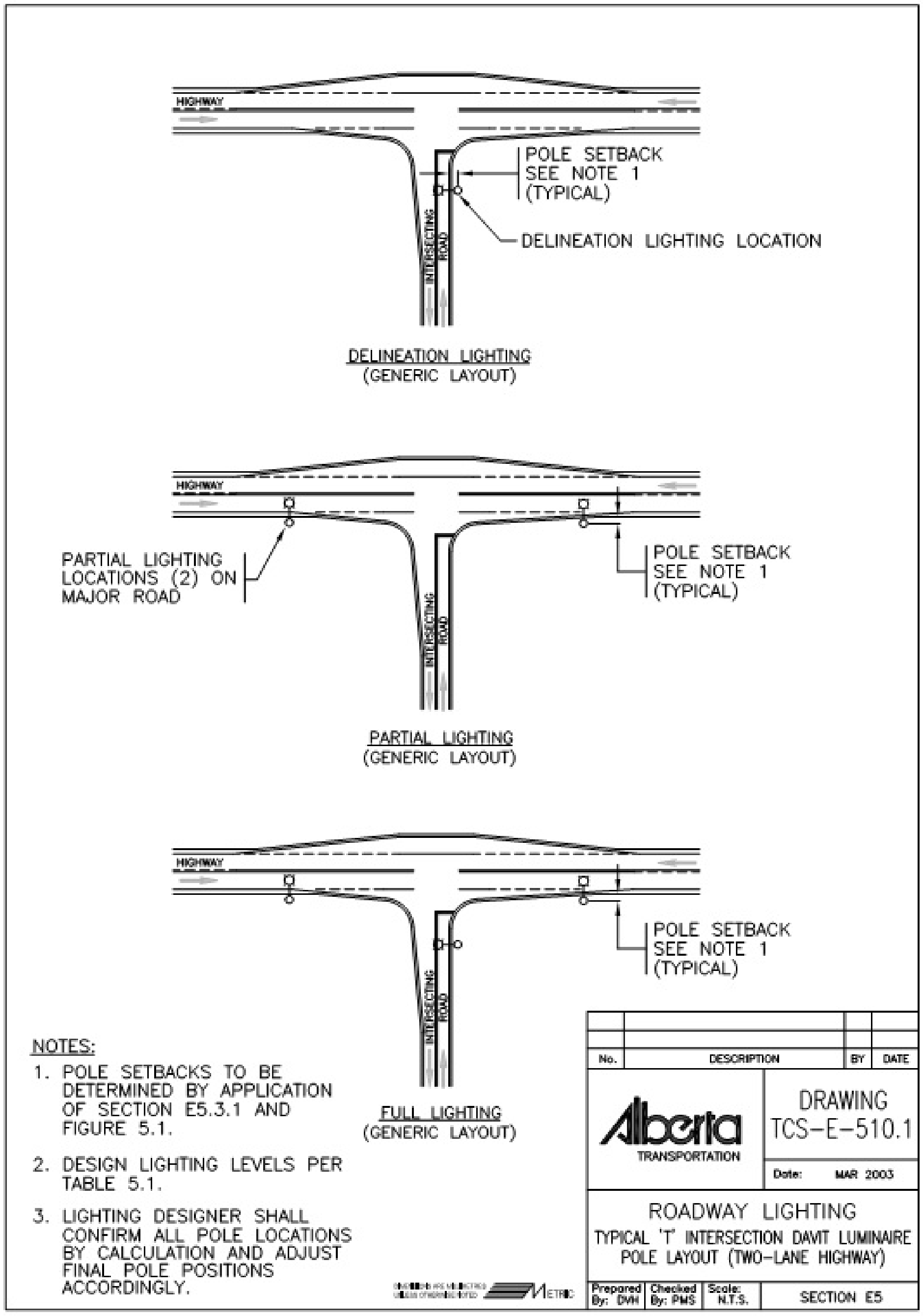
4.5 Illumination & Signalization

Illumination and signalization warrants were reviewed. The results are summarized in the Table below:

Location	Year	Illumination Warrant Score	Illumination Warrant Met? (Min. 120)	Signalization Warrant Score	Signalization Warrant Met?
Hwy. 38:10 & Hwy. 644:02	2021 1% Growth Rate	106	No		No
Hwy. 38:10 & Hwy. 644:02	2025 1% Growth Rate	136	Yes Partial		No
Hwy. 38:10 & Hwy. 644:02	2045 1% Growth Rate	136	Yes Partial		No
Hwy. 38:10 & Hwy. 644:02	2045 2% Growth Rate	136	Yes Partial	7	No

Partial illumination is warranted for the intersection in 2025. Since full urban lighting exists for all four legs of the intersection, no further improvements are required.

A Transportation of Canada Signalization Warrant Analysis was performed using the Peak Hour traffic data with 2% growth rate for Year 2045. The analysis indicated that signals are not warranted at the intersection for the next 24 years as the turning traffic volumes are too low.



4.6 Capacity Analysis

A capacity analysis was performed for the intersection for the 100th highest hour for the AM & PM Peak Hours for Years 2021, 2025, 2035 and 2045. The traffic analysis was completed using Synchro 10 software based on HCM 2000 and HCM 2010 methodology. A saturation flow of 1700 vpl was used in this analysis. See the table below for the results. Results below are reported in HCM 2000 methodology.

Hwy. 38:10, Hwy. 644:02 & 44th Street
<u>With Development in Years 2025, 2035 & 2045</u>

			Hwy. 38:10 South Leg	Hwy. 38:10 West Leg		Hwy. 644:02		44th Street
TIME PERIOD		PARAMETERS	NB All Turns	EB Left Turn	EB Thru & Rt	WB All Turns		SB All Turns
Year 2021	AM Peak	LOS	B	A	A	A		A
		Delay (s)	11.1	0.4	0.0	2.8		9.3
		v/c Ratio	0.16	0.00	0.00	0.02		0.03
		Queue 95th	4.6	0.1	0.0	0.6		0.7
	PM Peak	LOS	B	A	A	A		A
		Delay (s)	11.7	0.7	0.0	3.0		9.5
		v/c Ratio	0.122	0.01	0.00	0.03		0.04
		Queue 95th	6.5	0.1	0.0	0.7		1.0
Year 2025	AM Peak	LOS	B	A	A	A		B
		Delay (s)	11.9	1.0	0.0	2.7		10.0
		v/c Ratio	0.20	0.01	0.04	0.02		0.07
		Queue 95th	5.8	0.2	0.0	0.6		1.9

			Hwy. 38:10 South Leg	Hwy. 38:10 West Leg		Hwy. 644:02		44th Street
	TIME PERIOD	PARAMETERS	NB All Turns	EB Left Turn	EB Thru & Rt	WB All Turns		SB All Turns
	PM Peak	LOS	B	A	A	B		B
		Delay (s)	12.8	1.6	0.0	2.8		10.2
		v/c Ratio	0.27	0.01	0.02	0.03		0.08
		Queue 95th	8.6	0.3	0.0	0.7		2.0
Year 2035	AM Peak	LOS	B	A	A	A		B
		Delay (s)	12.7	1.1	0.0	2.7		10.4
		v/c Ratio	0.24	0.01	0.04	0.03		0.08
		Queue 95th	7.5	0.2	0.0	0.7		2.2
	PM Peak	LOS	B	A	A	B		B
		Delay (s)	14.1	1.6	0.0	2.9		10.6
		v/c Ratio	0.32	0.01	0.03	0.03		0.10
		Queue 95th	11.0	0.4	0.0	0.9		2.6
Year 2045	AM Peak	LOS	B	A	A	A		B
		Delay (s)	13.7	1.3	0.0	2.7		10.7
		v/c Ratio	0.29	0.01	0.04	0.03		0.10
		Queue 95th	9.4	0.3	0.0	0.8		2.7
	PM Peak	LOS	C	A	A	A		B
		Delay (s)	15.7	1.7	0.0	2.9		11.1
		v/c Ratio	0.38	0.02	0.03	0.04		0.12
		Queue 95th	14.1	0.4	0.0	1.0		3.3
	Using 2.0% Growth Rate non-compounded per year							
Year 2045	AM Peak	LOS	B	A	A	A		B
		Delay (s)	13.7	1.3	0.0	2.7		10.7
		v/c Ratio	0.29	0.01	0.04	0.03		0.10
		Queue 95th	9.4	0.3	0.0	0.8		2.7

		Hwy. 38:10 South Leg	Hwy. 38:10 West Leg		Hwy. 644:02		44th Street
TIME PERIOD	PARAMETERS	NB All Turns	EB Left Turn	EB Thru & Rt	WB All Turns		SB All Turns
PM Peak	LOS	C	A	A	A		B
	Delay (s)	20.2	1.6	0.0	3.0		11.8
	v/c Ratio	0.51	0.02	0.03	0.05		0.15
	Queue 95th	22.9	0.5	0.0	1.2		4.3

The Roadway Capacity Analysis indicates that the intersection will have sufficient capacity for the next 24 years with the proposed added development traffic with the LOS reaching only C on one leg of the intersection. Further to this, when the growth rate for all four legs of the intersection is increased from 1.0% growth per year to 2.0% growth per year, the capacity analysis still indicates that the intersection maintains its capacity for the next 24 years. See Appendices for detailed reports.

LEVEL OF SERVICE (LOS) CRITERIA

Control Delay Per Vehicle (s)	LOS by Volume to Capacity Ratio	
	≤1	>1
≤10	A	F
>10 and ≤15	B	F
>15 and ≤25	C	F
>25 and ≤35	D	F
>35 and ≤50	E	F
>50	F	F

Level of Service "A"

Level of Service "B"

Level of Service "C"

Level of Service "D"

Level of Service "E"

Level of Service "F"

4.7 Analysis Summary

A detailed analysis was completed for this report at the intersection of Highway 38:10, Highway 644:02 and 44th Street in the Town of Redwater. The results are as follows:

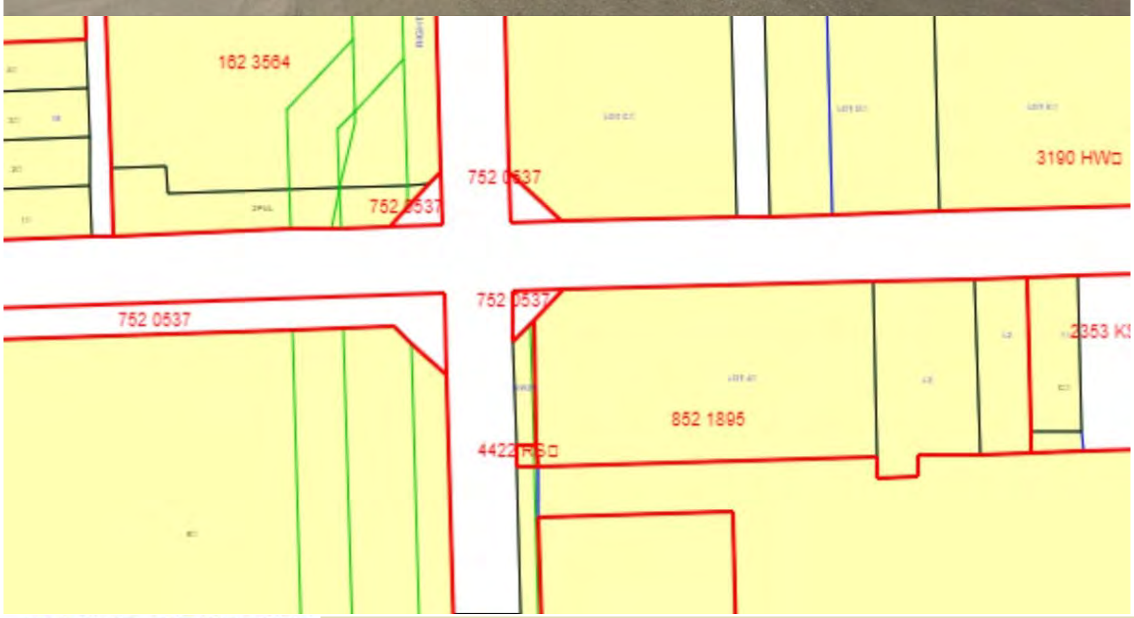
- Using Alberta Transportation Design Guidelines, the intersection treatment analysis indicated that a <u>Type IIc intersection treatment is warranted now in 2021</u> and was warranted many years before this upon review of past traffic volumes. A Type IIc intersection treatment requirement is maintained for the next 24 years, with the proposed development fully utilized in 2045.
- Using Synchro 10 software based on HCM 2000 and HCM 2010 methodology, the existing intersection treatment shows that the intersection has sufficient capacity to support traffic movements to a Level of Service of C for the next 24 years, with the proposed development fully utilized in 2045.
- Partial illumination is warranted in 2025, however no action is required since full urban street lighting exists on all four legs of the intersection.
- Traffic Signals at this intersection are not warranted for the next 24 years. Hence, a roundabout is also not a consideration for the next 24 years at this location.
- Sight distance for Design Vehicles of Semi-Trailer Combination (WB21, WB23, WB28, WB33) at the posted speed of 50 kph is sufficient.
- A Pedestrian Crossing Warrant Analysis was not completed at this location as there are no signs of pedestrian walkways in this area and are assumed to be zero to very low.

This intersection is within the Town of Redwater and thus an urban area. The posted speed is only 50 kph and the capacity analysis indicates that the longest delay times in 24 years are 14 – 16 seconds for a left turn/straight thru movement from the Hwy. 38:10 South Leg. The delays and queue lengths are minimal and the intersection should operate efficiently for 24 years and more with the present intersection treatment. There are no operational issues presently at the site.

There is an issue of limited right-of-way at this intersection. The highway was originally constructed within a basic 22.86m (75 foot) right-of-way. There is additional width available in the SW quadrant only. This 22.86m right-of-way will not allow for a full Type II intersection treatment as +40m is required for a desired rural cross-section (1 side: 3.7m + 3.5m + 2.3m + 5m SS + 3.5m Ditch + 3m BS). The existing right-of-way only allows for a modified intersection width improvement using a 0.5m shoulder width and 3:1 sideslopes, if only in a fill situation. Fortunately, at this location, there are no backslopes and the road is mainly in a fill situation. This would allow for the addition lane being added with the suggested modifications. See below.


44th Street
Hwy. 38:10
Hwy. 644:02
Hwy. 38:10

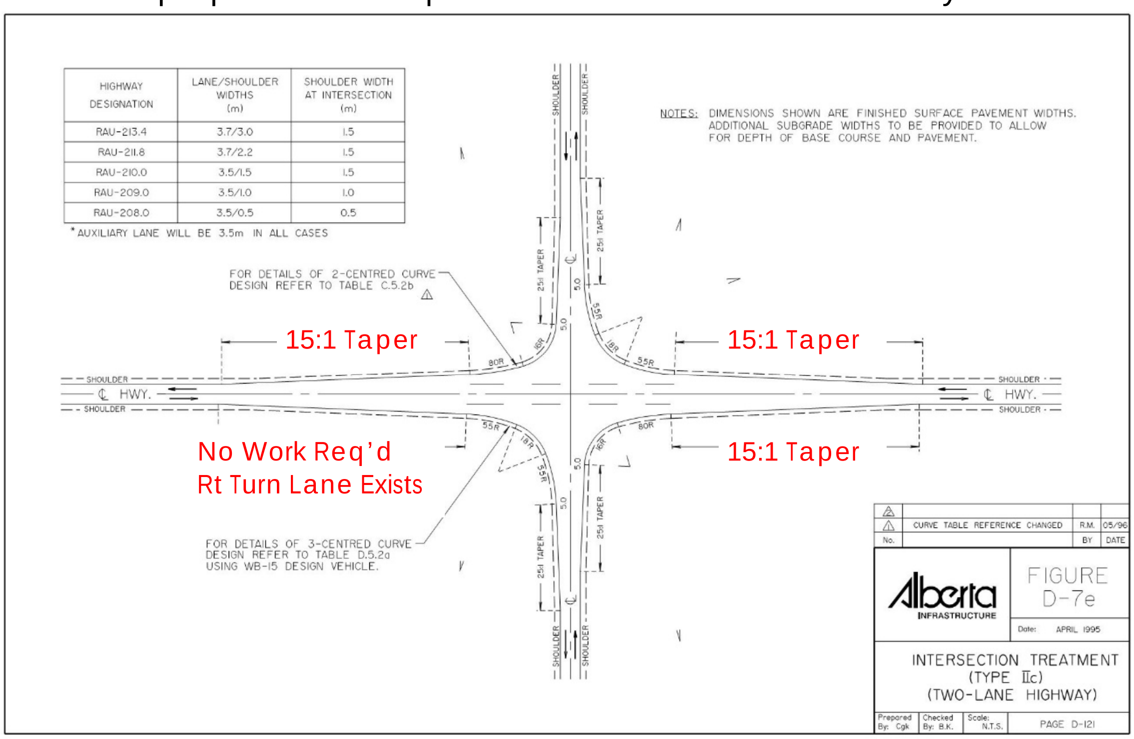

ARKTIK


162 3564
752 0537
752 0537
3190 HW
752 0537
752 0537
2353 KS
852 1895
4422 RS

It is also recommended that 15:1 tapers be utilized in lieu of 25:1 tapers since this location is within an established urban area with a 50 kph posted speed. This will also help avoid tapers from going through approaches and other intersections, since there are numerous approaches in this area. The 40:1 and 25:1 taper rates are shown on AT's design guidelines are mainly intended for rural situations, as there is often significantly speed reductions due to turning movements. These speed reductions are usually from a speed of 100 km/h. For an established urban location, traffic should be traveling at the posted speed of 70 kph, where turning movements would only consist of reductions of speed from 70 km/h to 20 - 30 km/h. The tables contained in Alberta Transportation's intersection treatment diagrams do not account for this and apply the same taper rate for design speeds from 50 to 110 km/h. It is common practice to use 15:1 taper rates in urban design, as there is limited room to provide long tapers. This is especially true for this location as longer tapers would cross other intersections or come very close to them, which is undesirable for many reasons, including being confusing for motorists and pedestrians.

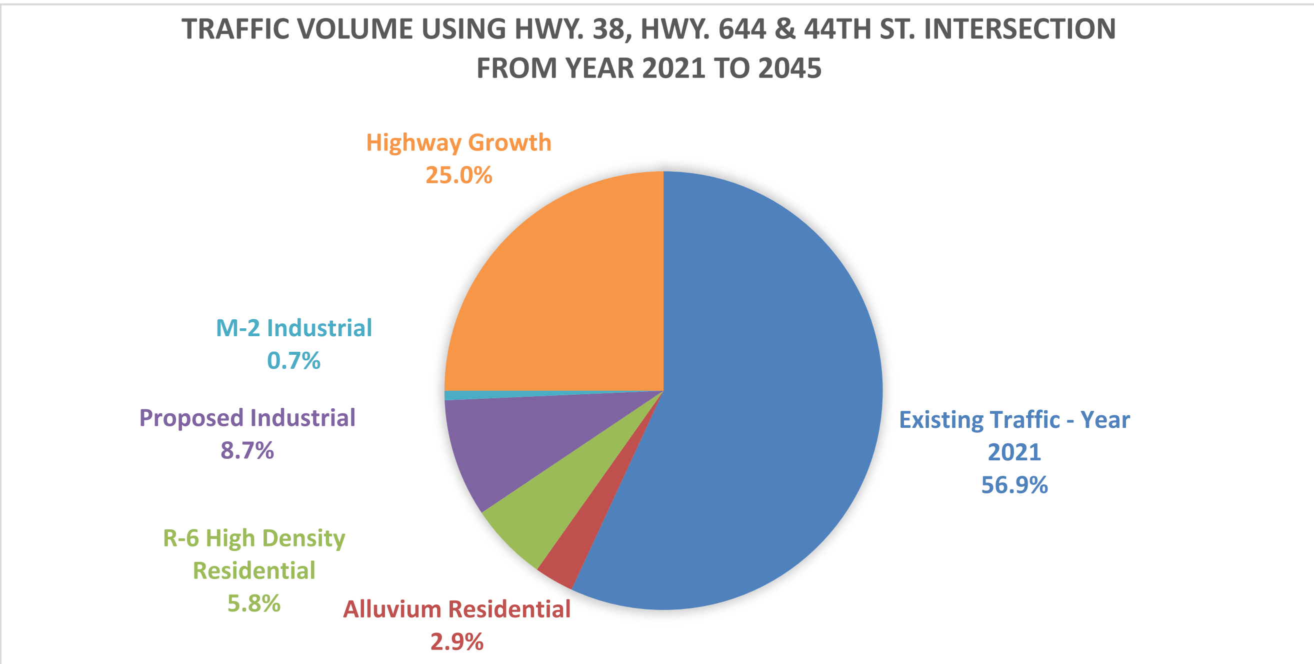
HIGHWAY DESIGN SPEED (km/h)	LENGTH AND TAPER RATIO "T" OF RIGHT TURN TAPER (m)
50	87.5 at 25:1
60	87.5 at 25:1
70	87.5 at 25:1
80	87.5 at 25:1
90	87.5 at 25:1
100	87.5 at 25:1
110	87.5 at 25:1
120	140.0 at 40:1
130	140.0 at 40:1

It is likely that additional right-of-way at this intersection will not be immediately attainable, and therefore, a modified intersection treatment as described above should suffice for proposed development in the area for the next 24 years.



In summary, a Type IIc intersection treatment is warranted in Year 2021 but with modifications to the standard type IIc treatment that include 0.5m wide shoulders, 3:1 sideslopes and 15:1 tapers. Improvements are not required in the SW quadrant.

Since other developments are presently being constructed in the area, cost sharing of this improvement is likely to be considered. The ratio of estimated existing and development traffic volumes using this intersection from 2021 to 2045 is shown below. This will change as more development is proposed.



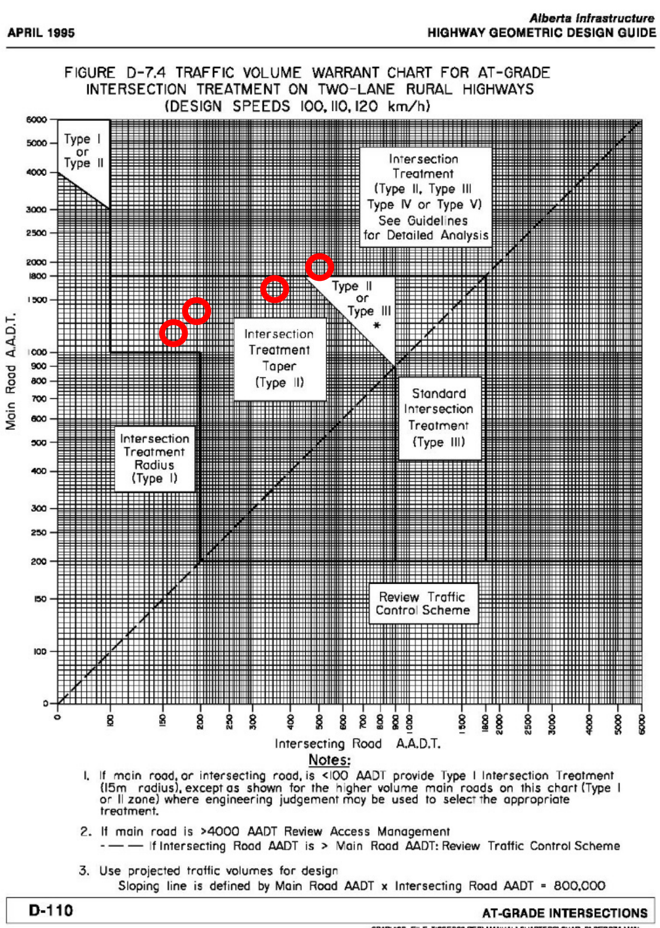
5. TRAFFIC ANALYSIS – HWY. 644 :02 & 47TH STREET

5.1 Design Speed

The posted speed on Highway 644:02 at this location is 50 km/hr up to 46th Street and 70 km/hr east of 46th Street. A design speed of 60 km/h and 80 km/hr respectively will be used for the analysis and the results assessed upon this.

5.2 Determination Based on Traffic Volume Warrant Chart

The 2025, 2035 and 2045 AADT values for the Hwy. 644:02 and 47th Street intersection indicates from referencing Figure D-7.4, "Traffic Volume Warrant Chart for At-Grade Intersection Treatment on Two-Lane Rural Highways (Design Speeds 100/110/120 km/h)" (using the west & north legs), that a Detailed Analysis is required in 2045.



5.3 Detailed Analysis

Right Turn

In accordance with Alberta Transportation's "Highway Geometric Design Guide" (Section D.7.7), an exclusive right turn lane is warranted on an undivided highway when all three of the following conditions are met:

- Main (or though) road AADT ≥ 1,800
- Intersecting road AADT ≥ 900
- Right turn daily traffic volume ≥ 360 for the movement in question.

The following table indicates the status of these requirements for right turns from Highway 644:02 westbound to 47th Street northbound.

Table 5.3.1 - Right Turn Warrant – West Bound

Condition	Existing Year 2021	Stage 1 No Dev. Traffic Year 2025	Stage 1 & Stage 2 (50%) Year 2035	Stage 1 & Stage 2 (100%) Year 2045
	(Condition Met)	(Condition Met)	(Condition Met)	(Condition Met)
Main Road (Hwy. 644)	1238	1416	1676	1884
AADT ≥ 1800	(No)	(No)	(No)	(Yes)
Intersecting Road (47th Street)	164	194	360	468
AADT ≥ 900	(No)	(No)	(No)	(No)
Right turn daily traffic ≥ 360	24	29	54	70
	(No)	(No)	(No)	(No)
For movement in question	(No)	(No)	(No)	(No)

Based on the projected volumes, an exclusive right turn lane is not required for the westbound direction for the next 24 years with the existing traffic in 2021 and added traffic from the proposed development.

Left Turn

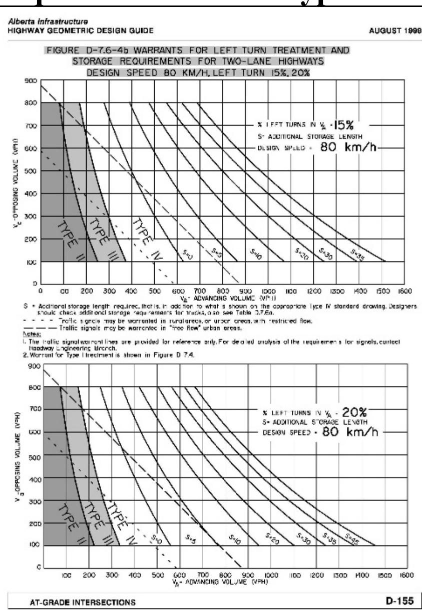
The Highway Geometric Design Guide Section D.7.6 gives graphical guidelines for determining left turn warrant. The graphs use peak (100th highest) hour volumes and factor in percent turning and design speed to identify the required treatment for the intersection. The following table shows the treatments needed for current and projected traffic volumes.

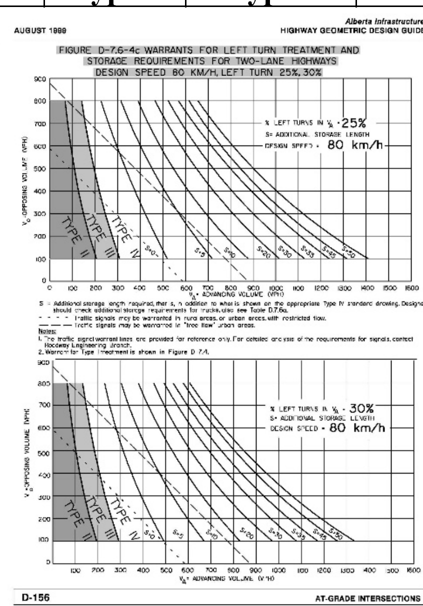
Table 5.3.2 - Left Turn Warrant – East Bound AM Peak

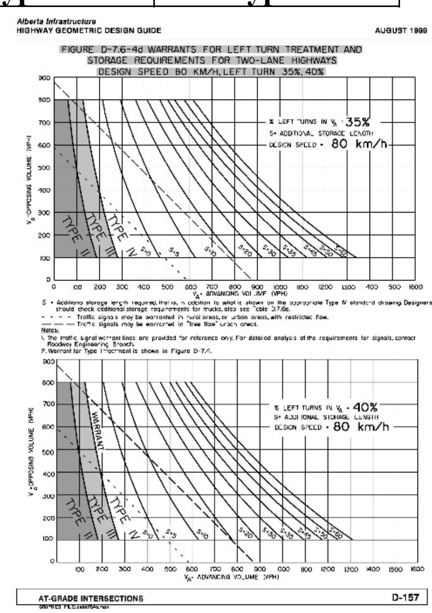
	Existing Year 2021	Stage 1 Year 2025	Stage 1 & Stage 2 (50%) Year 2035	Stage 1 & Stage 2 (100%) Year 2045
Peak 100th Hour – AM Peak Hr				
% Left Turns	23.3%	21.7%	29.8%	33.3%
V_a = Advancing Volume (VPH)	60	69	84	96
V_0 = Opposing Volume (VPH)	76	83	97	109
Vl = Left turning Volume (VPH)	14	15	25	32
Design Speed	80 km/hr	80 km/hr	80 km/hr	80 km/hr
Required Treatment Type	**Type I**	**Type I**	**Type II**	**Type II**

Table 5.3.3 - Left Turn Warrant – East Bound PM Peak

	Existing Year 2021	Stage 1 Year 2025	Stage 1 & Stage 2 (50%) Year 2035	Stage 1 & Stage 2 (100%) Year 2045
Peak 100th Hour – PM Peak Hr				
% Left Turns	2.6%	3.8%	9.4%	11.9%
V_a = Advancing Volume (VPH)	77	80	96	109
V_0 = Opposing Volume (VPH)	47	56	64	72
Vl = Left turning Volume (VPH)	2	3	9	13
Design Speed	80 km/hr	80 km/hr	80 km/hr	80 km/hr
Required Treatment Type	**Type I**	**Type I**	**Type II**	**Type II**







Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

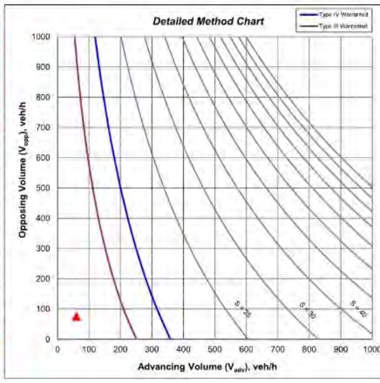
Main Rd: Hwy. 644:02 **Minor Rd:** 47th Street **Direction:** EB **Period:** AM Peak **Year of Analysis:** 2021 **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85^{th} percentile speed, km/h:	80
Main Road A.A.D.T.	1,238
Minor (intersecting) Road A.A.D.T	164
Left turn volume (V_{LT}), veh/h:	14
Advancing volume (V_{adv}), veh/h:	60
Opposing volume (V_{opp}), veh/h:	76
Left turn truck volume, trucks/h:	5
Right turn volume (V_{RT}), veh/day:	24

OUTPUT	Value
Percent left-turns in advancing volume:	23.3%
Percent trucks in left turn volume:	35.7%
Probability of conflict threshold:	1.52%
Calculated probability of conflicting arrival:	0.1%
Calculated conflicts per hour, veh/h:	0.0
Type I	
Detailed Method Not Required	
base storage requirement	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

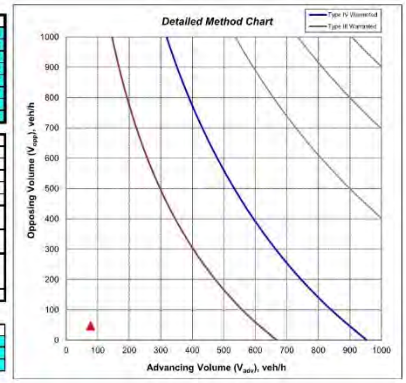
Main Rd: Hwy. 644:02 **Minor Rd:** 47th Street **Direction:** EB **Period:** PM Peak **Year of Analysis:** 2021 **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85^{th} percentile speed, km/h:	80
Main Road A.A.D.T.	1,238
Minor (intersecting) Road A.A.D.T	164
Left turn volume (V_{LT}), veh/h:	2
Advancing volume (V_{adv}), veh/h:	77
Opposing volume (V_{opp}), veh/h:	47
Left turn truck volume, trucks/h:	1
Right turn volume (V_{RT}), veh/day:	24

OUTPUT	Value
Percent left-turns in advancing volume:	2.6%
Percent trucks in left turn volume:	50.0%
Probability of conflict threshold:	1.52%
Calculated probability of conflicting arrival:	0.0%
Calculated conflicts per hour, veh/h:	0.0
Type I	
Detailed Method Not Required	
base storage requirement	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

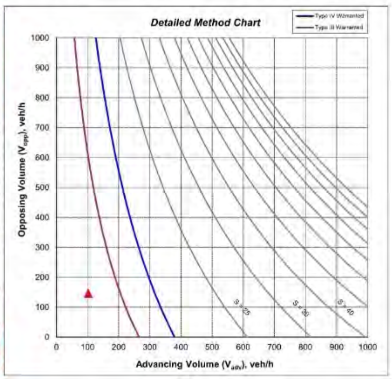
Main Rd: Hwy. 38:10 West Leg **Minor Rd:** 44th Street North Leg **Direction:** WB **Period:** AM Peak **Year of Analysis:** 2025 Stage 1 **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85^{th} percentile speed, km/h:	60
Main Road A.A.D.T.	3,106
Minor (intersecting) Road A.A.D.T	2,321
Left turn volume (V_{LT}), veh/h:	35
Advancing volume (V_{adv}), veh/h:	102
Opposing volume (V_{opp}), veh/h:	146
Left turn truck volume, trucks/h:	22
Right turn volume (V_{RT}), veh/day:	654

OUTPUT	Value
Percent left-turns in advancing volume:	34.3%
Percent trucks in left turn volume:	62.9%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.2%
Calculated conflicts per hour, veh/h:	0.2
Use Detailed Method	
Type II	RT Lane warranted
Additonal Storage Not Requied — *base storage requirement*	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

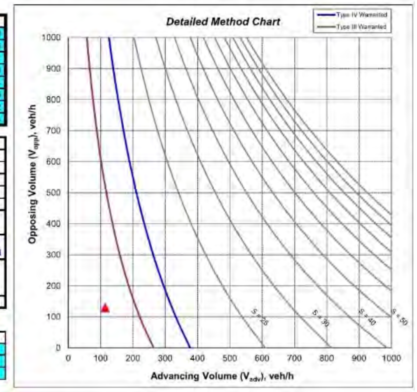
Main Rd: Hwy. 38:10 West Leg **Minor Rd:** 44th Street North Leg **Direction:** WB **Period:** PM Peak **Year of Analysis:** 2025 Stage 1 **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85^{th} percentile speed, km/h:	80
Main Road A.A.D.T.	3,106
Minor (intersecting) Road A.A.D.T	2,321
Left turn volume (V_{LT}), veh/h:	40
Advancing volume (V_{adv}), veh/h:	114
Opposing volume (V_{opp}), veh/h:	130
Left turn truck volume, trucks/h:	22
Right turn volume (V_{RT}), veh/day:	654

OUTPUT	Value
Percent left-turns in advancing volume:	35.1%
Percent trucks in left turn volume:	55.0%
Probability of conflict threshold:	2.14%
Calculated probability of conflicting arrival:	0.3%
Calculated conflicts per hour, veh/h:	0.3
Use Detailed Method	
Type II	RT Lane warranted
Additonal Storage Not Requied — *base storage requirement*	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

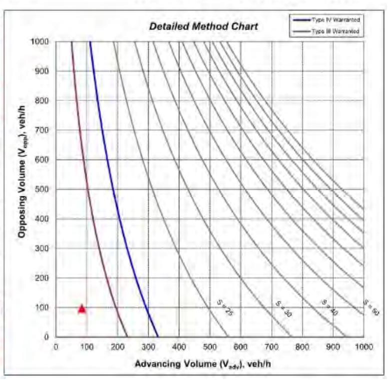
Main Rd: Hwy. 644:02 **Minor Rd:** 47th Street **Direction:** EB **Period:** AM Peak **Year of Analysis:** 2035 **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85^{th} percentile speed, km/h:	80
Main Road A.A.D.T.	1,676
Minor (intersecting) Road A.A.D.T	360
Left turn volume (V_{LT}), veh/h:	25
Advancing volume (V_{adv}), veh/h:	84
Opposing volume (V_{opp}), veh/h:	97
Left turn truck volume, trucks/h:	8
Right turn volume (V_{RT}), veh/day:	54

OUTPUT	Value
Percent left-turns in advancing volume:	29.8%
Percent trucks in left turn volume:	32.0%
Probability of conflict threshold:	1.52%
Calculated probability of conflicting arrival:	0.1%
Calculated conflicts per hour, veh/h:	0.1
Type II	
Detailed Method Not Required	
base storage requirement	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

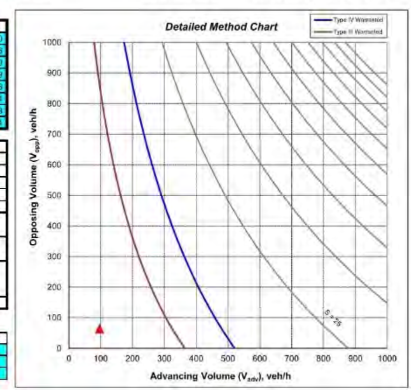
Main Rd: Hwy. 644:02 **Minor Rd:** 47th Street **Direction:** EB **Period:** PM Peak **Year of Analysis:** 2035 **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85^{th} percentile speed, km/h:	80
Main Road A.A.D.T.	1,676
Minor (intersecting) Road A.A.D.T	360
Left turn volume (V_{LT}), veh/h:	9
Advancing volume (V_{adv}), veh/h:	96
Opposing volume (V_{opp}), veh/h:	84
Left turn truck volume, trucks/h:	3
Right turn volume (V_{RT}), veh/day:	54

OUTPUT	Value
Percent left-turns in advancing volume:	9.4%
Percent trucks in left turn volume:	33.3%
Probability of conflict threshold:	1.52%
Calculated probability of conflicting arrival:	0.1%
Calculated conflicts per hour, veh/h:	0.1
Type II	
Detailed Method Not Required	
base storage requirement	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

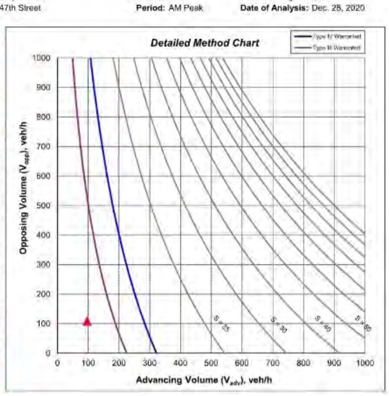
Main Rd: Hwy. 644:02 **Minor Rd:** 47th Street **Direction:** EB **Period:** AM Peak **Year of Analysis:** 2045 **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85^{th} percentile speed, km/h:	80
Main Road A.A.D.T.	1,884
Minor (intersecting) Road A.A.D.T	468
Left turn volume (V_{LT}), veh/h:	32
Advancing volume (V_{adv}), veh/h:	96
Opposing volume (V_{opp}), veh/h:	109
Left turn truck volume, trucks/h:	10
Right turn volume (V_{RT}), veh/day:	70

OUTPUT	Value
Percent left-turns in advancing volume:	33.3%
Percent trucks in left turn volume:	31.3%
Probability of conflict threshold:	1.52%
Calculated probability of conflicting arrival:	0.2%
Calculated conflicts per hour, veh/h:	0.2
Use Detailed Method	
Type II	
Additonal Storage Not Requied — *base storage requirement*	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



Alberta Transportation
Intersection Analysis
Two-Lane Undivided Highways

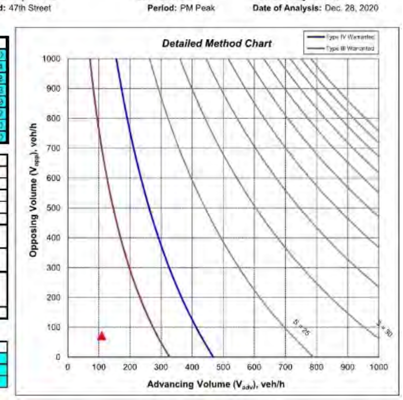
Main Rd: Hwy. 644:02 **Minor Rd:** 47th Street **Direction:** EB **Period:** PM Peak **Year of Analysis:** 2045 **Date of Analysis:** Dec. 28, 2020

INPUT	Value
85^{th} percentile speed, km/h:	80
Main Road A.A.D.T.	1,884
Minor (intersecting) Road A.A.D.T	468
Left turn volume (V_{LT}), veh/h:	13
Advancing volume (V_{adv}), veh/h:	109
Opposing volume (V_{opp}), veh/h:	72
Left turn truck volume, trucks/h:	10
Right turn volume (V_{RT}), veh/day:	70

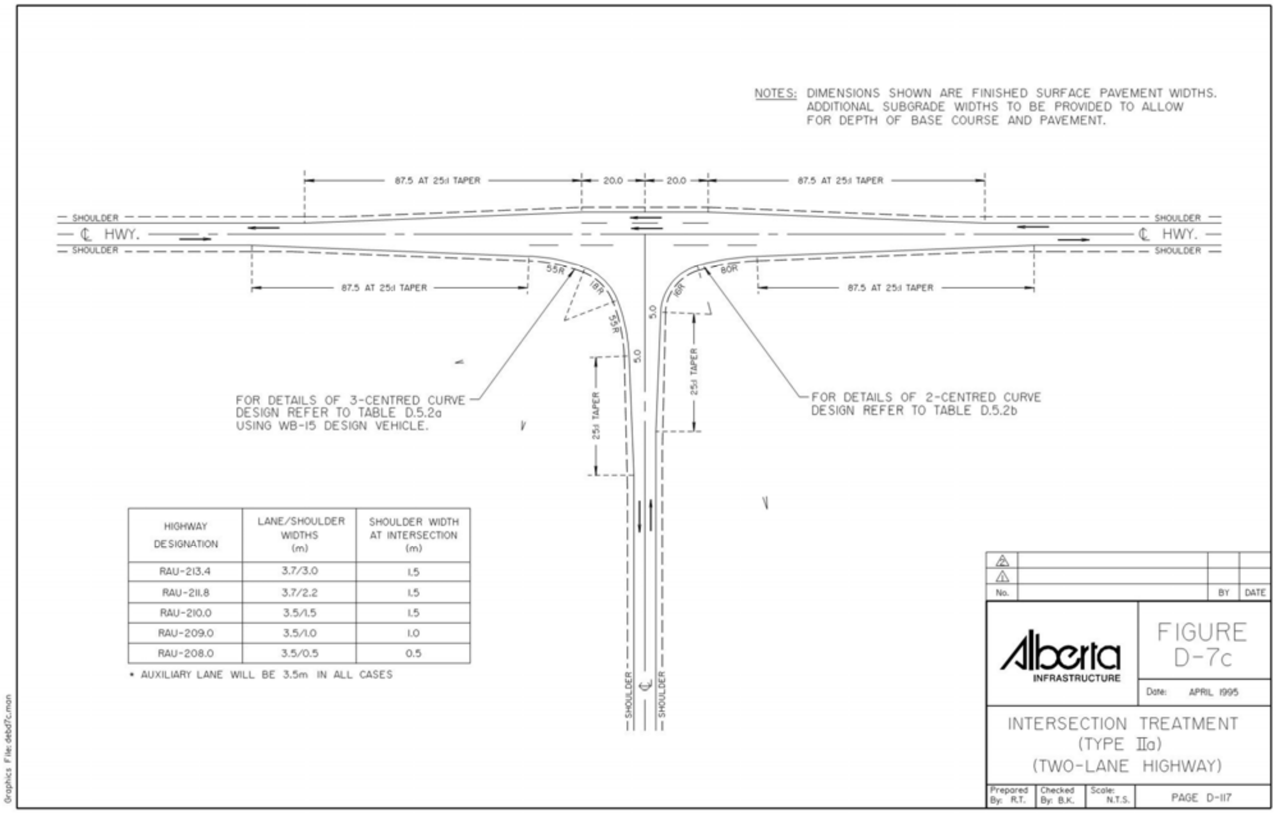
OUTPUT	Value
Percent left-turns in advancing volume:	11.9%
Percent trucks in left turn volume:	76.9%
Probability of conflict threshold:	1.52%
Calculated probability of conflicting arrival:	0.1%
Calculated conflicts per hour, veh/h:	0.1
Use Detailed Method	
Type II	
Additonal Storage Not Requied — *base storage requirement*	-
- standard storage length	-
+ additional truck storage	-
= total additional storage required	-

CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway (gap), s:	5.0
Average time to clear, s:	1.9



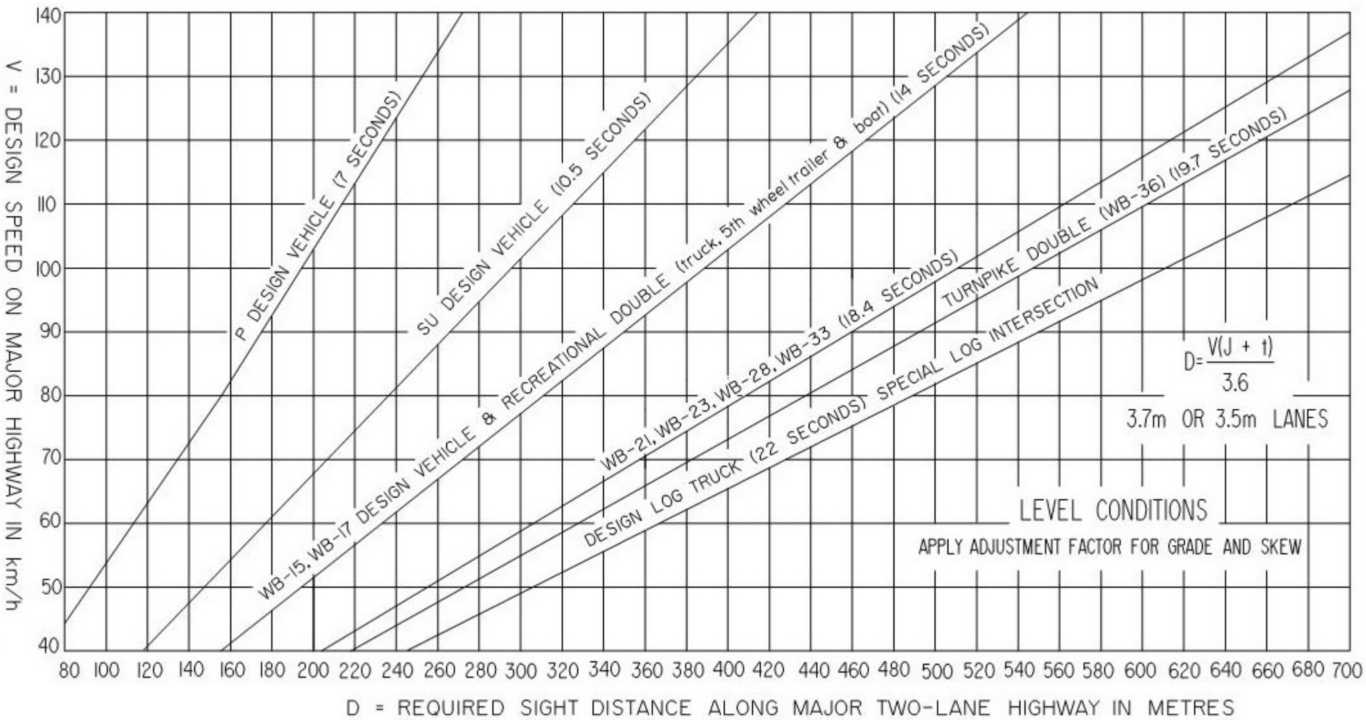
For the Eastbound direction of the intersection, a Type IIa intersection treatment is warranted in 2035 as shown below:



5.4 Intersectional Sight Distance

In accordance with section D.4, “Sight Distances at Intersections”, the sight distance for left turning vehicles from the approach, without interfering with vehicles nearing the intersection, is used for determination of minimum sight distance requirements. Using Fig. D-4.2.2.2 below, the required sight distances for various vehicle types with an 80 km/hr design speed are as follows:

Vehicle Type	Required Sight Distance – 80 km/hr.
Passenger Vehicle (P)	155 m
Single Unit or Bus (SU)	235 m
Semi-Trailer Combination (WB15)	310 m
Semi-Trailer Combination (WB21, WB23, WB28, WB33)	410 m



The site distance is greater than 410 metres in both directions on Hwy. 644:02 at the Hwy. 644/47th Street intersection.

5.5 Illumination & Signalization

Illumination and signalization warrants were reviewed. The results are summarized in the Table below:

Location	Year	Illumination Warrant Score	Illumination Warrant Met? (Min. 120)	Signalization Warrant Score	Signalization Warrant Met?
Hwy. 644:02 & 47th Street	2045	43	No	N/A	No

Illumination is not warranted for the intersection for the next 24 years.

Traffic signals are not warranted at the intersection for the next 24 years as the turning traffic volumes are too low.

5.6 Capacity Analysis

A capacity analysis was performed for the intersection for the 100th highest hour for the AM & PM Peak Hours for Years 2021, 2025, 2035 and 2045. The traffic analysis was completed using Synchro 10 software based on HCM 2000 and HCM 2010 methodology. A saturation flow of 1700 vpl was used in this analysis. See the table below for the results. Results below are reported in HCM 2000 methodology.

Hwy. 644:02 & 47th Street

With Development in Years 2035 & 2045

			Hwy. 644:02				47th Street
TIME PERIOD		PARAMETERS	EB All Turns	WB All Turns			SB All Turns
Year 2021	AM Peak	LOS	A	A			A
		Delay (s)	1.8	0.0			9.0
		v/c Ratio	0.01	0.05			0.00
		Queue 95th	0.2	0.0			0.1
	PM Peak	LOS	A	A			A
		Delay (s)	0.2	0.0			8.9
		v/c Ratio	0.01	0.03			0.02
		Queue 95th	0.0	0.0			0.5
Year 2025	AM Peak	LOS	A	A			A
		Delay (s)	1.7	0.0			9.1
		v/c Ratio	0.01	0.05			0.01
		Queue 95th	0.3	0.0			0.1
	PM Peak	LOS	A	A			A
		Delay (s)	0.3	0.0			8.9
		v/c Ratio	0.00	0.03			0.02
		Queue 95th	0.0	0.0			0.6

				Hwy. 644:02				47th Street
TIME PERIOD		PARAMETERS		EB All Turns	WB All Turns			SB All Turns
Year 2035	AM Peak	LOS		A	A			A
		Delay (s)		2.3	0.0			9.3
		v/c Ratio		0.02	0.06			0.01
		Queue 95th		0.4	0.0			0.3
	PM Peak	LOS		A	A			A
		Delay (s)		0.7	0.0			9.1
		v/c Ratio		0.01	0.04			0.04
		Queue 95th		0.1	0.0			1.0
Year 2045	AM Peak	LOS		A	A			A
		Delay (s)		2.7	0.0			9.3
		v/c Ratio		0.02	0.07			0.02
		Queue 95th		0.6	0.0			0.5
	PM Peak	LOS		A	A			A
		Delay (s)		1.0	0.0			9.3
		v/c Ratio		0.01	0.04			0.05
		Queue 95th		0.2	0.0			1.4
Using 2.0% Growth Rate non-compounded per year								
Year 2045	AM Peak	LOS		A	A			A
		Delay (s)		2.4	0.0			9.5
		v/c Ratio		0.02	0.08			0.02
		Queue 95th		0.6	0.0			0.5
	PM Peak	LOS		A	A			A
		Delay (s)		0.8	0.0			9.4
		v/c Ratio		0.01	0.05			0.06
		Queue 95th		0.2	0.0			1.4

The Roadway Capacity Analysis indicates that the intersection will have sufficient capacity for the next 24 years with the proposed added development traffic with the LOS reaching only A on all three legs of the intersection. Further to this, when the growth rate for Hwy. 644:02 is increased from 1.0% growth per year to 2.0% growth per year, the capacity analysis still indicates that the intersection maintains its capacity for the next 24 years. See Appendices for detailed reports.

LEVEL OF SERVICE (LOS) CRITERIA

Control Delay Per Vehicle (s)	LOS by Volume to Capacity Ratio	
	≤1	>1
≤10	A	F
>10 and ≤15	B	F
>15 and ≤25	C	F
>25 and ≤35	D	F
>35 and ≤50	E	F
>50	F	F


Level of Service "A"


Level of Service "B"


Level of Service "C"


Level of Service "D"


Level of Service "E"


Level of Service "F"

5.7 Analysis Summary

A detailed analysis was completed for this report at the intersection of Highway 644:02 and 47th Street in the Town of Redwater. The results are as follows:

- Using Alberta Transportation Design Guidelines, the intersection treatment analysis indicated that a Type IIa intersection treatment is warranted in 2035 once 50% of the proposed development has filled and has connected to 47th Street.
- Using Synchro 10 software based on HCM 2000 and HCM 2010 methodology, the existing intersection treatment shows that the intersection has sufficient

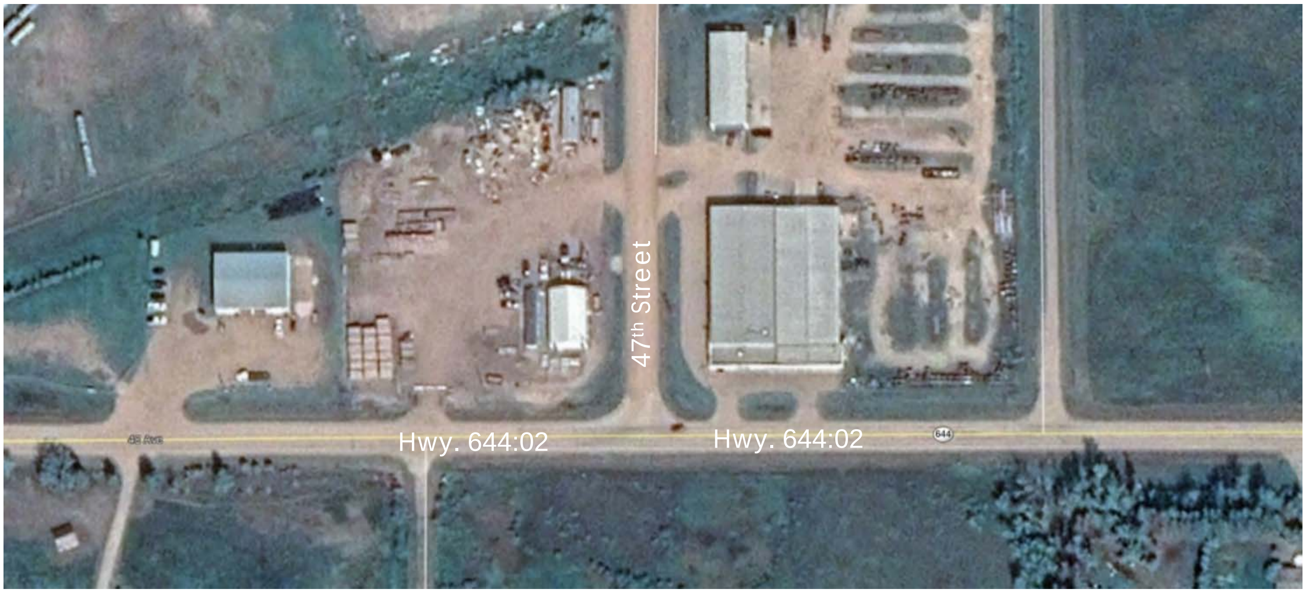
capacity to support traffic movements to a Level of Service of A for the next 24 years, with the proposed development fully utilized in 2045, with or without a Type IIa intersection treatment.

- Illumination is not warranted at this intersection for the next 24 years.
- Traffic Signals at this intersection are not warranted for the next 24 years.
- Sight distance for Design Vehicles of Semi-Trailer Combination (WB21, WB23, WB28, WB33) at the posted speed of 70 kph is sufficient.
- A Pedestrian Crossing Warrant Analysis was not completed at this location as there are no signs of pedestrian walkways in this area and are assumed to be zero to very low.

This intersection is within the Town of Redwater and thus an urban area. The posted speed is only 70 kph and the capacity analysis indicates that the longest delay times in 24 years are less than 10 seconds for any movement at the intersection. The delays and queue lengths are minimal and the intersection should operate efficiently for 24 years with the present intersection treatment. The turn radii are large and accommodates all truck traffic in the area. There are no operational issues presently at the site.

Future consideration should be made to change the posted speed in the area from 70 kph to 50 kph, so that all intersections and approaches are within a 50 kph posted speed zone.

There is an issue of limited right-of-way at this intersection. The highway was originally constructed within a basic 22.86m (75 foot) right-of-way. The existing right-of-way does not allow for a full Type IIa intersection treatment standard to be constructed. There is some additional width available on the north side of Hwy. 644 only, however the majority of the road widening in a Type IIa treatment would need to occur on the south side of Hwy. 644. Specifically, for a Type II intersection treatment on the south side would require +20m for a proper rural cross-section (1 side: 3.7m + 3.5m + 2.3m + 5m SS + 3.5m Ditch + 3m BS). The existing right-of-way only allows for a modified intersection width improvement using a 0.5m shoulder width and 3:1 sideslopes, if only in a fill situation. Fortunately, at this location, there are no backslopes and the road is mainly in a fill situation. This would allow for the addition lane being added with the suggested modifications. See below.

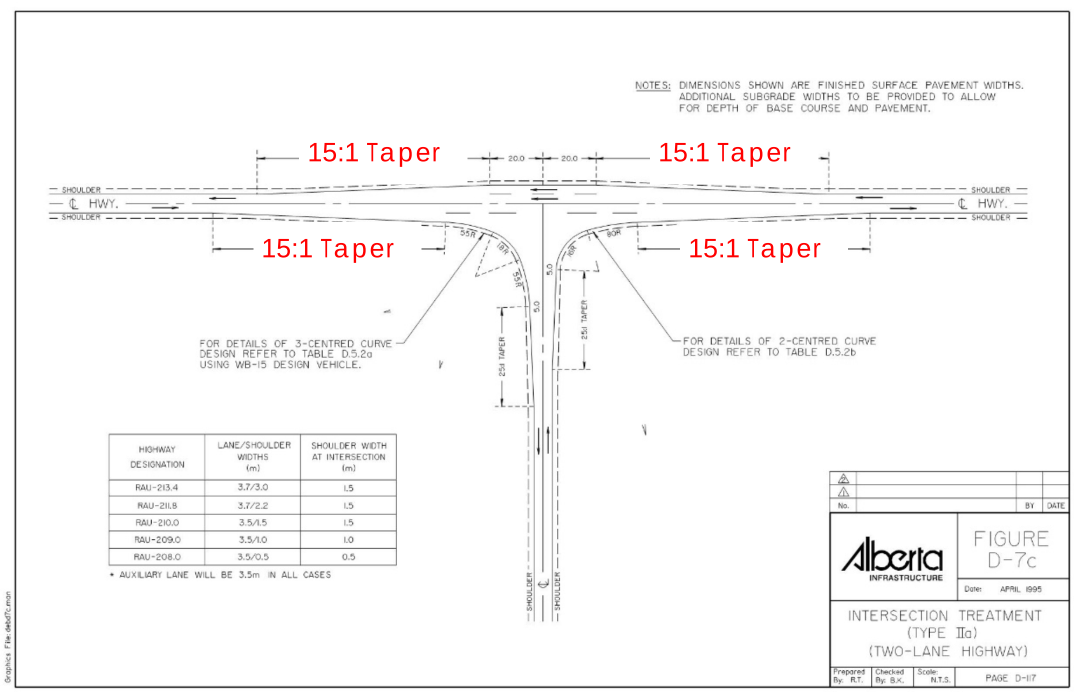

47th Street
Hwy. 644:02
Hwy. 644:02
644


962 1303

It is also recommended that 15:1 tapers be utilized in lieu of 25:1 tapers since this location is within an established urban area with a 70 kph and potentially reduced to 50 kph posted speed. This will also help avoid tapers from going through approaches and other intersections, since there are numerous approaches in this area. The 40:1 and 25:1 taper rates are shown on AT's design guidelines are mainly intended for rural situations, as there is often significantly speed reductions due to turning movements. These speed reductions are usually from a speed of 100 km/h. For an established urban location, traffic should be traveling at the posted speed of 70 kph, where turning movements would only consist of reductions of speed from 70 km/h to 20 - 30 km/h. The tables contained in Alberta Transportation's intersection treatment diagrams do not account for this and apply the same taper rate for design speeds from 50 to 110 km/h. It is common practice to use 15:1 taper rates in urban design, as there is limited room to provide long tapers. This is especially true for this location as longer tapers would cross other intersections or come very close to them, which is undesirable for many reasons, including being confusing for motorists and pedestrians.

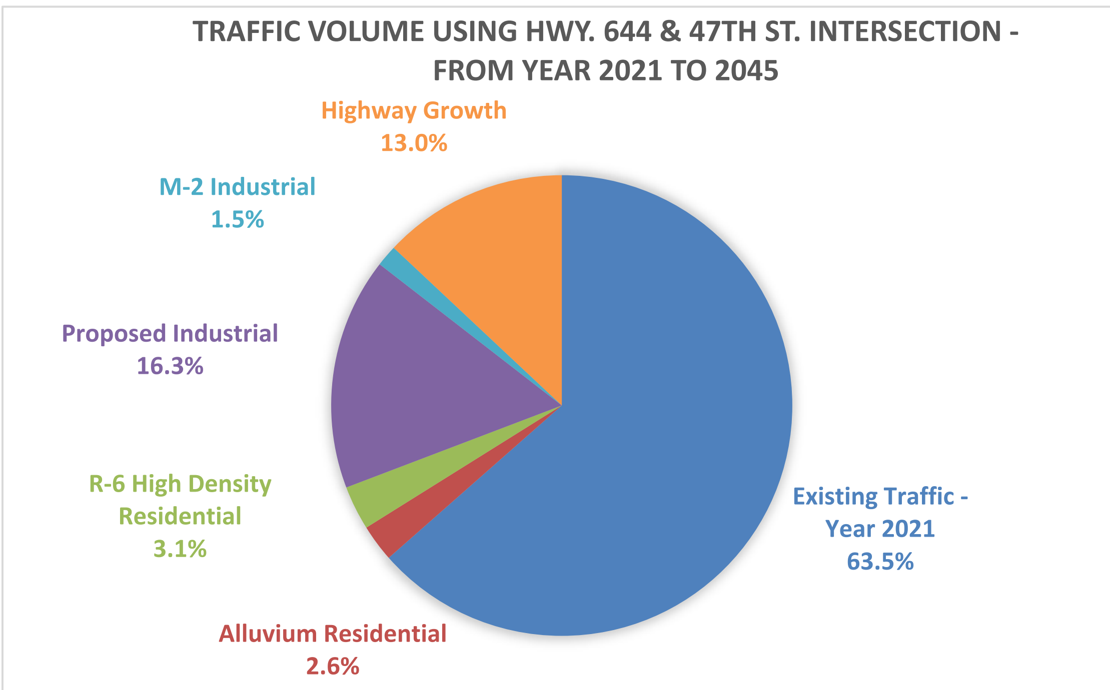
HIGHWAY DESIGN SPEED (km/h)	LENGTH AND TAPER RATIO "T" OF RIGHT TURN TAPER (m)
50	87.5 at 25:1
60	87.5 at 25:1
70	87.5 at 25:1
80	87.5 at 25:1
90	87.5 at 25:1
100	87.5 at 25:1
110	87.5 at 25:1
120	140.0 at 40:1
130	140.0 at 40:1

It is likely that additional right-of-way at this intersection will not be immediately attainable, and therefore, a modified intersection treatment as described above should suffice for proposed development in the area for the next 24 years.



In summary, a Type IIa intersection treatment is not warranted until 2035 (50% of Phase II occupied) by Alberta Transportation standards. A capacity analysis indicates delays would be minimal and within acceptable standards with or without an intersection improvement. In 2035, a Type IIa intersection treatment can be constructed but with modifications to the standard type IIc treatment that include 0.5m wide shoulders, 3:1 sideslopes and 15:1 tapers.

Since other developments are presently being constructed in the area, cost sharing of this improvement is likely to be considered. The ratio of estimated existing and development traffic volumes using this intersection from 2021 to 2045 is shown below. This will change as more development is proposed.



6. TRAFFIC ANALYSIS – 47TH STREET & 54TH AVENUE

6.1 Design Speed

The posted speed on 44th Street at this location is 50 km/hr. A design speed of 60 km/h will be used for the analysis and the results assessed upon this.

6.2 Determination Based on Traffic Volume Warrant Chart

The Alberta Transportation Design Guidelines are intended for provincial highway design and not necessary for local roadways, especially within urban municipalities. For this reason, the intersection analysis procedure outlined in Chapter D of the Alberta Transportation Design Guidelines will not be used for this intersection. Intersection treatment will be based on adequate capacity and urban road standards.

6.3 Capacity Analysis

A capacity analysis was performed for the intersection for the 100th highest hour for the AM & PM Peak Hours for Years 2021, 2025, 2035 and 2045. The traffic analysis was completed using Synchro 10 software based on HCM 2000 and HCM 2010 methodology. A saturation flow of 1700 vpl was used in this analysis. See the table below for the results. Results below are reported in HCM 2000 methodology.

44th Street & 54th Avenue
<u>With Development in Years 2025, 2035 & 2045</u>

				54th Avenue		44th Street		
	TIME PERIOD	PARAMETERS		EB All Turns	WB All Turns	NB All Turns	SB All Turns	
Year 2021	AM Peak	LOS		A	A	A	A	
		Delay (s)		1.1	0.0	9.1	8.8	
		v/c Ratio		0.00	0.05	0.02	0.01	
		Queue 95th		0.1	0.0	0.5	0.3	

				54th Avenue		44th Street		
TIME PERIOD		PARAMETERS		EB All Turns	WB All Turns	NB All Turns	SB All Turns	
	PM Peak	LOS		A	A	A	A	
	PM Peak	Delay (s)		4.1	0.0	9.3	9.0	
	PM Peak	v/c Ratio		0.01	0.00	0.04	0.02	
	PM Peak	Queue 95th		0.2	0.0	1.0	0.6	
Year 2025	AM Peak	LOS		A	A	A	A	
Year 2025	AM Peak	Delay (s)		0.7	3.6	9.2	8.9	
Year 2025	AM Peak	v/c Ratio		0.00	0.00	0.04	0.02	
Year 2025	AM Peak	Queue 95th		0.1	0.0	1.1	0.4	
Year 2025	PM Peak	LOS		A	A	A	A	
Year 2025	PM Peak	Delay (s)		2.8	4.2	9.5	9.1	
Year 2025	PM Peak	v/c Ratio		0.01	0.01	0.06	0.03	
Year 2025	PM Peak	Queue 95th		0.2	0.1	1.6	0.7	
Year 2035	AM Peak	LOS		A	A	A	A	
Year 2035	AM Peak	Delay (s)		0.8	4.0	9.2	9.0	
Year 2035	AM Peak	v/c Ratio		0.00	0.00	0.06	0.02	
Year 2035	AM Peak	Queue 95th		0.1	0.1	1.4	0.5	
Year 2035	PM Peak	LOS		A	A	A	A	
Year 2035	PM Peak	Delay (s)		2.7	3.9	9.7	9.3	
Year 2035	PM Peak	v/c Ratio		0.01	0.01	0.07	0.03	
Year 2035	PM Peak	Queue 95th		0.3	0.2	1.9	0.8	
Year 2045	AM Peak	LOS		A	A	A	A	
Year 2045	AM Peak	Delay (s)		0.7	4.0	9.3	9.2	
Year 2045	AM Peak	v/c Ratio		0.00	0.01	0.07	0.03	
Year 2045	AM Peak	Queue 95th		0.1	0.2	1.7	0.7	
Year 2045	PM Peak	LOS		A	A	A	A	
Year 2045	PM Peak	Delay (s)		2.7	4.1	10.0	9.5	
Year 2045	PM Peak	v/c Ratio		0.01	0.02	0.09	0.04	
Year 2045	PM Peak	Queue 95th		0.3	0.4	2.2	0.9	

			54th Avenue		44th Street		
TIME PERIOD	PARAMETERS		EB All Turns	WB All Turns	NB All Turns	SB All Turns	
Using 2.0% Growth Rate non-compounded per year on 44th Street							
Year 2045	AM Peak	LOS	A	A	A	A	
		Delay (s)	0.7	4.0	9.4	9.3	
		v/c Ratio	0.00	0.01	0.07	0.03	
		Queue 95th	0.1	0.2	1.9	0.8	
	PM Peak	LOS	A	A	B	A	
		Delay (s)	2.8	4.1	10.2	9.6	
		v/c Ratio	0.01	0.02	0.10	0.04	
		Queue 95th	0.3	0.4	2.7	1.1	

The Roadway Capacity Analysis indicates that the intersection will have sufficient capacity for the next 24 years with the proposed added development traffic with the LOS reaching only A on all three legs of the intersection. Further to this, when the growth rate for 44th Street is increased from 1.0% growth per year to 2.0% growth per year, the capacity analysis still indicates that the intersection maintains its capacity for the next 24 years. See Appendices for detailed reports.

6.4 Intersectional Sight Distance

In accordance with section D.4, “Sight Distances at Intersections”, the sight distance for left turning vehicles from the approach, without interfering with vehicles nearing the intersection, is used for determination of minimum sight distance requirements. Using Fig. D-4.2.2.2 below, the required sight distances for various vehicle types with an 80 km/hr design speed are as follows:

Vehicle Type	Required Sight Distance – 60 km/hr.
Passenger Vehicle (P)	112 m
Single Unit or Bus (SU)	178 m
Semi-Trailer Combination (WB15)	232 m
Semi-Trailer Combination (WB21, WB23, WB28, WB33)	305 m

The site distance is greater than 310 metres in both directions on 44th Street at the 44th Street/54th Avenue intersection.

6.5 Illumination & Signalization

Illumination and signalization warrants were reviewed. The results are summarized in the Table below:

Location	Year	Illumination Warrant Score	Illumination Warrant Met? (Min. 120)	Signalization Warrant Score	Signalization Warrant Met?
44th Street & 54th Avenue	2045 2% Growth Rate	76	No	N/A	No

Illumination is not warranted for the intersection for the next 24 years.

Traffic signals are not warranted at the intersection for the next 24 years as the turning traffic volumes are too low.

6.6 Analysis Summary

An intersection analysis was completed for this report at the intersection of 44th Street and 54th Avenue in the Town of Redwater. The results are as follows:

- Alberta Transportation Design Guidelines were not used for intersection treatment requirements as this intersection is not a provincial highway and are urban municipal road with posted speeds of 50 kph. Using provincial highway standards for internal municipal roadways would impose unnecessary design requirements on lower road classifications.
- Using Synchro 10 software based on HCM 2000 and HCM 2010 methodology, the existing intersection treatment shows that the intersection has sufficient capacity to support traffic movements to a Level of Service of A for the next 24 years, with the proposed development fully utilized in 2045, with the existing intersection configuration. Since the intersection functioning efficiently, no additional turning lanes or treatment improvements are warranted.
- Illumination is not warranted at this intersection for the next 24 years.
- Traffic Signals at this intersection are not warranted for the next 24 years.
- Sight distance for Design Vehicles of Semi-Trailer Combination (WB21, WB23, WB28, WB33) at the posted speed of 50 kph is sufficient.
- A Pedestrian Crossing Warrant Analysis was not completed at this location as there are no signs of pedestrian walkways in this area and are assumed to be

zero to very low.

In summary, this intersection is within the Town of Redwater and thus an urban area. The posted speed is only 50 kph and the capacity analysis indicates that the longest delay times in 24 years are 10 seconds or less for any movement at the intersection. The delays and queue lengths are minimal and the intersection should operate efficiently for 24 years with the present intersection treatment.

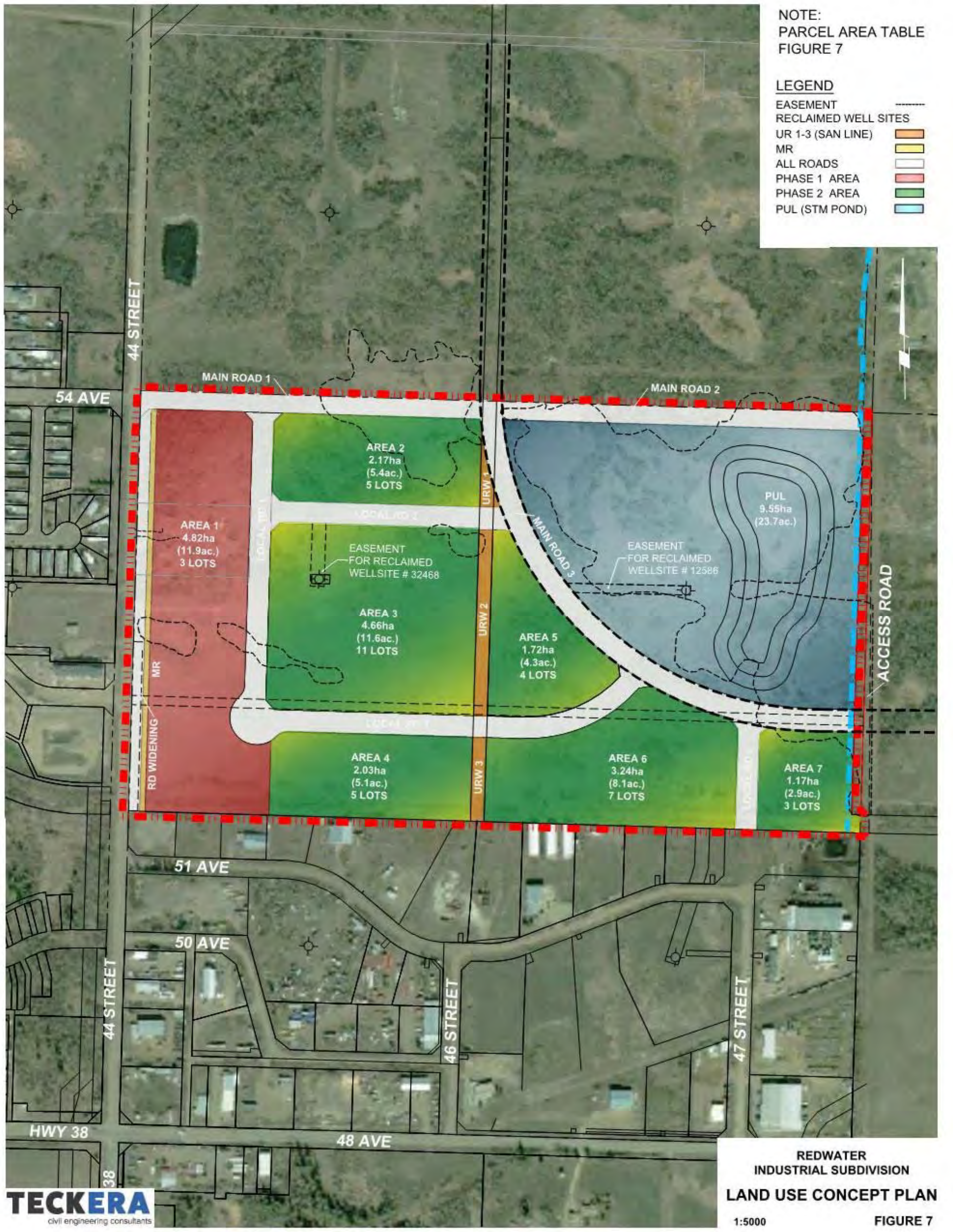
In summary, the existing intersection configuration is sufficient for the traffic projected to use this intersection by the proposed development.

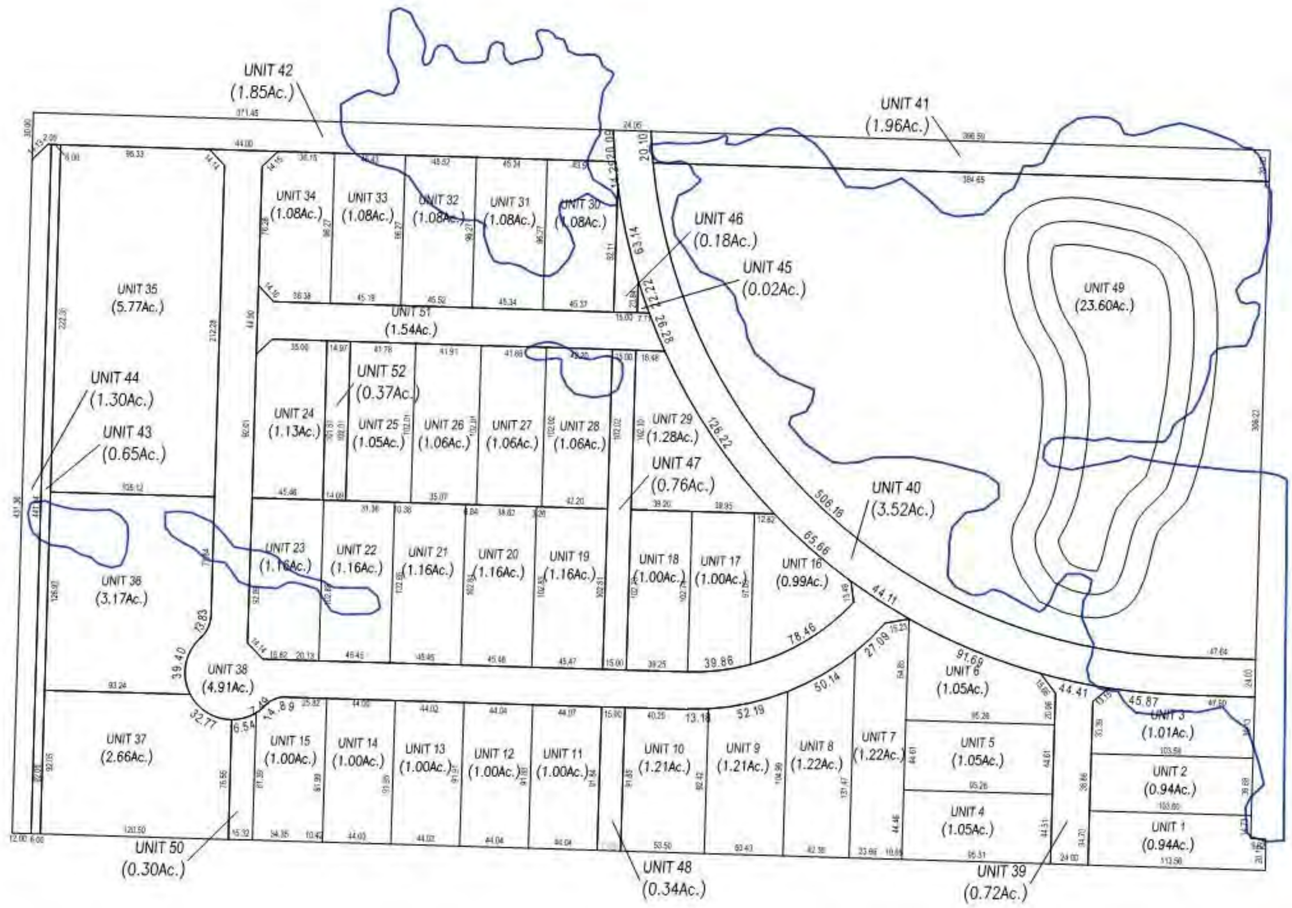
7. CONCLUSION & RECOMMENDATIONS

7.1 Recommendations

The proposed development is an Industrial Park Subdivision under the Town of Redwater's Land Use District defined as "Industrial (M2) District) as shown below:

The conceptual layout for the Proposed Development is shown below:





Parcel Area Table

Parcel #	Area m²	Hectares (ha.)	Acre (ac.)
UNIT 1	3800.00m²	0.38ha.	0.94ac.
UNIT 2	3800.00m²	0.38ha.	0.94ac.
UNIT 3	4087.72m²	0.41ha.	1.01ac.
UNIT 4	4238.98m²	0.42ha.	1.05ac.
UNIT 5	4250.00m²	0.42ha.	1.05ac.
UNIT 6	4238.19m²	0.42ha.	1.05ac.
UNIT 7	4925.96m²	0.49ha.	1.22ac.
UNIT 8	4942.80m²	0.49ha.	1.22ac.
UNIT 9	4904.73m²	0.49ha.	1.21ac.
UNIT 10	4912.36m²	0.49ha.	1.21ac.
UNIT 11	4046.86m²	0.40ha.	1.00ac.
UNIT 12	4046.86m²	0.40ha.	1.00ac.
UNIT 13	4046.86m²	0.40ha.	1.00ac.
UNIT 14	4046.86m²	0.40ha.	1.00ac.
UNIT 15	4046.86m²	0.40ha.	1.00ac.
UNIT 16	4025.38m²	0.40ha.	0.99ac.
UNIT 17	4030.00m²	0.40ha.	1.00ac.
UNIT 18	4030.00m²	0.40ha.	1.00ac.

Parcel Area Table

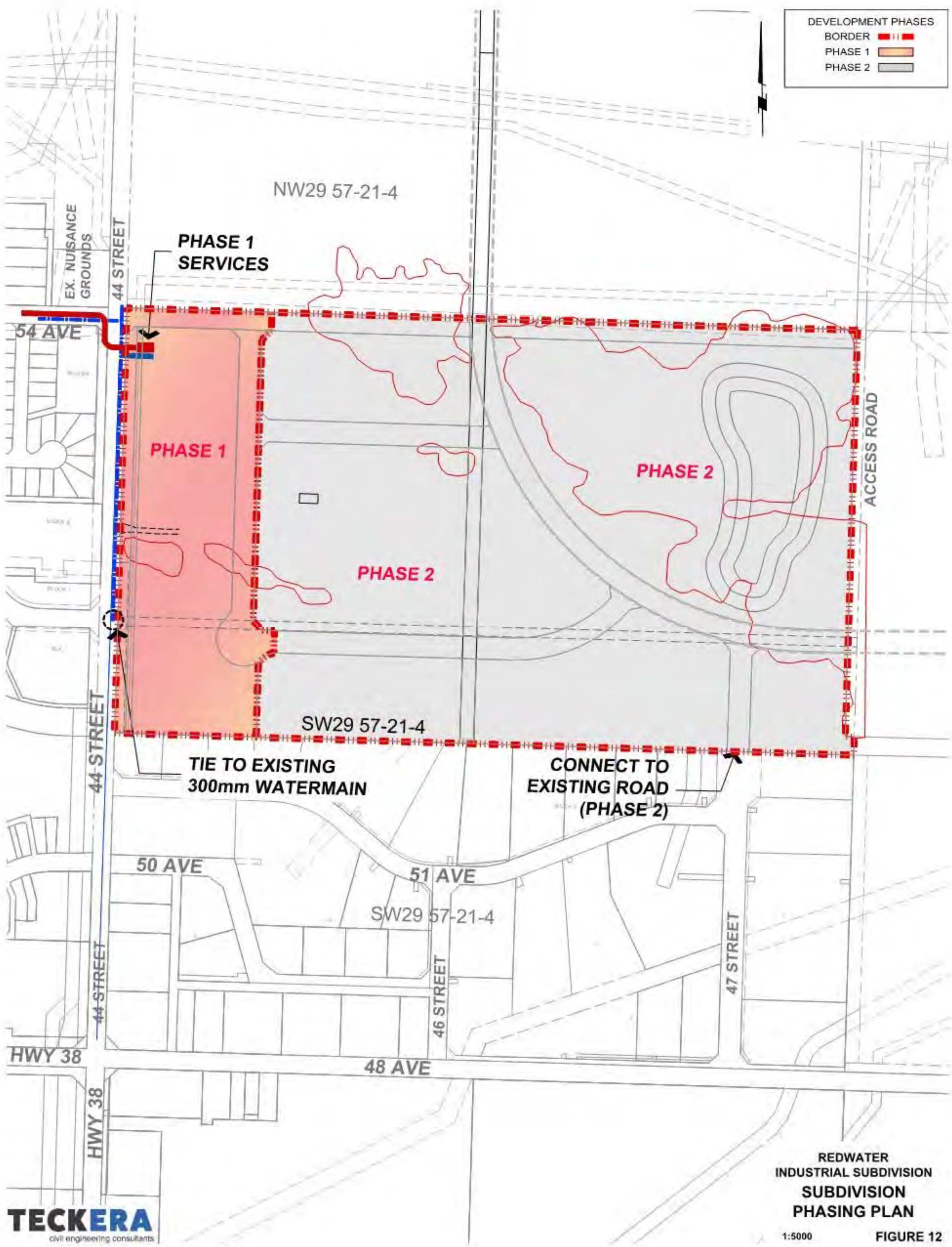
Parcel #	Area m²	Hectares (ha.)	Acre (ac.)
UNIT 19	4675.00m²	0.47ha.	1.16ac.
UNIT 20	4675.00m²	0.47ha.	1.16ac.
UNIT 21	4675.00m²	0.47ha.	1.16ac.
UNIT 22	4675.00m²	0.47ha.	1.16ac.
UNIT 23	4682.26m²	0.47ha.	1.16ac.
UNIT 24	4561.58m²	0.46ha.	1.13ac.
UNIT 25	4259.80m²	0.43ha.	1.05ac.
UNIT 26	4275.57m²	0.43ha.	1.06ac.
UNIT 27	4272.82m²	0.43ha.	1.06ac.
UNIT 28	4305.67m²	0.43ha.	1.06ac.
UNIT 29	5182.04m²	0.52ha.	1.28ac.
UNIT 30	4361.10m²	0.44ha.	1.08ac.
UNIT 31	4364.47m²	0.44ha.	1.08ac.
UNIT 32	4382.05m²	0.44ha.	1.08ac.
UNIT 33	4361.77m²	0.44ha.	1.08ac.
UNIT 34	4355.37m²	0.44ha.	1.08ac.
UNIT 35	23343.89m²	2.33ha.	5.77ac.
UNIT 36	12824.68m²	1.28ha.	3.17ac.

Parcel Area Table

Parcel #	Area m²	Hectares (ha.)	Acre (ac.)
UNIT 37	10778.40m²	1.08ha.	2.66ac.
UNIT 38	19876.15m²	1.99ha.	4.91ac.
UNIT 39	2902.00m²	0.29ha.	0.72ac.
UNIT 40	14229.26m²	1.42ha.	3.52ac.
UNIT 41	7914.45m²	0.79ha.	1.96ac.
UNIT 42	7496.30m²	0.75ha.	1.85ac.
UNIT 43	2648.06m²	0.26ha.	0.65ac.
UNIT 44	5246.26m²	0.52ha.	1.30ac.
UNIT 45	77.87m²	0.01ha.	0.02ac.
UNIT 46	716.12m²	0.07ha.	0.18ac.
UNIT 47	3072.49m²	0.31ha.	0.76ac.
UNIT 48	1377.66m²	0.14ha.	0.34ac.
UNIT 49	95514.77m²	9.55ha.	23.60ac.
UNIT 50	1208.44m²	0.12ha.	0.30ac.
UNIT 51	6238.44m²	0.62ha.	1.54ac.
UNIT 52	1510.19m²	0.15ha.	0.37ac.

The proposed layout creates a new access onto 44th Street to the west at 54th Avenue and a secondary access to the south through the existing industrial subdivision onto Highway 644:02 (48th Avenue) at 47 Street.

The anticipated phasing of the development is shown below:



The anticipated trip distribution for the proposed developmnet will first occur from one access point at the north west corner of the property at the junction of 54th Avenue & 44th Street for Phase 1. The anticipated trip distribution percentages for Phase 1 is shown below.

Figure 2.4.1 – Phase1 Only - 2025

In Phase 1, the traffic to the north along 44th Street from the development access is anticipated to be low as existing development to the north is low and the local roadway is not as developed as Highway 829 to the east. Traffic will likely utilize existing paved roadways and highways to the south. However, traffic will likely use 54th Avenue to the west, as this route is a shorter distance to the Redwater downtown area. This traffic is not expected to be large or heavy vehicles, just passenger vehicles running errands or going for lunch.

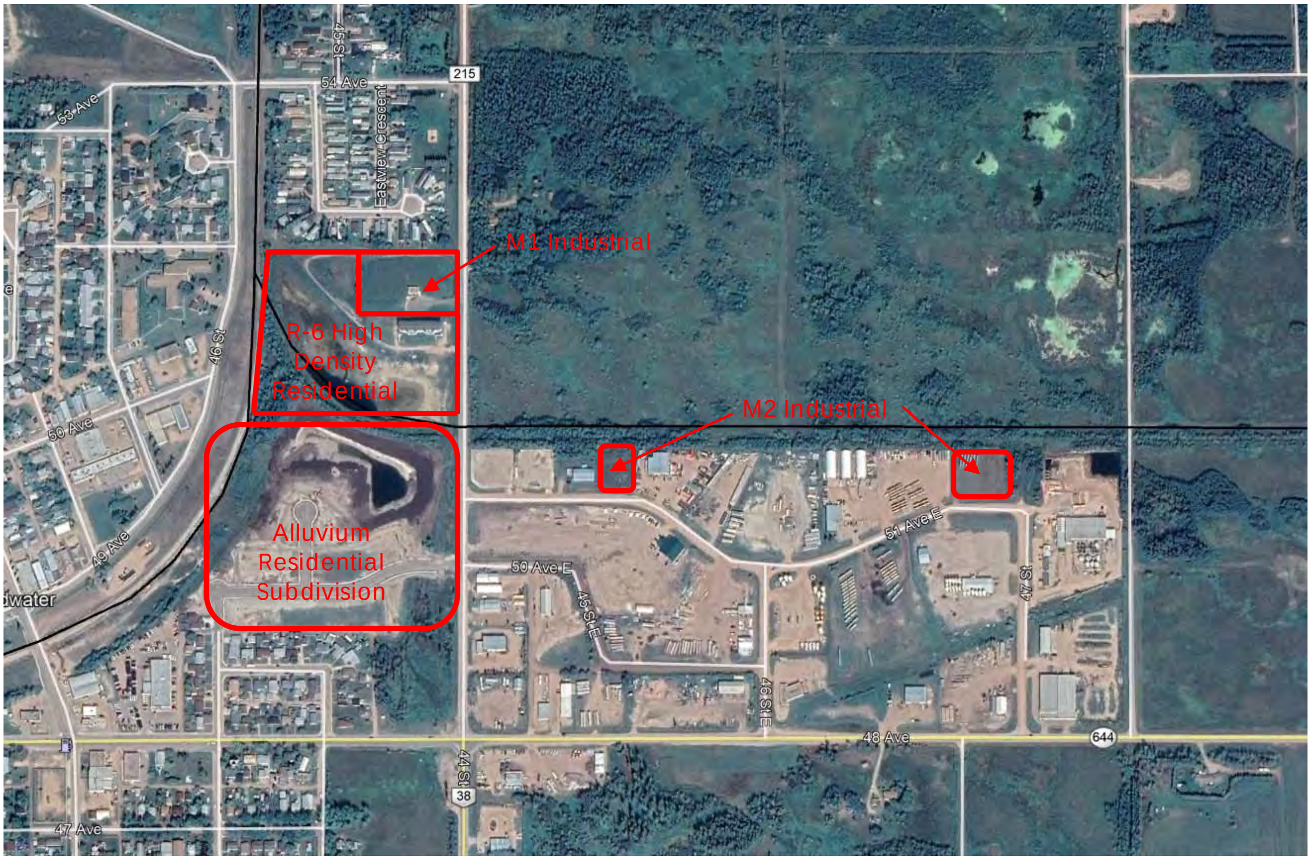
For Phase 2, slightly more traffic may go north from the north west corner of the development property. Most traffic still proceeds south to the junction of Highway

38 & Highway 644. Due to the location of the Alberta Industrial Heartland area, much of the proposed development is anticipated to service this area and its future growth.

A new access will be made to the south existing industrial park at 47th Street which connects to Highway 644 (48th Avenue). A portion of traffic from this intersection is anticipated to go east on Highway 644 and then north on Highway 829. The traffic on the west leg of this intersection is split 50% to the west and 50% to the south.

Figure 2.4.2 – Phase 1 & 2 – Year 2030 & 2040

Additional future background traffic was reviewed for the area surrounding the proposed development. There are three additional areas that new traffic can generate in the future along 44th Street and Hwy. 644:02 outside the development area as follows:



The above areas were added to the background traffic estimations.

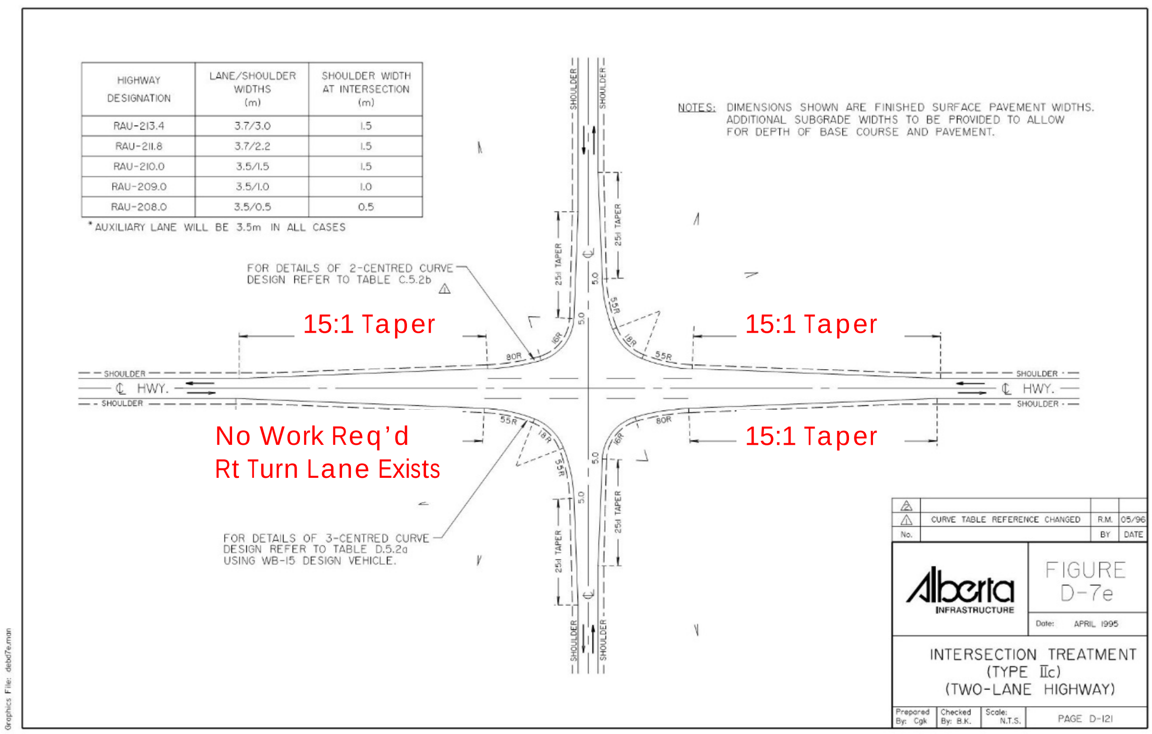
A detailed analysis was completed at the intersection of <u>Highway 38:10, Highway 644:02 and 44th Street</u>. The results are as follows:

- Using Alberta Transportation Design Guidelines, the intersection treatment analysis indicated that a Type IIc intersection treatment is warranted now in 2021 and was warranted many years before this upon review of past traffic volumes. A Type IIc intersection treatment requirement is maintained for the next 24 years, with the proposed development fully utilized in 2045.
- Using Synchro 10 software based on HCM 2000 and HCM 2010 methodology, the existing intersection treatment shows that the intersection has sufficient capacity to support traffic movements to a Level of Service of C for the next 24 years, with the proposed development fully utilized in 2045.
- Partial illumination is warranted in 2025, however no action is required since full urban street lighting exists on all four legs of the intersection.
- Traffic Signals at this intersection are not warranted for the next 24 years. Hence, a roundabout is also not a consideration for the next 24 years at this location.

- Sight distance for Design Vehicles of Semi-Trailer Combination (WB21, WB23, WB28, WB33) at the posted speed of 50 kph is sufficient.
- A Pedestrian Crossing Warrant Analysis was not completed at this location as there are no signs of pedestrian walkways in this area and are assumed to be zero to very low.

This intersection is within the Town of Redwater and thus an urban area. The posted speed is only 50 kph and the capacity analysis indicates that the longest delay times in 24 years are 14 – 16 seconds for a left turn/straight thru movement from the Hwy. 38:10 South Leg. The delays and queue lengths are minimal and the intersection should operate efficiently for 24 years and more with the present intersection treatment. There are no operational issues presently at the site.

It is likely that additional right-of-way at this intersection will not be immediately attainable, and therefore, a modified intersection treatment will be needed and should suffice for proposed development in the area for the next 24 years.



In summary, a Type IIc intersection treatment is warranted in Year 2021 but with modifications to the standard type IIc treatment that include 0.5m wide shoulders, 3:1 sideslopes and 15:1 tapers. Improvements are not required in the SW quadrant.

Since other developments are presently being constructed in the area, cost sharing of this improvement is likely to be considered.

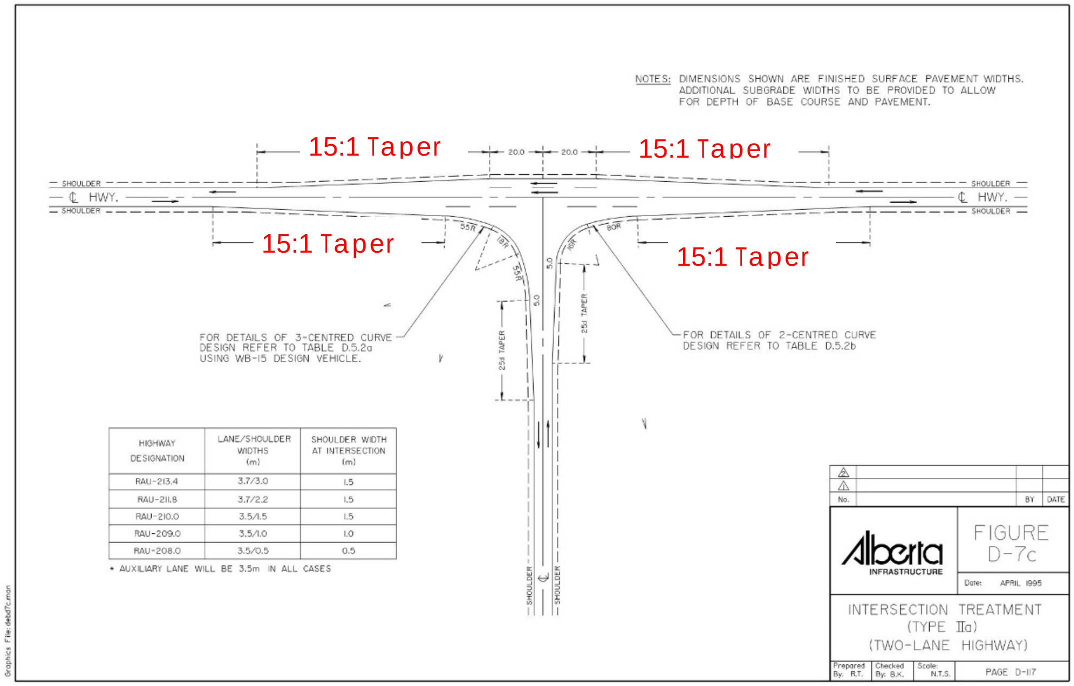
A detailed analysis was completed at the intersection of Highway 644:02 and 47th Street. The results are as follows:

- Using Alberta Transportation Design Guidelines, the intersection treatment analysis indicated that a Type IIa intersection treatment is warranted in 2035 once 50% of the proposed development has filled, after connecting to 47th Street.
- Using Synchro 10 software based on HCM 2000 and HCM 2010 methodology, the existing intersection treatment shows that the intersection has sufficient capacity to support traffic movements to a Level of Service of A for the next 24 years, with the proposed development fully utilized in 2045, with or without a Type IIa intersection treatment.
- Illumination is not warranted at this intersection for the next 24 years.
- Traffic Signals at this intersection are not warranted for the next 24 years.
- Sight distance for Design Vehicles of Semi-Trailer Combination (WB21, WB23, WB28, WB33) at the posted speed of 70 kph is sufficient.
- A Pedestrian Crossing Warrant Analysis was not completed at this location as there are no signs of pedestrian walkways in this area and are assumed to be zero to very low.

This intersection is within the Town of Redwater and thus an urban area. The posted speed is only 70 kph and the capacity analysis indicates that the longest delay times in 24 years are less than 10 seconds for any movement at the intersection. The delays and queue lengths are minimal and the intersection should operate efficiently for 24 years with the present intersection treatment. The turn radii are large and accommodates all truck traffic in the area. There are no operational issues presently at the site.

Future consideration should be made to change the posted speed in the area from 70 kph to 50 kph, so that all intersections and approaches are within a 50 kph posted speed zone.

It is likely that additional right-of-way at this intersection will not be immediately attainable, and therefore, a modified intersection treatment will be needed and should suffice for proposed development in the area for the next 24 years.



In summary, a Type IIa intersection treatment is not warranted until 2035 (50% of Phase II occupied) by Alberta Transportation standards. A capacity analysis indicates delays would be minimal and within acceptable standards with or without an intersection improvement. In 2035, a Type IIa intersection treatment can be constructed but with modifications to the standard type IIc treatment that include 0.5m wide shoulders, 3:1 sideslopes and 15:1 tapers.

Since other developments are presently being constructed in the area, cost sharing of this improvement is likely to be considered.

An intersection analysis was completed for this report at the intersection of <u>44th Street and 54th Avenue</u> in the Town of Redwater. The results are as follows:

- Alberta Transportation Design Guidelines were not used for intersection treatment requirements as this intersection is not a provincial highway and are urban municipal road with posted speeds of 50 kph. Using provincial highway standards for internal municipal roadways would impose unnecessary design requirements on lower road classifications.
- Using Synchro 10 software based on HCM 2000 and HCM 2010 methodology, the existing intersection treatment shows that the intersection has sufficient capacity to support traffic movements to a Level of Service of A for the next 24 years, with the proposed development fully utilized in 2045, with the existing

intersection configuration. Since the intersection functioning efficiently, no additional turning lanes or treatment improvements are warranted.

- Illumination is not warranted at this intersection for the next 24 years.
- Traffic Signals at this intersection are not warranted for the next 24 years.
- Sight distance for Design Vehicles of Semi-Trailer Combination (WB21, WB23, WB28, WB33) at the posted speed of 50 kph is sufficient.
- A Pedestrian Crossing Warrant Analysis was not completed at this location as there are no signs of pedestrian walkways in this area and are assumed to be zero to very low.

This intersection is within the Town of Redwater and thus an urban area. The posted speed is only 50 kph and the capacity analysis indicates that the longest delay times in 24 years are 10 seconds or less for any movement at the intersection. The delays and queue lengths are minimal and the intersection should operate efficiently for 24 years with the present intersection treatment.

In summary, the existing intersection configuration is sufficient for the traffic projected to use this intersection by the proposed development.

Overall, the proposed development will have minimal impact to the existing transportation network in the area. Due to recent economic slow downs, it is difficult to predict how fast this area will grow. Both a 1% growth rate and 2% growth were considered in preparation of this report.

7.2 Closure

This report has been prepared in accordance to provincial and municipal requirements and guidelines. The report provides findings and recommendations based on available data and site inspections.

Darcy O. Paulichuk, P. Eng.

PROFESSIONAL ENGINEER
DARCY PAULICHUK
ALBERTA

Dec. 31, 2020

APEGGA Permit to Practice Number: P12132

APPENDIX A

TRAFFIC DATA

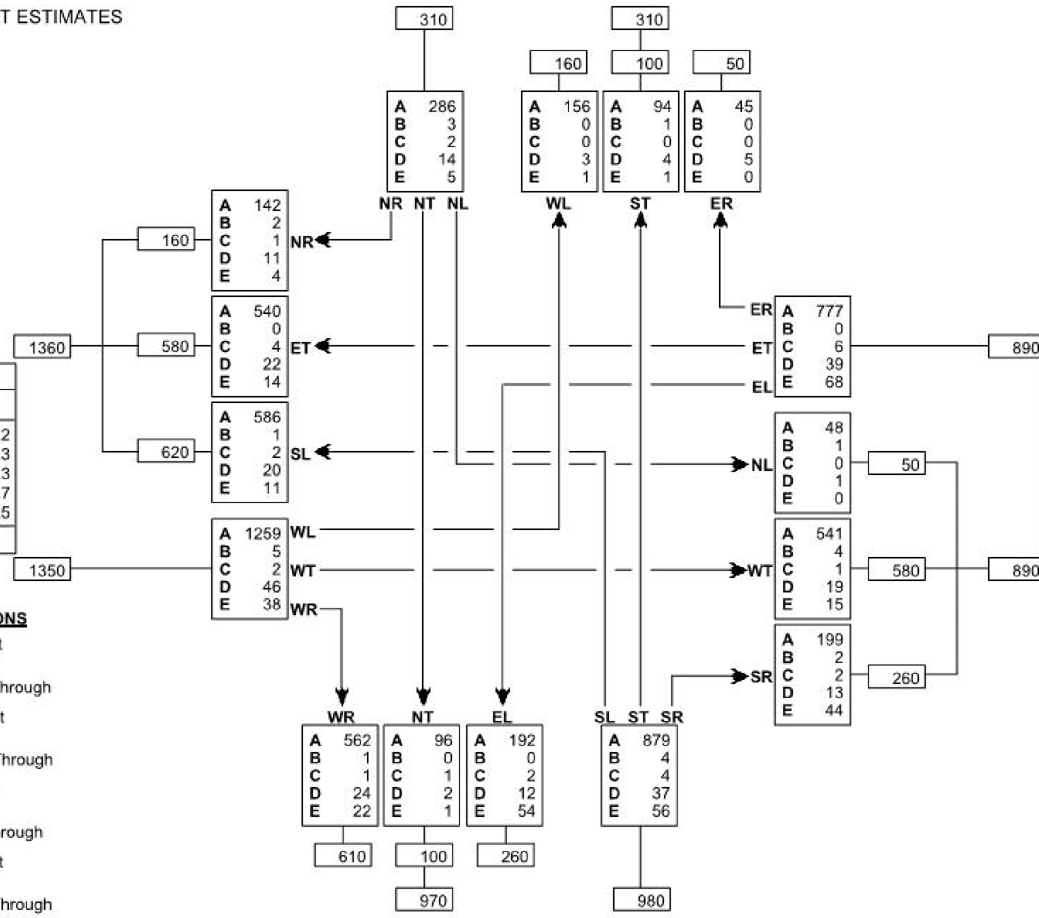
Turning Movement Summary Diagram

Reference No.: 997120

Intersection of:
38 & 644 AT REDWATER

2019 AADT / ASDT ESTIMATES

North On	44 St	
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	581	93.7
B: Recreational Vehicle	4	0.6
C: Bus	2	0.3
D: Single Unit Truck	26	4.2
E: Tractor Trailer Unit	7	1.1
ASDT 730	**AADT** 620	



West On	38	
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	2527	93.2
B: Recreational Vehicle	8	0.3
C: Bus	9	0.3
D: Single Unit Truck	99	3.7
E: Tractor Trailer Unit	67	2.5
ASDT 3210	**AADT** 2710	

East On	644	
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	1565	87.9
B: Recreational Vehicle	7	0.4
C: Bus	9	0.5
D: Single Unit Truck	72	4.0
E: Tractor Trailer Unit	127	7.1
ASDT 2110	**AADT** 1780	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Annual Average Daily Traffic
Average daily traffic expressed as vehicles per day fo period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day fo period of May 1 to September 30 (153 days)

South On	38	
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	1729	88.7
B: Recreational Vehicle	5	0.3
C: Bus	8	0.4
D: Single Unit Truck	75	3.8
E: Tractor Trailer Unit	133	6.8
ASDT 2310	**AADT** 1950	

Turning Movement Summary Diagram

Reference No.: 997120

Intersection of:
38 & 644 AT REDWATER

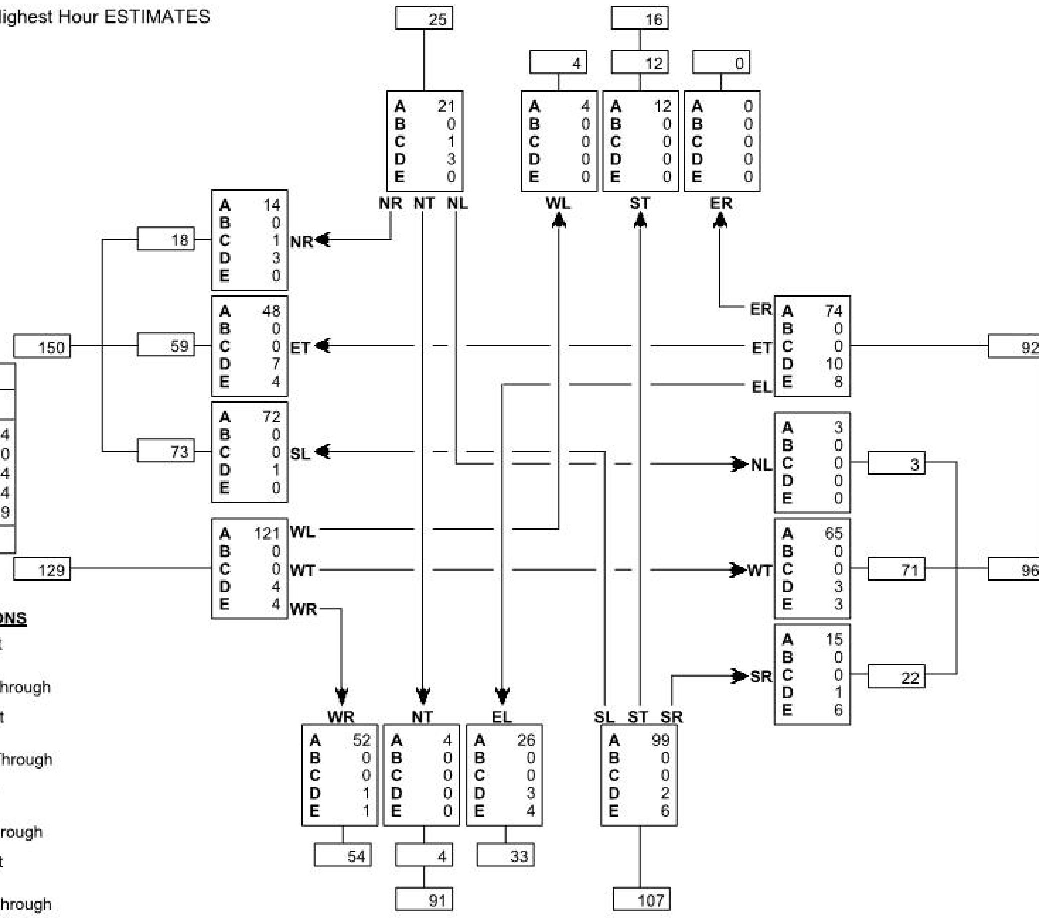
2019 a.m. 100th Highest Hour ESTIMATES

North On 44 St

Vehicle Type	Vol	%
A: Passenger Vehicle	37	90.2
B: Recreational Vehicle	0	0.0
C: Bus	1	2.4
D: Single Unit Truck	3	7.3
E: Tractor Trailer Unit	0	0.0
Total	41	

West On 38

Vehicle Type	Vol	%
A: Passenger Vehicle	255	91.4
B: Recreational Vehicle	0	0.0
C: Bus	1	0.4
D: Single Unit Truck	15	5.4
E: Tractor Trailer Unit	8	2.9
Total	279	



East On 644

Vehicle Type	Vol	%
A: Passenger Vehicle	157	83.5
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	14	7.4
E: Tractor Trailer Unit	17	9.0
Total	188	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

South On 38

Vehicle Type	Vol	%
A: Passenger Vehicle	181	91.4
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	6	3.0
E: Tractor Trailer Unit	11	5.6
Total	198	

Turning Movement Summary Diagram

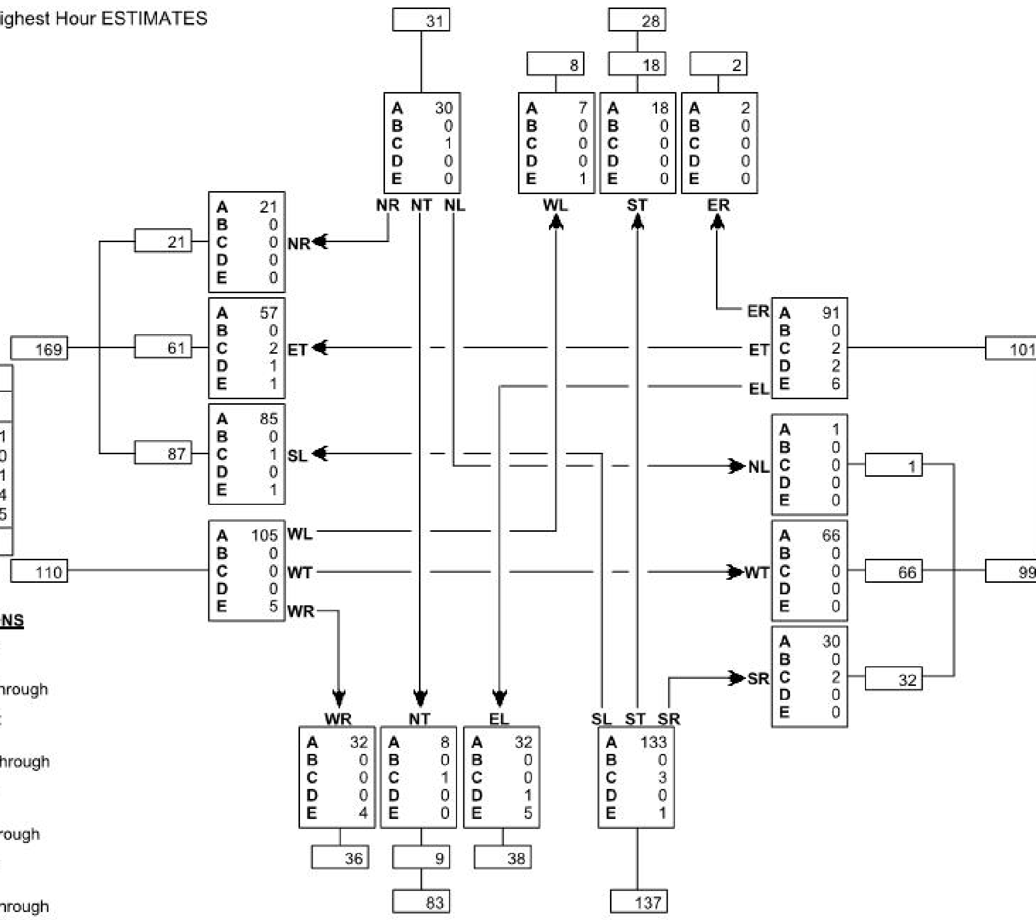
Reference No.: 997120

Intersection of:
38 & 644 AT REDWATER

2019 p.m. 100th Highest Hour ESTIMATES

North On 44 St		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	57	96.6
B: Recreational Vehicle	0	0.0
C: Bus	1	1.7
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	1	1.7
Total	59	

West On 38		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	268	96.1
B: Recreational Vehicle	0	0.0
C: Bus	3	1.1
D: Single Unit Truck	1	0.4
E: Tractor Trailer Unit	7	2.5
Total	279	



East On 644		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	188	94.0
B: Recreational Vehicle	0	0.0
C: Bus	4	2.0
D: Single Unit Truck	2	1.0
E: Tractor Trailer Unit	6	3.0
Total	200	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

South On 38		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	205	93.2
B: Recreational Vehicle	0	0.0
C: Bus	4	1.8
D: Single Unit Truck	1	0.5
E: Tractor Trailer Unit	10	4.5
Total	220	

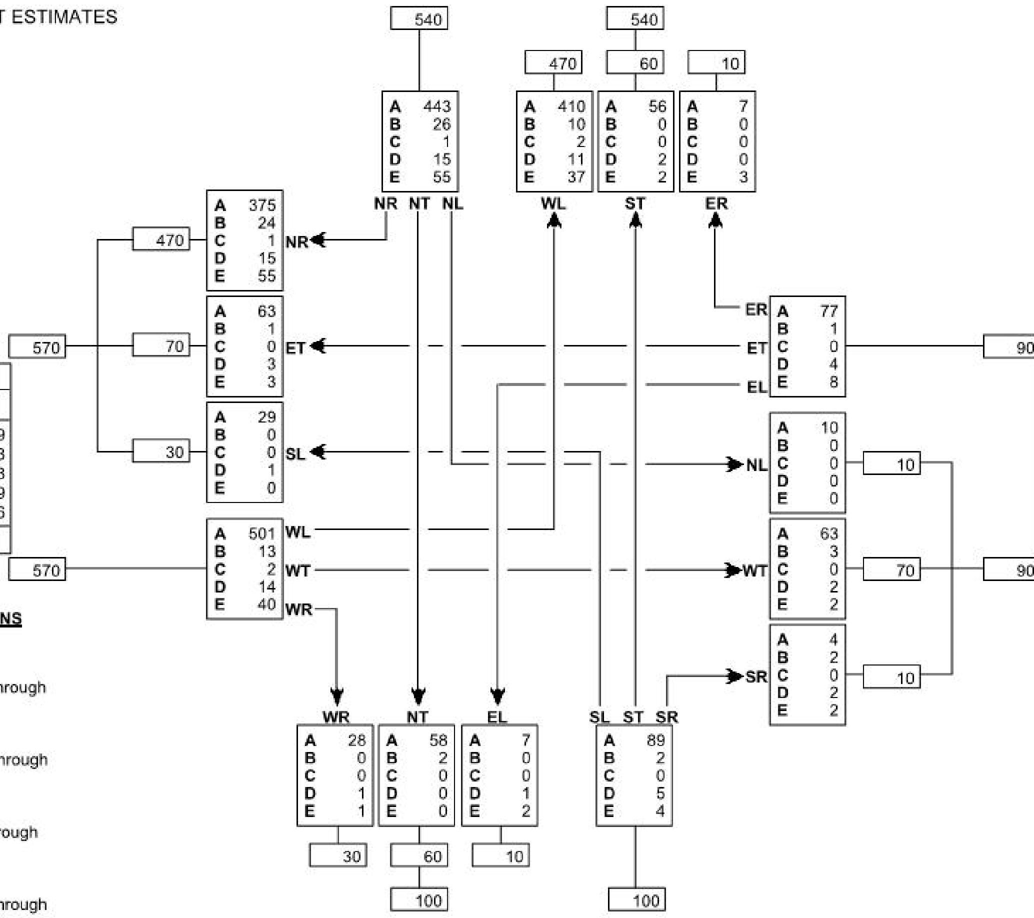
Turning Movement Summary Diagram

Reference No.: 100590

Intersection of:
644 & 829 E OF REDWATER

2019 AADT / ASDT ESTIMATES

North On 829		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	916	84.8
B: Recreational Vehicle	36	3.3
C: Bus	3	0.3
D: Single Unit Truck	28	2.6
E: Tractor Trailer Unit	97	9.0
ASDT 1280	**AADT** 1080	



West On 644		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	968	84.9
B: Recreational Vehicle	38	3.3
C: Bus	3	0.3
D: Single Unit Truck	33	2.9
E: Tractor Trailer Unit	98	8.6
ASDT 1350	**AADT** 1140	

East On Twp Rd 574		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	154	85.6
B: Recreational Vehicle	6	3.3
C: Bus	0	0.0
D: Single Unit Truck	8	4.4
E: Tractor Trailer Unit	12	6.7
ASDT 210	**AADT** 180	

South On Rge Rd 212		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	182	91.0
B: Recreational Vehicle	4	2.0
C: Bus	0	0.0
D: Single Unit Truck	7	3.5
E: Tractor Trailer Unit	7	3.5
ASDT 240	**AADT** 200	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Annual Average Daily Traffic
Average daily traffic expressed as vehicles per day fo period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day fo period of May 1 to September 30 (153 days)

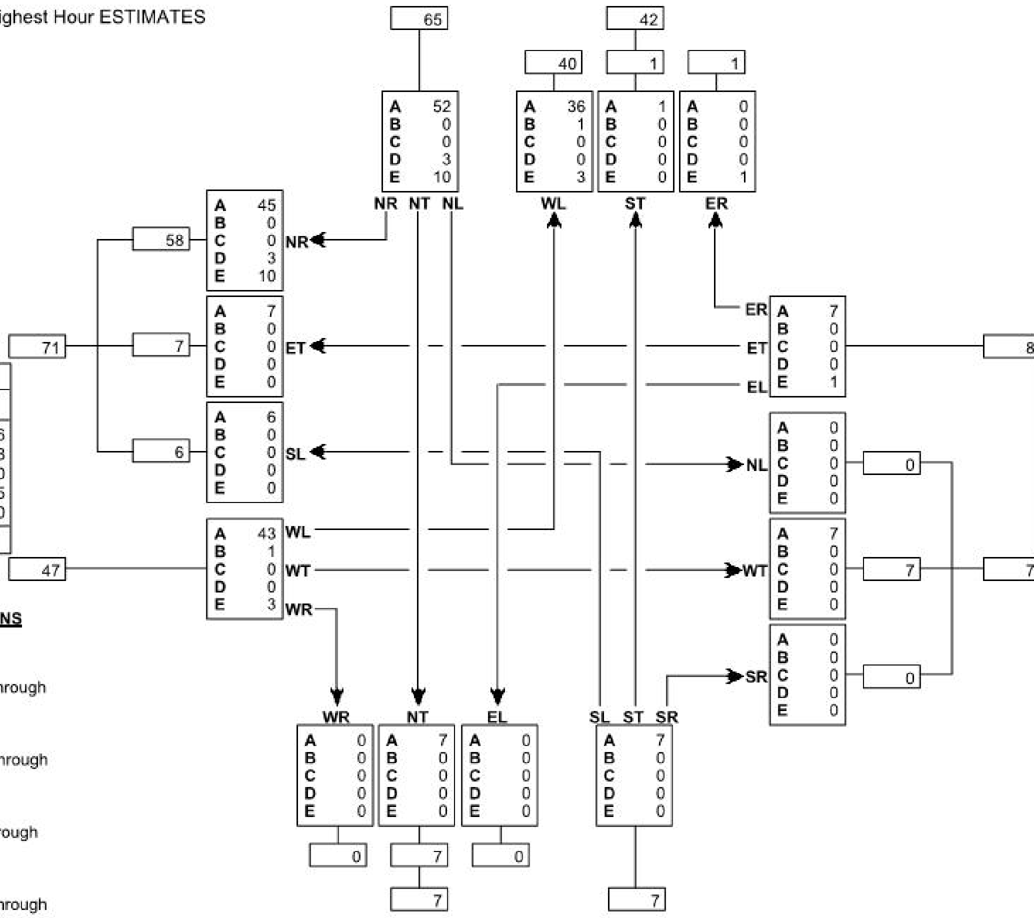
Turning Movement Summary Diagram

Reference No.: 100590

Intersection of:
644 & 829 E OF REDWATER

2019 a.m. 100th Highest Hour ESTIMATES

North On	829	
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	89	83.2
B: Recreational Vehicle	1	0.9
C: Bus	0	0.0
D: Single Unit Truck	3	2.8
E: Tractor Trailer Unit	14	13.1
Total	107	



West On	644	
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	101	85.6
B: Recreational Vehicle	1	0.8
C: Bus	0	0.0
D: Single Unit Truck	3	2.5
E: Tractor Trailer Unit	13	11.0
Total	118	

East On	Twp Rd 574	
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	14	93.3
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	1	6.7
Total	15	

South On	Rge Rd 212	
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	14	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	0	0.0
Total	14	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

Turning Movement Summary Diagram

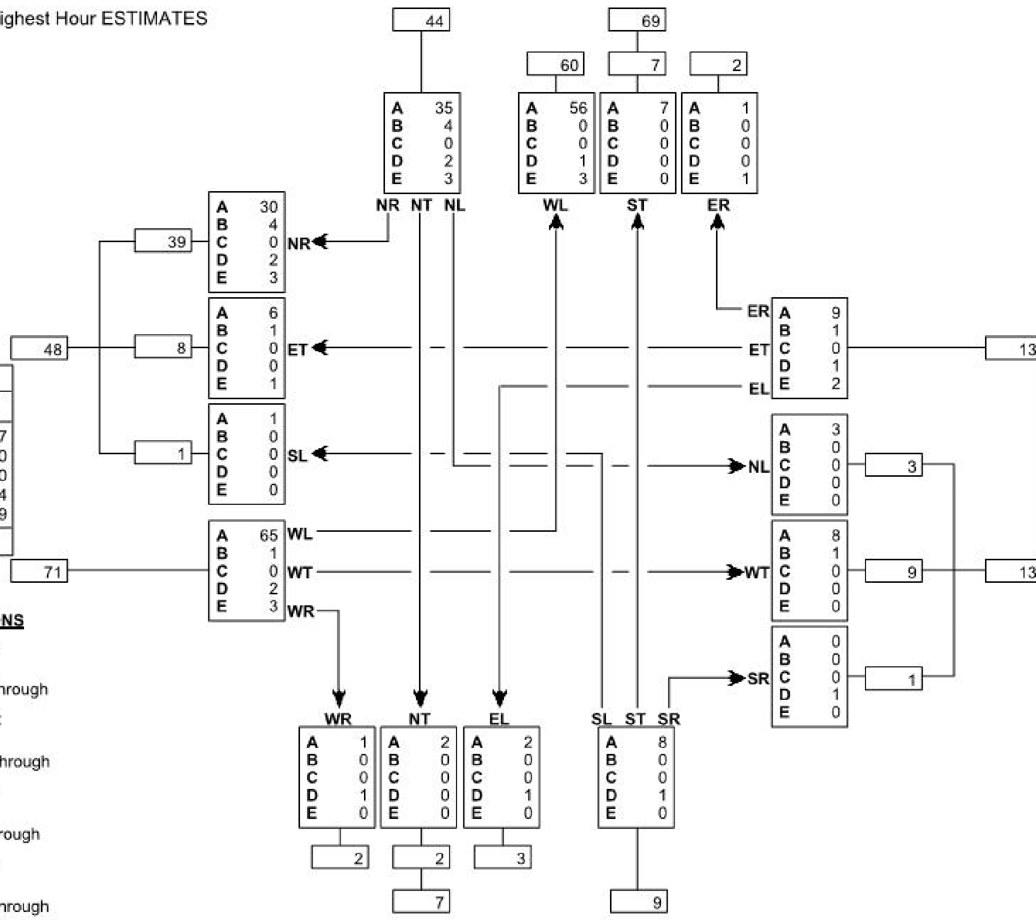
Reference No.: 100590

Intersection of:
644 & 829 E OF REDWATER

2019 p.m. 100th Highest Hour ESTIMATES

North On	829	
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	99	87.6
B: Recreational Vehicle	4	3.5
C: Bus	0	0.0
D: Single Unit Truck	3	2.7
E: Tractor Trailer Unit	7	6.2
Total	113	

West On	644	
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	102	85.7
B: Recreational Vehicle	6	5.0
C: Bus	0	0.0
D: Single Unit Truck	4	3.4
E: Tractor Trailer Unit	7	5.9
Total	119	



East On	Twp Rd 574	
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	20	76.9
B: Recreational Vehicle	2	7.7
C: Bus	0	0.0
D: Single Unit Truck	2	7.7
E: Tractor Trailer Unit	2	7.7
Total	26	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

South On	Rge Rd 212	
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	13	81.3
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	3	18.8
E: Tractor Trailer Unit	0	0.0
Total	16	

APPENDIX B

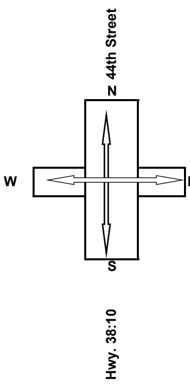
HWY. 38:10, HWY. 644:02 & 44TH STREET INTERSECTION ANALYSIS

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

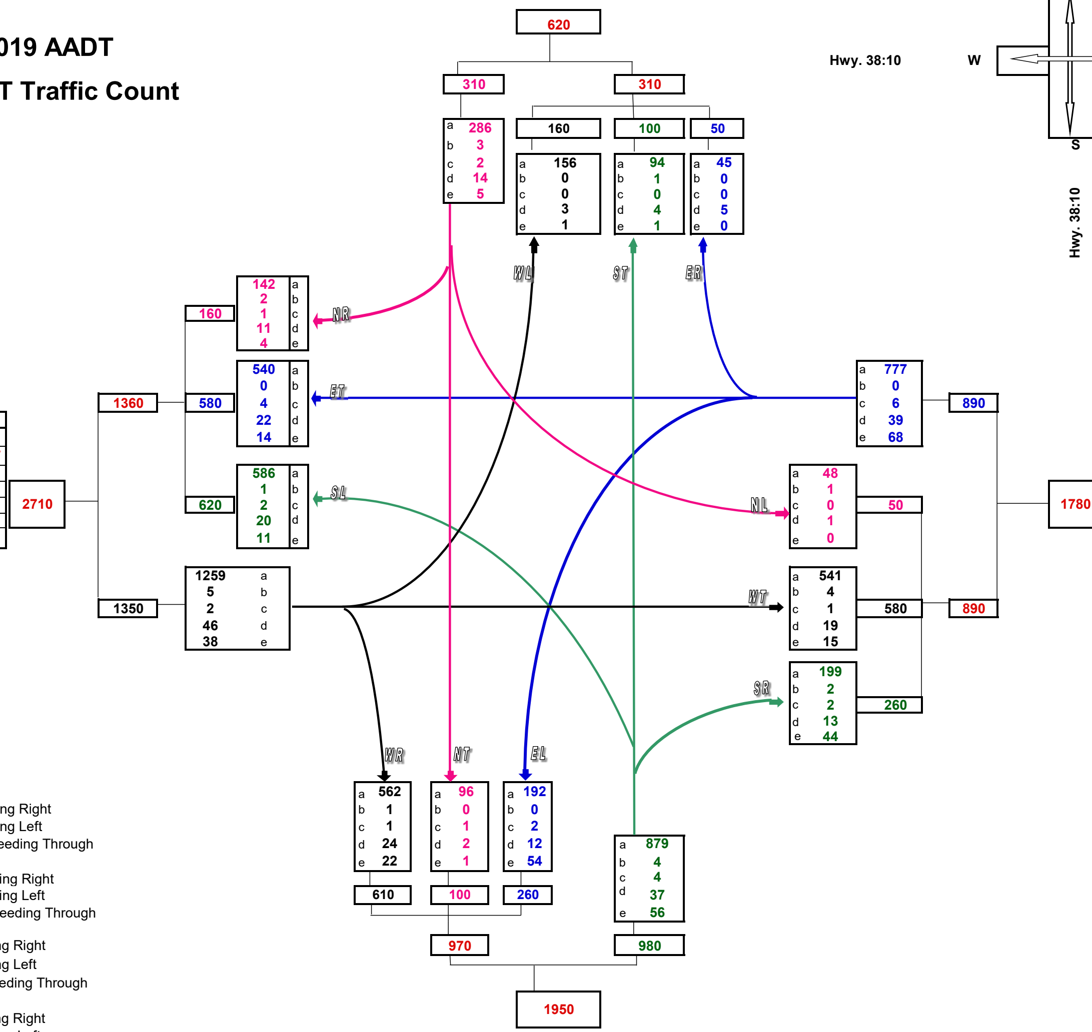
Intersection of: **Hwy. 38:10, Hwy. 644:02 & 44th Street**

NORTH LEG ON	44th Street	
Vehicle Type	**Vol.**	**%**
A - Passenger Vehicle	581	93.71
B - Recreational Vehicle	4	0.65
C - Bus	2	0.32
D - Single Unit Truck	26	4.19
E - Tractor Trailer Unit	7	1.13
Total	620	



2019 AADT
from AT Traffic Count

WEST LEG ON	Hwy. 38:10	
Vehicle Type	**Vol.**	**%**
A - Passenger Vehicle	2527	93.247
B - Recreational Vehicle	8	0.30
C - Bus	9	0.33
D - Single Unit Truck	99	3.65
E - Tractor Trailer Unit	67	2.47
Total	2710	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	**Vol.**	**%**
A - Passenger Vehicle	1565	87.92
B - Recreational Vehicle	7	0.39
C - Bus	9	0.51
D - Single Unit Truck	72	4.04
E - Tractor Trailer Unit	127	7.13
Total	1780	

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	**Vol.**	**%**
A - Passenger Vehicle	1729	88.67
B - Recreational Vehicle	5	0.26
C - Bus	8	0.41
D - Single Unit Truck	75	3.85
E - Tractor Trailer Unit	133	6.82
Total	1950	

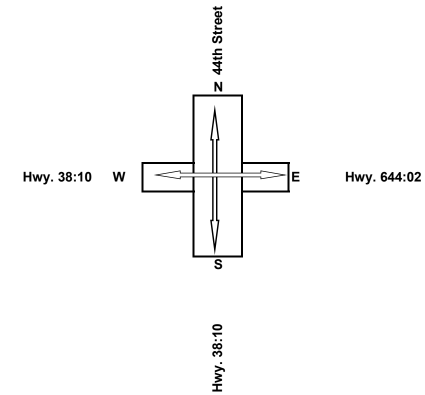
AADT Conversion Factor
1.69

D&A PAULICHUK CONSULTING LTD.

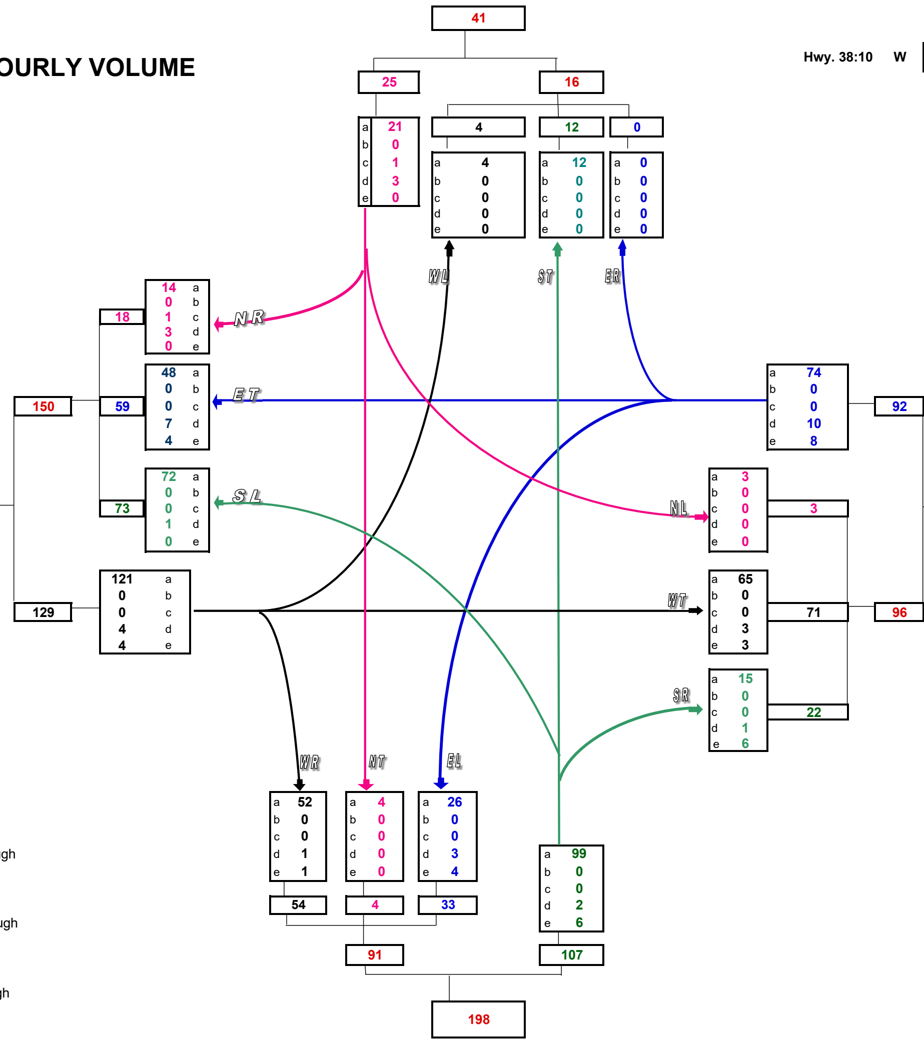
Turning Movement Summary Diagram

2019 AM PEAK HOURLY VOLUME

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	37	90.2
B - Recreational Vehicle	0	0.0
C - Bus	1	2.4
D - Single Unit Truck	3	7.3
E - Tractor Trailer Unit	0	0.0
Total	41	



WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	255	91.4
B - Recreational Vehicle	0	0.0
C - Bus	1	0.4
D - Single Unit Truck	15	5.4
E - Tractor Trailer Unit	8	2.9
Total	279	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	157	83.5
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	14	7.4
E - Tractor Trailer Unit	17	9.0
Total	188	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

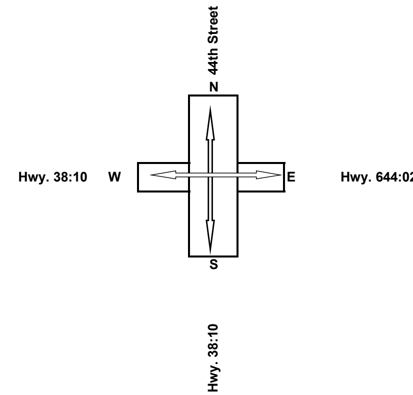
SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	181	91.4
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	6	3.0
E - Tractor Trailer Unit	11	5.6
Total	198	

AM Peak 2.57
PM Peak

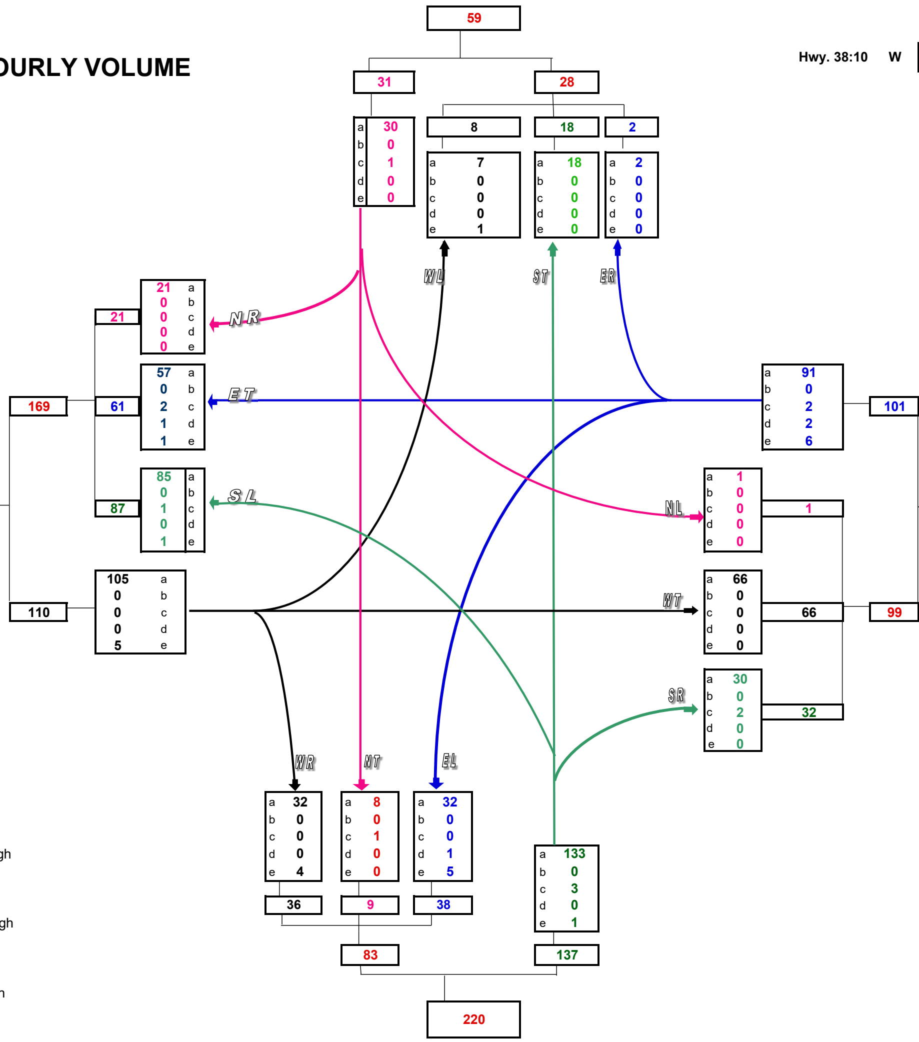
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	57	96.6
B - Recreational Vehicle	0	0.0
C - Bus	1	1.7
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	1	1.7
Total	59	



2019 PM PEAK HOURLY VOLUME



WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	268	96.1
B - Recreational Vehicle	0	0.0
C - Bus	3	1.1
D - Single Unit Truck	1	0.4
E - Tractor Trailer Unit	7	2.5
Total	279	

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	188	94.0
B - Recreational Vehicle	0	0.0
C - Bus	4	2.0
D - Single Unit Truck	2	1.0
E - Tractor Trailer Unit	6	3.0
Total	200	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

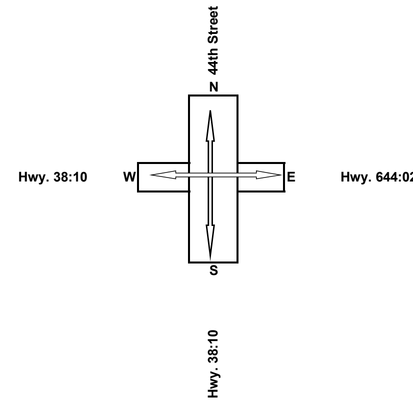
SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	205	93.2
B - Recreational Vehicle	0	0.0
C - Bus	4	1.8
D - Single Unit Truck	1	0.5
E - Tractor Trailer Unit	10	4.5
Total	220	

AM Peak	
PM Peak	2.40

D&A PAULICHUK CONSULTING LTD.

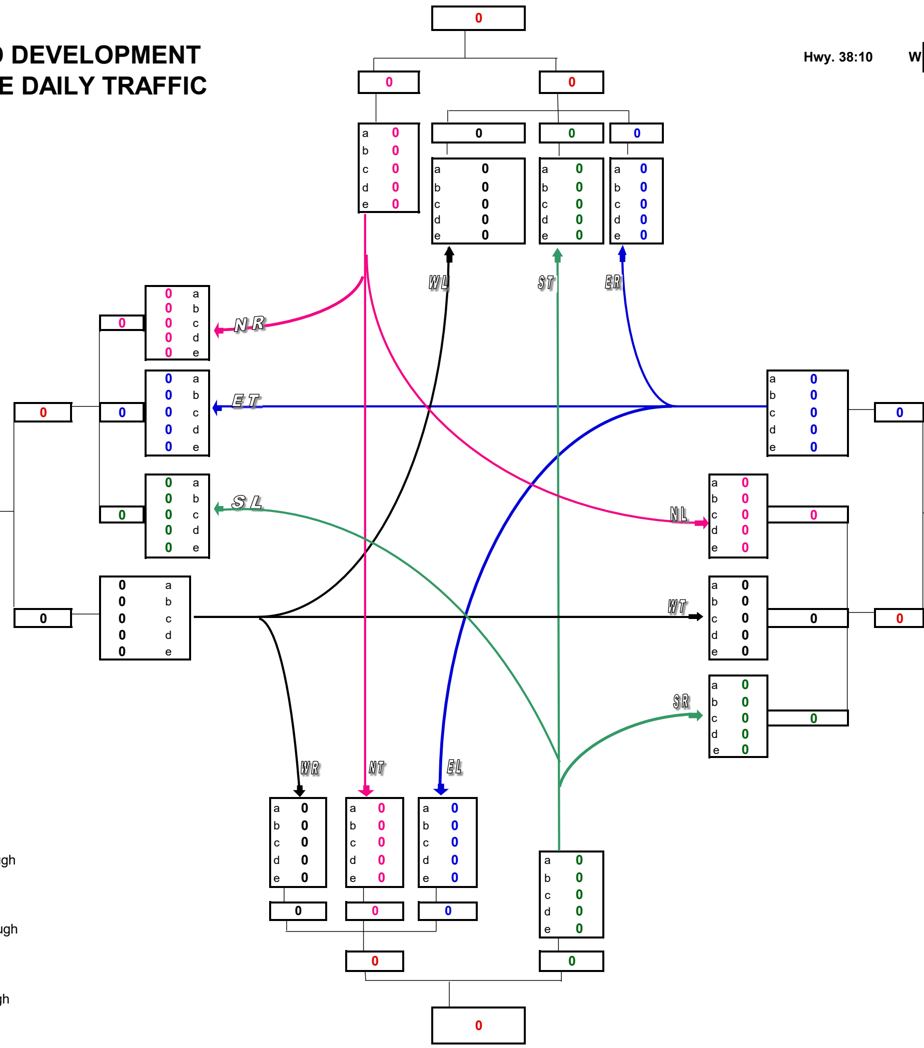
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	



2021 PROJECTED DEVELOPMENT ANNUAL AVERAGE DAILY TRAFFIC

WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

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EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Traffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

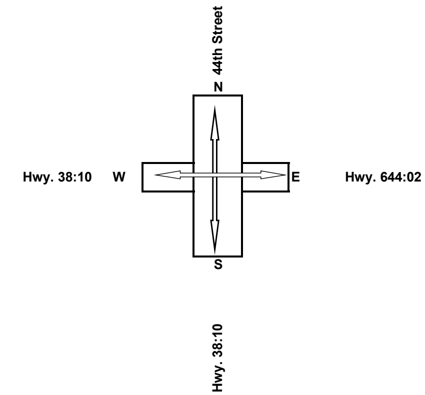
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

D&A PAULICHUK CONSULTING LTD.

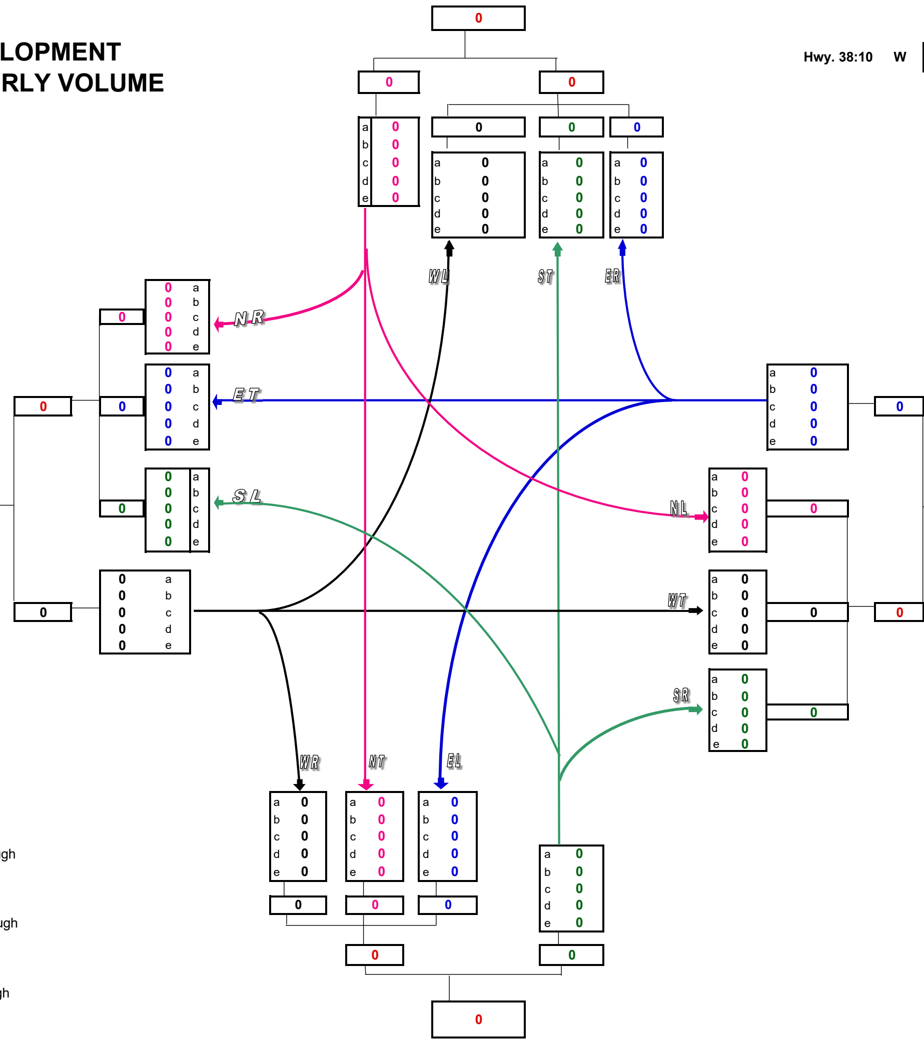
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	



2021 DEVELOPMENT
AM PEAK HOURLY VOLUME

WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Taffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

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Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

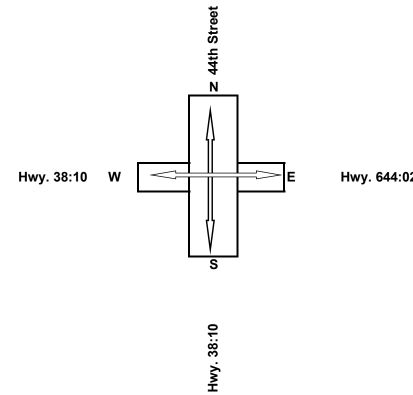
SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

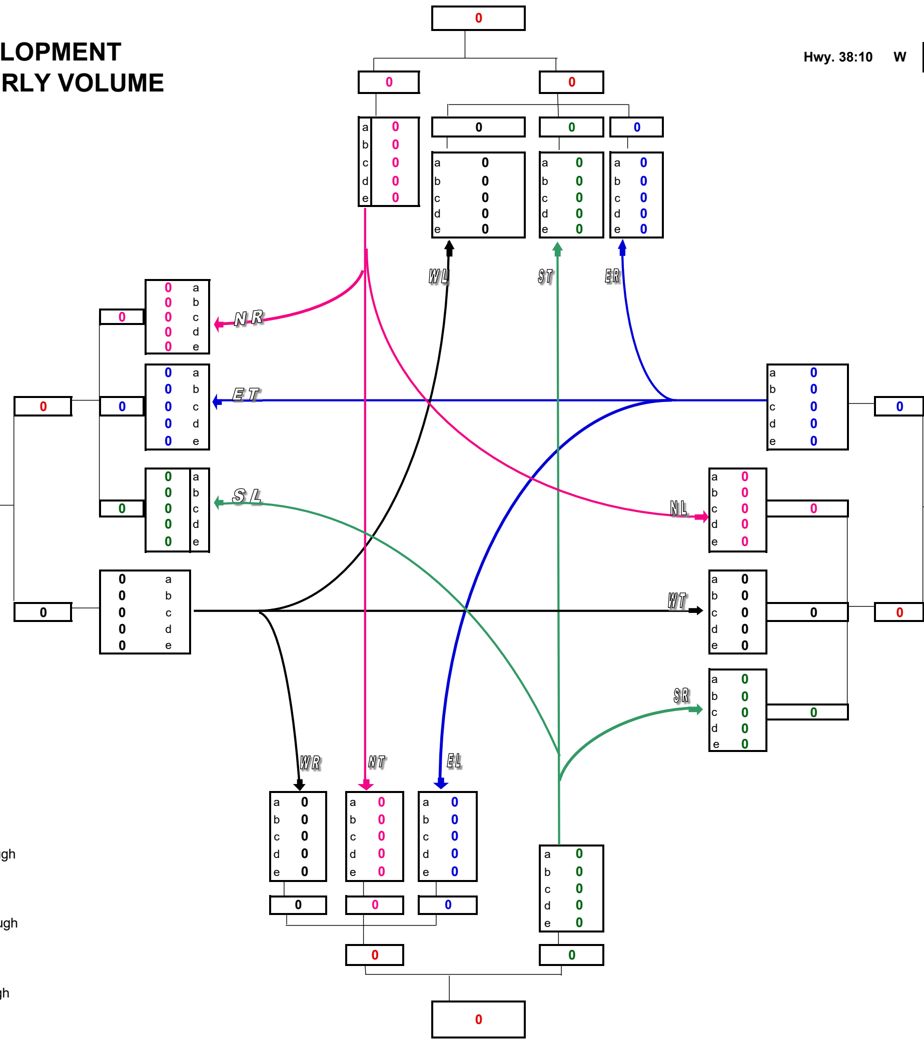
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2021 DEVELOPMENT
PM PEAK HOURLY VOLUME

NORTH LEG ON		44th Street
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	





WEST LEG ON		Hwy. 38:10
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

EAST LEG ON		Hwy. 644:02
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

TURNING MOVEMENT ABBREVIATIONS

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WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

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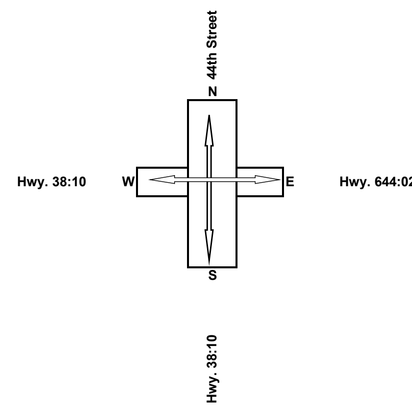
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON		Hwy. 38:10
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

D&A PAULICHUK CONSULTING LTD.

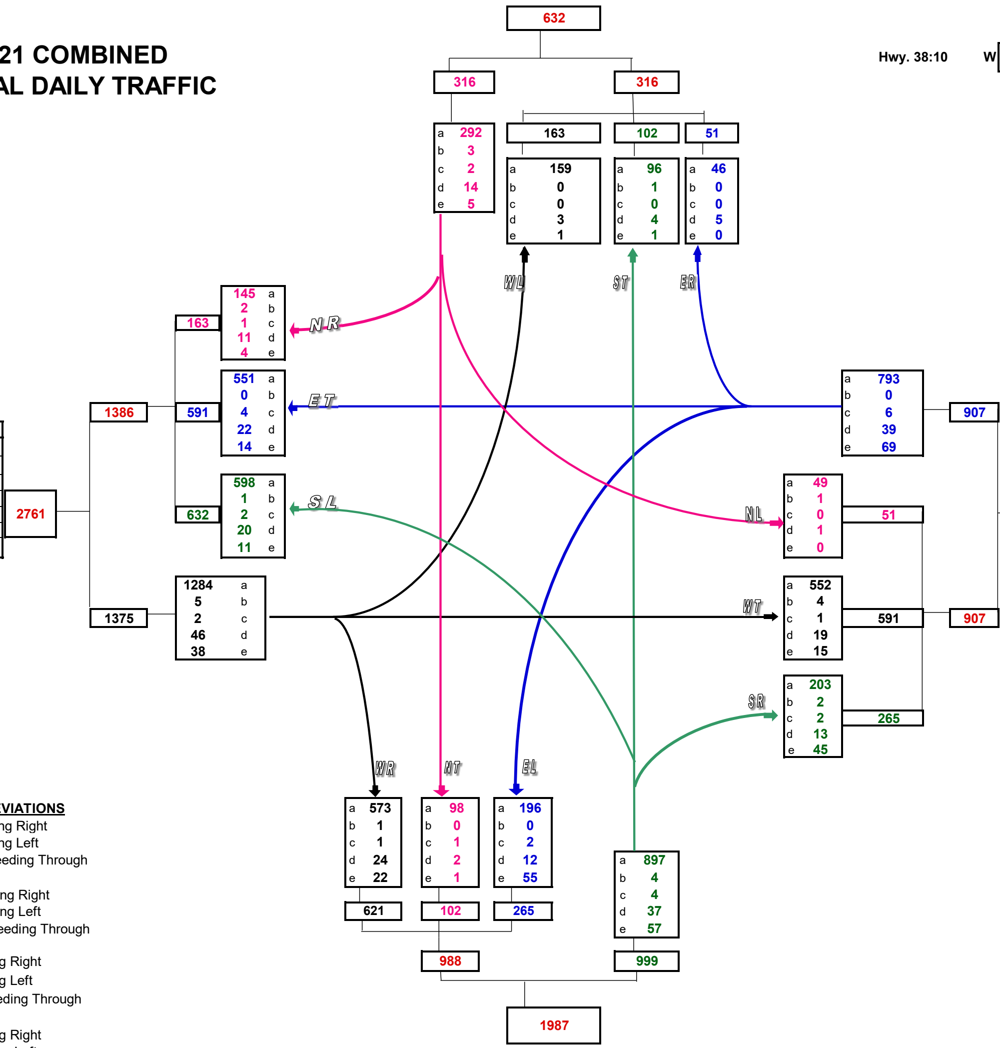
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	593	-
B - Recreational Vehicle	4	-
C - Bus	2	-
D - Single Unit Truck	26	-
E - Tractor Trailer Unit	7	-
Total	632	



2021 COMBINED ANNUAL DAILY TRAFFIC

WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	2578	93.4
B - Recreational Vehicle	8	0.3
C - Bus	9	0.3
D - Single Unit Truck	99	3.6
E - Tractor Trailer Unit	67	2.4
Total	2761	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1597	88.0
B - Recreational Vehicle	7	0.4
C - Bus	9	0.5
D - Single Unit Truck	72	4.0
E - Tractor Trailer Unit	129	7.1
Total	1814	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
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EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

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WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1764	88.8
B - Recreational Vehicle	5	0.3
C - Bus	8	0.4
D - Single Unit Truck	75	3.8
E - Tractor Trailer Unit	135	6.8
Total	1987	

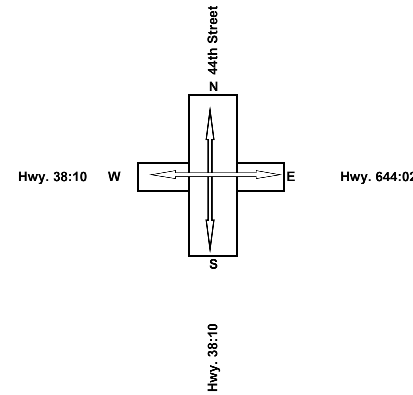
2021
2019
2

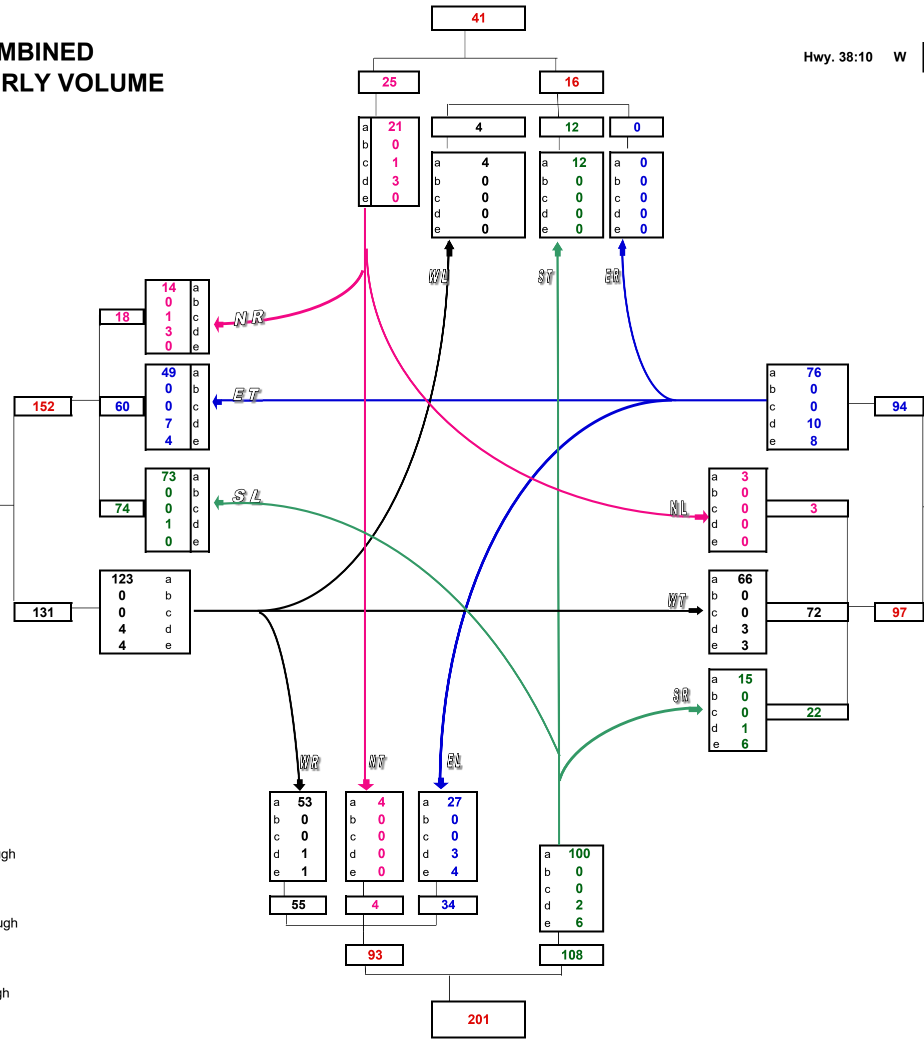
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	37	90.2
B - Recreational Vehicle	0	0.0
C - Bus	1	2.4
D - Single Unit Truck	3	7.3
E - Tractor Trailer Unit	0	0.0
Total	41	

2021 COMBINED AM PEAK HOURLY VOLUME





WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	259	91.5
B - Recreational Vehicle	0	0.0
C - Bus	1	0.4
D - Single Unit Truck	15	5.3
E - Tractor Trailer Unit	8	2.8
Total	283	

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	160	83.8
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	14	7.3
E - Tractor Trailer Unit	17	8.9
Total	191	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
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ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	184	91.5
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	6	3.0
E - Tractor Trailer Unit	11	5.5
Total	201	

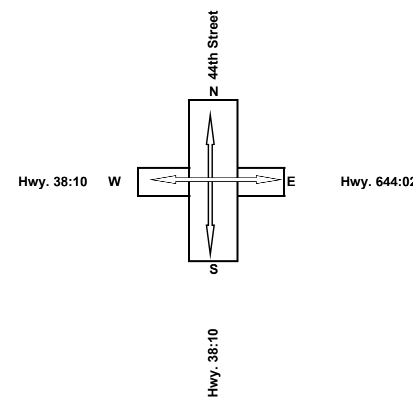
2021
2019
2

D&A PAULICHUK CONSULTING LTD.

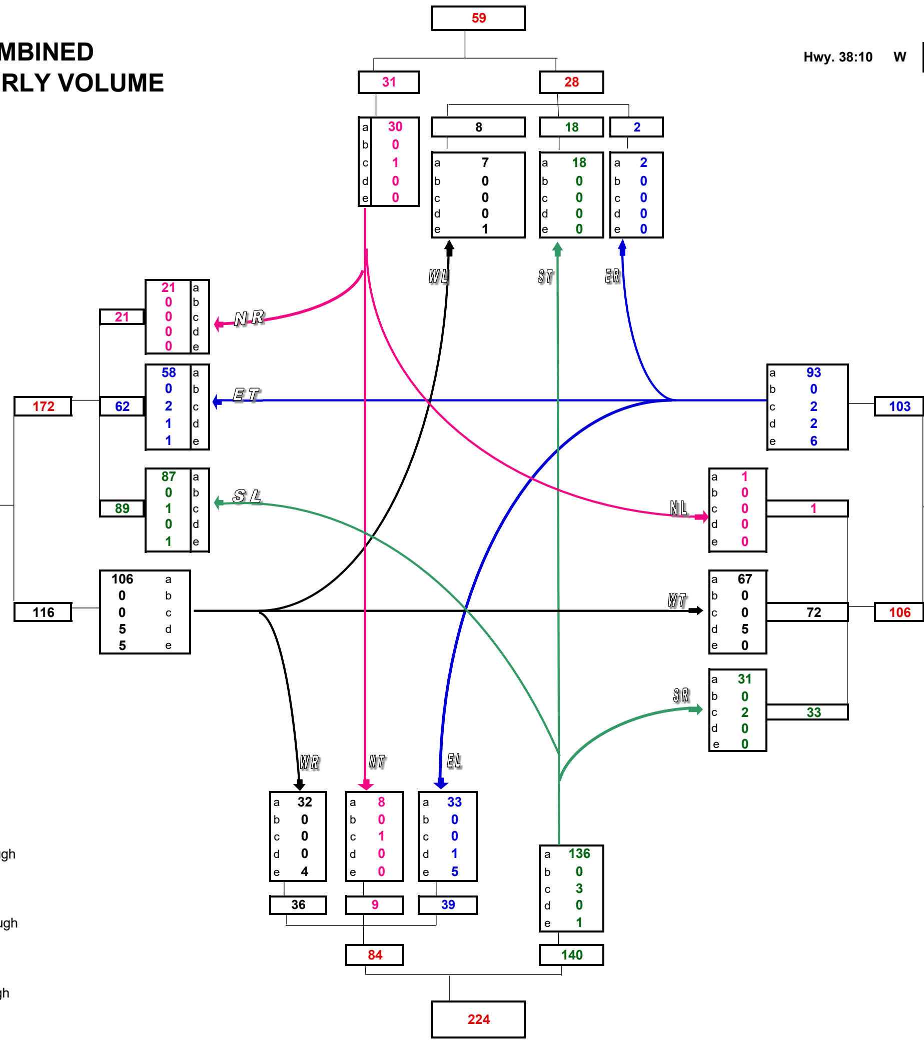
Turning Movement Summary Diagram

2021 COMBINED
PM PEAK HOURLY VOLUME

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	57	96.6
B - Recreational Vehicle	0	0.0
C - Bus	1	1.7
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	1	1.7
Total	59	



WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	272	94.4
B - Recreational Vehicle	0	0.0
C - Bus	3	1.0
D - Single Unit Truck	6	2.1
E - Tractor Trailer Unit	7	2.4
Total	288	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	192	91.9
B - Recreational Vehicle	0	0.0
C - Bus	4	1.9
D - Single Unit Truck	7	3.3
E - Tractor Trailer Unit	6	2.9
Total	209	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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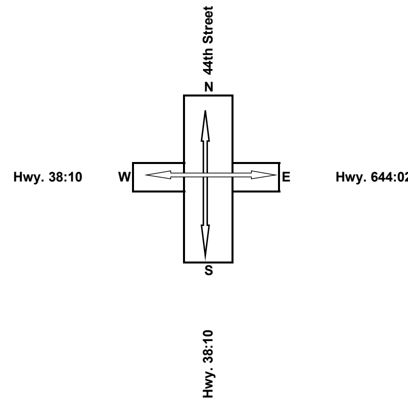
SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	209	93.3
B - Recreational Vehicle	0	0.0
C - Bus	4	1.8
D - Single Unit Truck	1	0.4
E - Tractor Trailer Unit	10	4.5
Total	224	

2021
2019
2

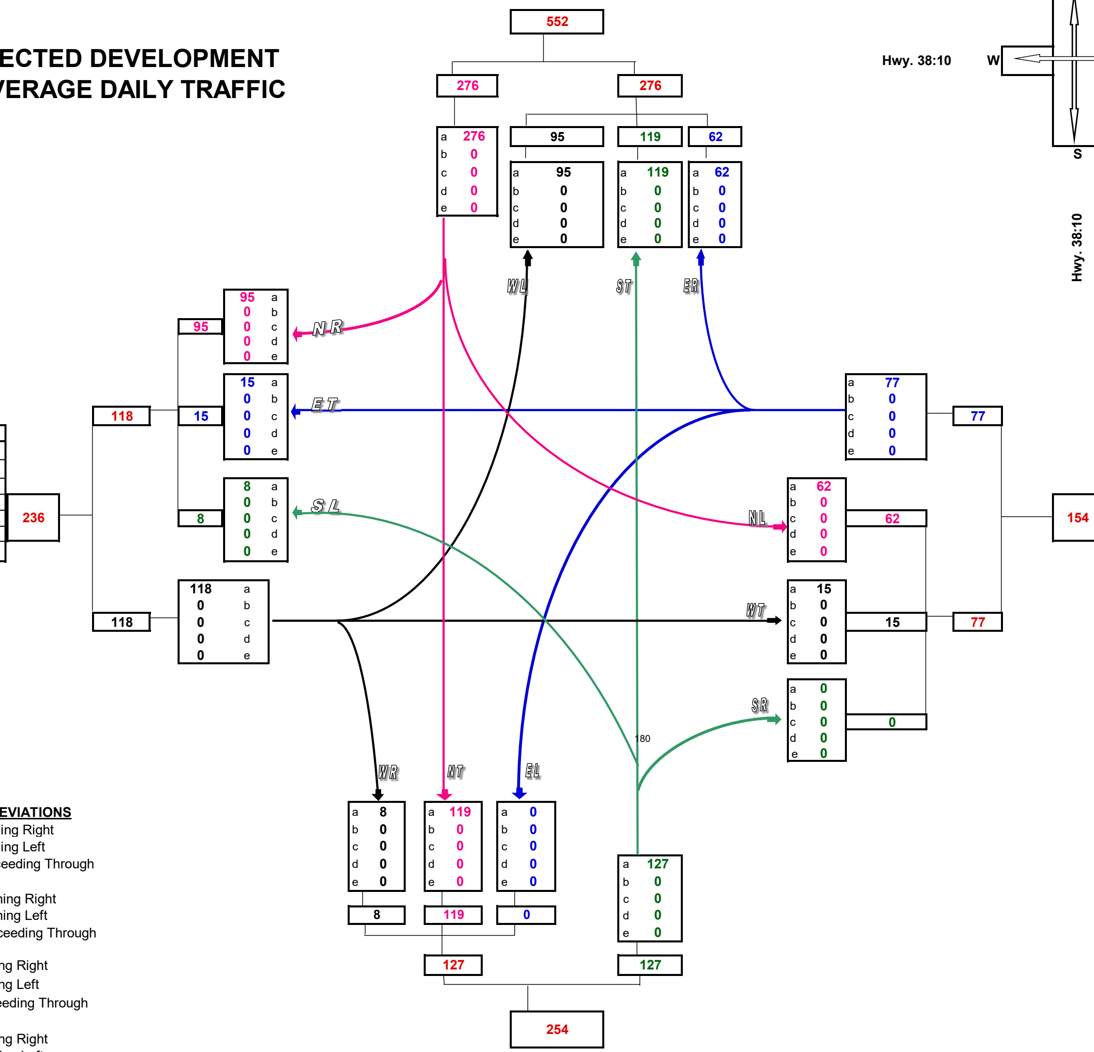
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	552	100.0%
B - Recreational Vehicle	0	0.0%
C - Bus	0	0.0%
D - Single Unit Truck	0	0.0%
E - Tractor Trailer Unit	0	0.0%
Total	552	



2025 PROJECTED DEVELOPMENT ANNUAL AVERAGE DAILY TRAFFIC



WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	236	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	236	

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	154	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	154	

TURNING MOVEMENT ABBREVIATIONS

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ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
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ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

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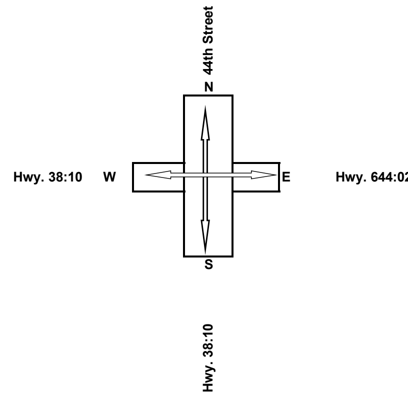
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	254	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	254	

D&A PAULICHUK CONSULTING LTD.

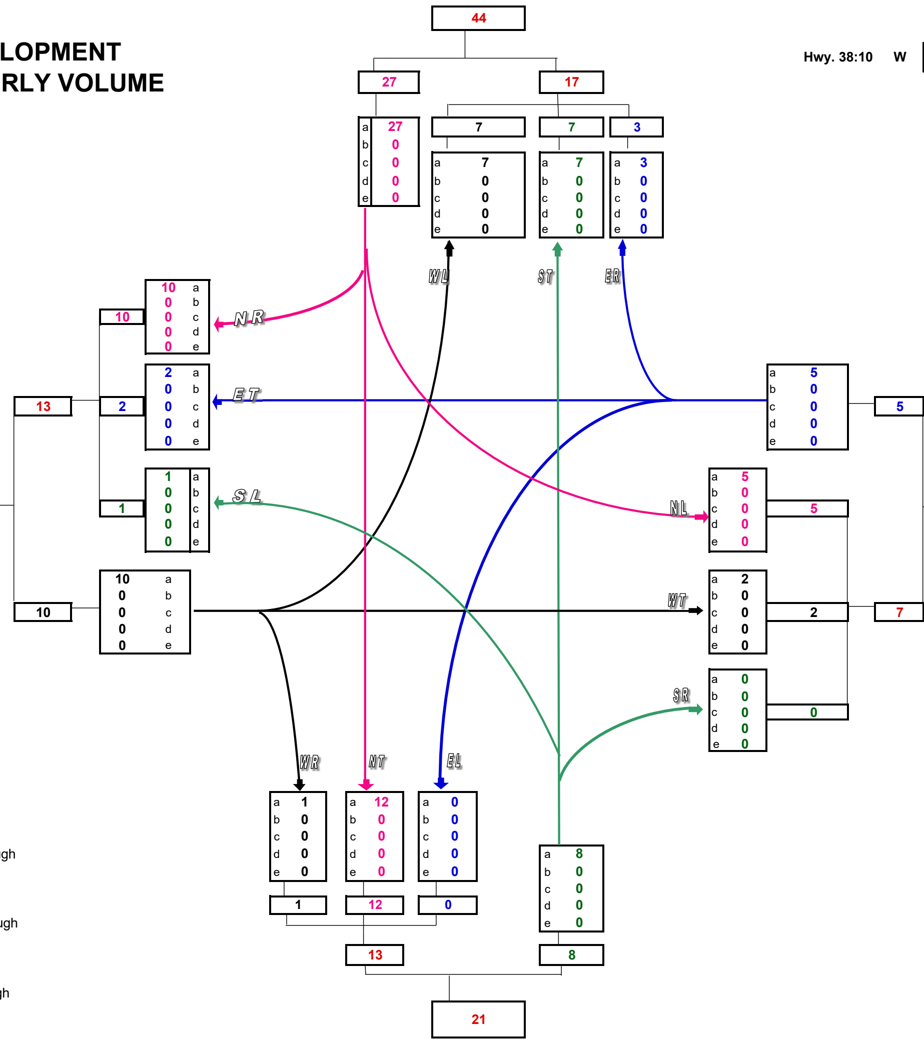
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	44	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	44	



2025 DEVELOPMENT
AM PEAK HOURLY VOLUME

WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	23	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	23	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	12	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	12	

TURNING MOVEMENT ABBREVIATIONS

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EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

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Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

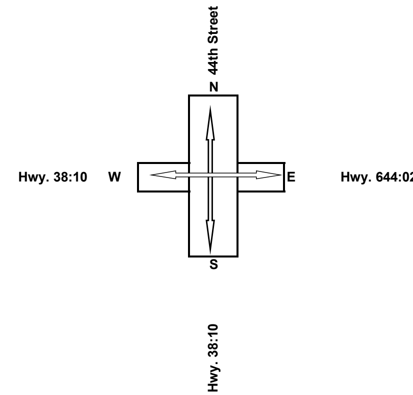
SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	21	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	21	

D&A PAULICHUK CONSULTING LTD.

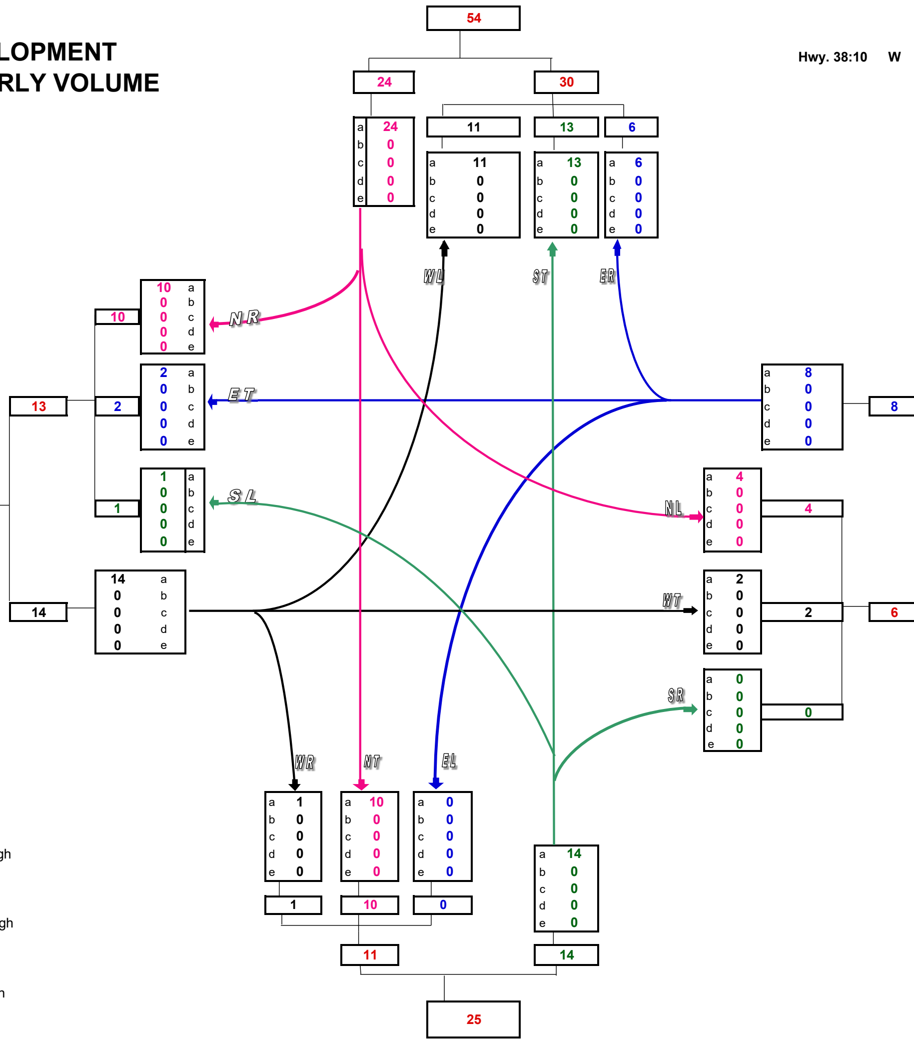
Turning Movement Summary Diagram

2025 DEVELOPMENT
PM PEAK HOURLY VOLUME

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	54	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	54	



WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	27	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	27	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	14	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	14	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

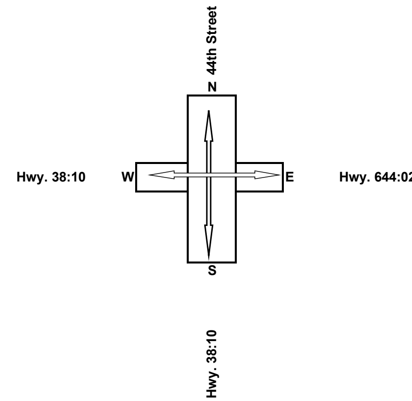
SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	25	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	25	

D&A PAULICHUK CONSULTING LTD.

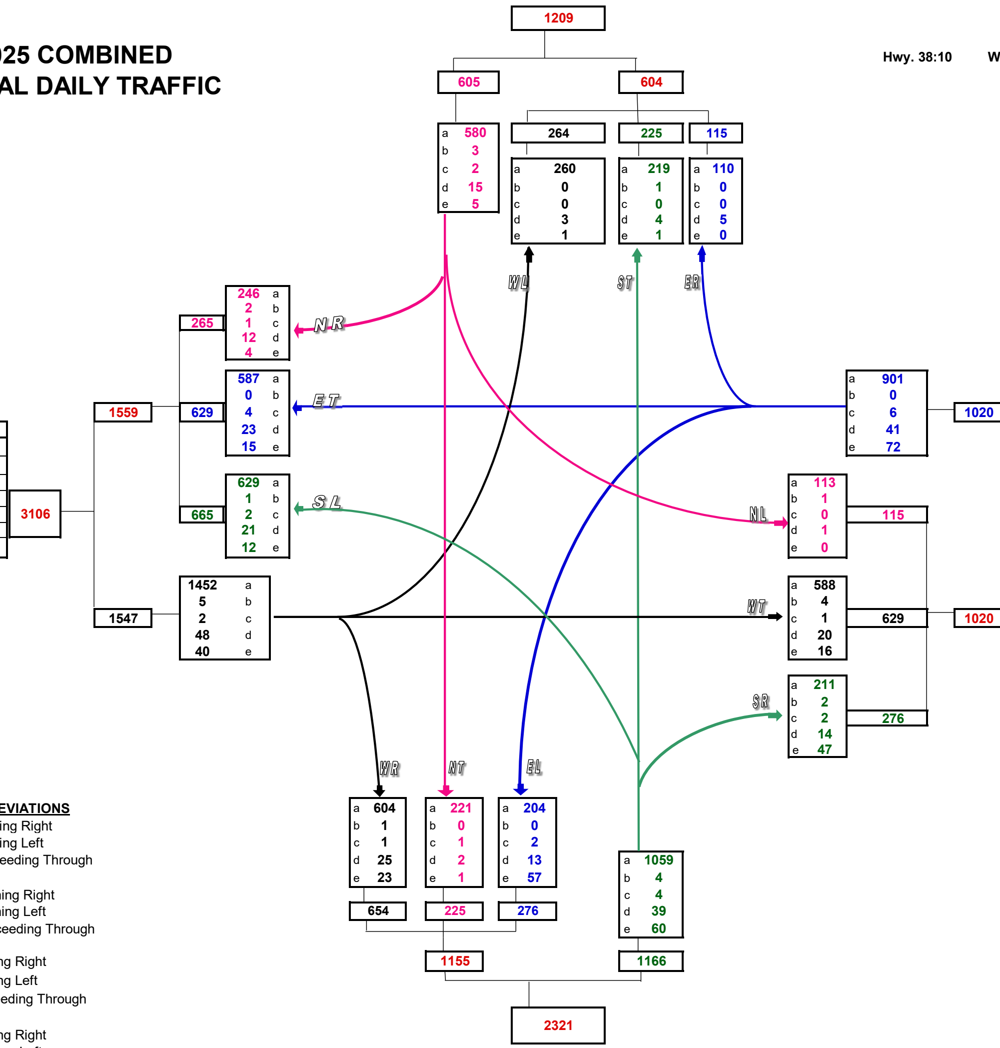
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1169	-
B - Recreational Vehicle	4	-
C - Bus	2	-
D - Single Unit Truck	27	-
E - Tractor Trailer Unit	7	-
Total	1209	

2025 COMBINED ANNUAL DAILY TRAFFIC



WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	2914	93.8
B - Recreational Vehicle	8	0.3
C - Bus	9	0.3
D - Single Unit Truck	104	3.3
E - Tractor Trailer Unit	71	2.3
Total	3106	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1813	88.9
B - Recreational Vehicle	7	0.3
C - Bus	9	0.4
D - Single Unit Truck	76	3.7
E - Tractor Trailer Unit	135	6.6
Total	2040	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

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EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

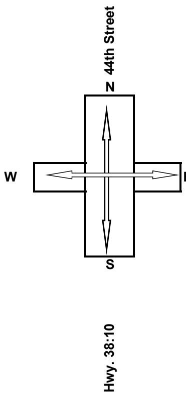
SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	2088	90.0
B - Recreational Vehicle	5	0.2
C - Bus	8	0.3
D - Single Unit Truck	79	3.4
E - Tractor Trailer Unit	141	6.1
Total	2321	

2025
2019
6

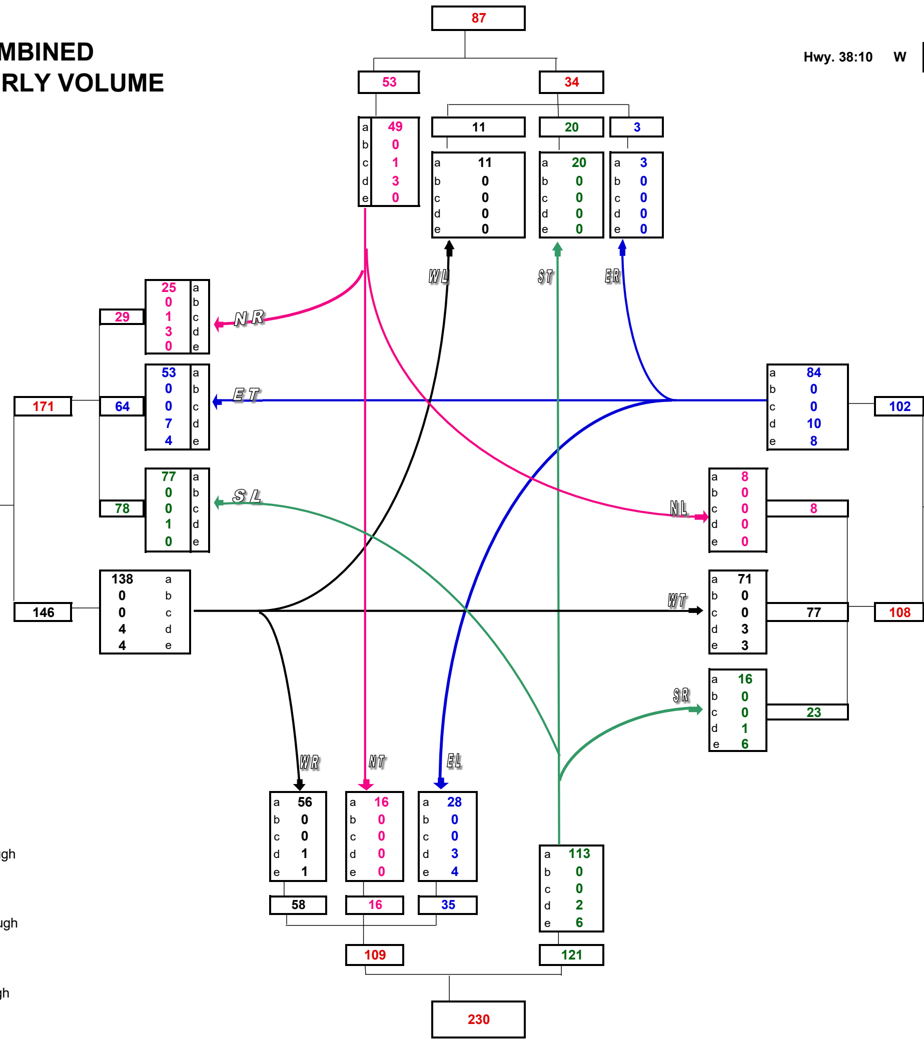
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

NORTH LEG ON		44th Street
Vehicle Type	Vol.	%
A - Passenger Vehicle	83	95.4
B - Recreational Vehicle	0	0.0
C - Bus	1	1.1
D - Single Unit Truck	3	3.4
E - Tractor Trailer Unit	0	0.0
Total	87	



2025 COMBINED
AM PEAK HOURLY VOLUME



WEST LEG ON		Hwy. 38:10
Vehicle Type	Vol.	%
A - Passenger Vehicle	293	92.4
B - Recreational Vehicle	0	0.0
C - Bus	1	0.3
D - Single Unit Truck	15	4.7
E - Tractor Trailer Unit	8	2.5
Total	317	

317

EAST LEG ON		Hwy. 644:02
Vehicle Type	Vol.	%
A - Passenger Vehicle	179	85.2
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	14	6.7
E - Tractor Trailer Unit	17	8.1
Total	210	

210

TURNING MOVEMENT ABBREVIATIONS

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EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

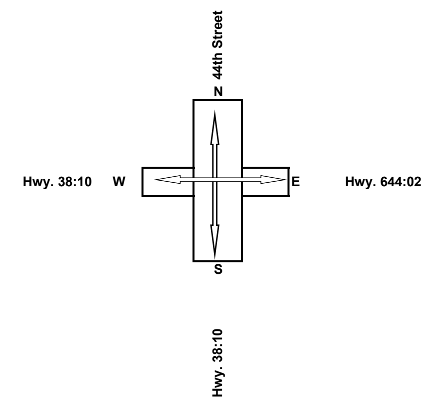
SOUTH LEG ON		Hwy. 38:10
Vehicle Type	Vol.	%
A - Passenger Vehicle	213	92.6
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	6	2.6
E - Tractor Trailer Unit	11	4.8
Total	230	

2025
2019
6

D&A PAULICHUK CONSULTING LTD.

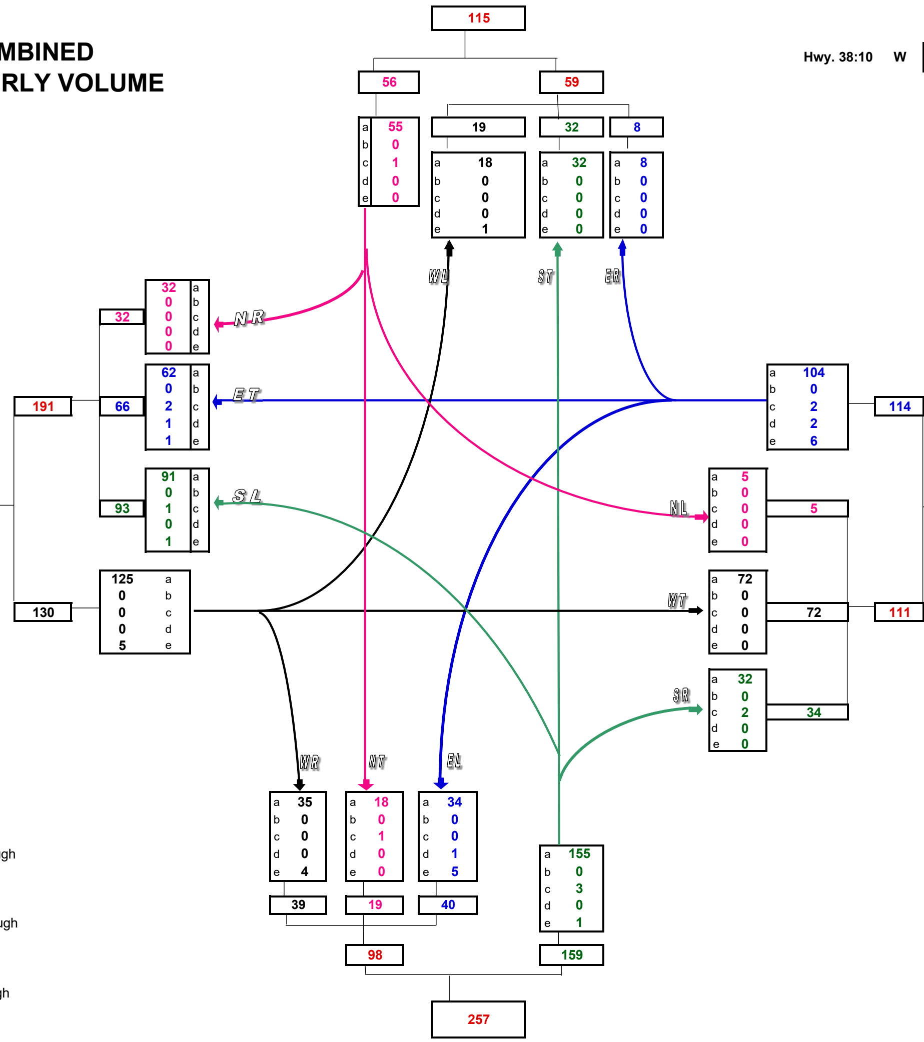
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	113	98.3
B - Recreational Vehicle	0	0.0
C - Bus	1	0.9
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	1	0.9
Total	115	



2025 COMBINED
PM PEAK HOURLY VOLUME

WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	310	96.6
B - Recreational Vehicle	0	0.0
C - Bus	3	0.9
D - Single Unit Truck	1	0.3
E - Tractor Trailer Unit	7	2.2
Total	321	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	213	94.7
B - Recreational Vehicle	0	0.0
C - Bus	4	1.8
D - Single Unit Truck	2	0.9
E - Tractor Trailer Unit	6	2.7
Total	225	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
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SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

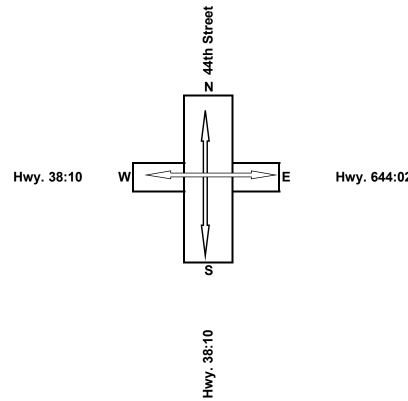
SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	242	94.2
B - Recreational Vehicle	0	0.0
C - Bus	4	1.6
D - Single Unit Truck	1	0.4
E - Tractor Trailer Unit	10	3.9
Total	257	

2025
2019
6

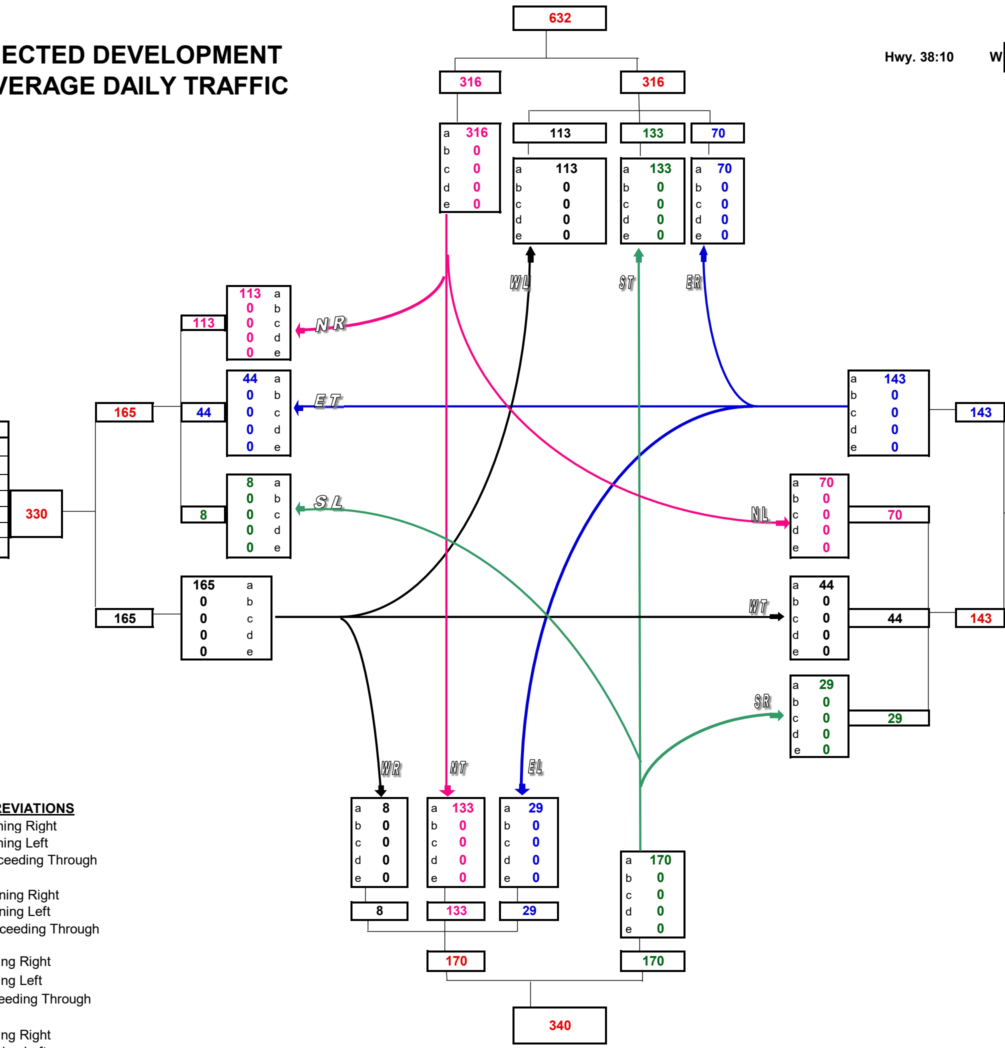
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	632	100.0%
B - Recreational Vehicle	0	0.0%
C - Bus	0	0.0%
D - Single Unit Truck	0	0.0%
E - Tractor Trailer Unit	0	0.0%
Total	632	



2035 PROJECTED DEVELOPMENT ANNUAL AVERAGE DAILY TRAFFIC



WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	330	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	330	

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	286	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	286	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

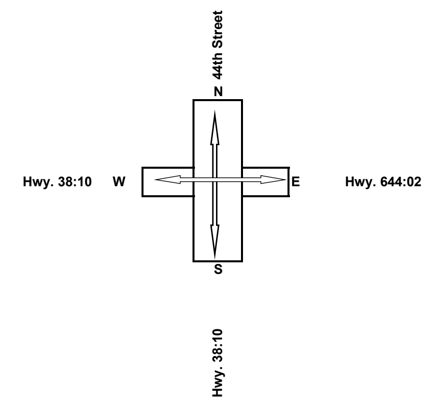
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	340	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	340	

D&A PAULICHUK CONSULTING LTD.

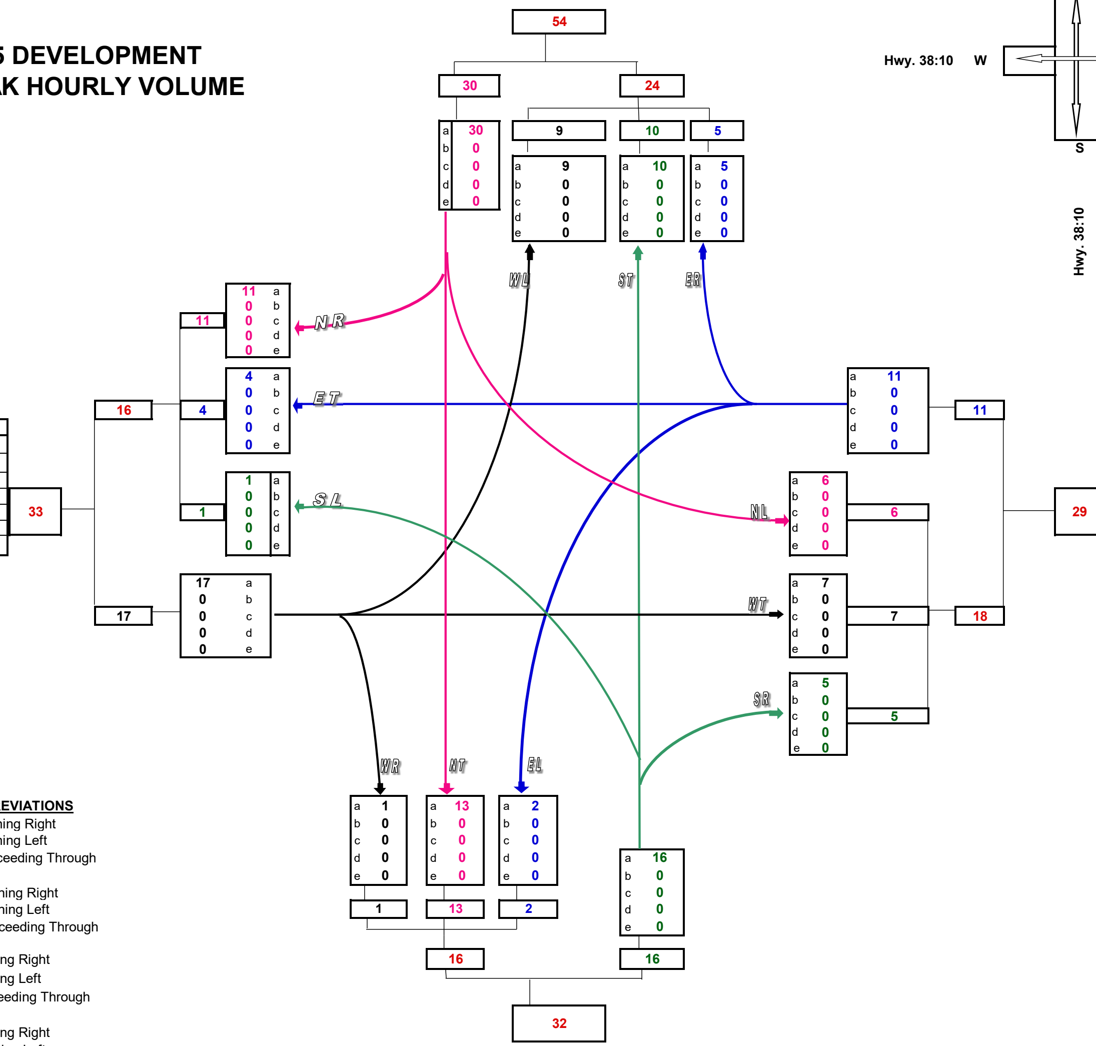
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	54	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	54	



2035 DEVELOPMENT
AM PEAK HOURLY VOLUME

WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	33	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	33	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	29	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	29	

TURNING MOVEMENT ABBREVIATIONS

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SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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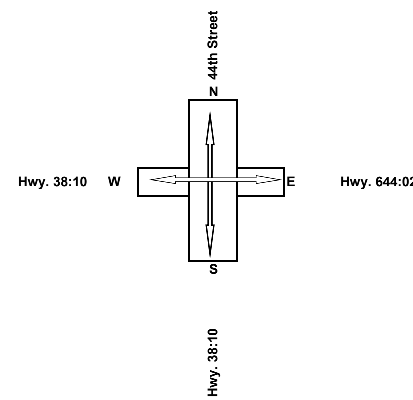
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	32	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	32	

D&A PAULICHUK CONSULTING LTD.

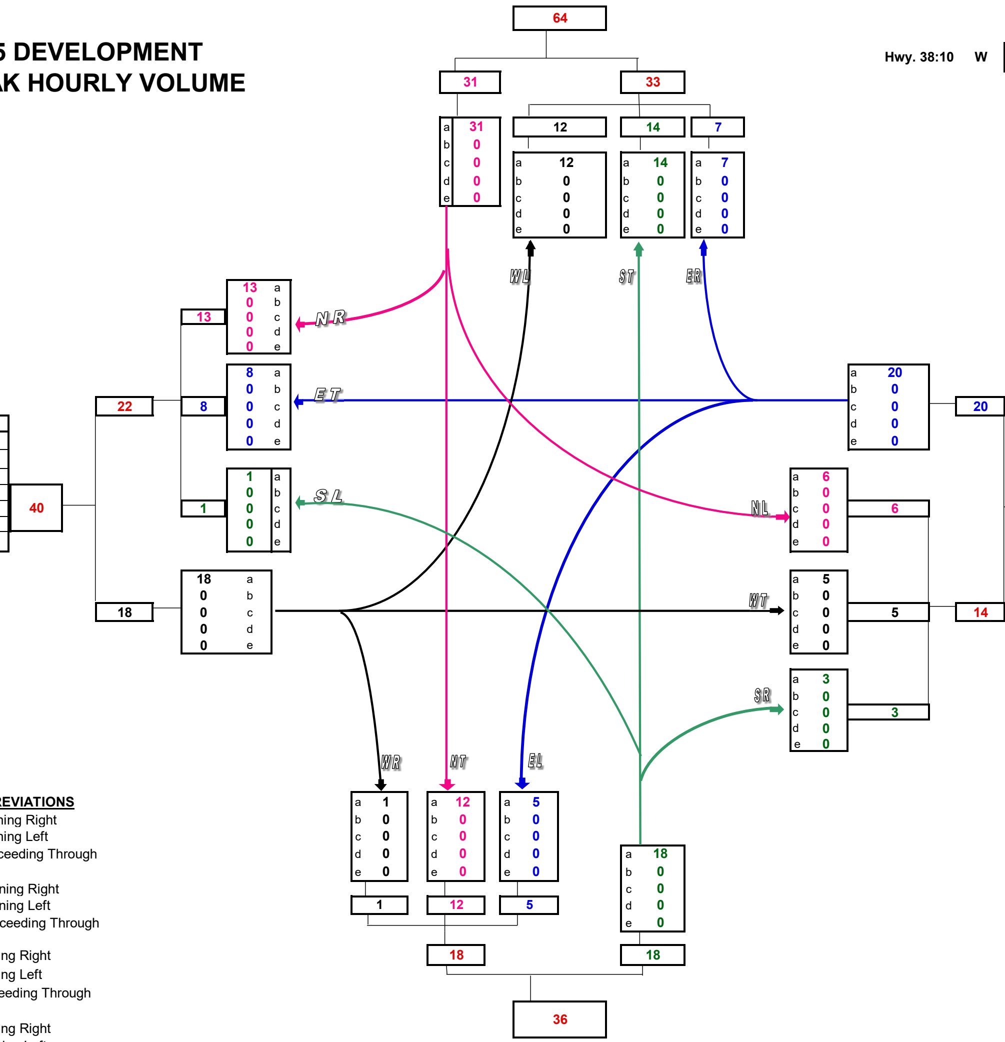
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	64	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	64	



2035 DEVELOPMENT
PM PEAK HOURLY VOLUME

WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	40	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	40	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	34	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	34	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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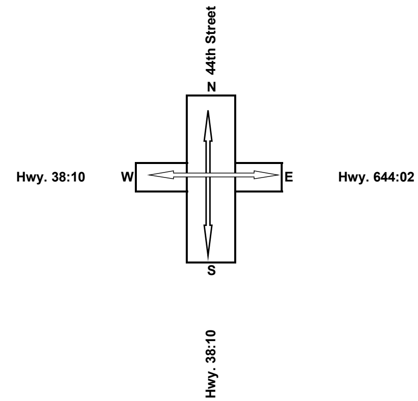
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	36	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	36	

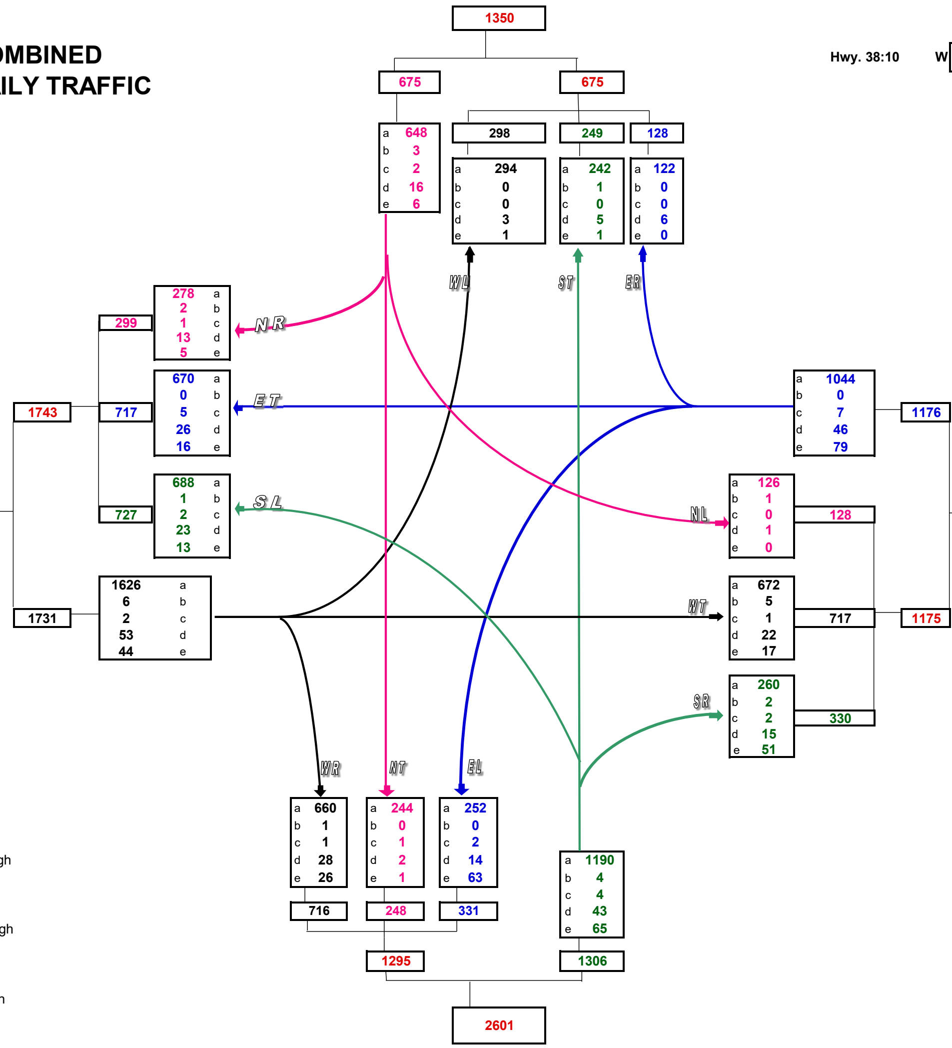
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1306	-
B - Recreational Vehicle	4	-
C - Bus	2	-
D - Single Unit Truck	30	-
E - Tractor Trailer Unit	8	-
Total	1350	



2035 COMBINED ANNUAL DAILY TRAFFIC



WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	3262	93.9
B - Recreational Vehicle	9	0.3
C - Bus	10	0.3
D - Single Unit Truck	115	3.3
E - Tractor Trailer Unit	78	2.2
Total	3474	

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	2102	89.4
B - Recreational Vehicle	8	0.3
C - Bus	10	0.4
D - Single Unit Truck	84	3.6
E - Tractor Trailer Unit	147	6.3
Total	2351	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Taffic from West Turning Left
WT: Taffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	2346	90.2
B - Recreational Vehicle	5	0.2
C - Bus	8	0.3
D - Single Unit Truck	87	3.3
E - Tractor Trailer Unit	155	6.0
Total	2601	

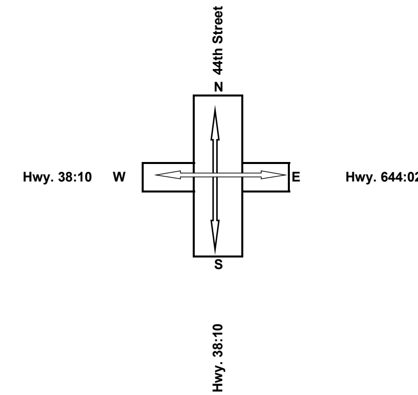
2035
2019
16

D&A PAULICHUK CONSULTING LTD.

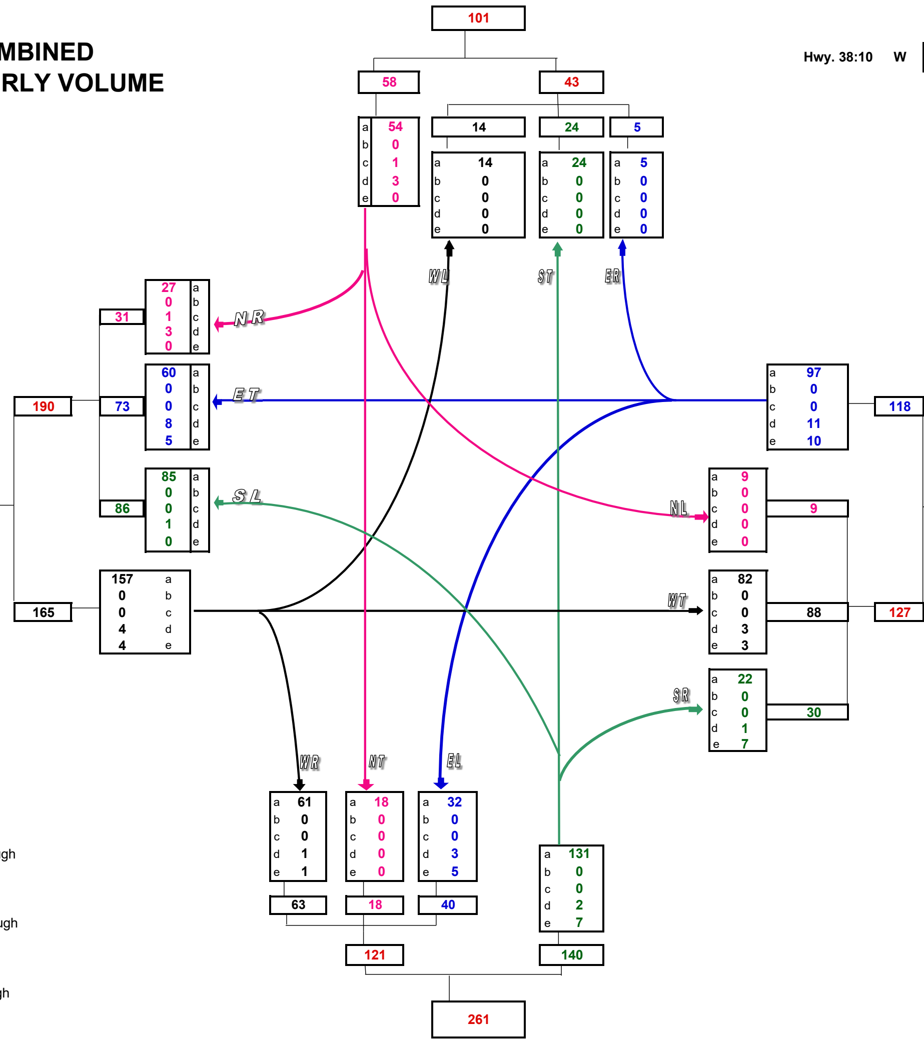
Turning Movement Summary Diagram

2035 COMBINED
AM PEAK HOURLY VOLUME

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	97	96.0
B - Recreational Vehicle	0	0.0
C - Bus	1	1.0
D - Single Unit Truck	3	3.0
E - Tractor Trailer Unit	0	0.0
Total	101	



WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	329	92.7
B - Recreational Vehicle	0	0.0
C - Bus	1	0.3
D - Single Unit Truck	16	4.5
E - Tractor Trailer Unit	9	2.5
Total	355	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	210	85.7
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	15	6.1
E - Tractor Trailer Unit	20	8.2
Total	245	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	242	92.7
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	6	2.3
E - Tractor Trailer Unit	13	5.0
Total	261	

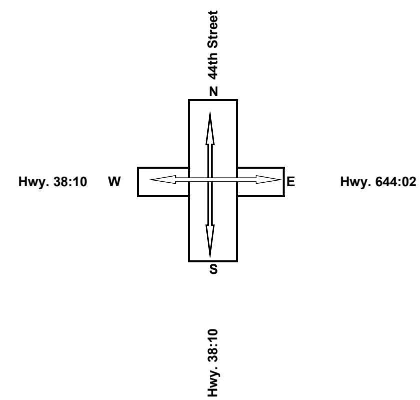
2035
2019
16

D&A PAULICHUK CONSULTING LTD.

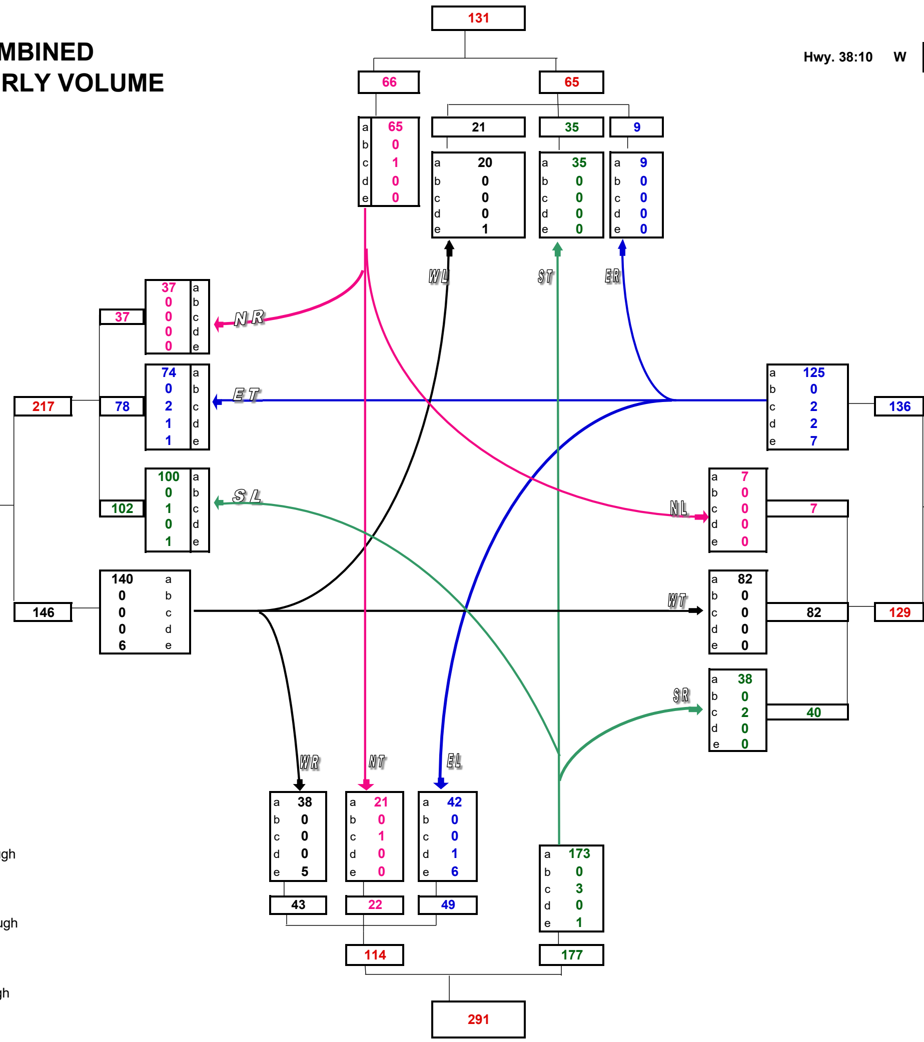
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	129	98.5
B - Recreational Vehicle	0	0.0
C - Bus	1	0.8
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	1	0.8
Total	131	

2035 COMBINED
PM PEAK HOURLY VOLUME



WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	351	96.7
B - Recreational Vehicle	0	0.0
C - Bus	3	0.8
D - Single Unit Truck	1	0.3
E - Tractor Trailer Unit	8	2.2
Total	363	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	252	95.1
B - Recreational Vehicle	0	0.0
C - Bus	4	1.5
D - Single Unit Truck	2	0.8
E - Tractor Trailer Unit	7	2.6
Total	265	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	274	94.2
B - Recreational Vehicle	0	0.0
C - Bus	4	1.4
D - Single Unit Truck	1	0.3
E - Tractor Trailer Unit	12	4.1
Total	291	

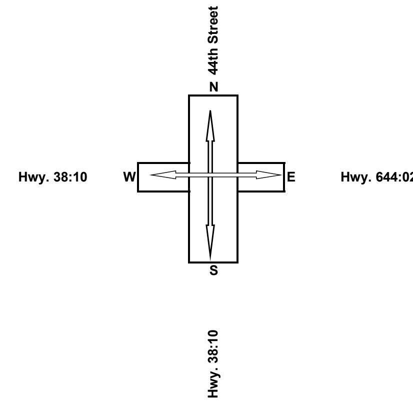
2035
2019
16

D&A PAULICHUK CONSULTING LTD.

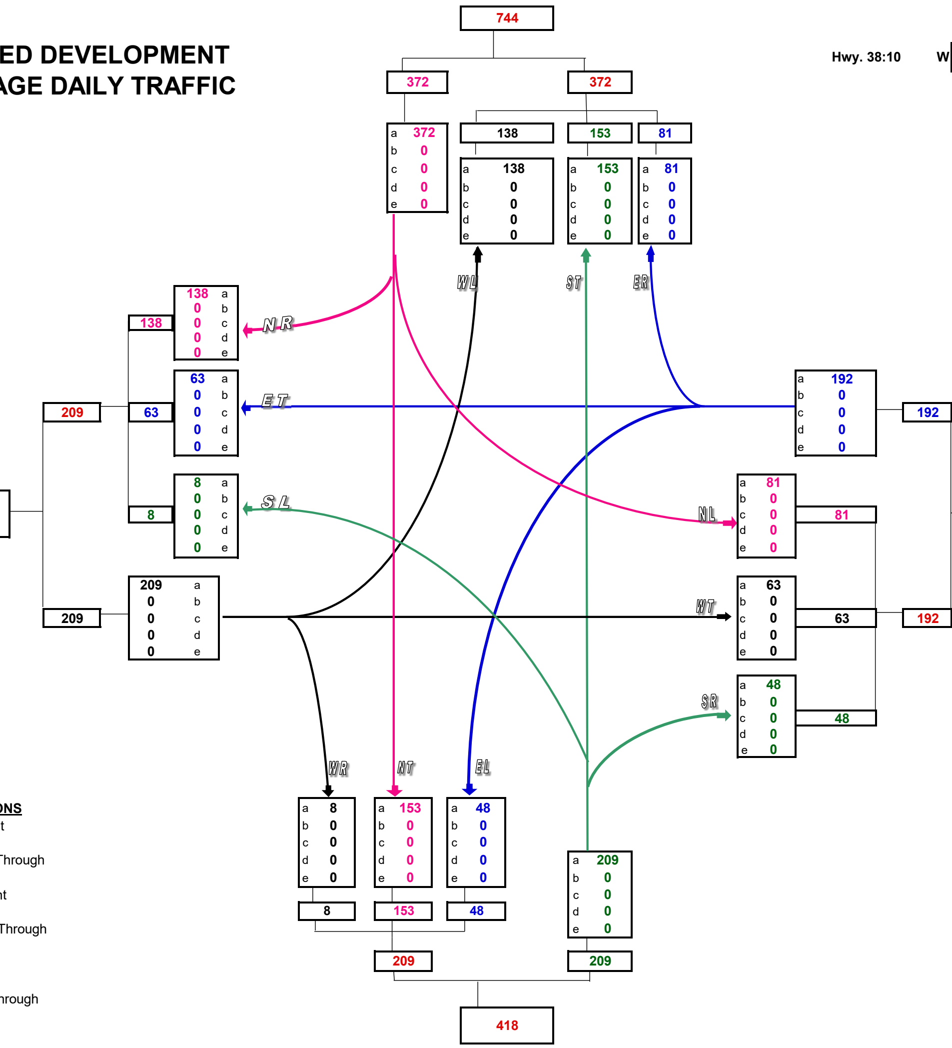
Turning Movement Summary Diagram

2045 PROJECTED DEVELOPMENT ANNUAL AVERAGE DAILY TRAFFIC

NORTH LEG ON		44th Street
Vehicle Type	Vol.	%
A - Passenger Vehicle	744	100.0%
B - Recreational Vehicle	0	0.0%
C - Bus	0	0.0%
D - Single Unit Truck	0	0.0%
E - Tractor Trailer Unit	0	0.0%
Total	744	



WEST LEG ON		Hwy. 38:10
Vehicle Type	Vol.	%
A - Passenger Vehicle	418	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	418	



EAST LEG ON		Hwy. 644:02
Vehicle Type	Vol.	%
A - Passenger Vehicle	384	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	384	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Taffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

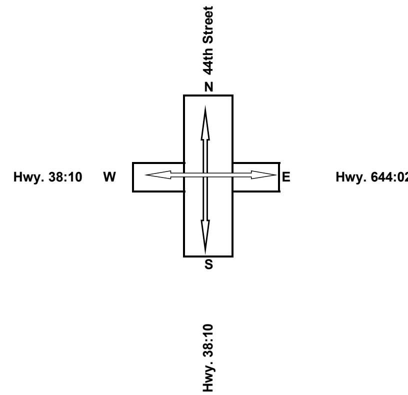
SOUTH LEG ON		Hwy. 38:10
Vehicle Type	Vol.	%
A - Passenger Vehicle	418	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	418	

![D&A Paulichuk Consulting Ltd.]

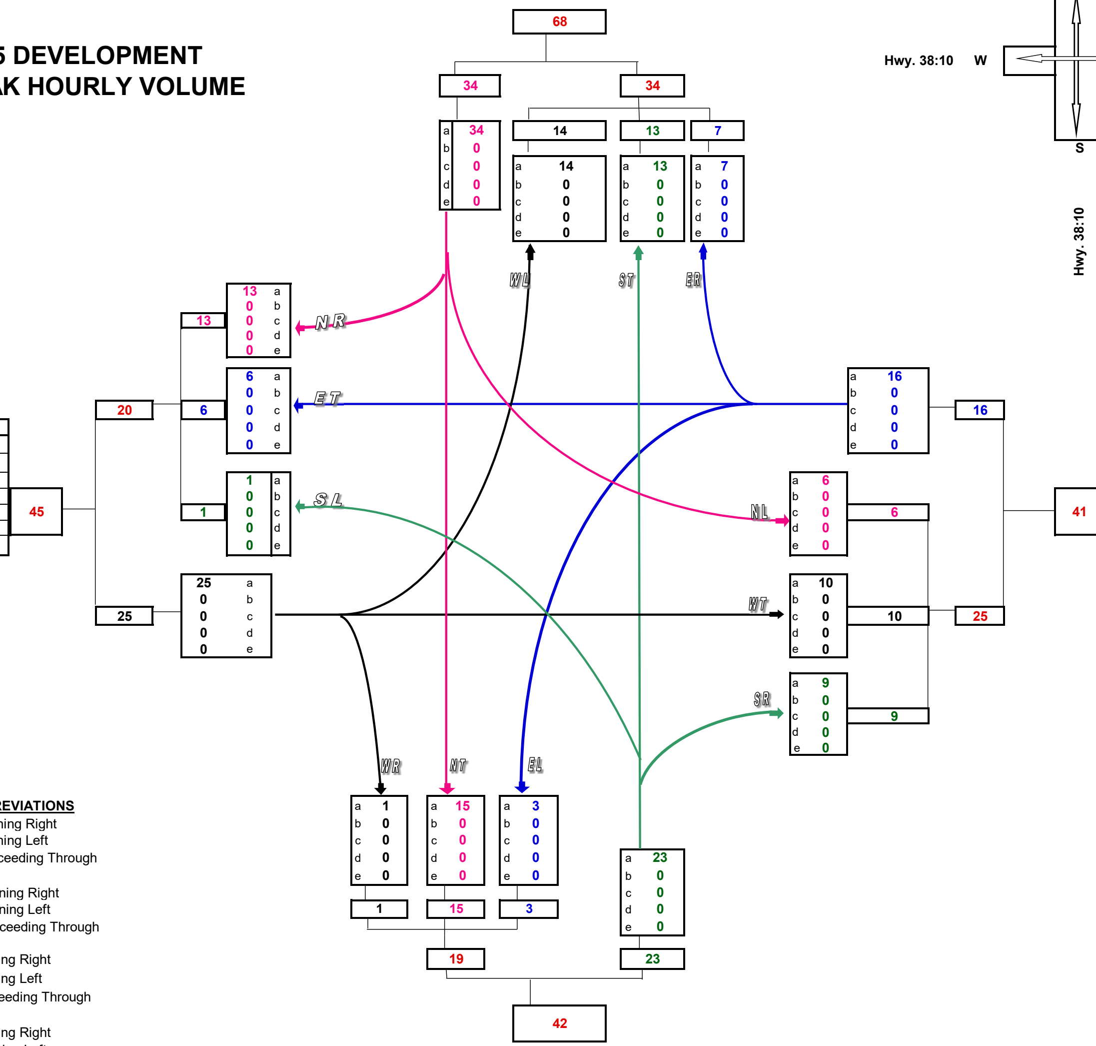
Turning Movement Summary Diagram

2045 DEVELOPMENT
AM PEAK HOURLY VOLUME

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	68	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	68	



WEST LEG ON	Hwy. 63:01	
Vehicle Type	Vol.	%
A - Passenger Vehicle	45	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	45	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	41	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	41	

SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	42	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	42	

TURNING MOVEMENT ABBREVIATIONS

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EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

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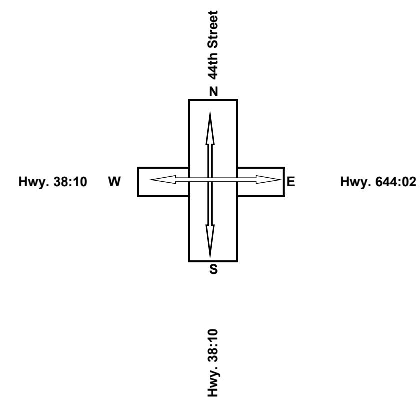
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

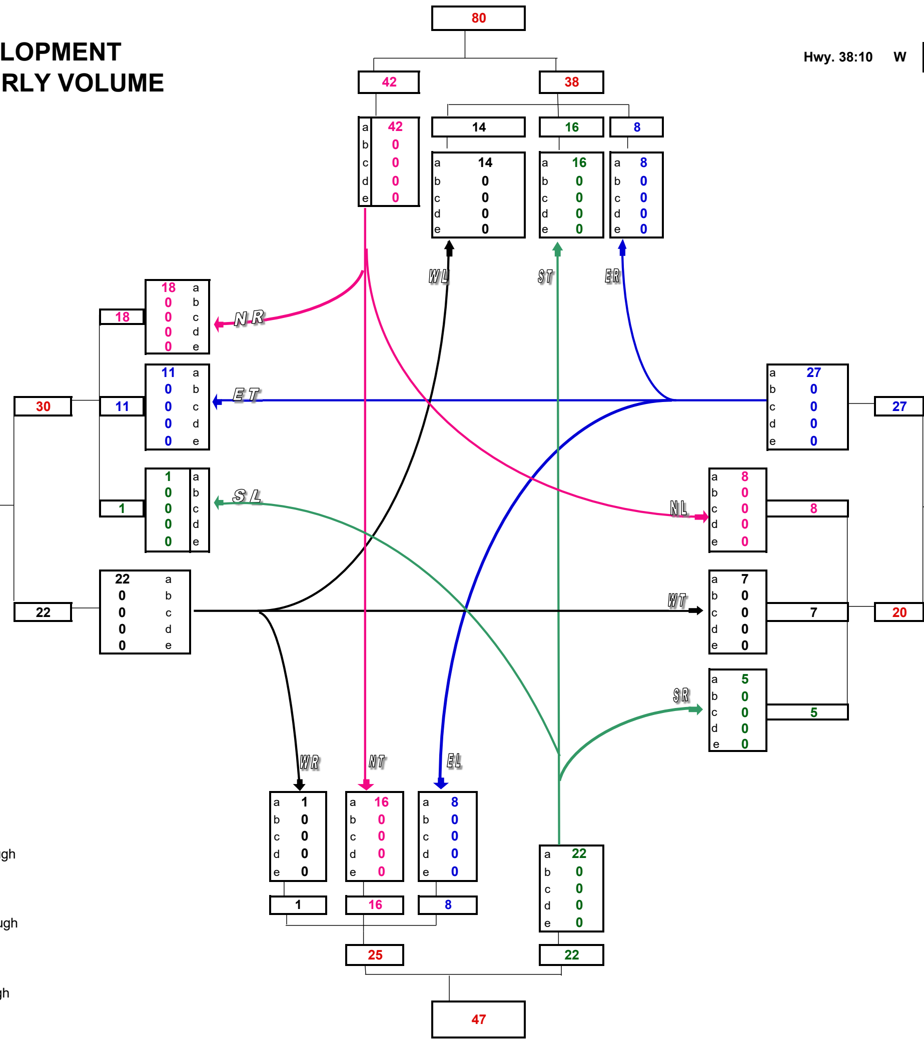
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	80	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	80	



2045 DEVELOPMENT
PM PEAK HOURLY VOLUME

WEST LEG ON	Hwy. 63:01	
Vehicle Type	Vol.	%
A - Passenger Vehicle	52	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	52	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	47	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	47	

TURNING MOVEMENT ABBREVIATIONS

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WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

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Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	47	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	47	

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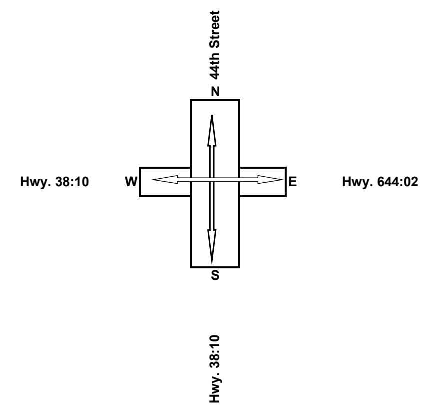
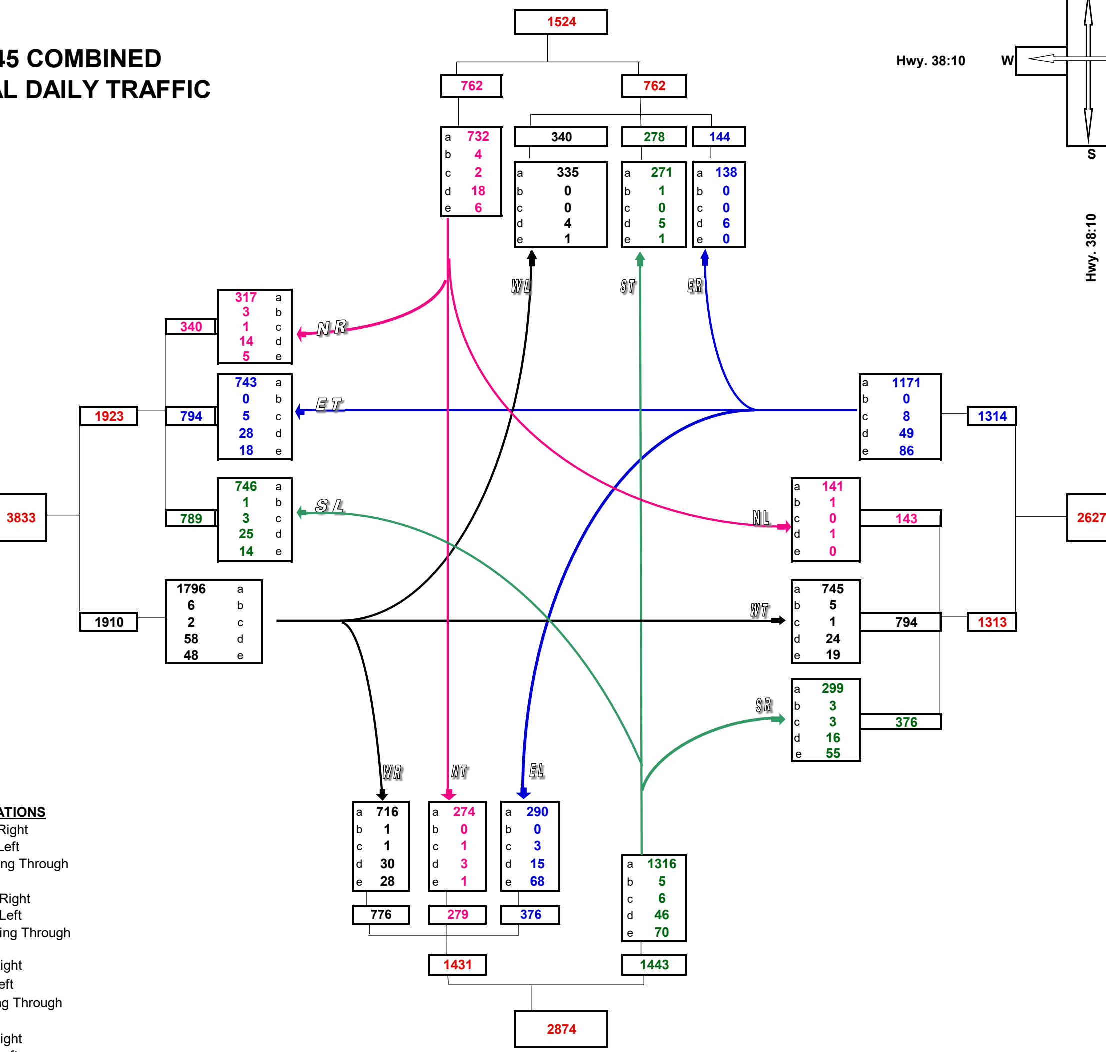
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1476	-
B - Recreational Vehicle	5	-
C - Bus	2	-
D - Single Unit Truck	33	-
E - Tractor Trailer Unit	8	-
Total	1524	

2045 COMBINED ANNUAL DAILY TRAFFIC





WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	3602	94.0
B - Recreational Vehicle	10	0.3
C - Bus	11	0.3
D - Single Unit Truck	125	3.3
E - Tractor Trailer Unit	85	2.2
Total	3833	

3833

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	2356	89.7
B - Recreational Vehicle	9	0.3
C - Bus	12	0.5
D - Single Unit Truck	90	3.4
E - Tractor Trailer Unit	160	6.1
Total	2627	

2627

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WL: Traffic from West Turning Left
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TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	2596	90.3
B - Recreational Vehicle	6	0.2
C - Bus	11	0.4
D - Single Unit Truck	94	3.3
E - Tractor Trailer Unit	167	5.8
Total	2874	

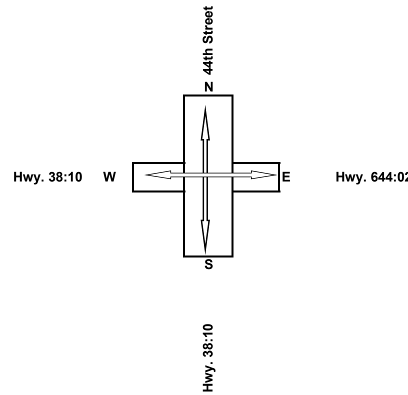
2045
2019
26

D&A PAULICHUK CONSULTING LTD.

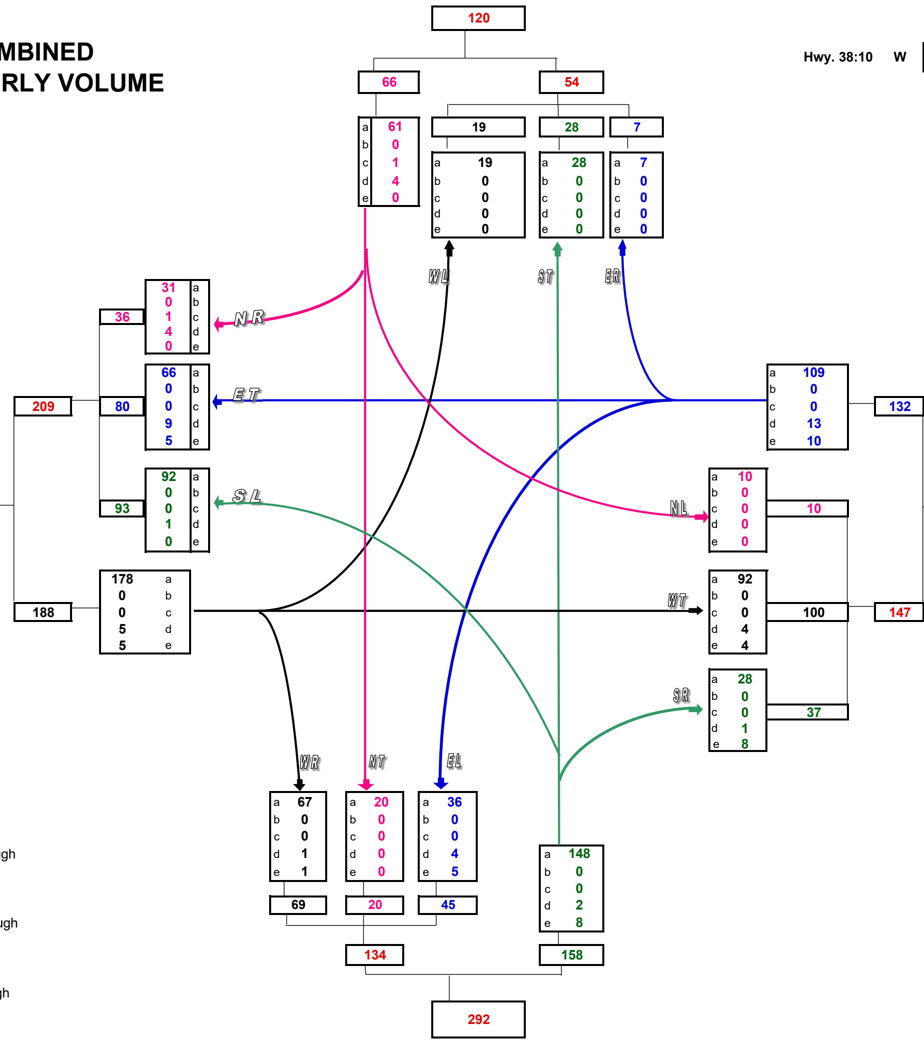
Turning Movement Summary Diagram

2045 COMBINED
AM PEAK HOURLY VOLUME

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	115	95.8
B - Recreational Vehicle	0	0.0
C - Bus	1	0.8
D - Single Unit Truck	4	3.3
E - Tractor Trailer Unit	0	0.0
Total	120	



WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	367	92.4
B - Recreational Vehicle	0	0.0
C - Bus	1	0.3
D - Single Unit Truck	19	4.8
E - Tractor Trailer Unit	10	2.5
Total	397	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	239	85.7
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	18	6.5
E - Tractor Trailer Unit	22	7.9
Total	279	

TURNING MOVEMENT ABBREVIATIONS

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WL: Traffic from West Turning Left
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TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	271	92.8
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	7	2.4
E - Tractor Trailer Unit	14	4.8
Total	292	

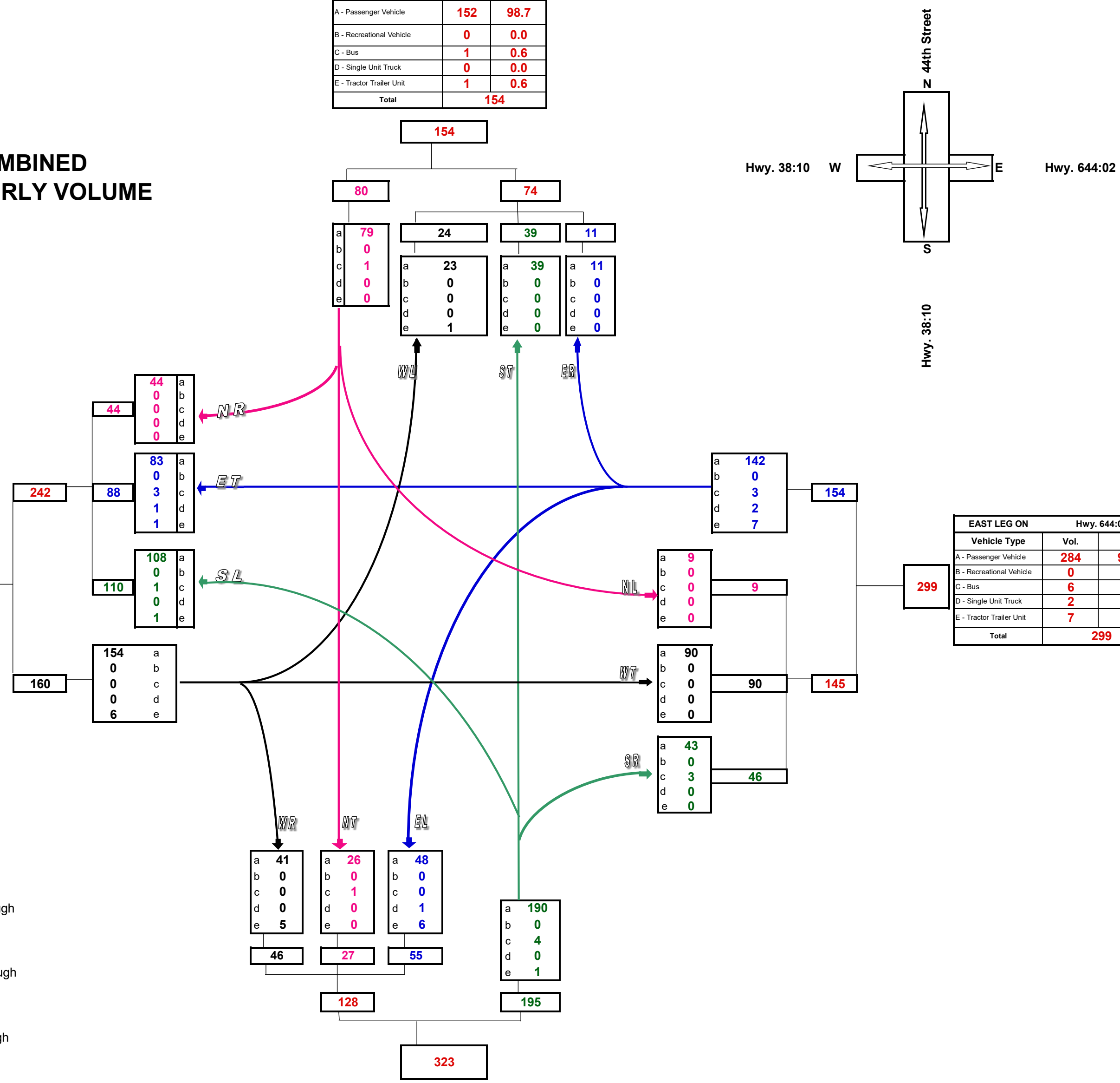
2045
2019
26

D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2045 COMBINED
PM PEAK HOURLY VOLUME

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	152	98.7
B - Recreational Vehicle	0	0.0
C - Bus	1	0.6
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	1	0.6
Total	154	



WEST LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	389	96.8
B - Recreational Vehicle	0	0.0
C - Bus	4	1.0
D - Single Unit Truck	1	0.2
E - Tractor Trailer Unit	8	2.0
Total	402	

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	284	95.0
B - Recreational Vehicle	0	0.0
C - Bus	6	2.0
D - Single Unit Truck	2	0.7
E - Tractor Trailer Unit	7	2.3
Total	299	

TURNING MOVEMENT ABBREVIATIONS

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WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	Hwy. 38:10	
Vehicle Type	Vol.	%
A - Passenger Vehicle	305	94.4
B - Recreational Vehicle	0	0.0
C - Bus	5	1.5
D - Single Unit Truck	1	0.3
E - Tractor Trailer Unit	12	3.7
Total	323	

2045
2019
26

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Hwy. 38:10	Main Road	**Date**	December 28, 2020
Hwy. 644:02	Minor Road	**Other**	Year 2021 with Proposed Development using 1% Growth Rate
Redwater	City/Town		

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	4		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	100		5		OK	
Channelization Factor					OK	20
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**26**

OPERATIONAL FACTORS

	Value	Rating	Weight	Comments	Check	Score
Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	2761	2	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	20
AADT on Minor Road (2-way)	1987	3	20		OK	60
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	0	5	Refer to Table 1(B) for ratings.	OK	0
Operating Speed or Posted Speed on Major Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
					Operational Factors Subtotal	**80**

ENVIRONMENTAL FACTOR

	Value	Rating	Weight	Comments	Check	Score
Lighted Developments within 150 m radius of intersection	0	0	5	Maximum of 4 quadrants	OK	0
					Environmental Factor Subtotal	**0**

COLLISION HISTORY

	Value	Rating	Weight	Comments	Check	Score
Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
					Collision History Subtotal	**0**

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY

Geometric Factors Subtotal	26
Operational Factor Subtotal	80
Environmental Factor Subtotal	0
Collision History Subtotal	0
TOTAL POINTS	**106**

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

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Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Hwy. 38:10	Main Road	**Date**	December 28, 2020
Hwy. 644:02	Minor Road	**Other**	Year 2025 with Proposed Development using 1% Growth Rate
Redwater	City/Town		

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	4		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	100		5		OK	
Channelization Factor					OK	20
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**26**

OPERATIONAL FACTORS

	Value	Rating	Weight	Comments	Check	Score
Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	3106	3	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	30
AADT on Minor Road (2-way)	2321	4	20		OK	80
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	0	5	Refer to Table 1(B) for ratings.	OK	0
Operating Speed or Posted Speed on Major Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
					Operational Factors Subtotal	**110**

ENVIRONMENTAL FACTOR

	Value	Rating	Weight	Comments	Check	Score
Lighted Developments within 150 m radius of intersection	0	0	5	Maximum of 4 quadrants	OK	0
					Environmental Factor Subtotal	**0**

COLLISION HISTORY

	Value	Rating	Weight	Comments	Check	Score
Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
					Collision History Subtotal	**0**

Check Intersection Signalization:
Intersection is not Signalized

ILLUMINATION WARRANTED
REVIEW SITE AND COLLISIONS TO DETERMINE LIGHTING TYPE (PARTIAL OR DELINEATION)

SUMMARY

Geometric Factors Subtotal	26
Operational Factor Subtotal	110
Environmental Factor Subtotal	0
Collision History Subtotal	0
TOTAL POINTS	**136**

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

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Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Hwy. 38:10	Main Road	**Date**	December 28, 2020
Hwy. 644:02	Minor Road	**Other**	Year 2045 with Proposed Development using 1% Growth Rate
Redwater	City/Town		

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	4		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	100		5		OK	
Channelization Factor					OK	20
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**26**

OPERATIONAL FACTORS

	Value	Rating	Weight	Comments	Check	Score
Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	3833	3	10	Either Use the two AADT inputs **OR** the Descriptive Signalization	OK	30
AADT on Minor Road (2-way)	2874	4	20	Warrant (Unused values should be set to Zero) Refer to Table	OK	80
Signalization Warrant	Descriptive	0	30	1(B) for description and rating values for signalization warrant.	OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	0	5	Refer to Table 1(B) for ratings.	OK	0
Operating Speed or Posted Speed on Major Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
					Operational Factors Subtotal	**110**

ENVIRONMENTAL FACTOR

	Value	Rating	Weight	Comments	Check	Score
Lighted Developments within 150 m radius of intersection	0	0	5	Maximum of 4 quadrants	OK	0
					Environmental Factor Subtotal	**0**

COLLISION HISTORY

	Value	Rating	Weight	Comments	Check	Score
Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
					Collision History Subtotal	**0**

Check Intersection Signalization:
Intersection is not Signalized

ILLUMINATION WARRANTED
REVIEW SITE AND COLLISIONS TO DETERMINE LIGHTING TYPE (PARTIAL OR DELINEATION)

SUMMARY

Geometric Factors Subtotal	26
Operational Factor Subtotal	110
Environmental Factor Subtotal	0
Collision History Subtotal	0
TOTAL POINTS	**136**

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Hwy. 38:10	Main Road	**Date**	December 28, 2020
Hwy. 644:02	Minor Road	**Other**	Year 2045 with Proposed Development using 2% Growth Rate
Redwater	City/Town		

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	4		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	100		5		OK	
Channelization Factor					OK	20
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**26**

OPERATIONAL FACTORS

	Value	Rating	Weight	Comments	Check	Score
Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	4539	3	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	30
AADT on Minor Road (2-way)	3384	4	20		OK	80
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	0	5	Refer to Table 1(B) for ratings.	OK	0
Operating Speed or Posted Speed on Major Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
					Operational Factors Subtotal	**110**

ENVIRONMENTAL FACTOR

	Value	Rating	Weight	Comments	Check	Score
Lighted Developments within 150 m radius of intersection	0	0	5	Maximum of 4 quadrants	OK	0
					Environmental Factor Subtotal	**0**

COLLISION HISTORY

	Value	Rating	Weight	Comments	Check	Score
Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
					Collision History Subtotal	**0**

Check Intersection Signalization:
Intersection is not Signalized

ILLUMINATION WARRANTED
REVIEW SITE AND COLLISIONS TO DETERMINE LIGHTING TYPE (PARTIAL OR DELINEATION)

SUMMARY	
Geometric Factors Subtotal	26
Operational Factor Subtotal	110
Environmental Factor Subtotal	0
Collision History Subtotal	0
TOTAL POINTS	**136**

2005 Canadian Matrix Traffic Signal Warrant Analysis

Main Street (name)	Highway 38:10	Direction (EW or NS)	EW	Date:	Dec 28, 2020
Side Street (name)	Hwy. 38:10/44th Street	Direction (EW or NS)	NS	City:	Urban
Quadrant (if appl)	Year 2045 2% GR				

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
Hwy. 644:02	WB	0	0	1	0	0	0	1	
Hwy. 38:10	EB	0	0	1	1	0	0	2	
Hwy. 38:10	NB	0	0	1	0	0			
44 Street	SB	0	0	1	0	0			

Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	n
Central Business District	(y/n)	y

Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Highway 38:10	EW	50	10.0%	y	0.0
Hwy. 38:10/44th Street	NS	50	10.0%	y	

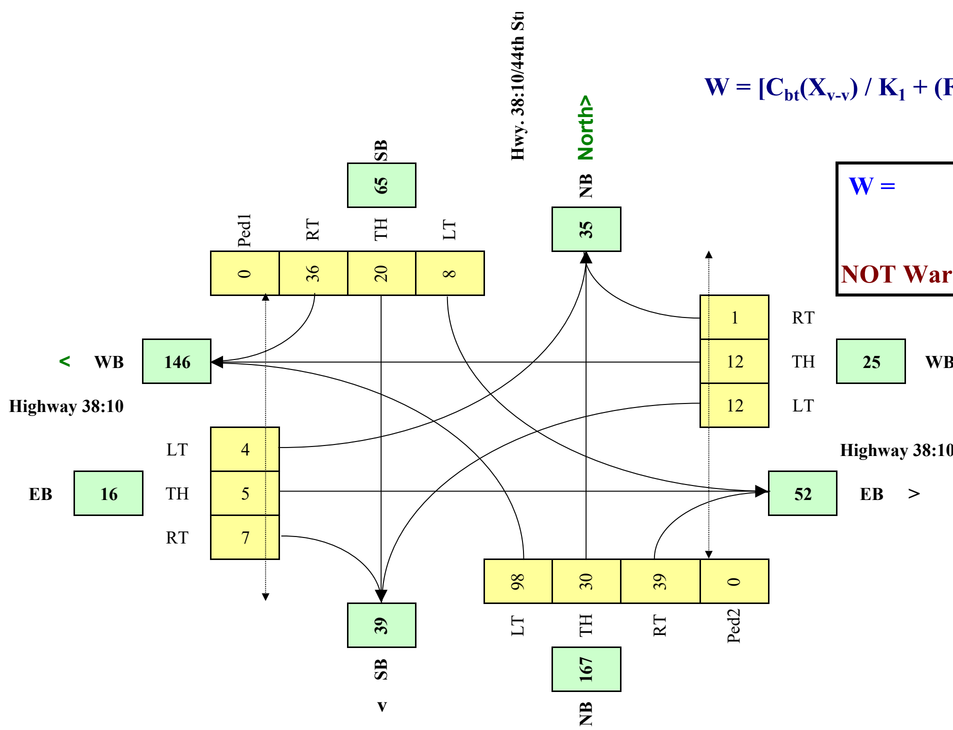
Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S side
7:30 - 8:30	112	31	43	11	21	41	54	96	7	20	119	84	0	0	0	0
8:30 - 9:30	101	28	39	10	19	37	49	86	6	18	107	76	0	0	0	0
11:30 - 12:30	56	16	22	6	11	21	27	48	4	10	60	42	0	0	0	0
12:30 - 13:30	67	22	27	5	15	25	34	53	6	14	54	28	0	0	0	0
16:00 - 17:00	121	39	49	9	27	45	60	95	10	24	96	50	0	0	0	0
17:00 - 18:00	134	43	54	10	30	50	67	105	11	27	107	56	0	0	0	0
Total (6-hour peak)	**590**	**178**	**233**	**50**	**122**	**218**	**71**	**69**	**8**	**24**	**27**	**42**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**98**	**30**	**39**	**8**	**20**	**36**	**12**	**12**	**1**	**4**	**5**	**7**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v-v}) / K_1 + (F\ (X_{v-p})\ L) / K_2] \times C_i$$

W =	7	7	0
		Veh	*Ped*

NOT Warranted



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	72	55	34	60	0	74	12	22	3	4	18
Future Volume (Veh/h)	4	72	55	34	60	0	74	12	22	3	4	18
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	4	76	58	36	63	0	78	13	23	3	4	19
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	63			76			240	219	76	248	219	63
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	63			76			240	219	76	248	219	63
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	100			98			88	98	98	100	99	98
cM capacity (veh/h)	1521			1504			667	648	963	649	648	980

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	80	58	99	114	26
Volume Left	4	0	36	78	3
Volume Right	0	58	0	23	19
cSH	1521	1700	1504	709	861
Volume to Capacity	0.00	0.03	0.02	0.16	0.03
Queue Length 95th (m)	0.1	0.0	0.6	4.6	0.7
Control Delay (s)	0.4	0.0	2.8	11.1	9.3
Lane LOS	A		A	B	A
Approach Delay (s)	0.2		2.8	11.1	9.3
Approach LOS				B	A

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	33.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	72	36	39	62	2	89	18	33	1	9	21
Future Volume (Veh/h)	8	72	36	39	62	2	89	18	33	1	9	21
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	8	76	38	41	65	2	94	19	35	1	9	22
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	67			76			266	241	76	284	240	66
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	67			76			266	241	76	284	240	66
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	99			97			85	97	96	100	99	98
cM capacity (veh/h)	1516			1504			632	626	963	599	627	976

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	84	38	108	148	32
Volume Left	8	0	41	94	1
Volume Right	0	38	2	35	22
cSH	1516	1700	1504	687	830
Volume to Capacity	0.01	0.02	0.03	0.22	0.04
Queue Length 95th (m)	0.1	0.0	0.7	6.5	1.0
Control Delay (s)	0.7	0.0	3.0	11.7	9.5
Lane LOS	A		A	B	A
Approach Delay (s)	0.5		3.0	11.7	9.5
Approach LOS				B	A

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	36.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	77	58	35	64	3	78	20	23	8	16	29
Future Volume (Veh/h)	11	77	58	35	64	3	78	20	23	8	16	29
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	12	81	61	37	67	3	82	21	24	8	17	31
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	70			81			287	249	81	282	248	68
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	70			81			287	249	81	282	248	68
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	99			98			86	97	97	99	97	97
cM capacity (veh/h)	1512			1498			600	619	957	606	621	973

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	93	61	107	127	56
Volume Left	12	0	37	82	8
Volume Right	0	61	3	24	31
cSH	1512	1700	1498	650	773
Volume to Capacity	0.01	0.04	0.02	0.20	0.07
Queue Length 95th (m)	0.2	0.0	0.6	5.8	1.9
Control Delay (s)	1.0	0.0	2.7	11.9	10.0
Lane LOS	A		A	B	B
Approach Delay (s)	0.6		2.7	11.9	10.0
Approach LOS				B	B

Intersection Summary			
Average Delay	5.5		
Intersection Capacity Utilization	35.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	72	39	40	66	8	93	32	34	5	19	32
Future Volume (Veh/h)	19	72	39	40	66	8	93	32	34	5	19	32
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	20	76	41	42	69	8	98	34	36	5	20	34
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	77			76			317	277	76	326	273	73
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	77			76			317	277	76	326	273	73
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	99			97			83	94	96	99	97	96
cM capacity (veh/h)	1503			1504			565	592	963	546	595	967

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	96	41	119	168	59
Volume Left	20	0	42	98	5
Volume Right	0	41	8	36	34
cSH	1503	1700	1504	626	757
Volume to Capacity	0.01	0.02	0.03	0.27	0.08
Queue Length 95th (m)	0.3	0.0	0.7	8.6	2.0
Control Delay (s)	1.6	0.0	2.8	12.8	10.2
Lane LOS	A		A	B	B
Approach Delay (s)	1.1		2.8	12.8	10.2
Approach LOS				B	B

Intersection Summary			
Average Delay	6.7		
Intersection Capacity Utilization	38.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	14	88	63	40	73	5	86	24	30	9	18	31
Future Volume (Veh/h)	14	88	63	40	73	5	86	24	30	9	18	31
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	15	93	66	42	77	5	91	25	32	9	19	33
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	82			93			329	289	93	331	286	80
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	82			93			329	289	93	331	286	80
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	99			97			84	96	97	98	97	97
cM capacity (veh/h)	1497			1483			557	585	943	551	587	959

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	108	66	124	148	61
Volume Left	15	0	42	91	9
Volume Right	0	66	5	32	33
cSH	1497	1700	1483	617	734
Volume to Capacity	0.01	0.04	0.03	0.24	0.08
Queue Length 95th (m)	0.2	0.0	0.7	7.5	2.2
Control Delay (s)	1.1	0.0	2.7	12.7	10.4
Lane LOS	A		A	B	B
Approach Delay (s)	0.7		2.7	12.7	10.4
Approach LOS				B	B

Intersection Summary			
Average Delay	5.8		
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	21	82	43	49	78	9	102	35	40	7	22	37
Future Volume (Veh/h)	21	82	43	49	78	9	102	35	40	7	22	37
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	22	86	45	52	82	9	107	37	42	7	23	39
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	91			86			371	325	86	381	320	86
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	91			86			371	325	86	381	320	86
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	99			97			79	93	96	99	96	96
cM capacity (veh/h)	1485			1492			511	552	951	491	555	950

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	108	45	143	186	69
Volume Left	22	0	52	107	7
Volume Right	0	45	9	42	39
cSH	1485	1700	1492	580	713
Volume to Capacity	0.01	0.03	0.03	0.32	0.10
Queue Length 95th (m)	0.4	0.0	0.9	11.0	2.6
Control Delay (s)	1.6	0.0	2.9	14.1	10.6
Lane LOS	A		A	B	B
Approach Delay (s)	1.1		2.9	14.1	10.6
Approach LOS				B	B

Intersection Summary			
Average Delay	7.2		
Intersection Capacity Utilization	41.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	100	69	45	80	7	93	28	37	10	20	36
Future Volume (Veh/h)	19	100	69	45	80	7	93	28	37	10	20	36
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	20	105	73	47	84	7	98	29	39	11	21	38
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	91			105			375	330	105	380	326	88
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	91			105			375	330	105	380	326	88
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	99			97			81	95	96	98	96	96
cM capacity (veh/h)	1485			1468			511	550	928	500	553	949

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	125	73	138	166	70
Volume Left	20	0	47	98	11
Volume Right	0	73	7	39	38
cSH	1485	1700	1468	580	700
Volume to Capacity	0.01	0.04	0.03	0.29	0.10
Queue Length 95th (m)	0.3	0.0	0.8	9.4	2.7
Control Delay (s)	1.3	0.0	2.7	13.7	10.7
Lane LOS	A		A	B	B
Approach Delay (s)	0.8		2.7	13.7	10.7
Approach LOS				B	B

Intersection Summary			
Average Delay	6.2		
Intersection Capacity Utilization	39.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	90	46	55	88	11	110	39	46	9	27	44
Future Volume (Veh/h)	24	90	46	55	88	11	110	39	46	9	27	44
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	25	95	48	58	93	12	116	41	48	9	28	46
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	105			95			420	366	95	428	360	99
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	105			95			420	366	95	428	360	99
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	98			96			75	92	95	98	95	95
cM capacity (veh/h)	1468			1480			463	519	940	447	523	935

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	120	48	163	205	83
Volume Left	25	0	58	116	9
Volume Right	0	48	12	48	46
cSH	1468	1700	1480	539	676
Volume to Capacity	0.02	0.03	0.04	0.38	0.12
Queue Length 95th (m)	0.4	0.0	1.0	14.1	3.3
Control Delay (s)	1.7	0.0	2.9	15.7	11.1
Lane LOS	A		A	C	B
Approach Delay (s)	1.2		2.9	15.7	11.1
Approach LOS				C	B

Intersection Summary			
Average Delay	7.8		
Intersection Capacity Utilization	44.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	27	107	56	67	105	11	134	43	54	10	30	50
Future Volume (Veh/h)	27	107	56	67	105	11	134	43	54	10	30	50
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	28	113	59	71	111	12	141	45	57	11	32	53
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	123			113			497	434	113	508	428	117
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	123			113			497	434	113	508	428	117
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	98			95			65	90	94	97	93	94
cM capacity (veh/h)	1446			1458			399	469	919	382	473	914

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	141	59	194	243	96
Volume Left	28	0	71	141	11
Volume Right	0	59	12	57	53
cSH	1446	1700	1458	475	622
Volume to Capacity	0.02	0.03	0.05	0.51	0.15
Queue Length 95th (m)	0.5	0.0	1.2	22.9	4.3
Control Delay (s)	1.6	0.0	3.0	20.2	11.8
Lane LOS	A		A	C	B
Approach Delay (s)	1.1		3.0	20.2	11.8
Approach LOS				C	B

Intersection Summary			
Average Delay	9.4		
Intersection Capacity Utilization	48.4%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX C

HWY. 644:02 & 47TH STREET INTERSECTION ANALYSIS

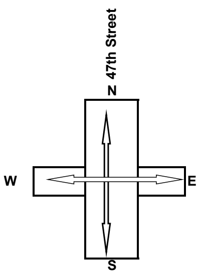
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

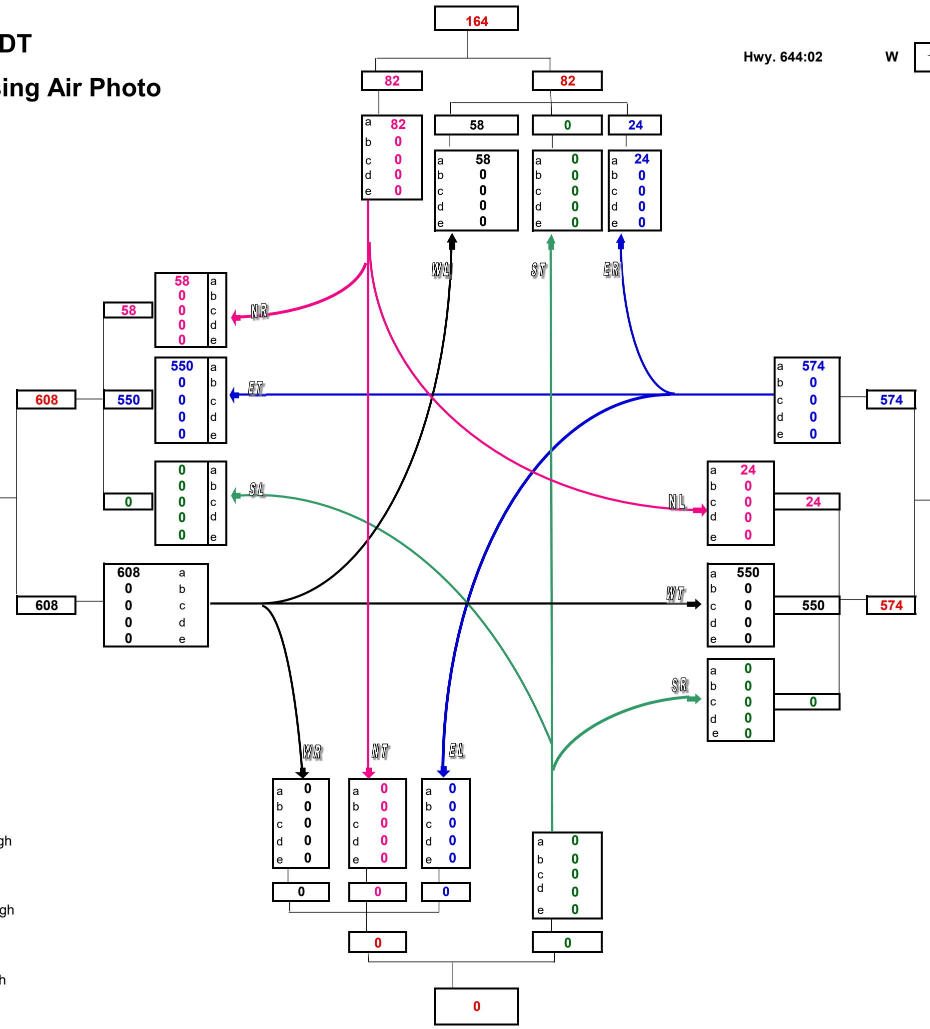
Intersection of: Hwy. 38:10, Hwy. 644:02 & 44th Street

2019 AADT
from Estimation using Air Photo

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	164	100.00
B - Recreational Vehicle	0	0.00
C - Bus	0	0.00
D - Single Unit Truck	0	0.00
E - Tractor Trailer Unit	0	0.00
Total	164	



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1216	100
B - Recreational Vehicle	0	0.00
C - Bus	0	0.00
D - Single Unit Truck	0	0.00
E - Tractor Trailer Unit	0	0.00
Total	1216	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1148	100.00
B - Recreational Vehicle	0	0.00
C - Bus	0	0.00
D - Single Unit Truck	0	0.00
E - Tractor Trailer Unit	0	0.00
Total	1148	

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Taffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

AADT Conversion Factor
1.69

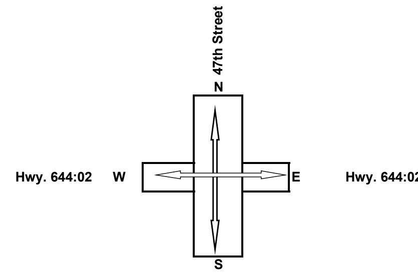
D&A PAULICHUK CONSULTING LTD.

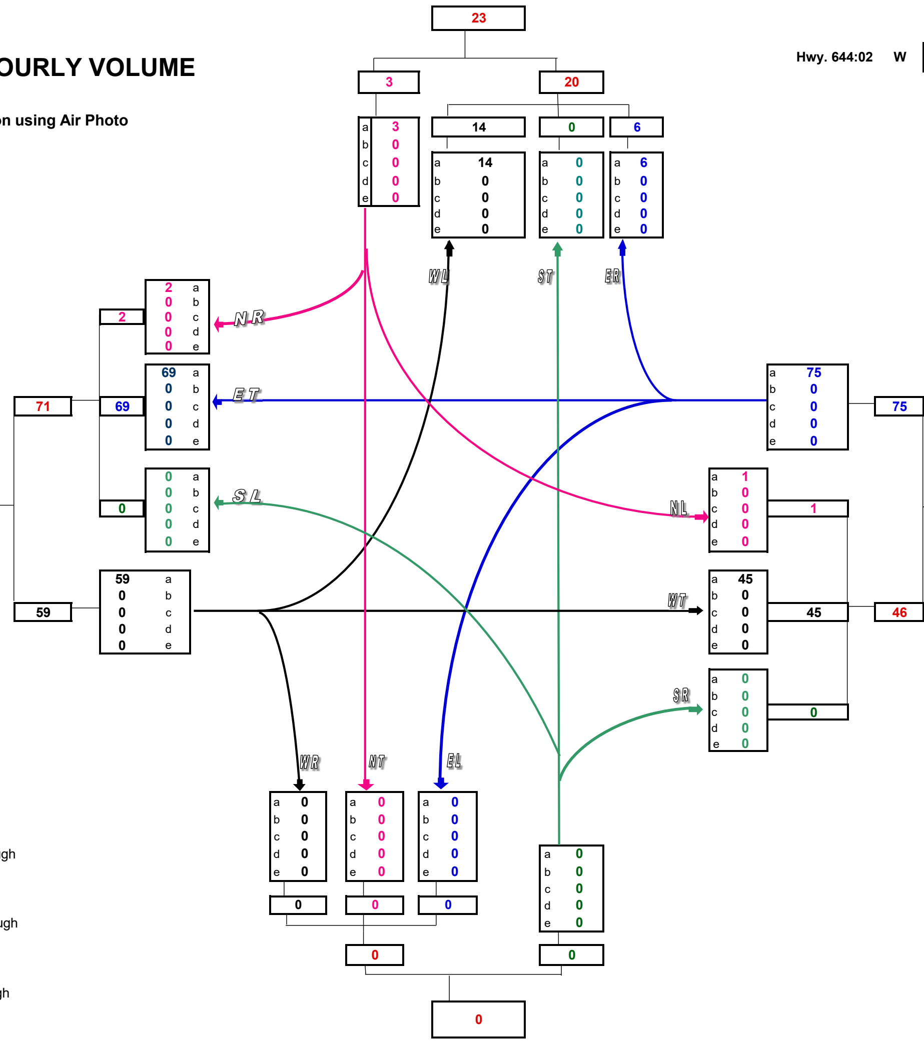
Turning Movement Summary Diagram

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	23	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	23	

2019 AM PEAK HOURLY VOLUME

from Estimation using Air Photo





WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	130	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	130	

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	121	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	121	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

AM Peak 2.57
PM Peak

D&A PAULICHUK CONSULTING LTD.

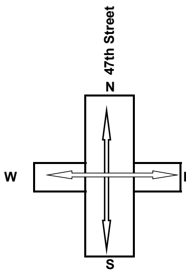
Turning Movement Summary Diagram

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	21	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	21	

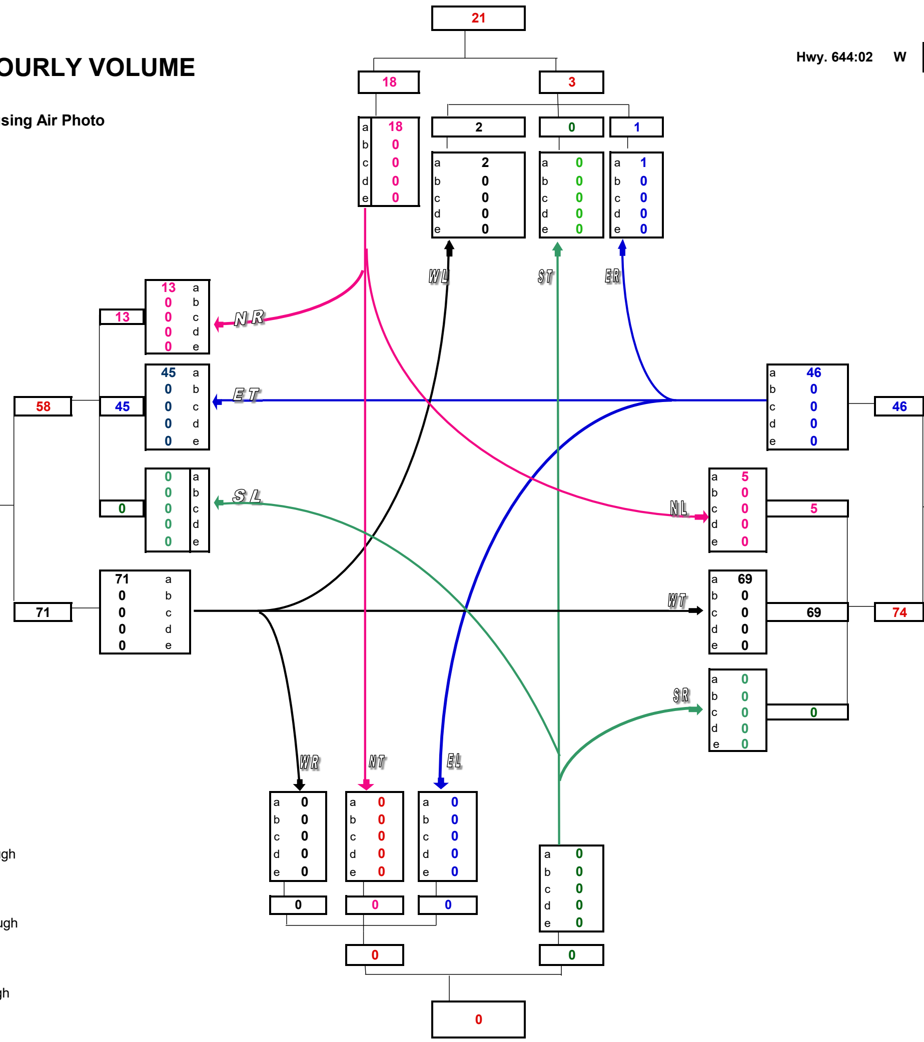
2019 PM PEAK HOURLY VOLUME

from Estimation using Air Photo

Hwy. 644:02 W



Hwy. 644:02



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	129	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	129	

129

120

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	120	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	120	

TURNING MOVEMENT ABBREVIATIONS

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NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

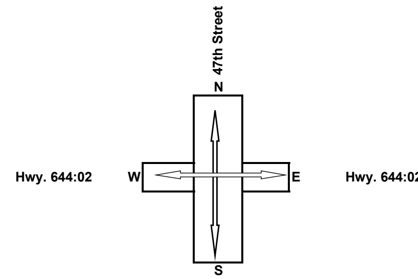
SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

AM Peak
PM Peak 2.40

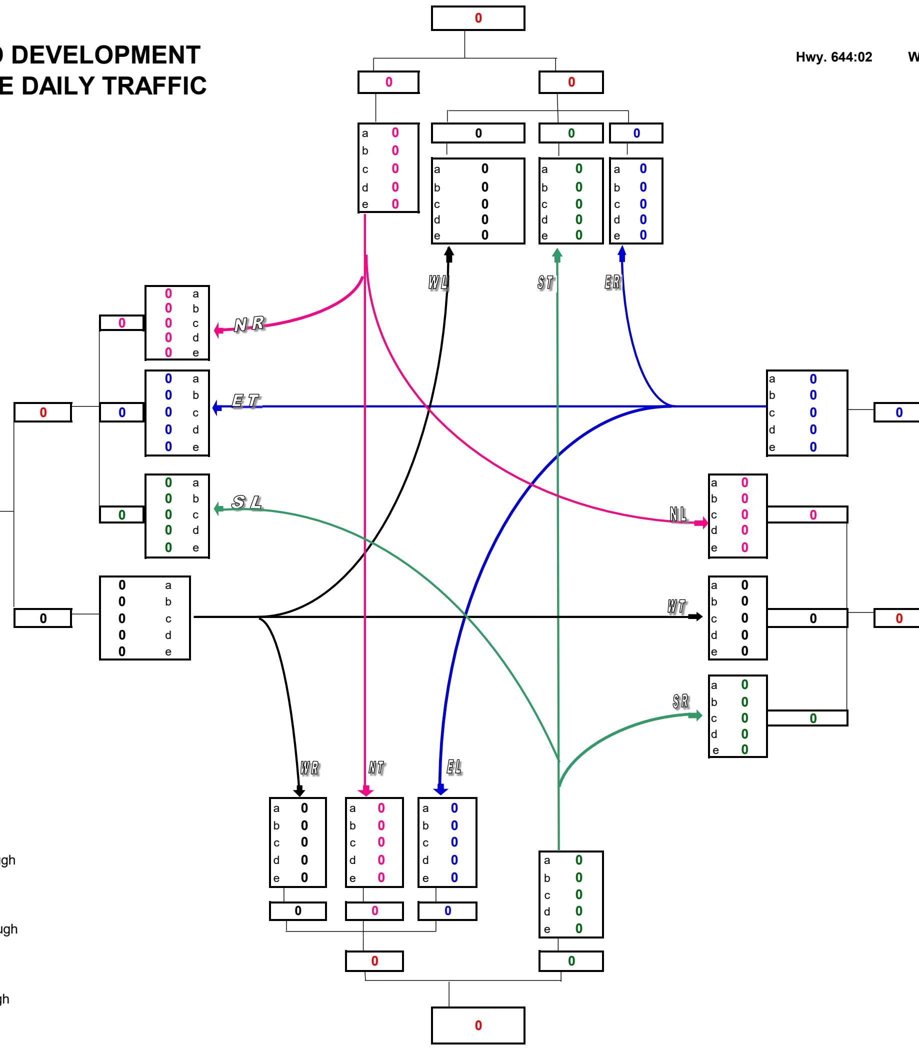
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	



2021 PROJECTED DEVELOPMENT ANNUAL AVERAGE DAILY TRAFFIC



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

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EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Traffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

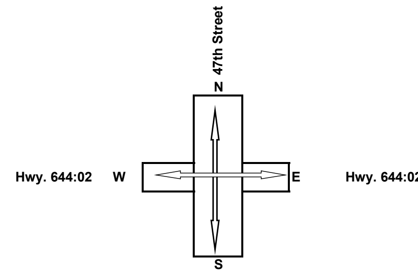
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

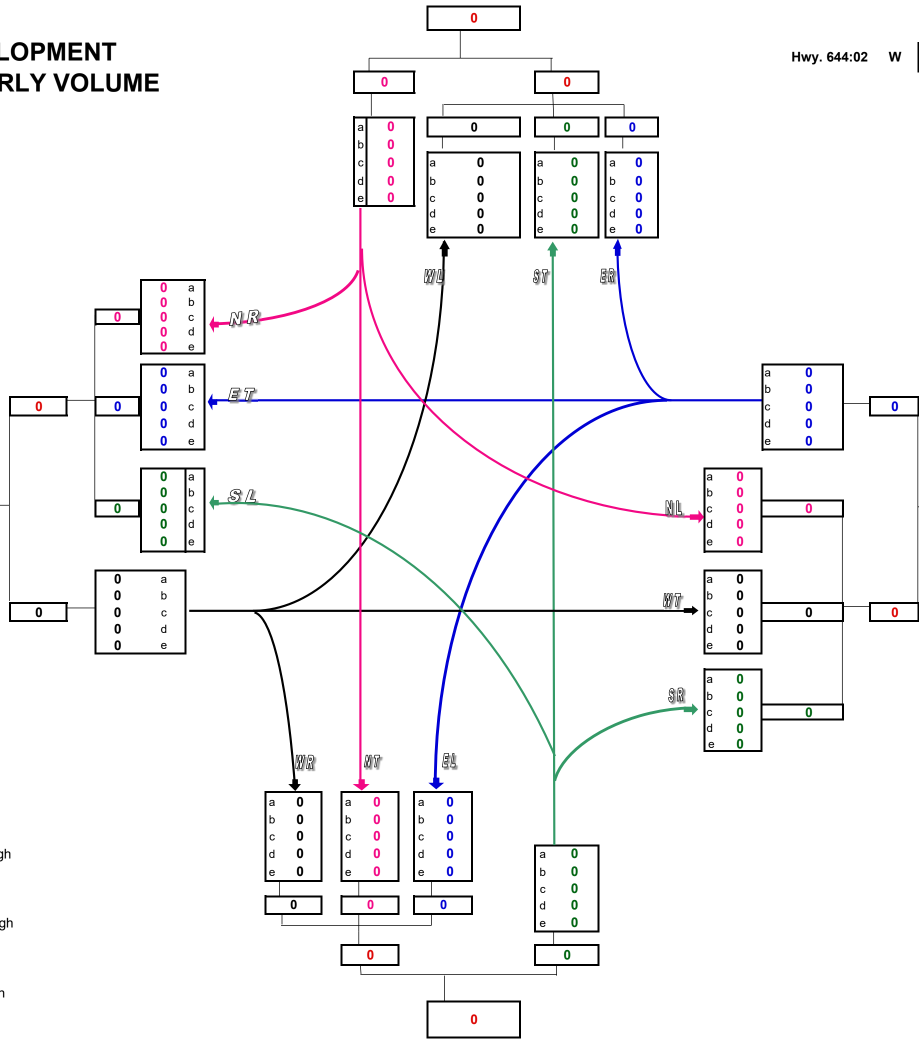
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	



2021 DEVELOPMENT
AM PEAK HOURLY VOLUME



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

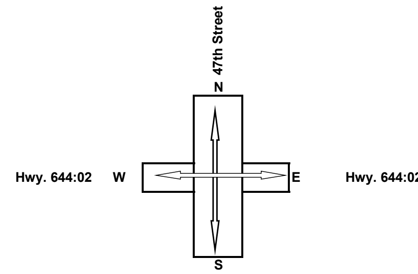
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

D&A PAULICHUK CONSULTING LTD.

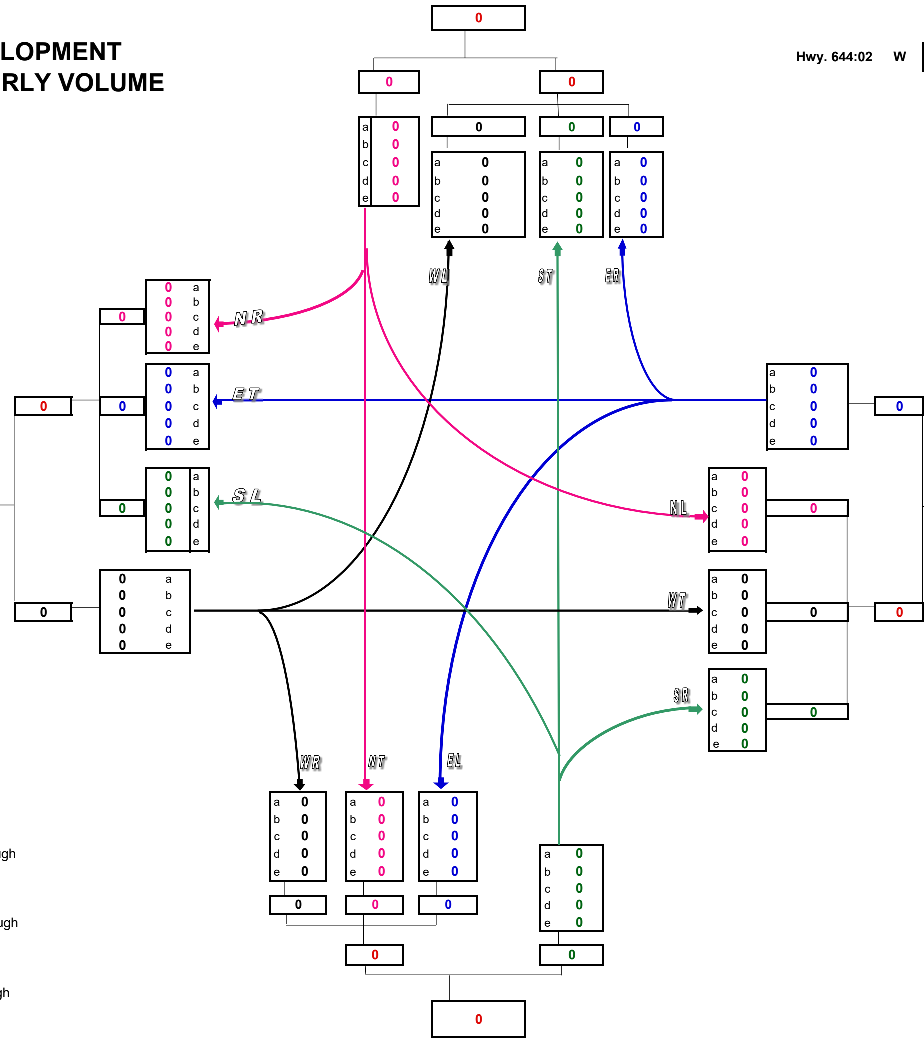
Turning Movement Summary Diagram

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	



2021 DEVELOPMENT
PM PEAK HOURLY VOLUME

WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

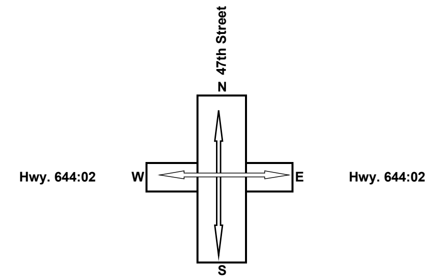
SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

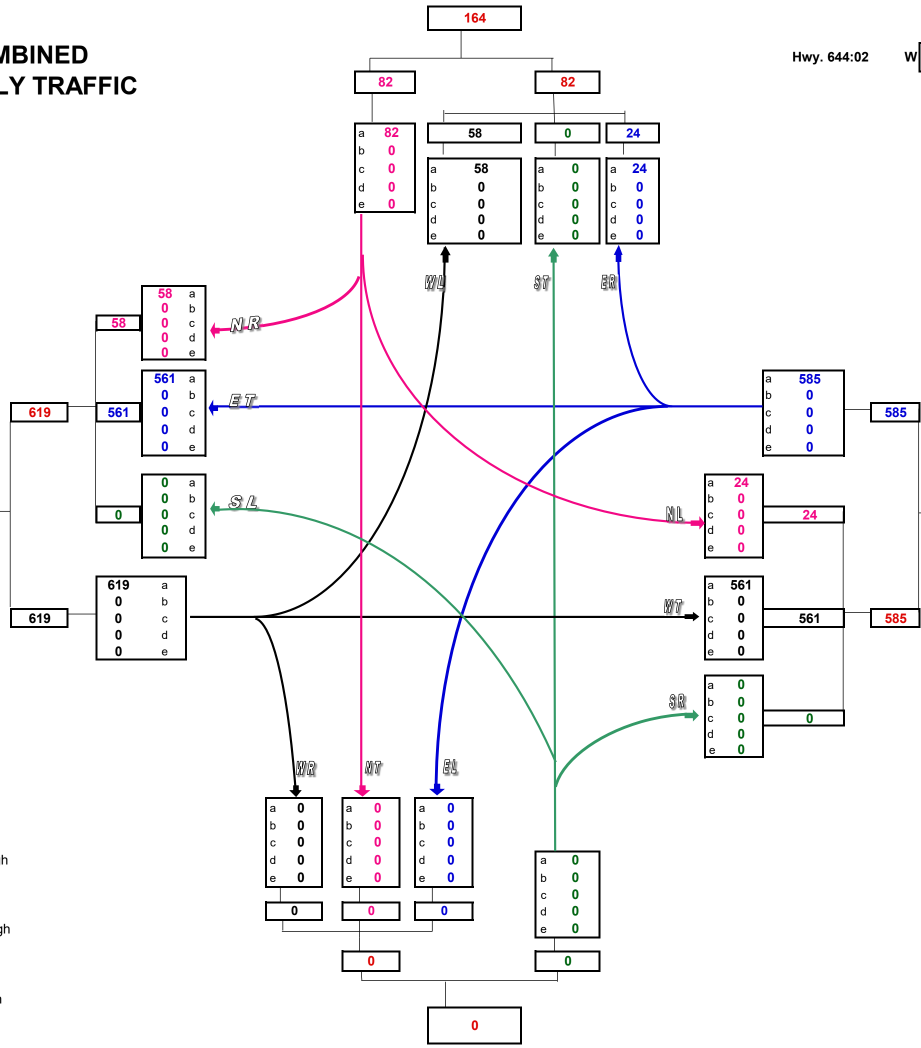
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2021 COMBINED ANNUAL DAILY TRAFFIC

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	164	-
B - Recreational Vehicle	0	-
C - Bus	0	-
D - Single Unit Truck	0	-
E - Tractor Trailer Unit	0	-
Total	164	





WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1238	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	1238	

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1170	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	1170	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

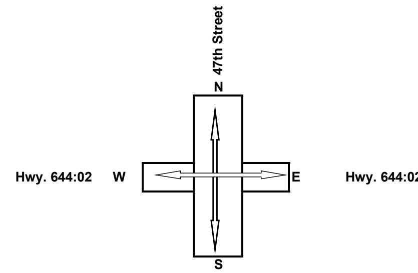
2021
2019
2

D&A PAULICHUK CONSULTING LTD.

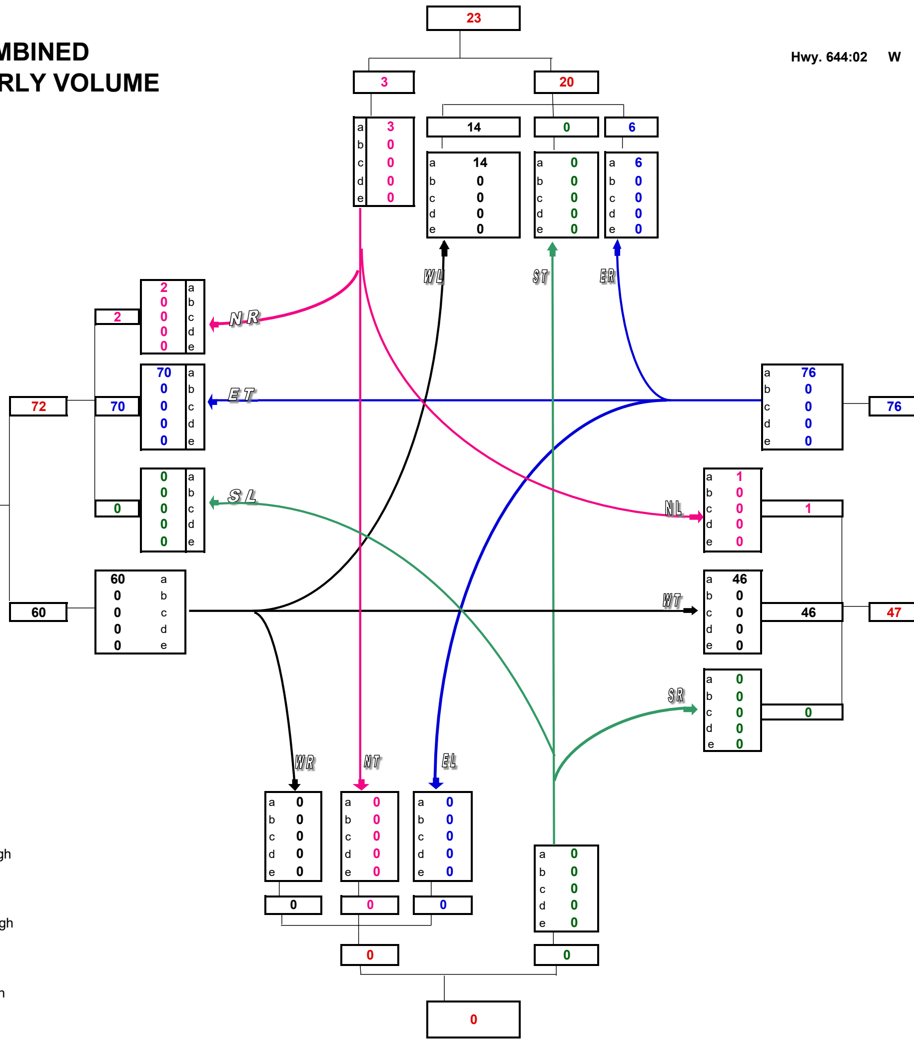
Turning Movement Summary Diagram

2021 COMBINED
AM PEAK HOURLY VOLUME

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	23	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	23	



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	132	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	132	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	123	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	123	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

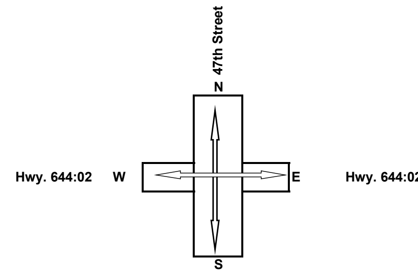
2021
2019
2

D&A PAULICHUK CONSULTING LTD.

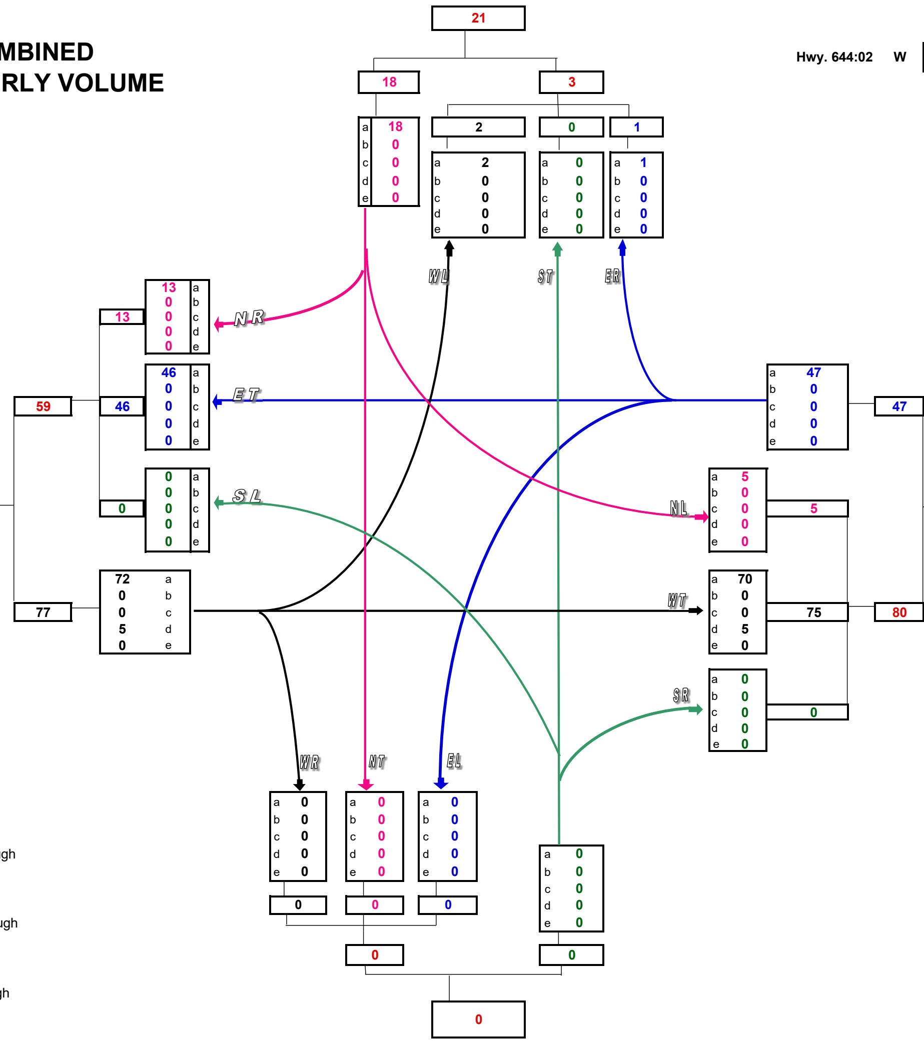
Turning Movement Summary Diagram

2021 COMBINED
PM PEAK HOURLY VOLUME

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	21	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	21	



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	131	96.3
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	5	3.7
E - Tractor Trailer Unit	0	0.0
Total	136	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	122	96.1
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	5	3.9
E - Tractor Trailer Unit	0	0.0
Total	127	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

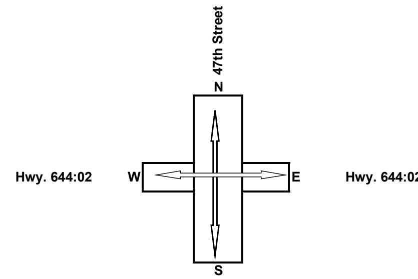
SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

2021
2019
2

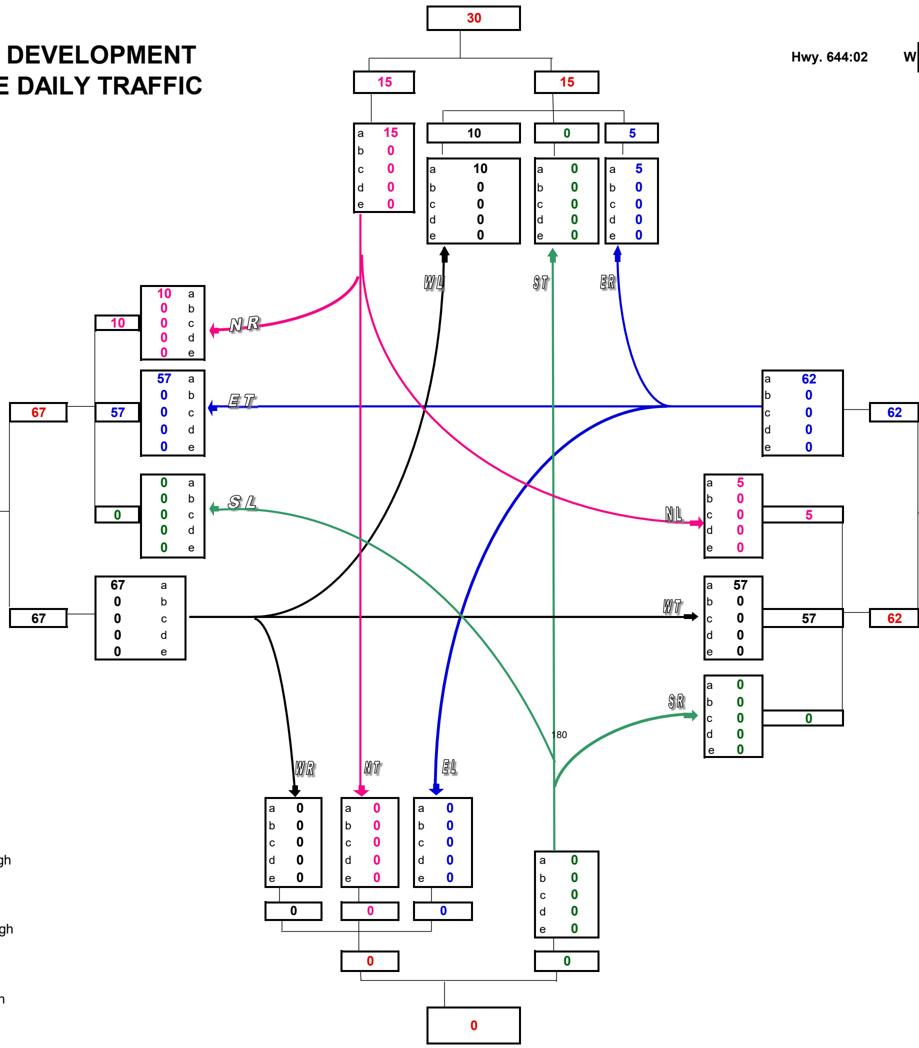
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	30	100.0%
B - Recreational Vehicle	0	0.0%
C - Bus	0	0.0%
D - Single Unit Truck	0	0.0%
E - Tractor Trailer Unit	0	0.0%
Total	30	



2025 PROJECTED DEVELOPMENT ANNUAL AVERAGE DAILY TRAFFIC



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	134	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	134	

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	124	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	124	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
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NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

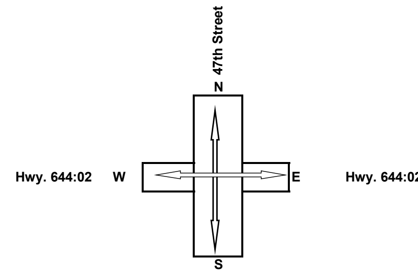
SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

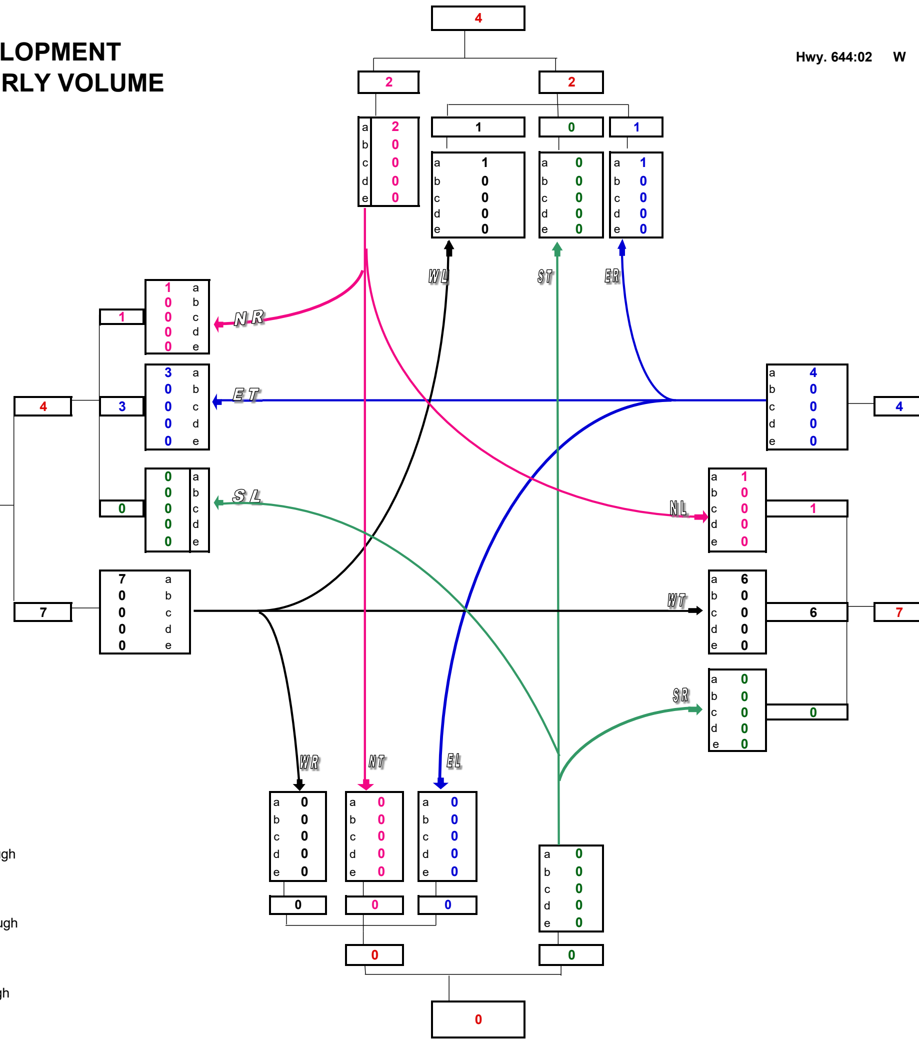
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2025 DEVELOPMENT
AM PEAK HOURLY VOLUME

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	4	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	4	





WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	11	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	11	

11

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	11	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	11	

11

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
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NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

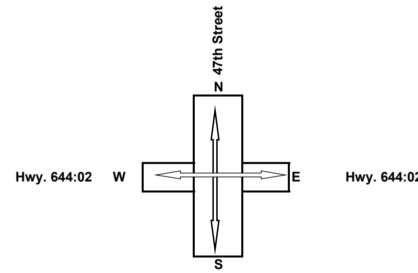
SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

D&A PAULICHUK CONSULTING LTD.

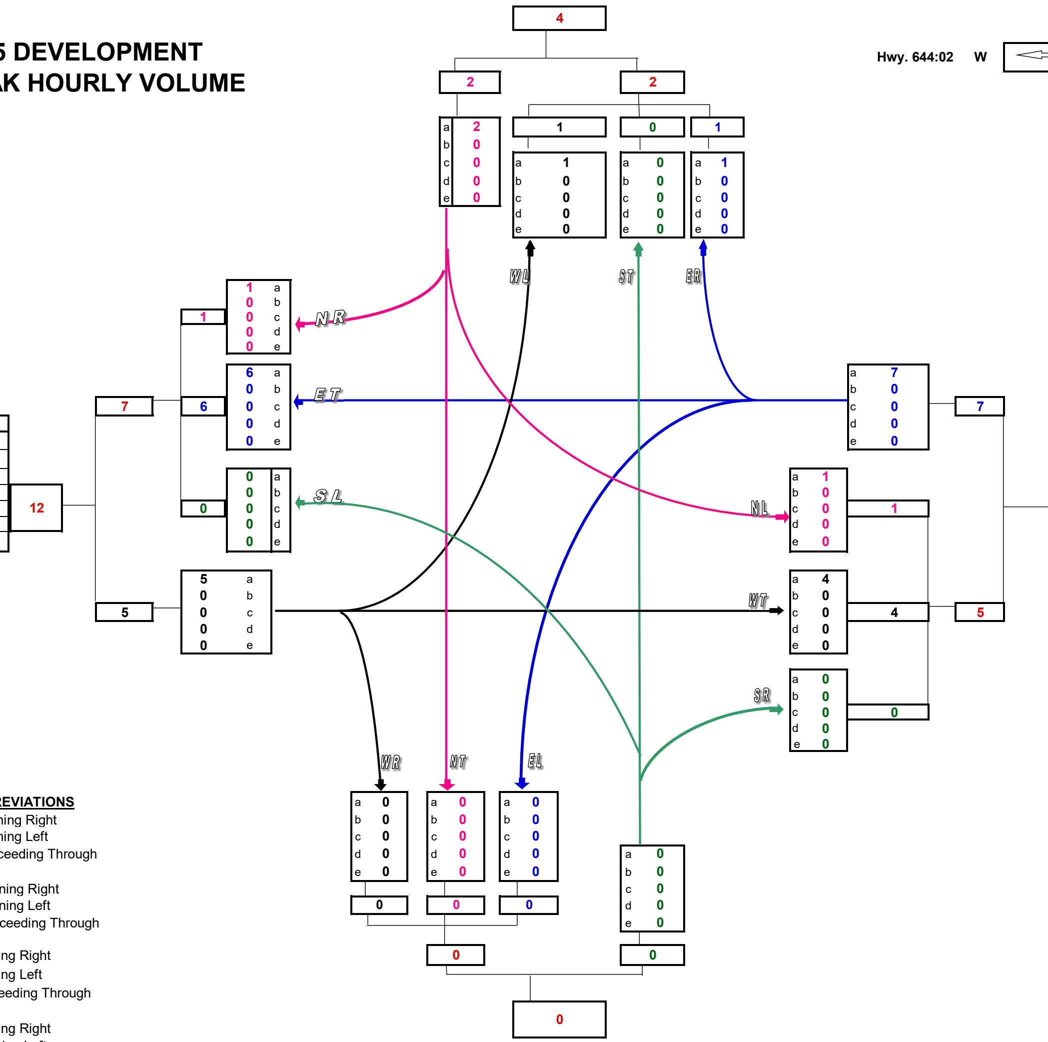
Turning Movement Summary Diagram

2025 DEVELOPMENT
PM PEAK HOURLY VOLUME

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	4	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	4	



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	12	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	12	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	12	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	12	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
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SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

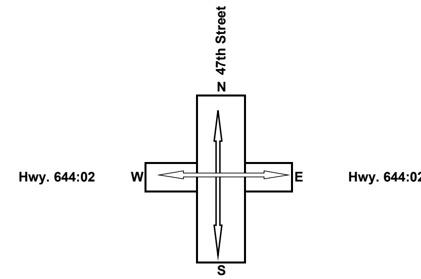
SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

D&A PAULICHUK CONSULTING LTD.

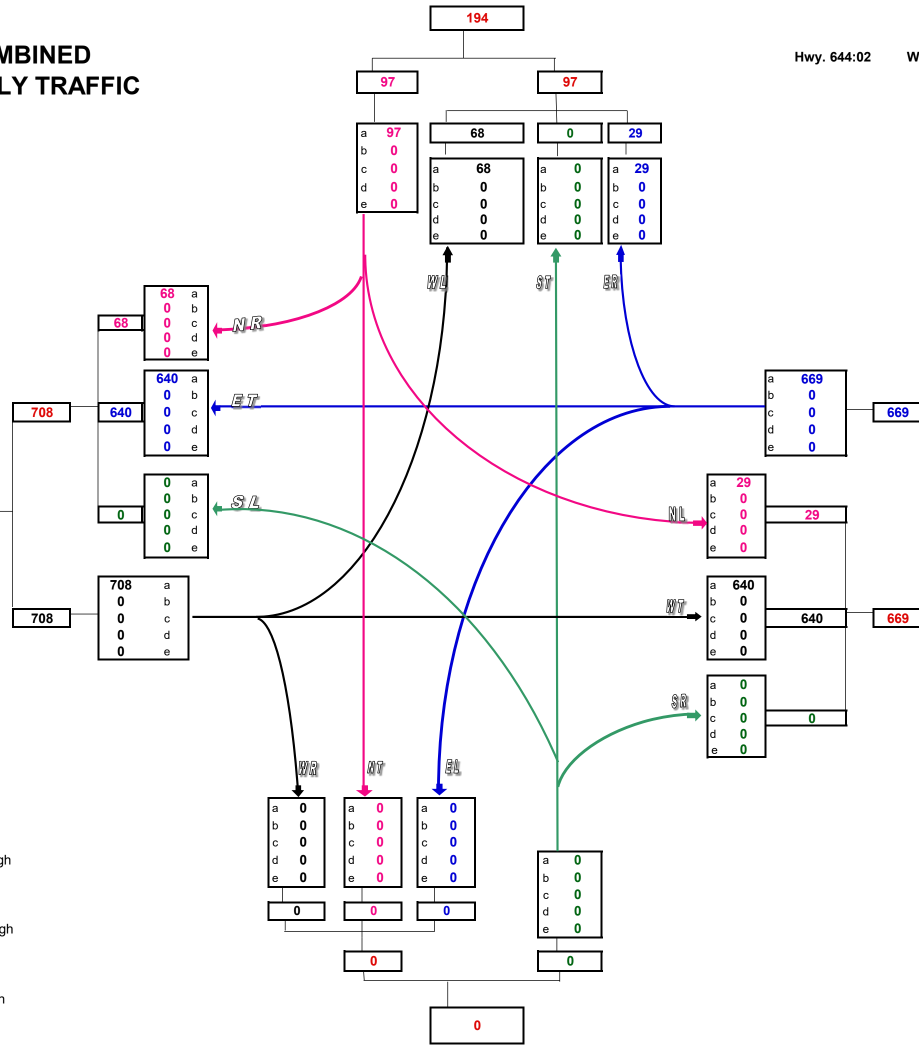
Turning Movement Summary Diagram

2025 COMBINED ANNUAL DAILY TRAFFIC

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	194	-
B - Recreational Vehicle	0	-
C - Bus	0	-
D - Single Unit Truck	0	-
E - Tractor Trailer Unit	0	-
Total	194	



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1416	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	1416	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1338	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	1338	

TURNING MOVEMENT ABBREVIATIONS

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NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

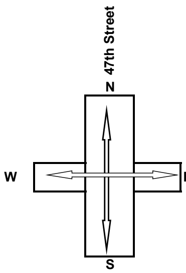
2025
2019
6

D&A PAULICHUK CONSULTING LTD.

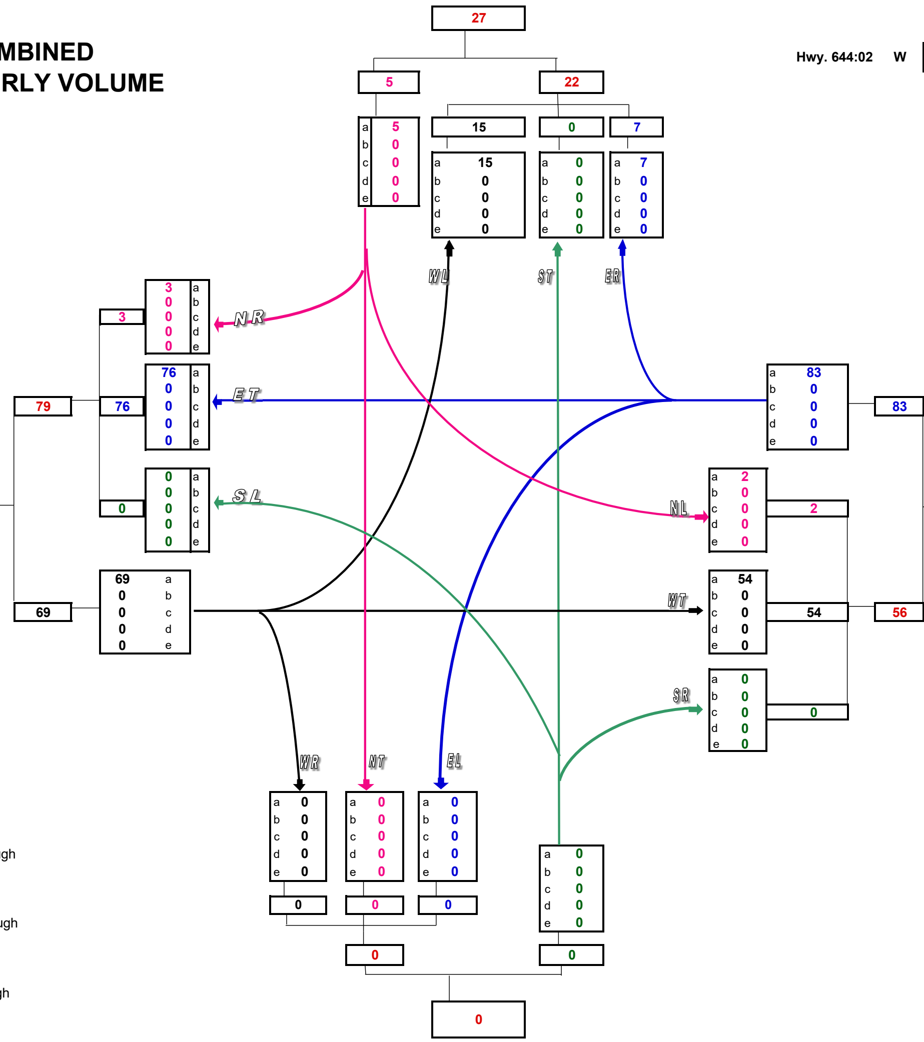
Turning Movement Summary Diagram

2025 COMBINED
AM PEAK HOURLY VOLUME

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	27	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	27	



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	148	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	148	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	139	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	139	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

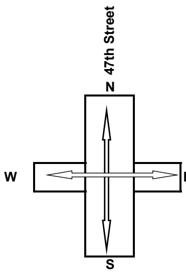
2025
2019
6

D&A PAULICHUK CONSULTING LTD.

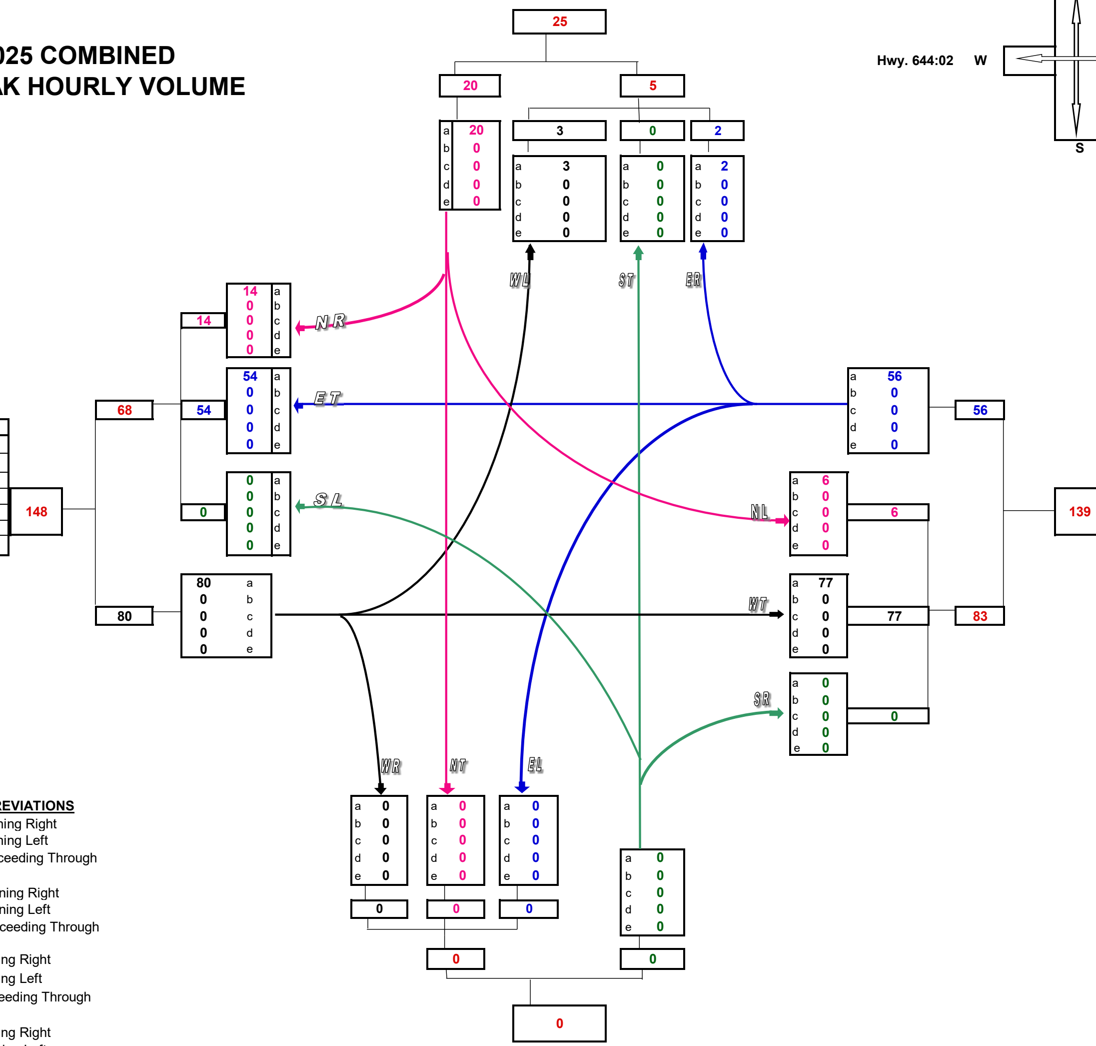
Turning Movement Summary Diagram

2025 COMBINED
PM PEAK HOURLY VOLUME

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	25	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	25	



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	148	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	148	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	139	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	139	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

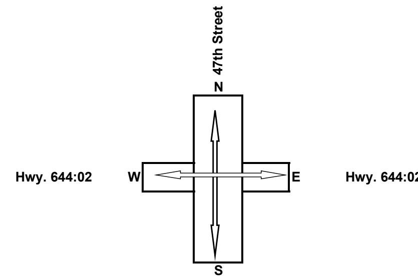
SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

2025
2019
6

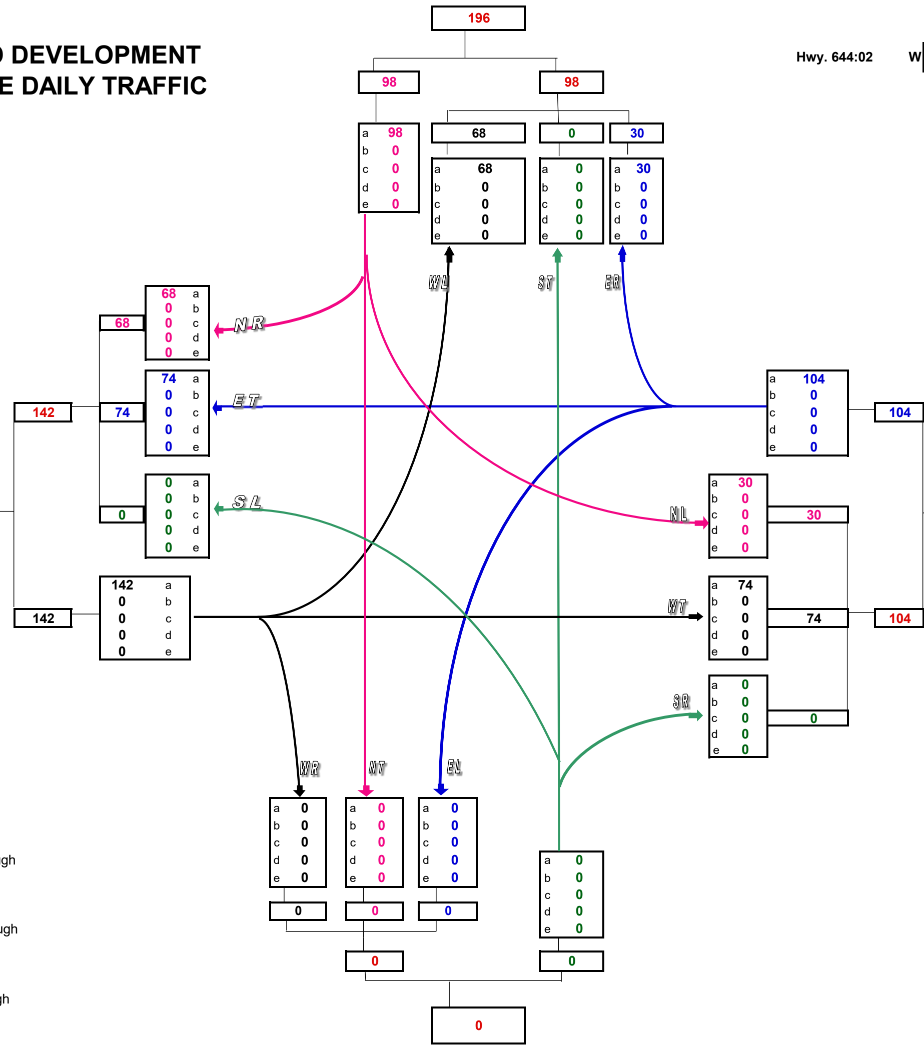
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	196	100.0%
B - Recreational Vehicle	0	0.0%
C - Bus	0	0.0%
D - Single Unit Truck	0	0.0%
E - Tractor Trailer Unit	0	0.0%
Total	196	



2035 PROJECTED DEVELOPMENT ANNUAL AVERAGE DAILY TRAFFIC



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	284	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	284	

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	208	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	208	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
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NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

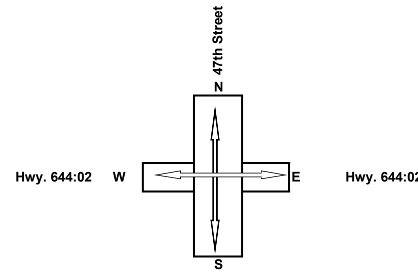
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

D&A PAULICHUK CONSULTING LTD.

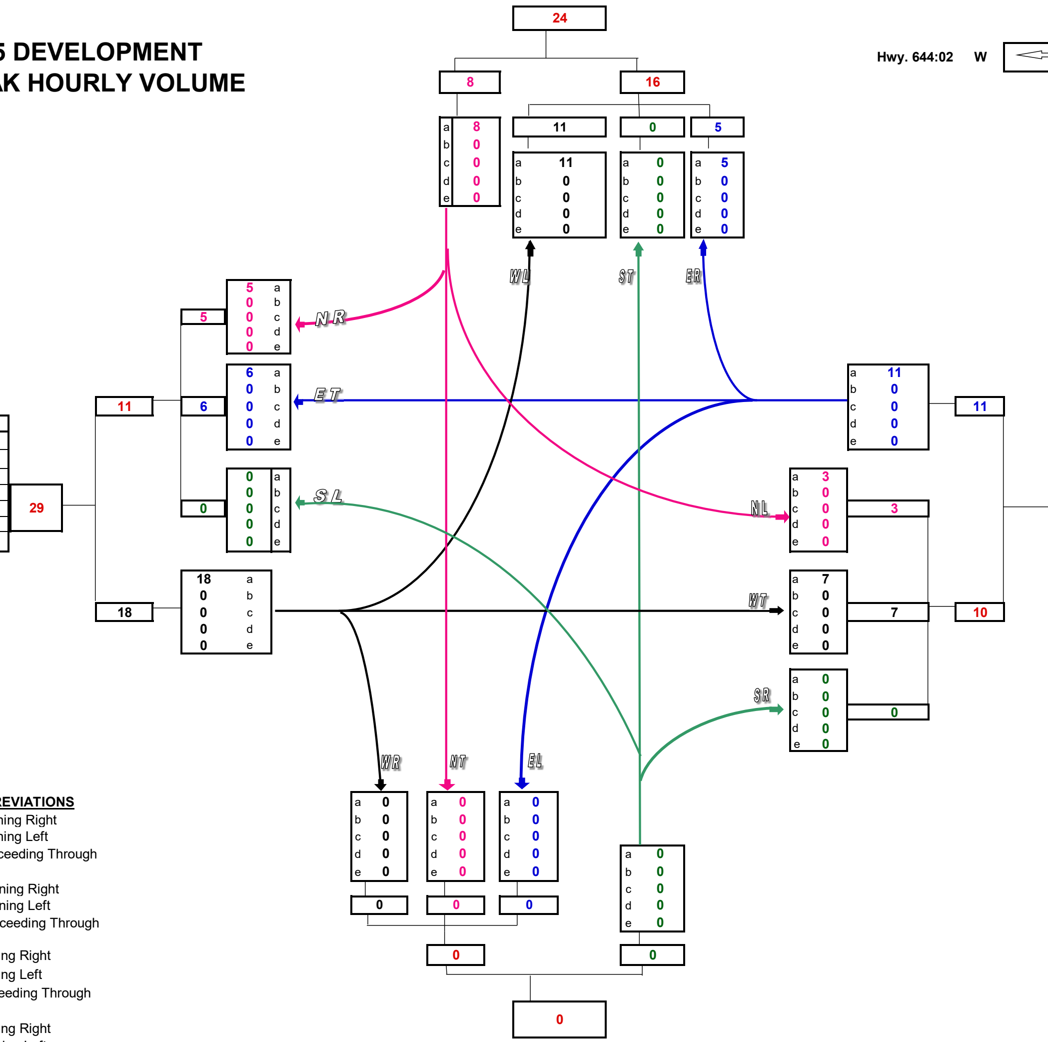
Turning Movement Summary Diagram

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	24	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	24	



2035 DEVELOPMENT
AM PEAK HOURLY VOLUME

WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	29	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	29	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	21	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	21	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

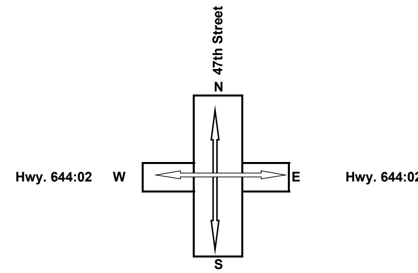
SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

PAULICHUK CONSULTING LTD.

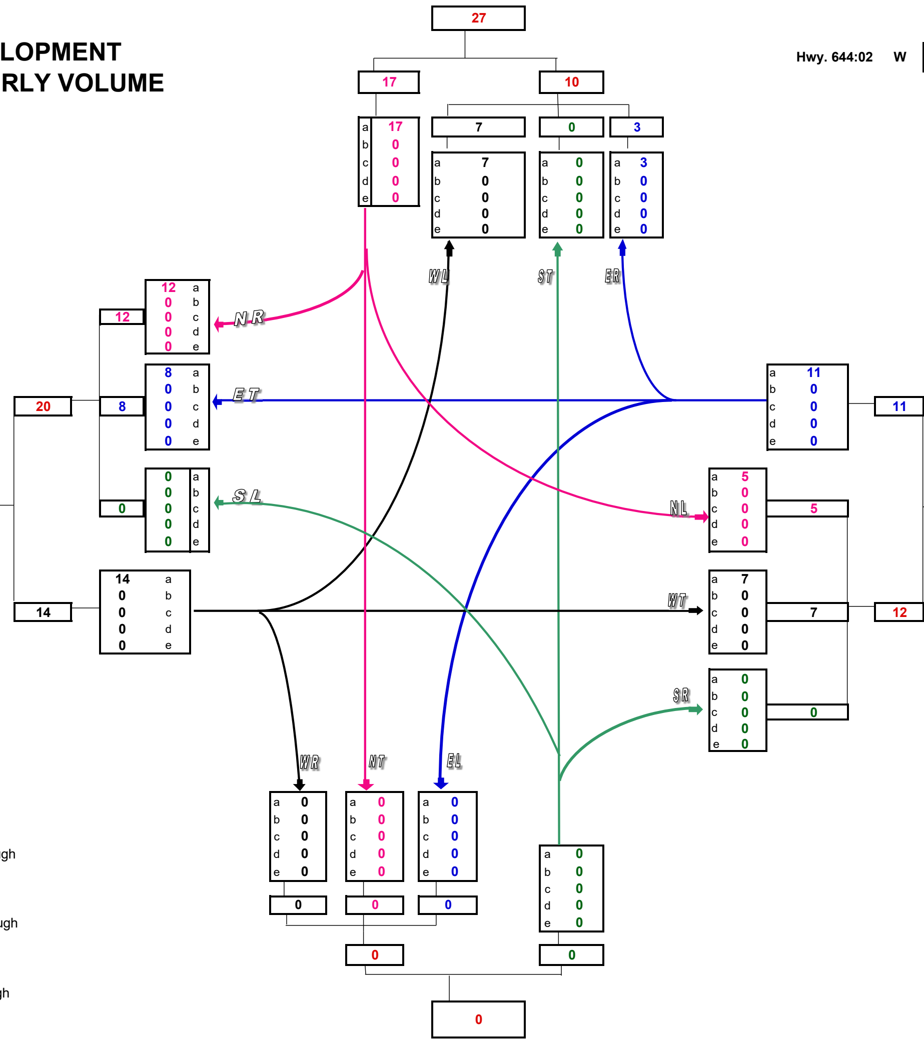
Turning Movement Summary Diagram

2035 DEVELOPMENT
PM PEAK HOURLY VOLUME

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	27	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	27	



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	34	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	34	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	23	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	23	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

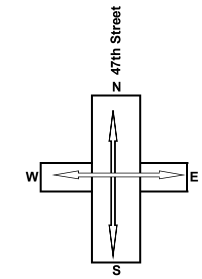
SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

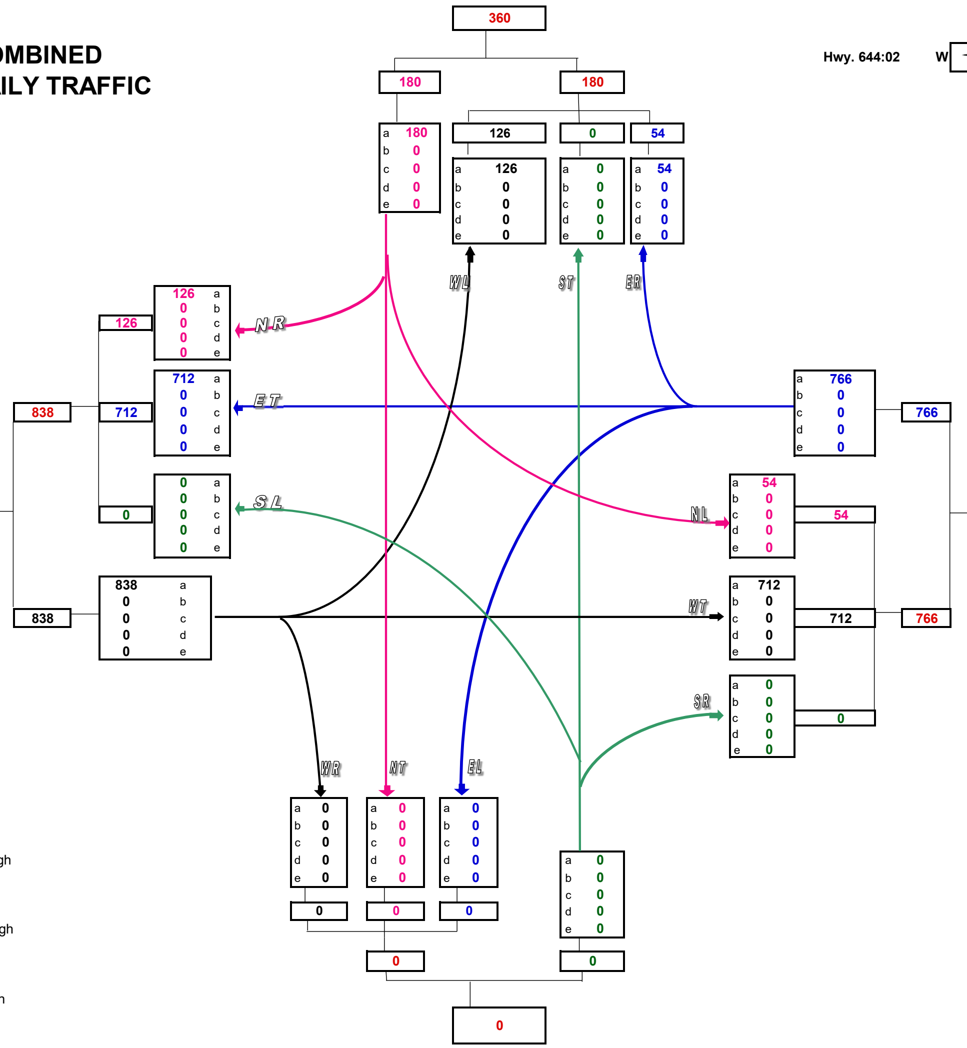
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2035 COMBINED ANNUAL DAILY TRAFFIC

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	360	-
B - Recreational Vehicle	0	-
C - Bus	0	-
D - Single Unit Truck	0	-
E - Tractor Trailer Unit	0	-
Total	360	





WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1676	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	1676	

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1532	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	1532	

TURNING MOVEMENT ABBREVIATIONS

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SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

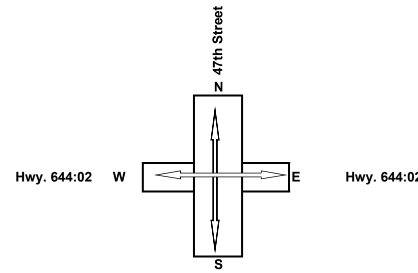
2035
2019
16

D&A PAULICHUK CONSULTING LTD.

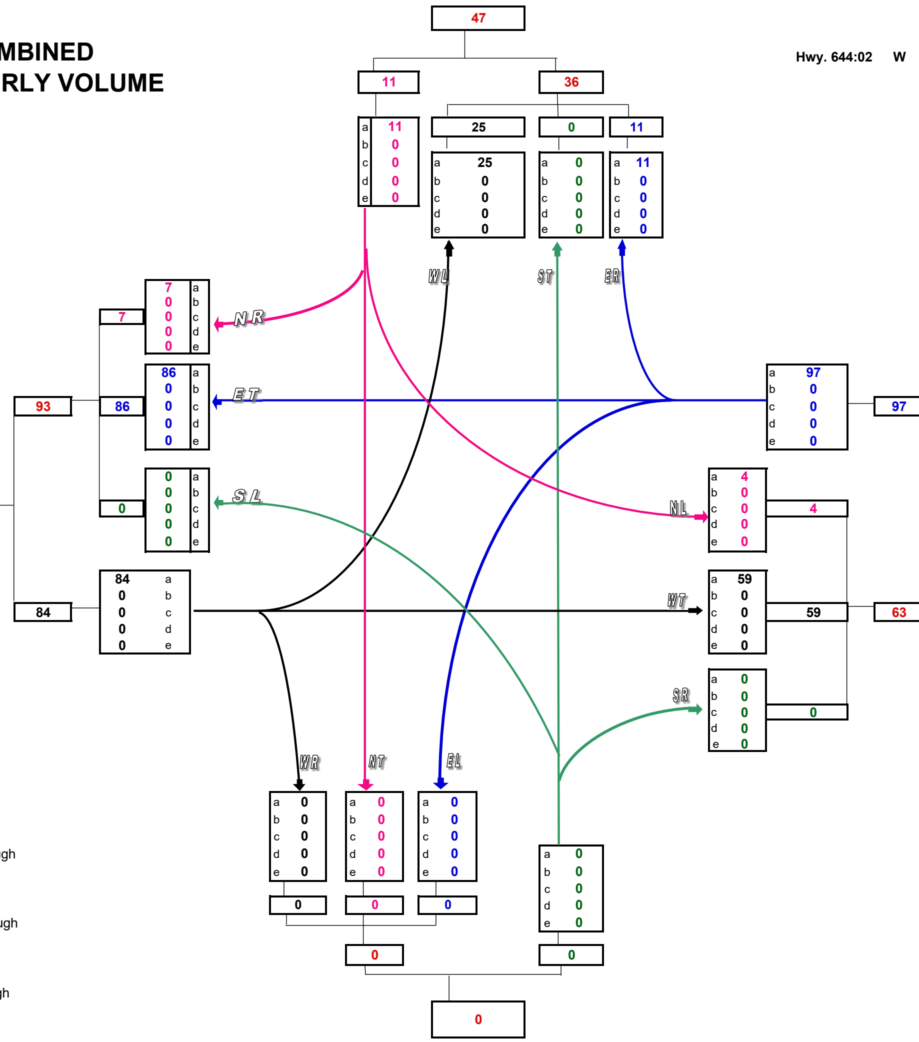
Turning Movement Summary Diagram

2035 COMBINED
AM PEAK HOURLY VOLUME

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	47	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	47	



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	177	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	177	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	160	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	160	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

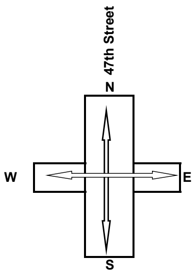
SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

2035
2019
16

D&A PAULICHUK CONSULTING LTD.

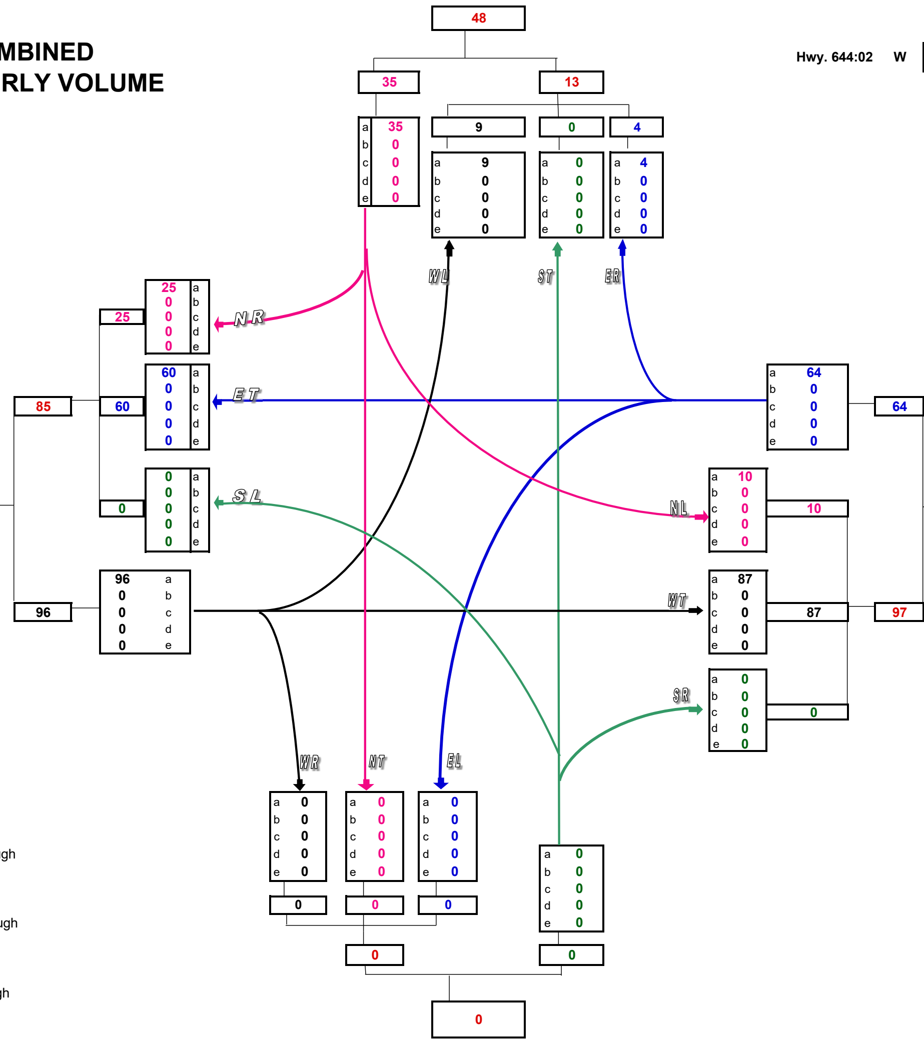
Turning Movement Summary Diagram

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	48	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	48	



2035 COMBINED
PM PEAK HOURLY VOLUME

WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	181	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	181	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	161	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	161	

TURNING MOVEMENT ABBREVIATIONS

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SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

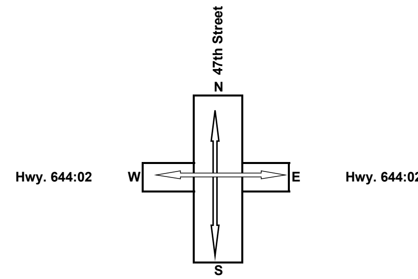
SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

2035
2019
16

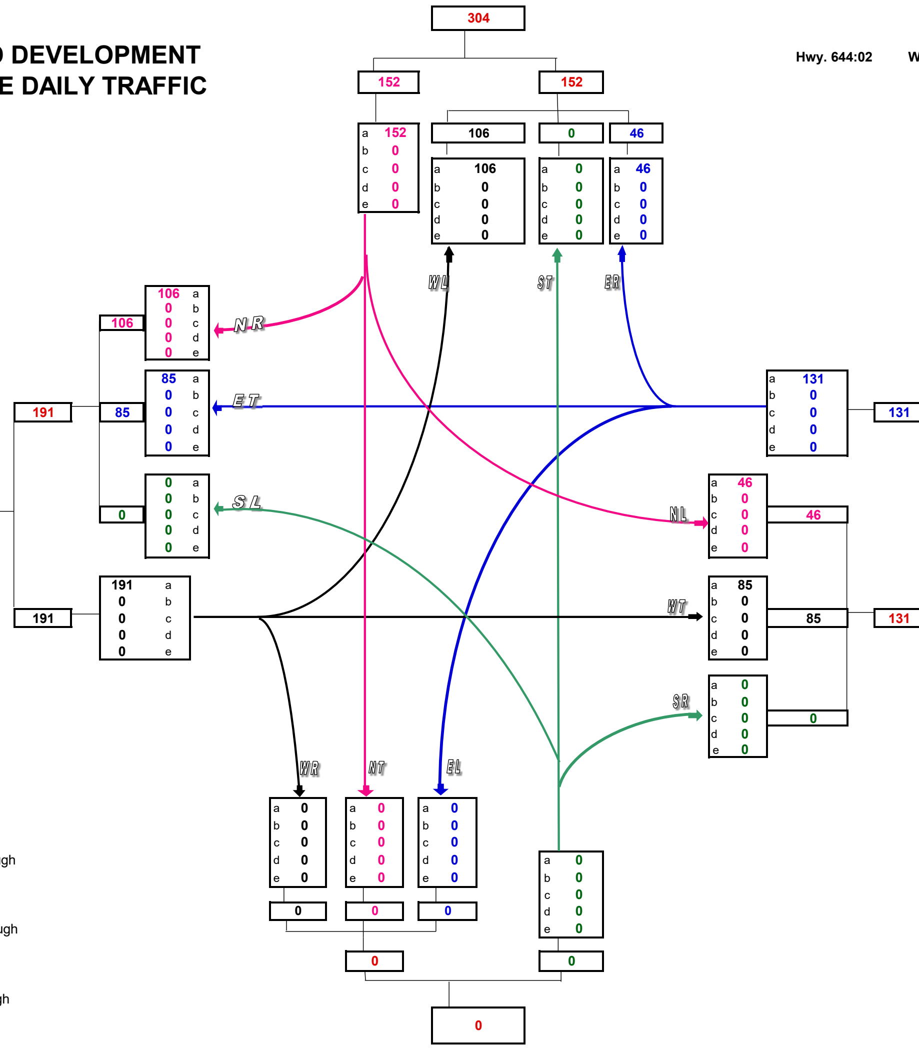
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	304	100.0%
B - Recreational Vehicle	0	0.0%
C - Bus	0	0.0%
D - Single Unit Truck	0	0.0%
E - Tractor Trailer Unit	0	0.0%
Total	304	



2045 PROJECTED DEVELOPMENT ANNUAL AVERAGE DAILY TRAFFIC



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	382	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	382	

EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	262	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	262	

TURNING MOVEMENT ABBREVIATIONS

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SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

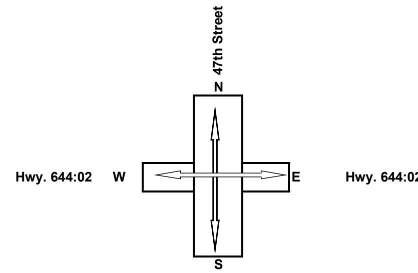
SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

D&A PAULICHUK CONSULTING LTD.

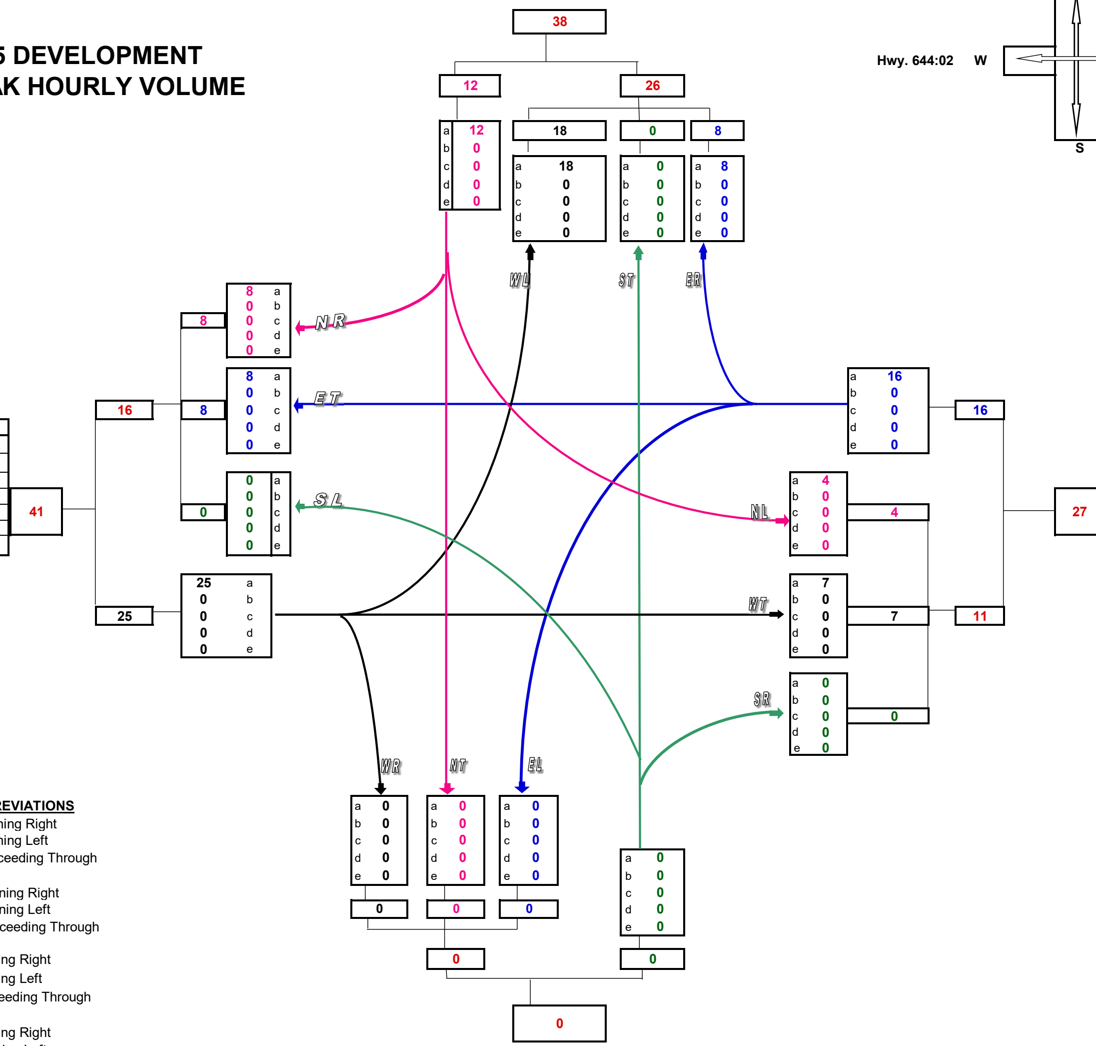
Turning Movement Summary Diagram

2045 DEVELOPMENT
AM PEAK HOURLY VOLUME

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	38	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	38	



WEST LEG ON	Hwy. 63:01	
Vehicle Type	Vol.	%
A - Passenger Vehicle	41	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	41	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	27	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	27	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
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NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

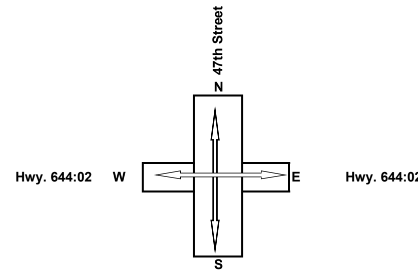
SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

D&A PAULICHUK CONSULTING LTD.

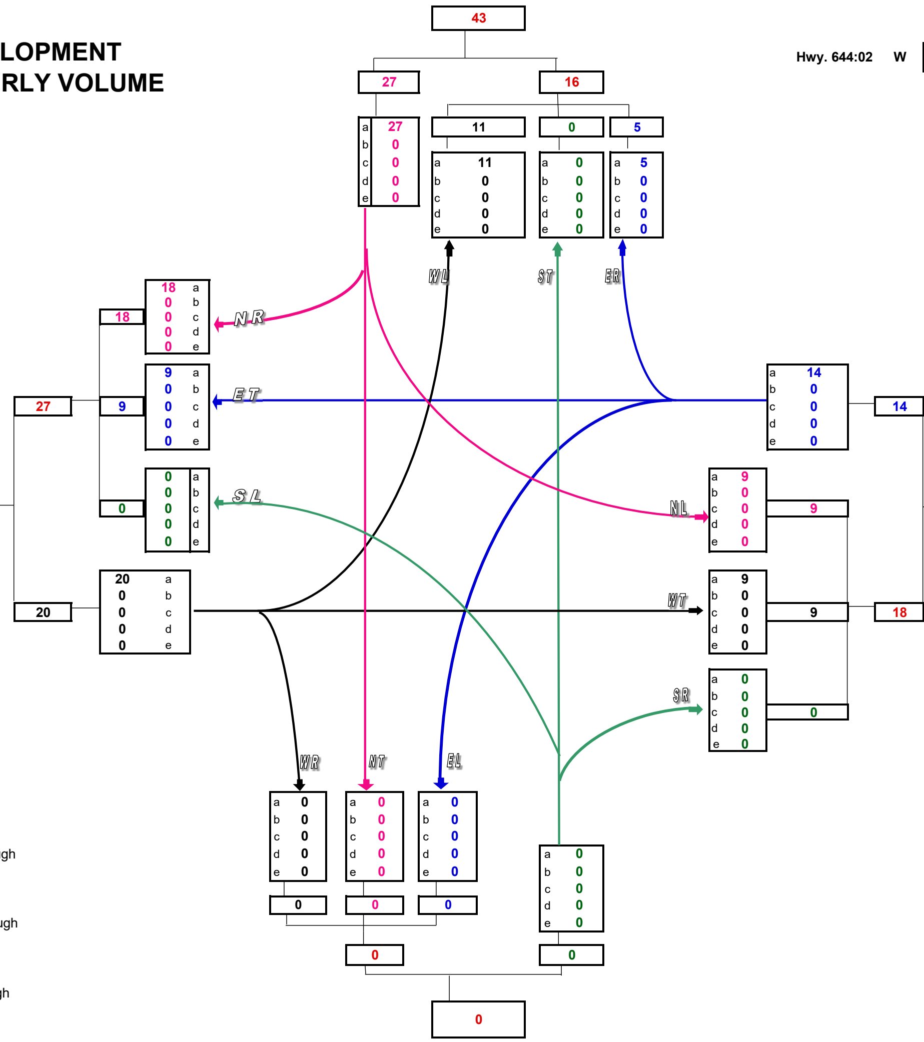
Turning Movement Summary Diagram

2045 DEVELOPMENT
PM PEAK HOURLY VOLUME

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	43	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	43	



WEST LEG ON	Hwy. 63:01	
Vehicle Type	Vol.	%
A - Passenger Vehicle	47	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	47	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	32	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	32	

TURNING MOVEMENT ABBREVIATIONS

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NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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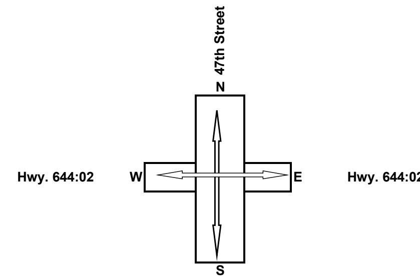
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

D&A PAULICHUK CONSULTING LTD.

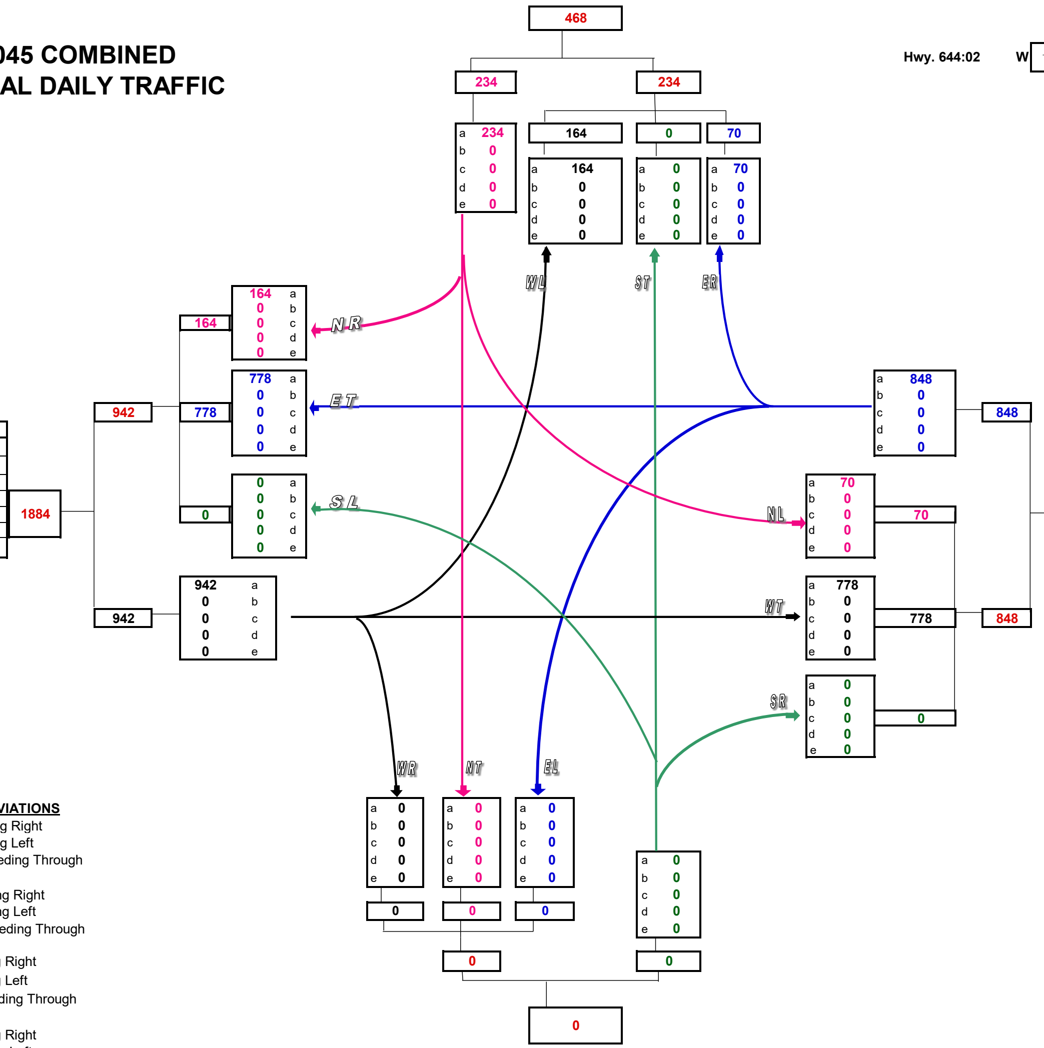
Turning Movement Summary Diagram

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	468	-
B - Recreational Vehicle	0	-
C - Bus	0	-
D - Single Unit Truck	0	-
E - Tractor Trailer Unit	0	-
Total	468	



2045 COMBINED ANNUAL DAILY TRAFFIC

WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1884	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	1884	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1696	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	1696	

TURNING MOVEMENT ABBREVIATIONS

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SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

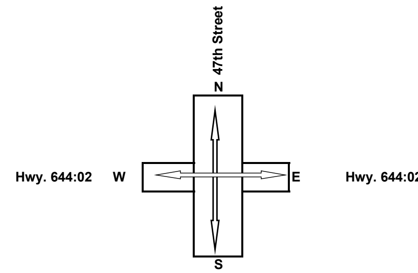
2045
2019
26

D&A PAULICHUK CONSULTING LTD.

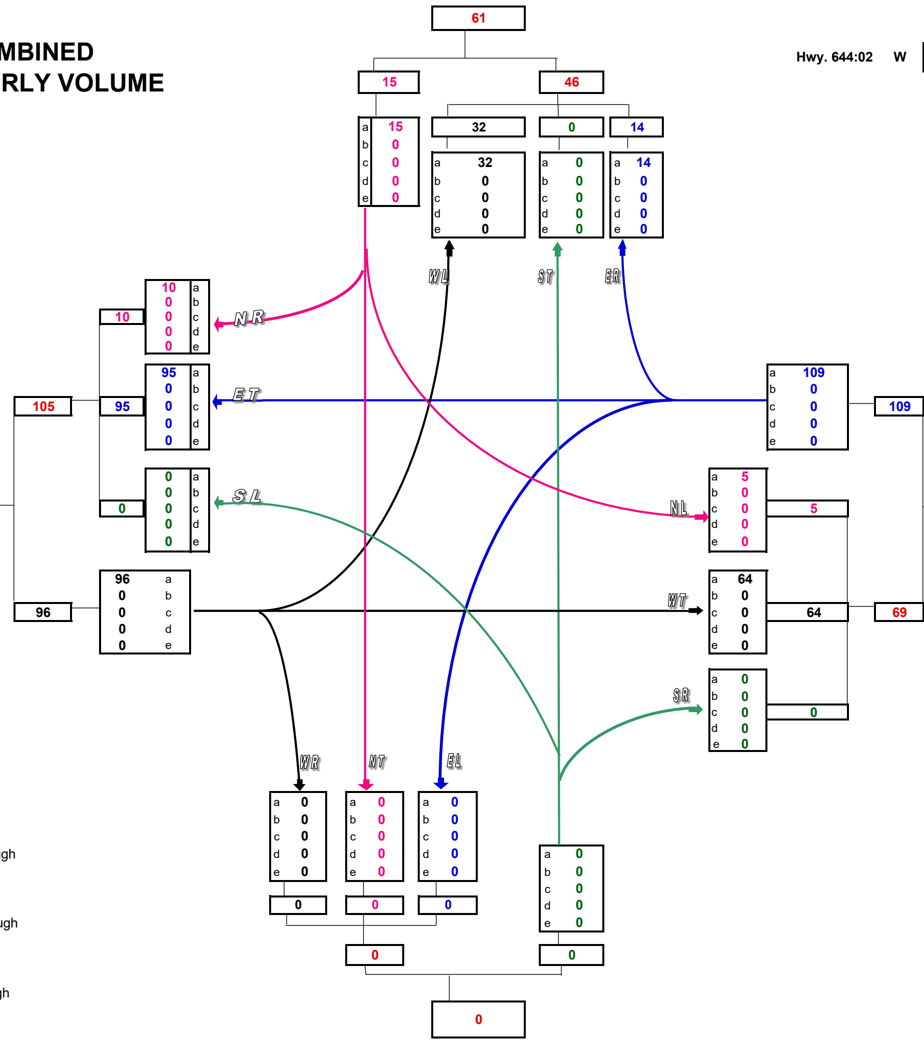
Turning Movement Summary Diagram

2045 COMBINED
AM PEAK HOURLY VOLUME

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	61	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	61	



WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	201	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	201	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	178	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	178	

TURNING MOVEMENT ABBREVIATIONS

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SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

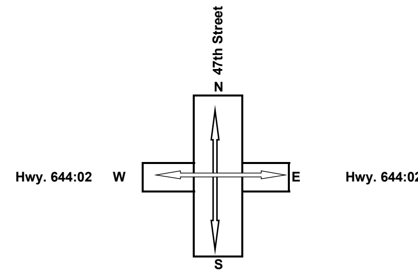
SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

2045
2019
26

D&A PAULICHUK CONSULTING LTD.

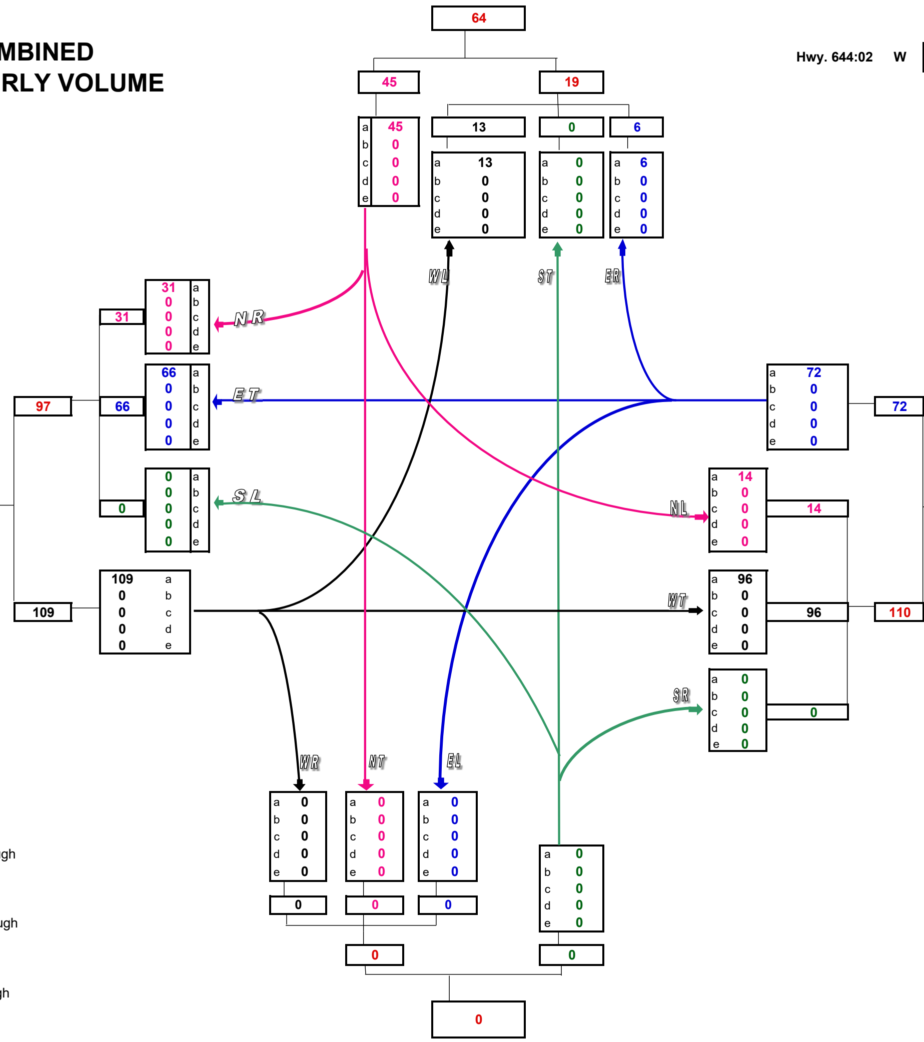
Turning Movement Summary Diagram

NORTH LEG ON	47th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	64	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	64	



2045 COMBINED
PM PEAK HOURLY VOLUME

WEST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	206	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	206	



EAST LEG ON	Hwy. 644:02	
Vehicle Type	Vol.	%
A - Passenger Vehicle	182	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	182	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON		
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

2045
2019
26

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Hwy. 644:02	Main Road	**Date**	December 28, 2020
47th Street	Minor Road	**Other**	Year 2045 with Proposed Development
Redwater	City/Town		

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	4		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	100		5		OK	
Channelization Factor					OK	20
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	3	1	3	Number of legs = 3 or more	OK	3
					Geometric Factors Subtotal	**23**

OPERATIONAL FACTORS

	Value	Rating	Weight	Comments	Check	Score
Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	1884	1	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	10
AADT on Minor Road (2-way)	468	0	20		OK	0
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	0	5	Refer to Table 1(B) for ratings.	OK	0
Operating Speed or Posted Speed on Major Road (km/h)	70	2	5	Refer to Table 1(B), note #3	OK	10
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
					Operational Factors Subtotal	**20**

ENVIRONMENTAL FACTOR

	Value	Rating	Weight	Comments	Check	Score
Lighted Developments within 150 m radius of intersection	0	0	5	Maximum of 4 quadrants	OK	0
					Environmental Factor Subtotal	**0**

COLLISION HISTORY

	Value	Rating	Weight	Comments	Check	Score
Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
					Collision History Subtotal	**0**

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY	
Geometric Factors Subtotal	23
Operational Factor Subtotal	20
Environmental Factor Subtotal	0
Collision History Subtotal	0
TOTAL POINTS	**43**

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	14	46	76	6	1	2
Future Volume (Veh/h)	14	46	76	6	1	2
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	15	48	80	6	1	2
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	86				161	83
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	86				161	83
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	99				100	100
cM capacity (veh/h)	1492				803	955

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	63	86	3
Volume Left	15	0	1
Volume Right	0	6	2
cSH	1492	1700	898
Volume to Capacity	0.01	0.05	0.00
Queue Length 95th (m)	0.2	0.0	0.1
Control Delay (s)	1.8	0.0	9.0
Lane LOS	A		A
Approach Delay (s)	1.8	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	20.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	75	46	1	5	13
Future Volume (Veh/h)	2	75	46	1	5	13
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	2	79	48	1	5	14
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	49				132	48
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	49				132	48
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	100				99	99
cM capacity (veh/h)	1539				843	998

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	81	49	19
Volume Left	2	0	5
Volume Right	0	1	14
cSH	1539	1700	952
Volume to Capacity	0.00	0.03	0.02
Queue Length 95th (m)	0.0	0.0	0.5
Control Delay (s)	0.2	0.0	8.9
Lane LOS	A		A
Approach Delay (s)	0.2	0.0	8.9
Approach LOS			A

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	16.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	15	54	76	7	2	3
Future Volume (Veh/h)	15	54	76	7	2	3
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	16	57	80	7	2	3
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	87				172	84
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	87				172	84
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	99				100	100
cM capacity (veh/h)	1490				791	954

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	73	87	5
Volume Left	16	0	2
Volume Right	0	7	3
cSH	1490	1700	881
Volume to Capacity	0.01	0.05	0.01
Queue Length 95th (m)	0.3	0.0	0.1
Control Delay (s)	1.7	0.0	9.1
Lane LOS	A		A
Approach Delay (s)	1.7	0.0	9.1
Approach LOS			A

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	21.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	3	77	54	2	6	14
Future Volume (Veh/h)	3	77	54	2	6	14
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	3	81	57	2	6	15
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	59				145	58
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	59				145	58
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	100				99	98
cM capacity (veh/h)	1526				827	986

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	84	59	21
Volume Left	3	0	6
Volume Right	0	2	15
cSH	1526	1700	935
Volume to Capacity	0.00	0.03	0.02
Queue Length 95th (m)	0.0	0.0	0.6
Control Delay (s)	0.3	0.0	8.9
Lane LOS	A		A
Approach Delay (s)	0.3	0.0	8.9
Approach LOS			A

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	18.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	25	59	86	11	4	7
Future Volume (Veh/h)	25	59	86	11	4	7
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	26	62	91	12	4	7
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	103				211	97
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	103				211	97
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	98				99	99
cM capacity (veh/h)	1470				746	938

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	88	103	11
Volume Left	26	0	4
Volume Right	0	12	7
cSH	1470	1700	858
Volume to Capacity	0.02	0.06	0.01
Queue Length 95th (m)	0.4	0.0	0.3
Control Delay (s)	2.3	0.0	9.3
Lane LOS	A		A
Approach Delay (s)	2.3	0.0	9.3
Approach LOS			A

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	22.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	9	87	60	4	10	25
Future Volume (Veh/h)	9	87	60	4	10	25
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	9	92	63	4	11	26
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	67				175	65
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	67				175	65
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	99				99	97
cM capacity (veh/h)	1516				792	977

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	101	67	37
Volume Left	9	0	11
Volume Right	0	4	26
cSH	1516	1700	914
Volume to Capacity	0.01	0.04	0.04
Queue Length 95th (m)	0.1	0.0	1.0
Control Delay (s)	0.7	0.0	9.1
Lane LOS	A		A
Approach Delay (s)	0.7	0.0	9.1
Approach LOS			A

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	23.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	32	64	95	14	5	10
Future Volume (Veh/h)	32	64	95	14	5	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	34	67	100	15	5	11
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	115				242	108
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	115				242	108
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	98				99	99
cM capacity (veh/h)	1455				712	925

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	101	115	16
Volume Left	34	0	5
Volume Right	0	15	11
cSH	1455	1700	846
Volume to Capacity	0.02	0.07	0.02
Queue Length 95th (m)	0.6	0.0	0.5
Control Delay (s)	2.7	0.0	9.3
Lane LOS	A		A
Approach Delay (s)	2.7	0.0	9.3
Approach LOS			A

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	23.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	13	96	66	6	14	31
Future Volume (Veh/h)	13	96	66	6	14	31
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	14	101	69	6	15	33
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	75				201	72
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	75				201	72
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	99				98	97
cM capacity (veh/h)	1505				763	968

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	115	75	48
Volume Left	14	0	15
Volume Right	0	6	33
cSH	1505	1700	893
Volume to Capacity	0.01	0.04	0.05
Queue Length 95th (m)	0.2	0.0	1.4
Control Delay (s)	1.0	0.0	9.3
Lane LOS	A		A
Approach Delay (s)	1.0	0.0	9.3
Approach LOS			A

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	23.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	32	75	113	14	5	10
Future Volume (Veh/h)	32	75	113	14	5	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	34	79	119	15	5	11
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	134				274	126
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	134				274	126
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	98				99	99
cM capacity (veh/h)	1432				683	903

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	113	134	16
Volume Left	34	0	5
Volume Right	0	15	11
cSH	1432	1700	820
Volume to Capacity	0.02	0.08	0.02
Queue Length 95th (m)	0.6	0.0	0.5
Control Delay (s)	2.4	0.0	9.5
Lane LOS	A		A
Approach Delay (s)	2.4	0.0	9.5
Approach LOS			A

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	28.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	13	114	77	6	14	31
Future Volume (Veh/h)	13	114	77	6	14	31
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	14	120	81	6	15	33
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	87				232	84
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	87				232	84
tC, single (s)	4.1				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.4
p0 queue free %	99				98	97
cM capacity (veh/h)	1490				732	954

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	134	87	48
Volume Left	14	0	15
Volume Right	0	6	33
cSH	1490	1700	871
Volume to Capacity	0.01	0.05	0.06
Queue Length 95th (m)	0.2	0.0	1.4
Control Delay (s)	0.8	0.0	9.4
Lane LOS	A		A
Approach Delay (s)	0.8	0.0	9.4
Approach LOS			A

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	25.0%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX D

44TH STREET & 54th AVENUE INTERSECTION ANALYSIS

D&A PAULICHUK CONSULTING LTD.

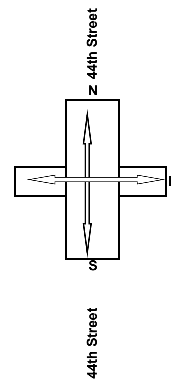
Turning Movement Summary Diagram

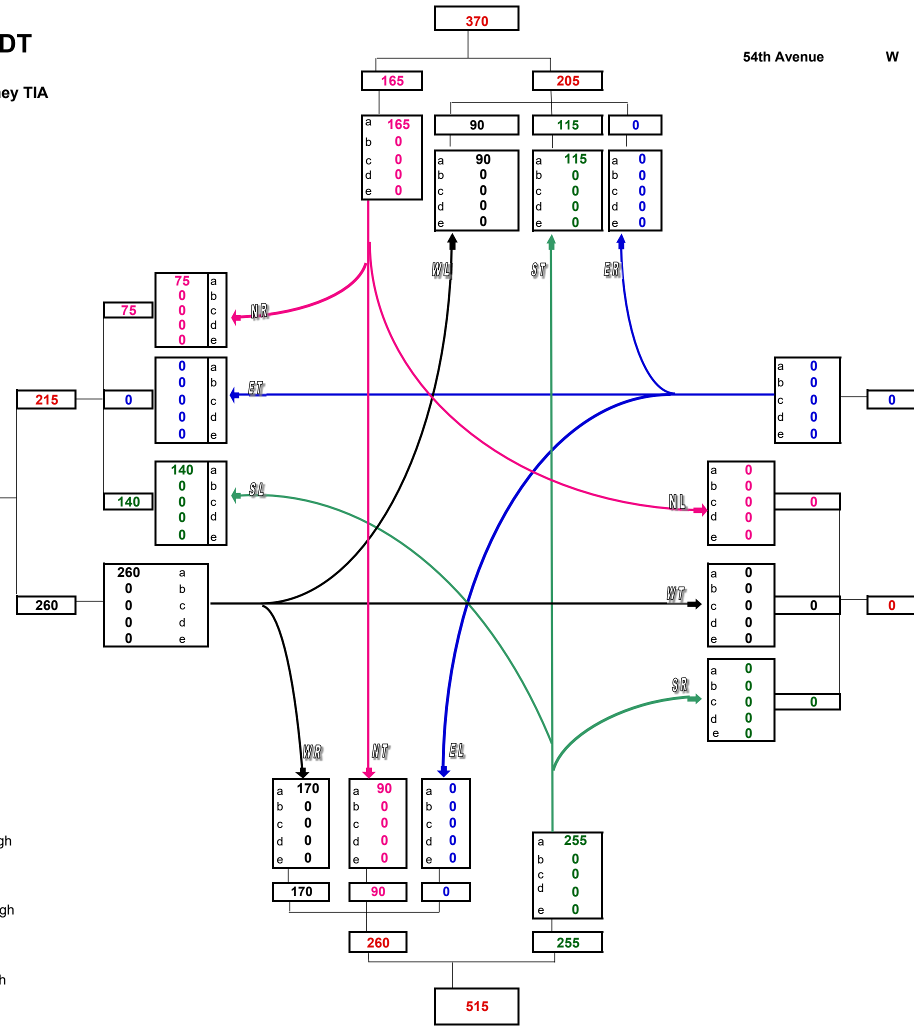
Intersection of: **Hwy. 38:10, Hwy. 644:02 & 44th Street**

2019 AADT

From McElhanney TIA

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	370	100.00
B - Recreational Vehicle	0	0.00
C - Bus	0	0.00
D - Single Unit Truck	0	0.00
E - Tractor Trailer Unit	0	0.00
Total	370	





WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	475	100
B - Recreational Vehicle	0	0.00
C - Bus	0	0.00
D - Single Unit Truck	0	0.00
E - Tractor Trailer Unit	0	0.00
Total	475	

475

EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

0

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

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Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	515	100.00
B - Recreational Vehicle	0	0.00
C - Bus	0	0.00
D - Single Unit Truck	0	0.00
E - Tractor Trailer Unit	0	0.00
Total	515	

AADT Conversion Factor
1.69

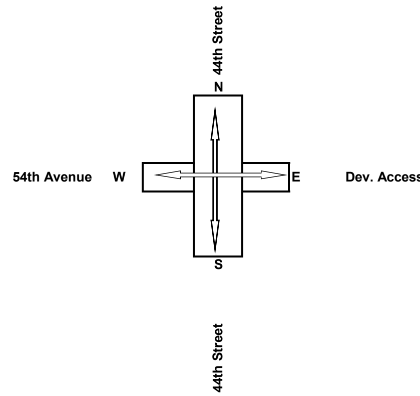
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

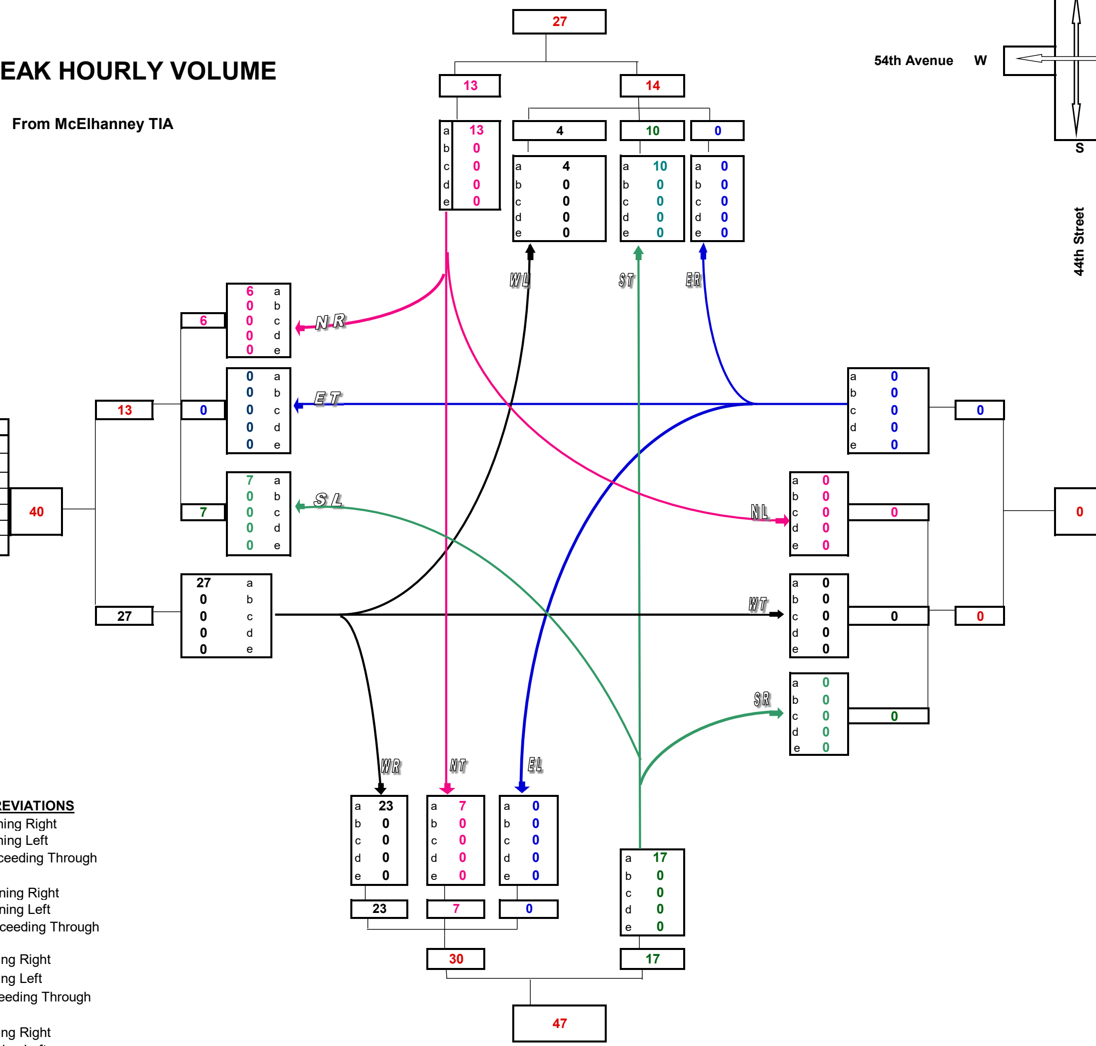
NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	27	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	27	

2019 AM PEAK HOURLY VOLUME

From McElhanney TIA



WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	40	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	40	



EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

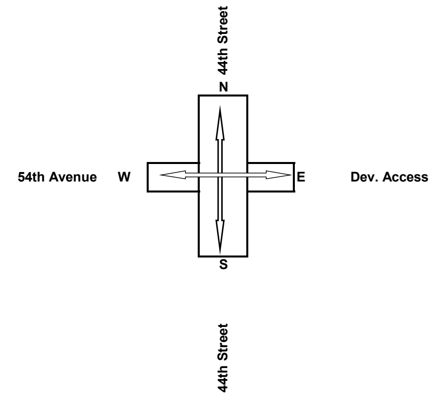
SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	47	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	47	

AM Peak	2.57
PM Peak	

D&A PAULICHUK CONSULTING LTD.

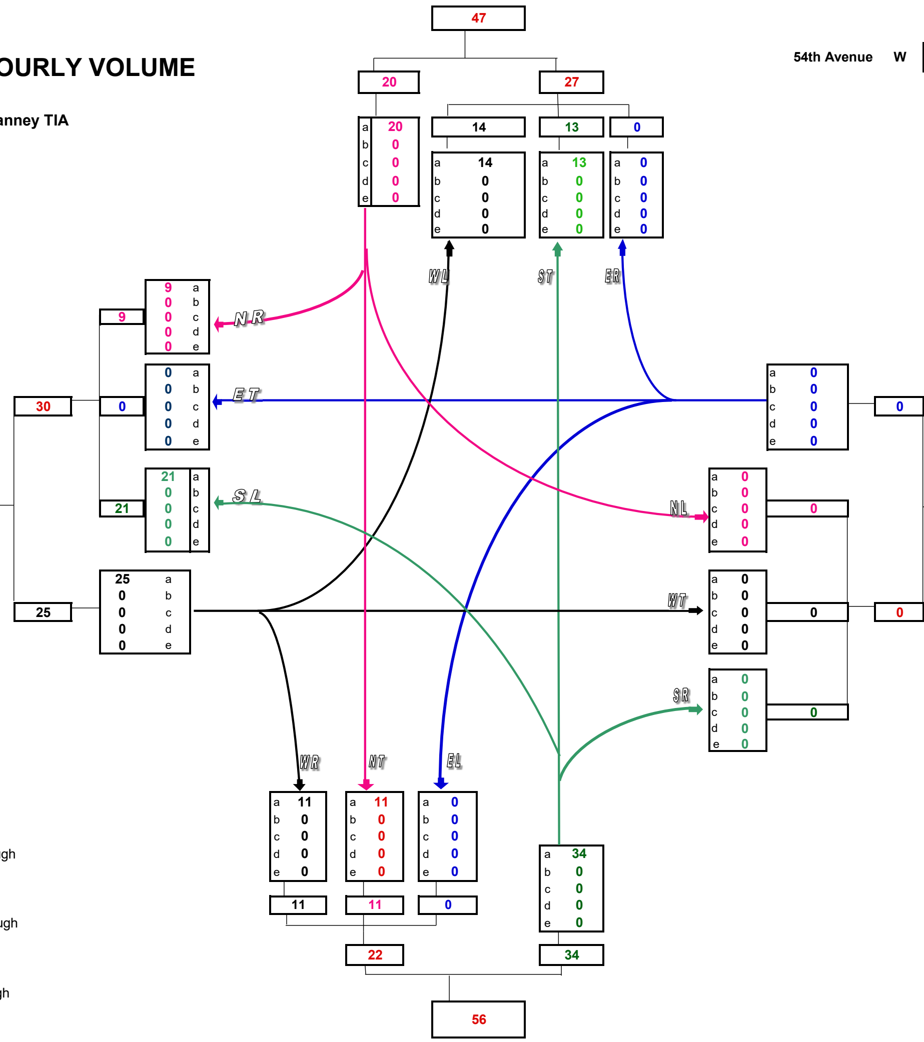
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	47	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	47	



2019 PM PEAK HOURLY VOLUME

From McElhanney TIA



WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	55	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	55	

55

EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

0

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
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SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	56	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	56	

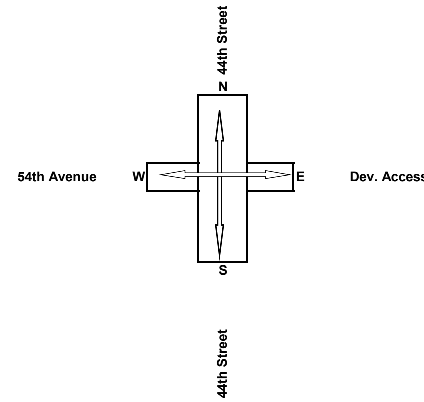
AM Peak
PM Peak 2.40

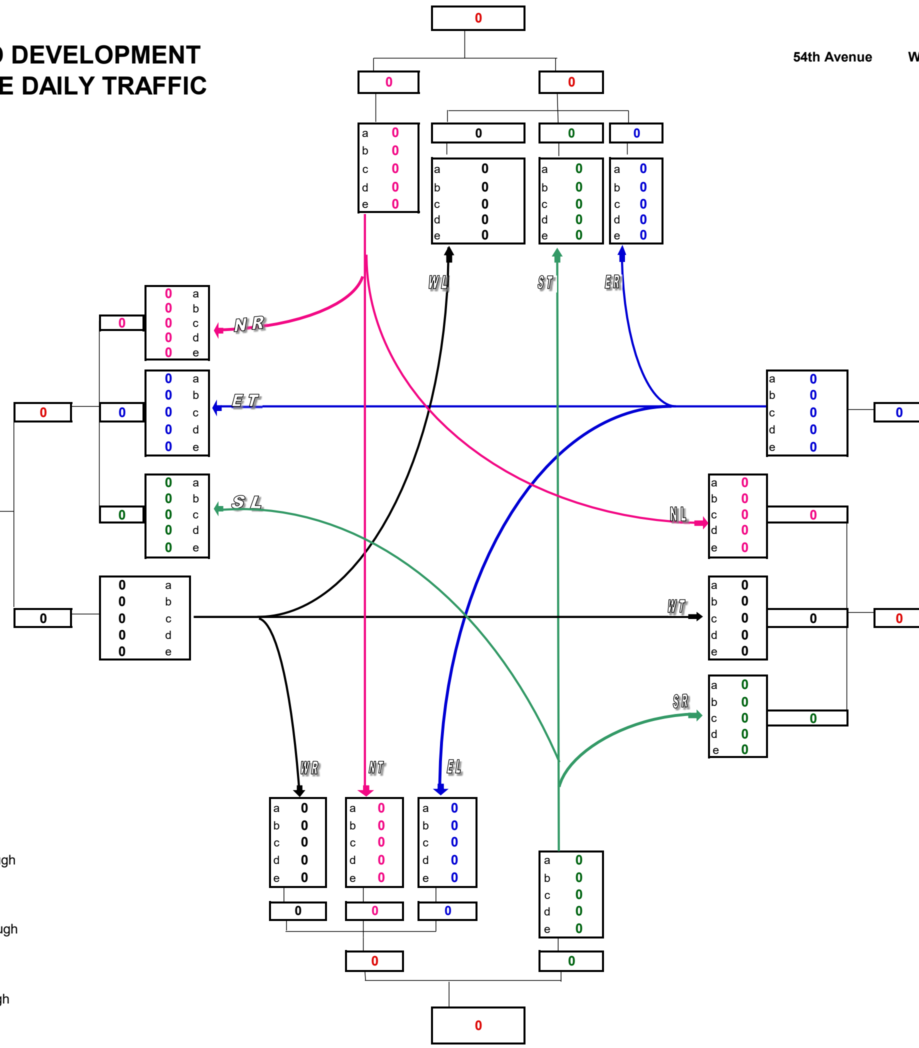
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2021 PROJECTED DEVELOPMENT ANNUAL AVERAGE DAILY TRAFFIC

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	





WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Traffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

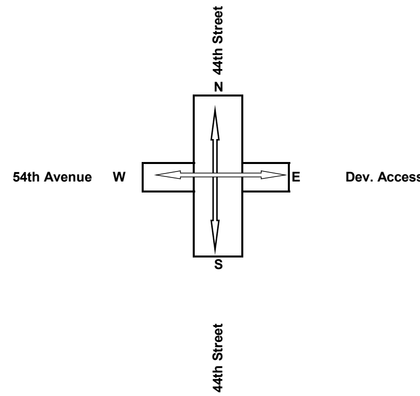
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

D&A PAULICHUK CONSULTING LTD.

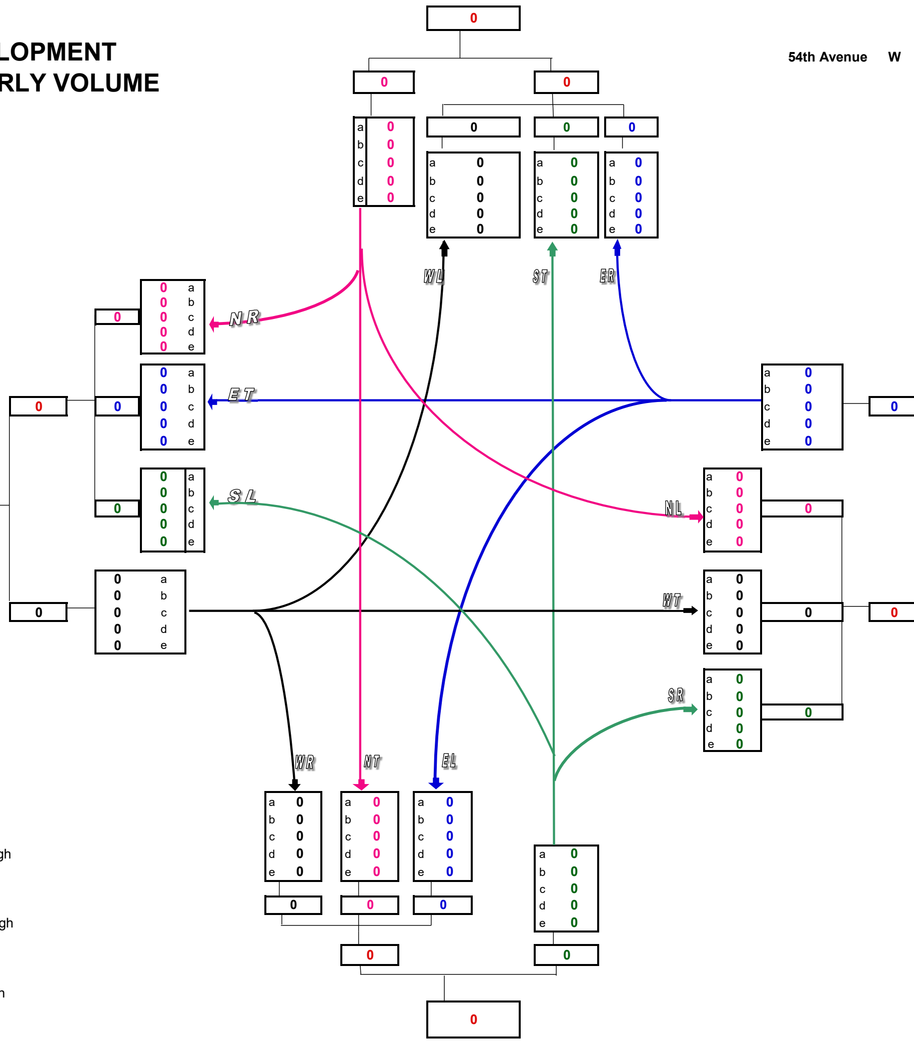
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	



2021 DEVELOPMENT
AM PEAK HOURLY VOLUME

WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	



EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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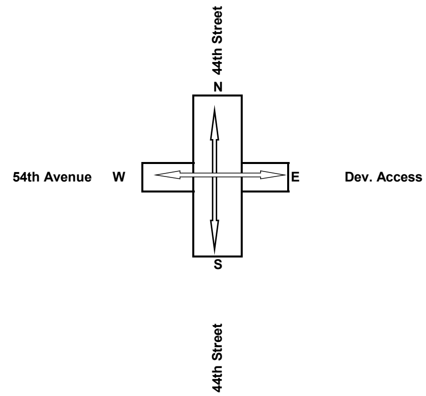
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

D&A PAULICHUK CONSULTING LTD.

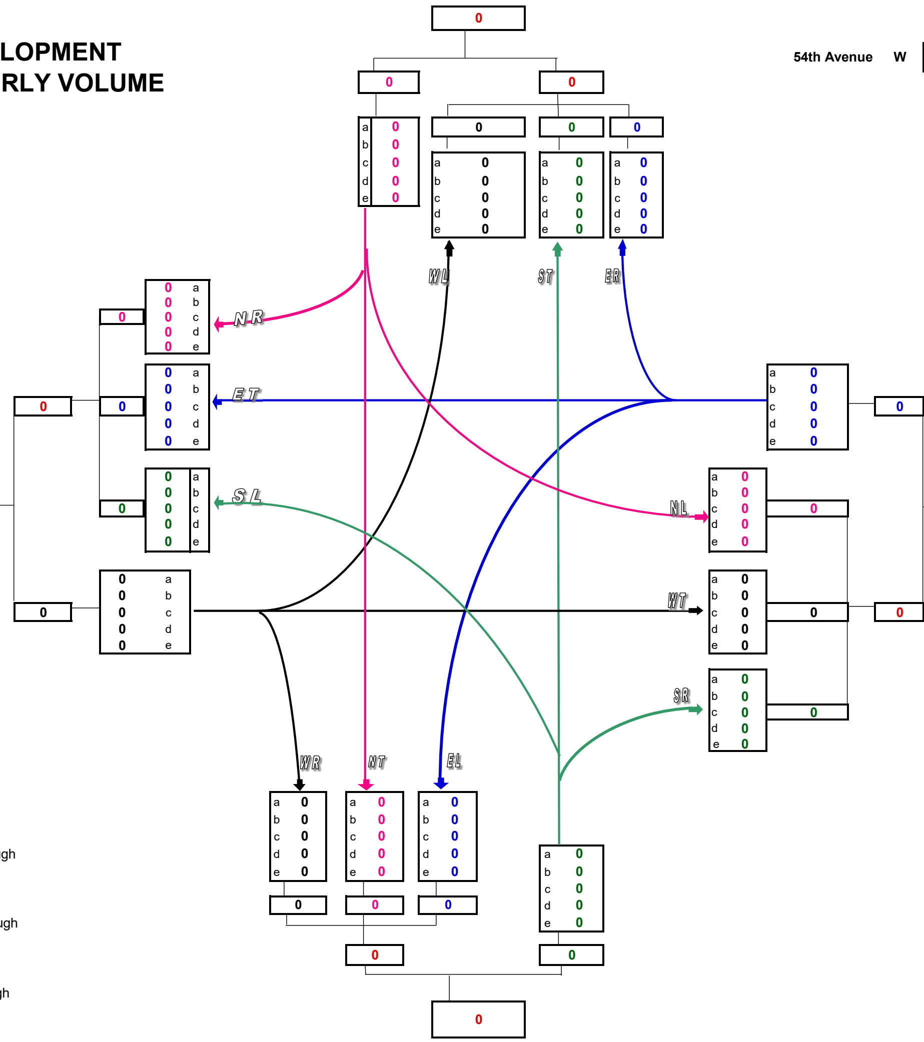
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	



2021 DEVELOPMENT
PM PEAK HOURLY VOLUME

WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	



EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
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SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

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EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

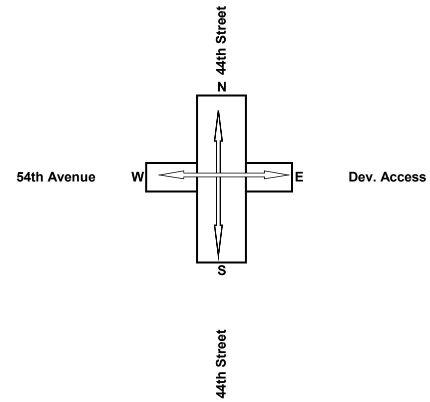
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

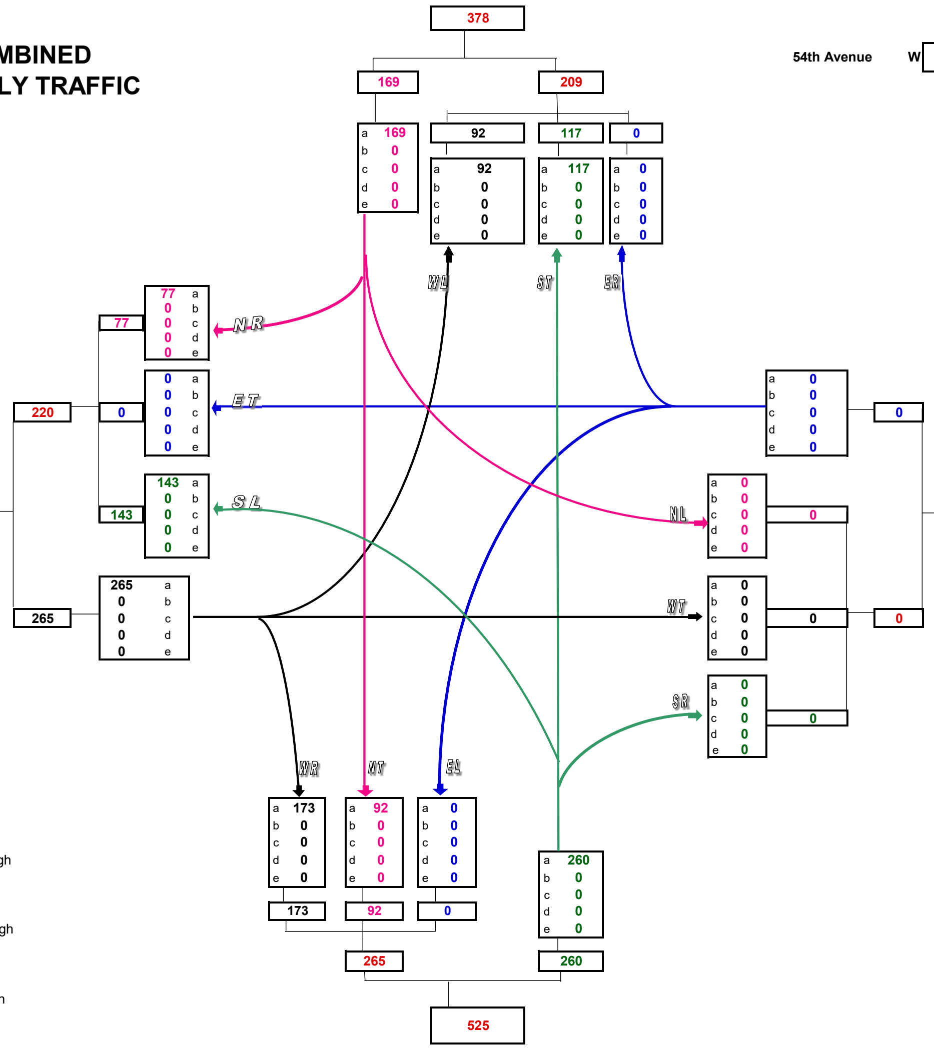
Turning Movement Summary Diagram

2021 COMBINED ANNUAL DAILY TRAFFIC

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	378	-
B - Recreational Vehicle	0	-
C - Bus	0	-
D - Single Unit Truck	0	-
E - Tractor Trailer Unit	0	-
Total	378	



WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	485	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	485	



EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

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Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

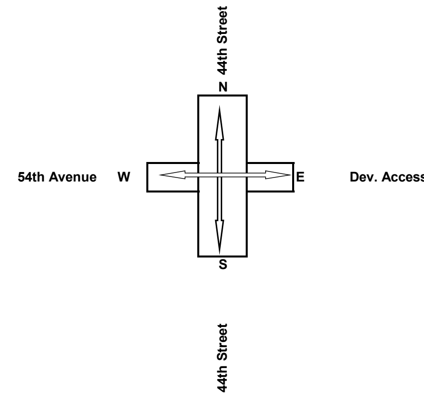
SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	525	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	525	

2021
2019
2

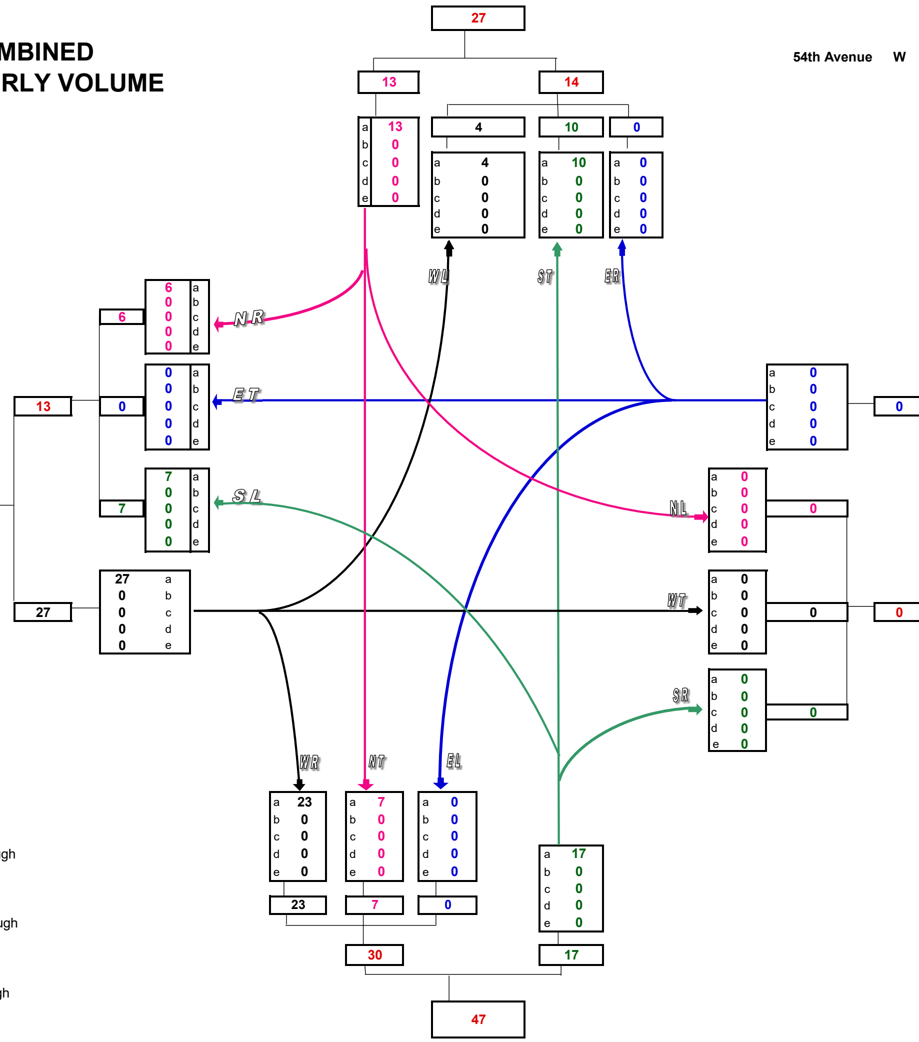
Turning Movement Summary Diagram

NORTH LEG ON		44th Street
Vehicle Type	Vol.	%
A - Passenger Vehicle	27	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	27	

2021 COMBINED
AM PEAK HOURLY VOLUME



WEST LEG ON		54th Avenue
Vehicle Type	Vol.	%
A - Passenger Vehicle	40	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	40	



EAST LEG ON		Dev. Access
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	#DIV/0!
B - Recreational Vehicle	0	#DIV/0!
C - Bus	0	#DIV/0!
D - Single Unit Truck	0	#DIV/0!
E - Tractor Trailer Unit	0	#DIV/0!
Total	0	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON		44th Street
Vehicle Type	Vol.	%
A - Passenger Vehicle	47	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	47	

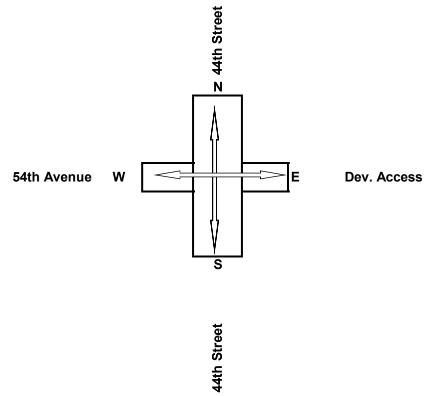
2021
2019
2

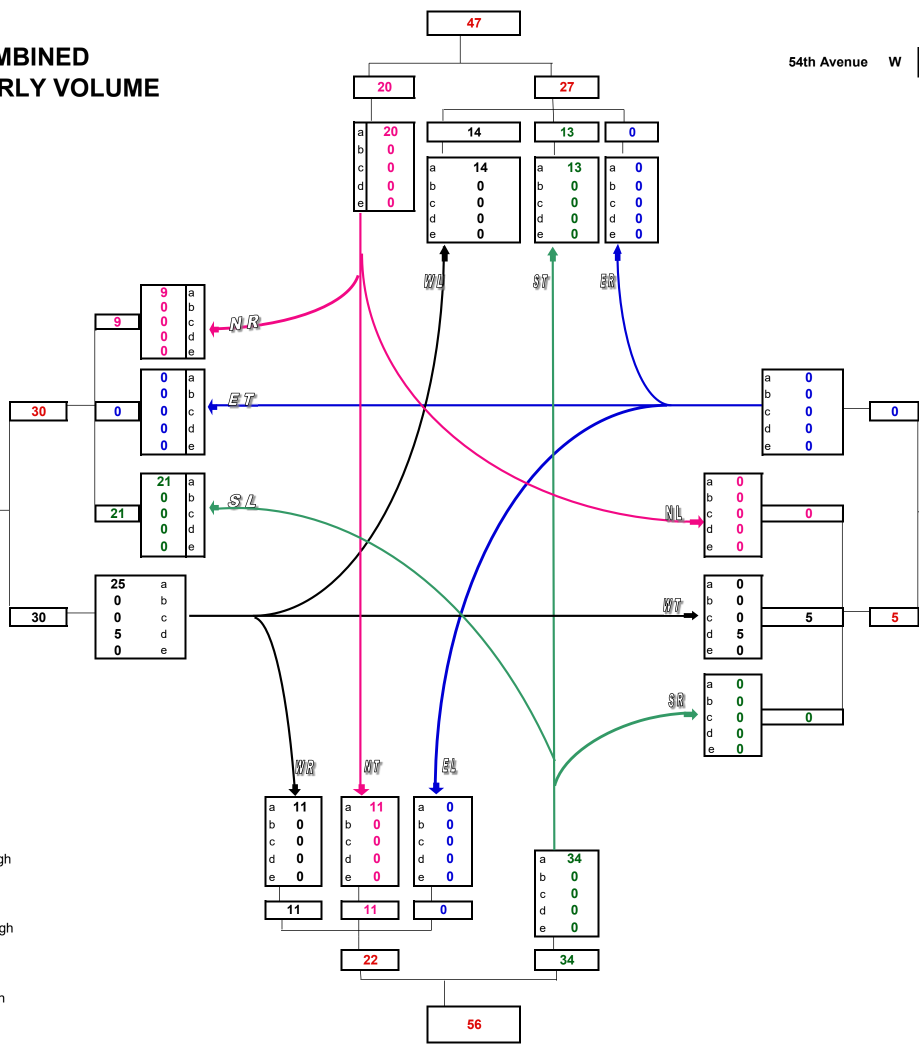
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	47	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	47	

2021 COMBINED PM PEAK HOURLY VOLUME





WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	55	91.7
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	5	8.3
E - Tractor Trailer Unit	0	0.0
Total	60	

EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	0	0.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	5	100.0
E - Tractor Trailer Unit	0	0.0
Total	5	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

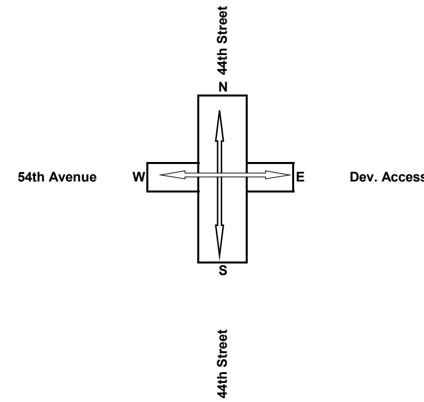
SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	56	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	56	

2021
2019
2

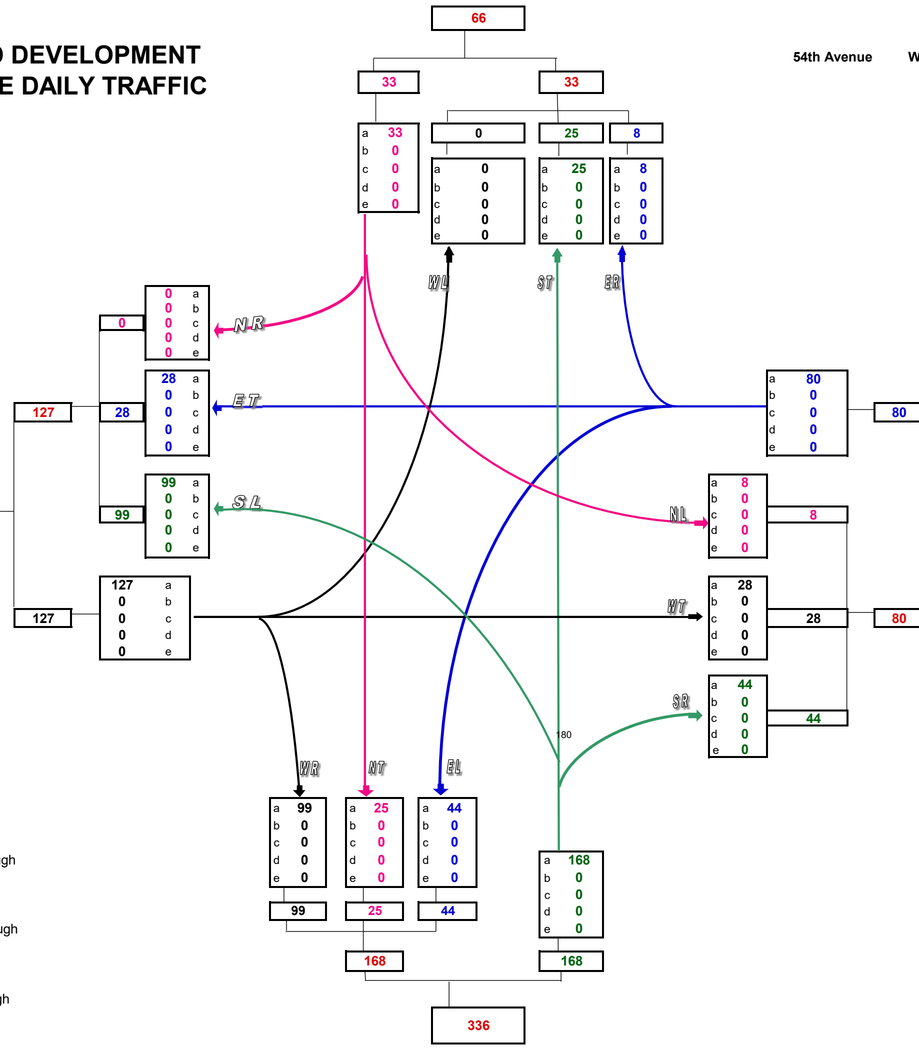
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	66	100.0%
B - Recreational Vehicle	0	0.0%
C - Bus	0	0.0%
D - Single Unit Truck	0	0.0%
E - Tractor Trailer Unit	0	0.0%
Total	66	



2025 PROJECTED DEVELOPMENT ANNUAL AVERAGE DAILY TRAFFIC



WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	254	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	254	

EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	160	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	160	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

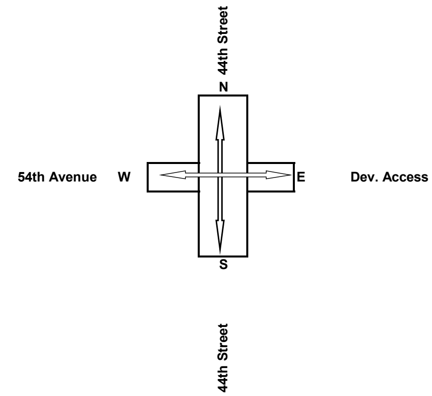
SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	336	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	336	

D&A PAULICHUK CONSULTING LTD.

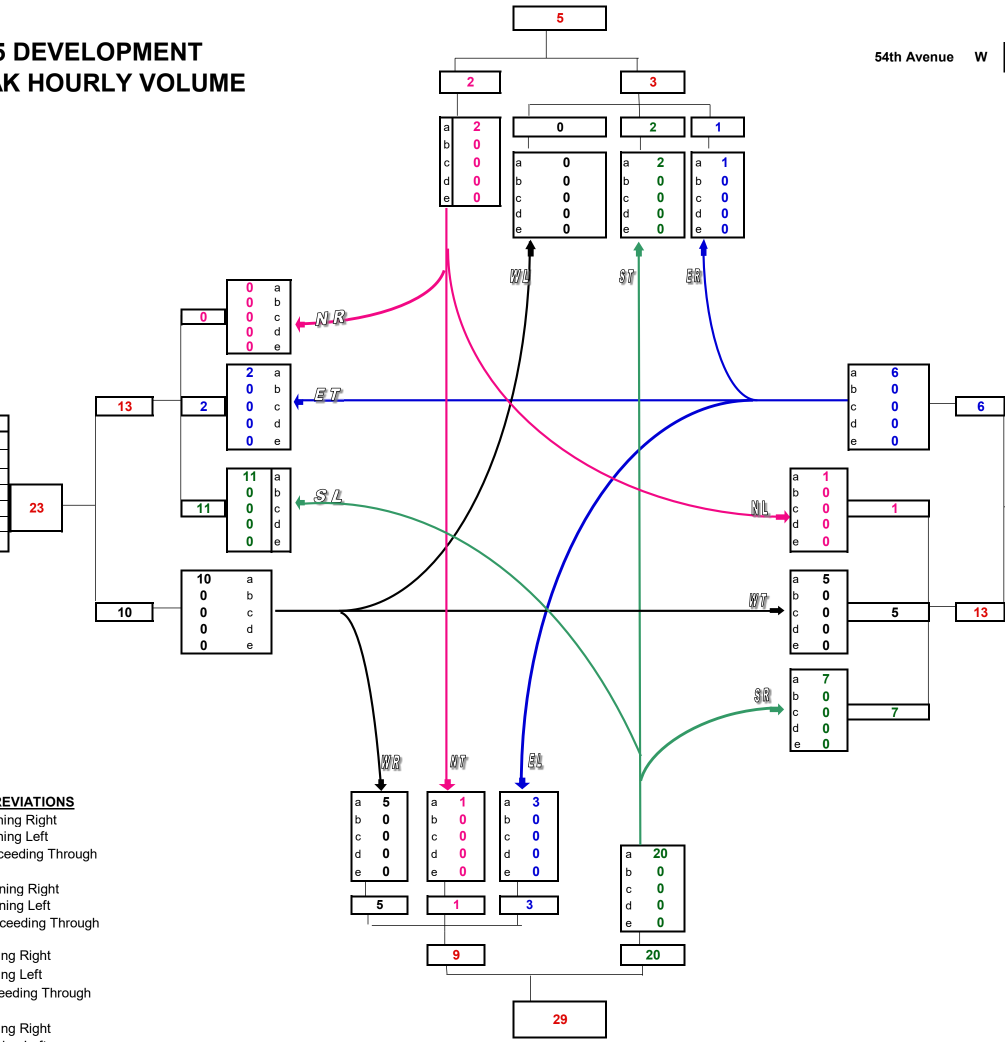
Turning Movement Summary Diagram

2025 DEVELOPMENT
AM PEAK HOURLY VOLUME

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	5	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	5	



WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	23	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	23	



EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	19	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	19	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

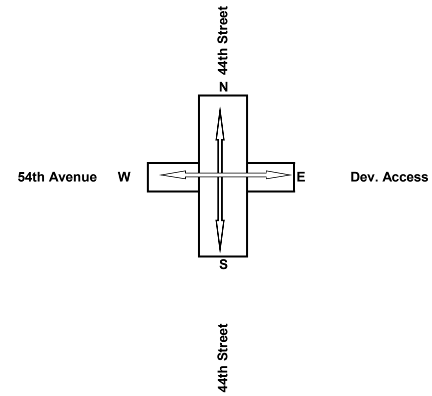
SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	29	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	29	

D&A PAULICHUK CONSULTING LTD.

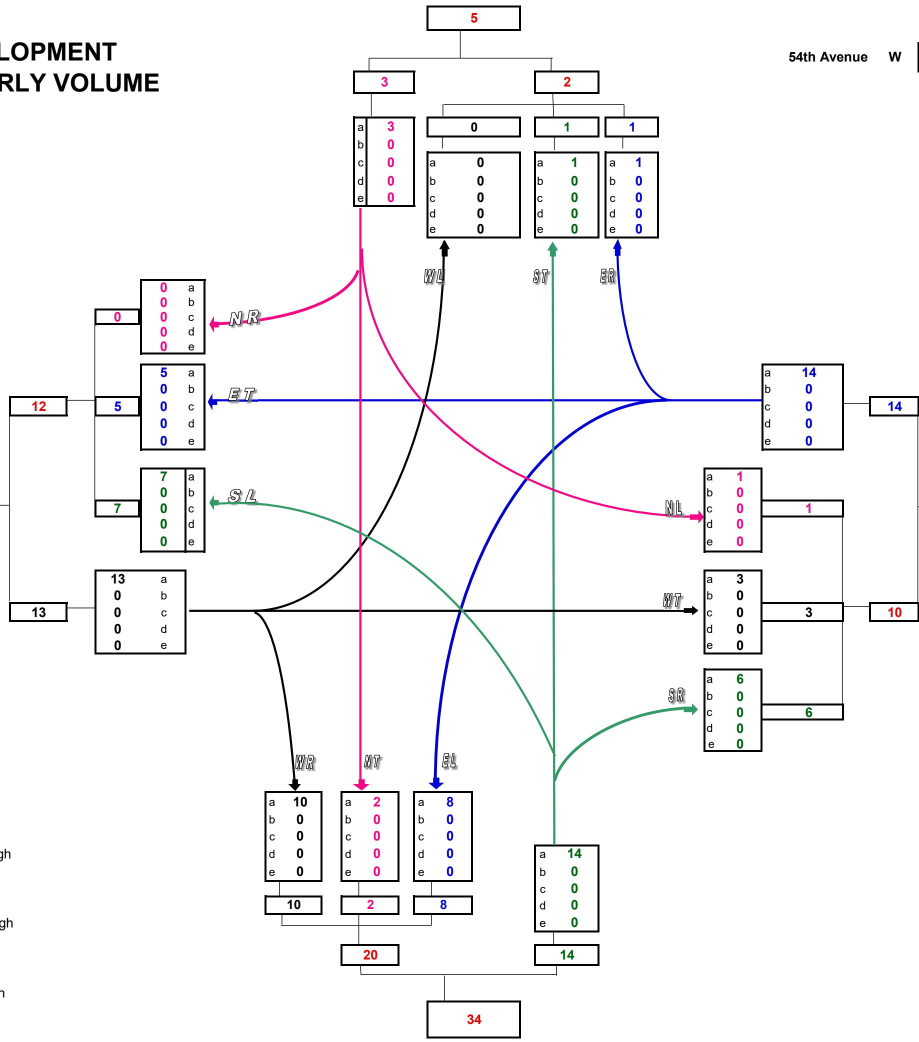
Turning Movement Summary Diagram

2025 DEVELOPMENT
PM PEAK HOURLY VOLUME

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	5	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	5	



WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	25	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	25	



EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	24	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	24	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

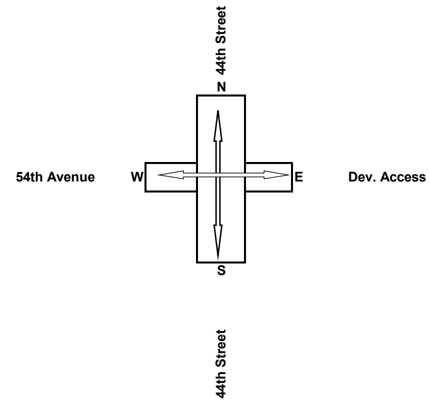
SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	34	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	34	

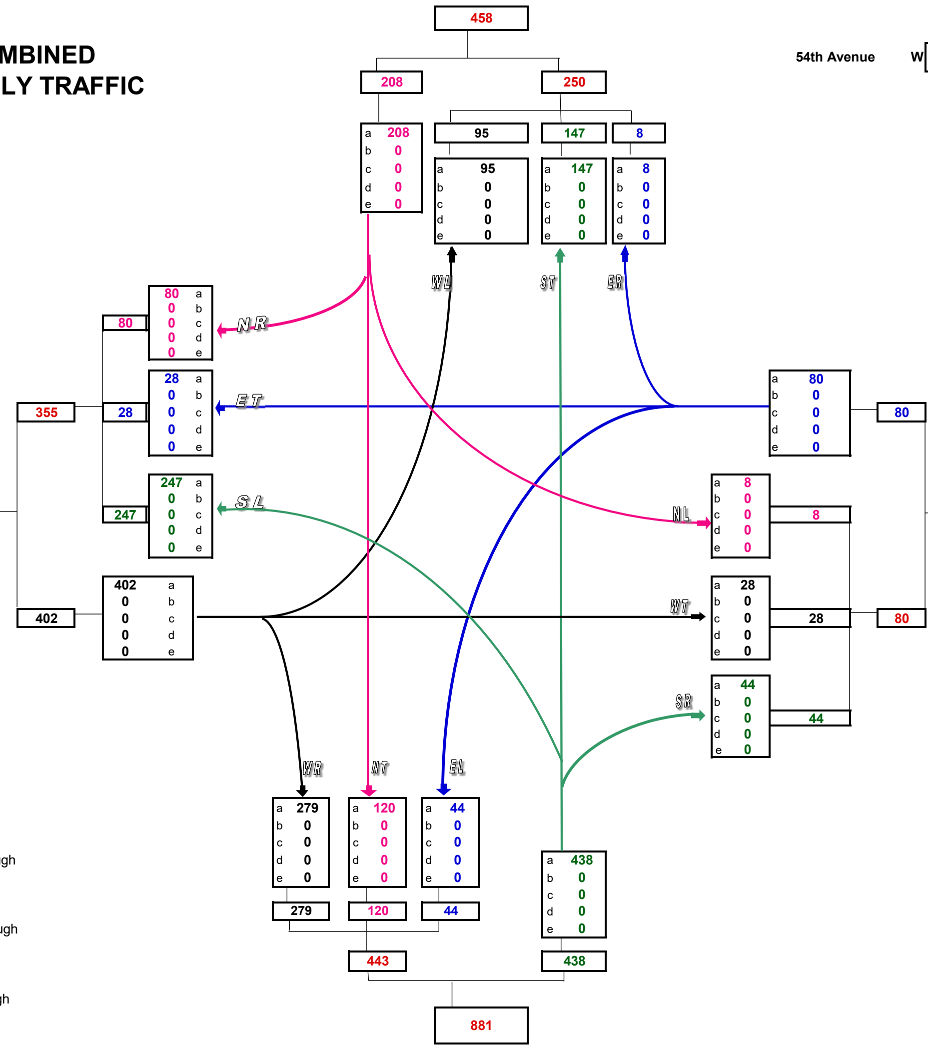
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	458	-
B - Recreational Vehicle	0	-
C - Bus	0	-
D - Single Unit Truck	0	-
E - Tractor Trailer Unit	0	-
Total	458	

2025 COMBINED ANNUAL DAILY TRAFFIC





WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	757	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	757	

EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	160	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	160	

TURNING MOVEMENT ABBREVIATIONS

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SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

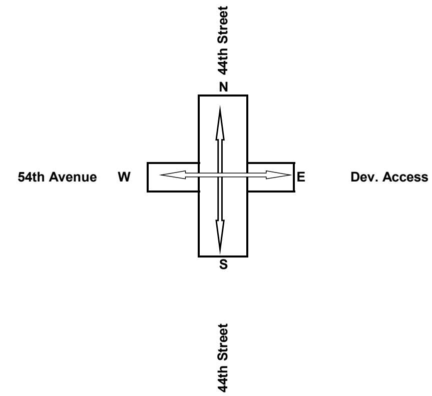
SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	881	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	881	

D&A PAULICHUK CONSULTING LTD.

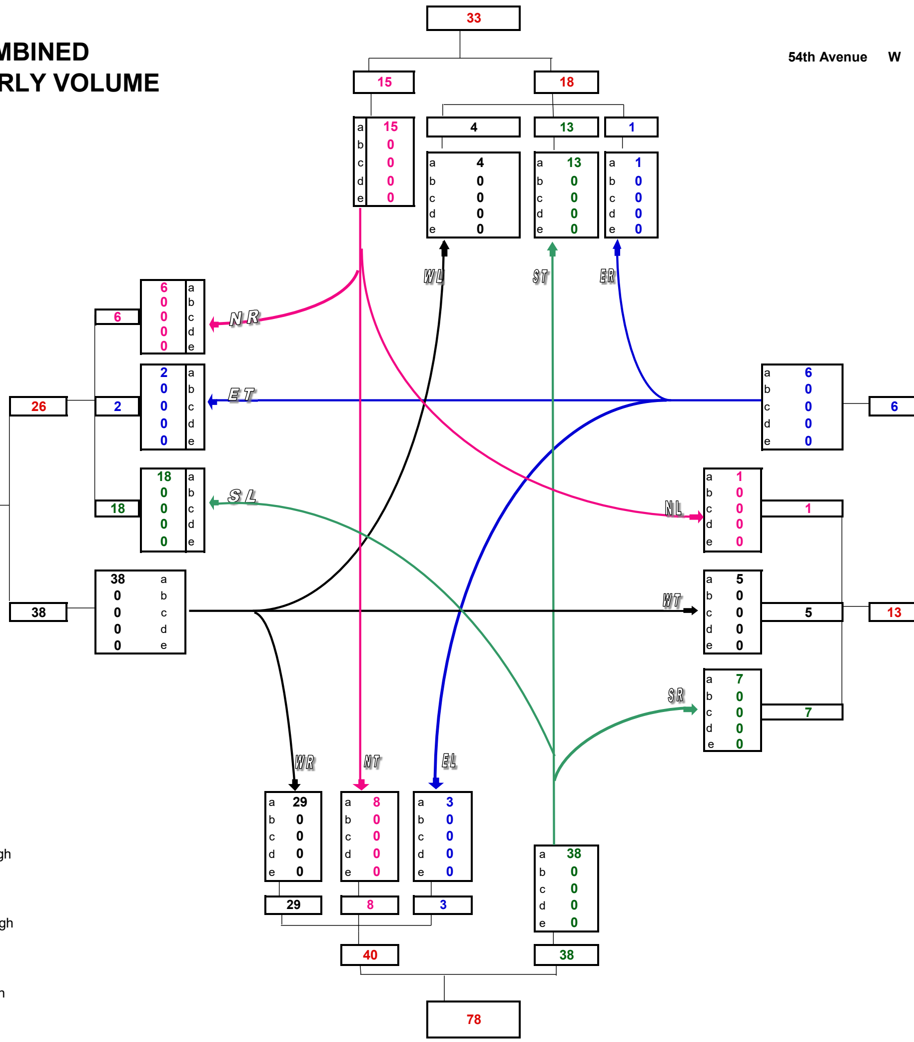
Turning Movement Summary Diagram

2025 COMBINED
AM PEAK HOURLY VOLUME

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	33	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	33	



WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	64	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	64	



EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	19	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	19	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

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EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	78	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	78	

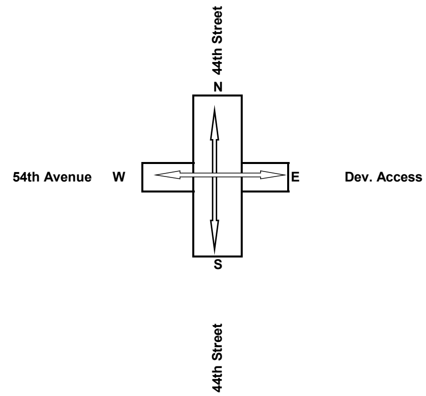
2025
2019
6

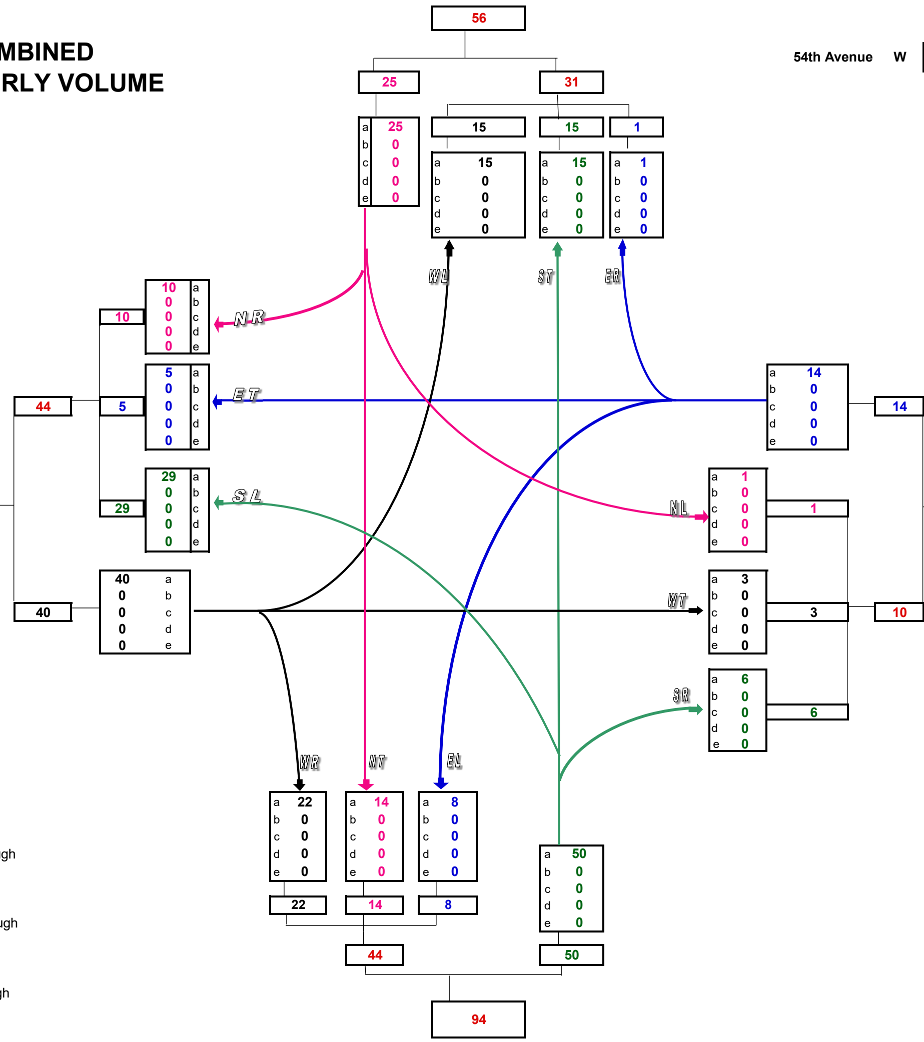
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2025 COMBINED
PM PEAK HOURLY VOLUME

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	56	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	56	





WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	84	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	84	

EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	24	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	24	

TURNING MOVEMENT ABBREVIATIONS

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ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	94	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	94	

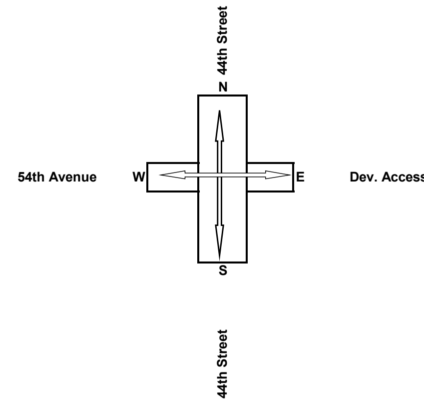
2025
2019
6

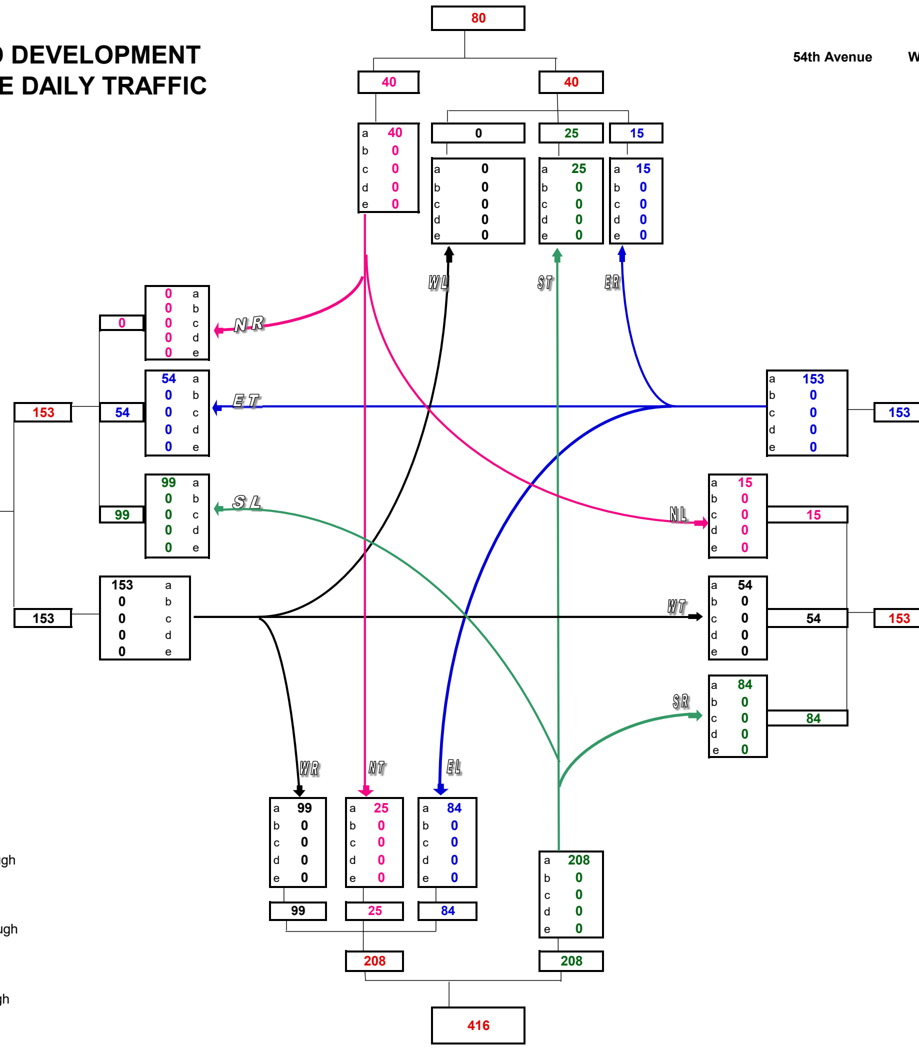
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2035 PROJECTED DEVELOPMENT ANNUAL AVERAGE DAILY TRAFFIC

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	80	100.0%
B - Recreational Vehicle	0	0.0%
C - Bus	0	0.0%
D - Single Unit Truck	0	0.0%
E - Tractor Trailer Unit	0	0.0%
Total	80	





WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	306	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	306	

EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	306	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	306	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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ASDT: Average Summer Daily Traffic
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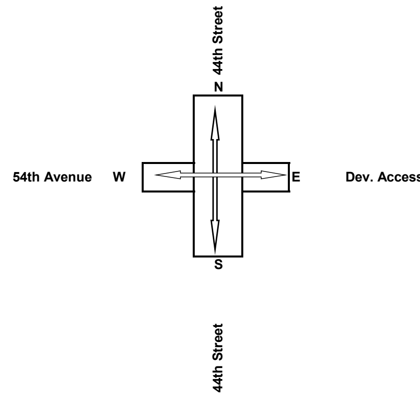
SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	416	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	416	

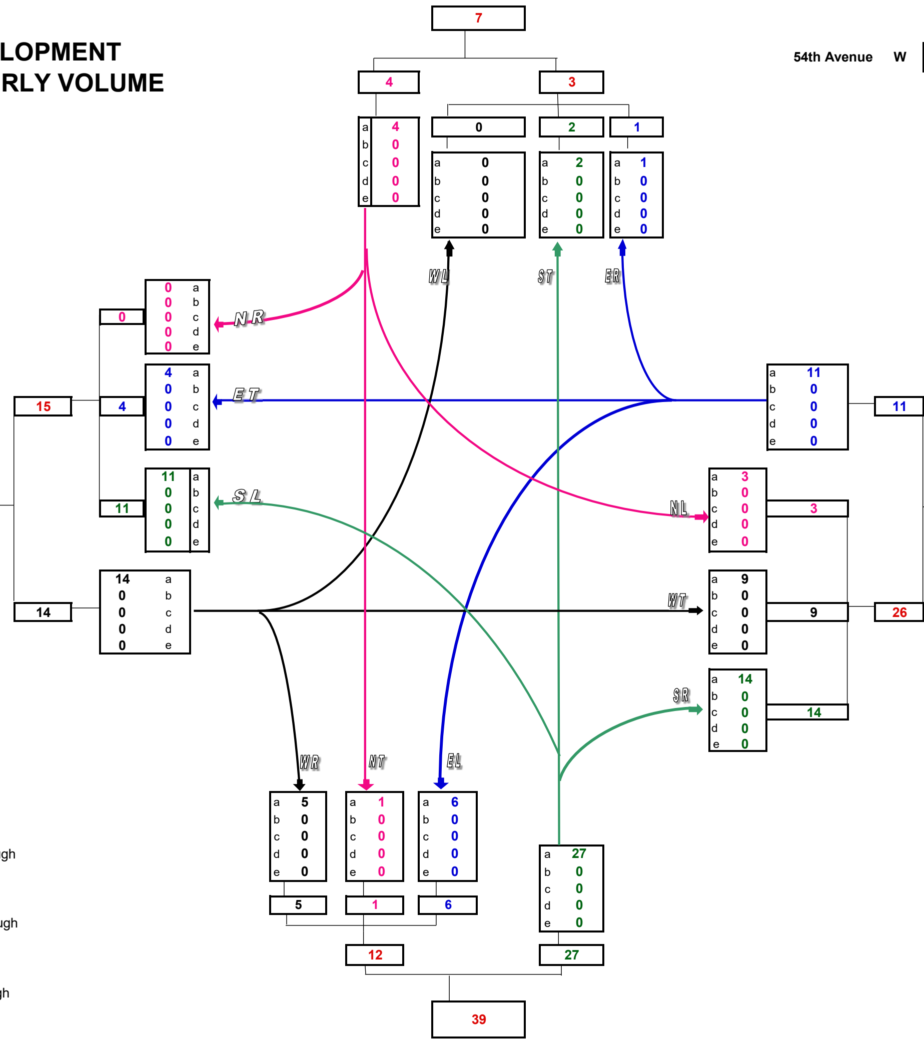
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2035 DEVELOPMENT
AM PEAK HOURLY VOLUME

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	7	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	7	





WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	29	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	29	

EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	37	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	37	

SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	39	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	39	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
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NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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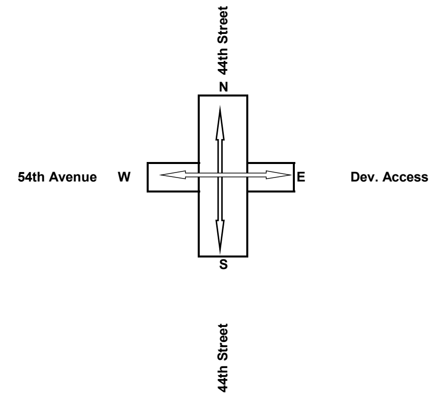
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

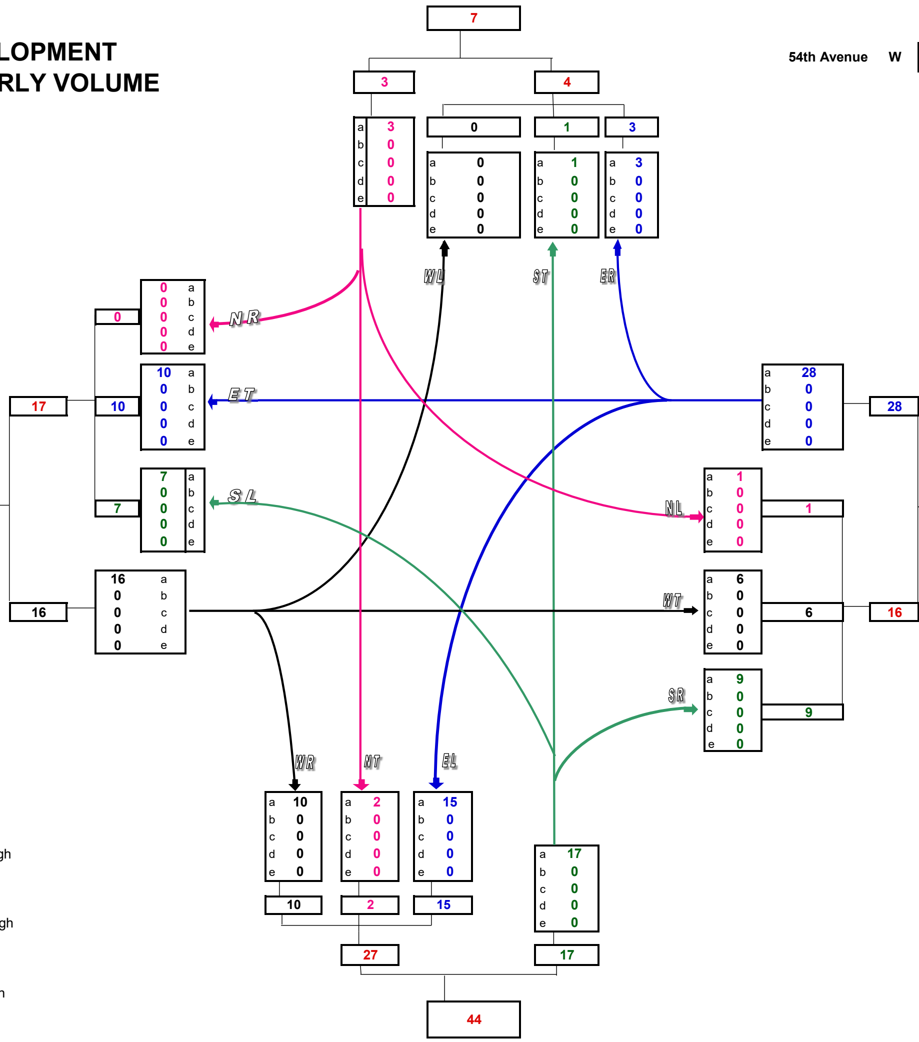
PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	7	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	7	

2035 DEVELOPMENT
PM PEAK HOURLY VOLUME





WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	33	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	33	

33

EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	44	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	44	

44

TURNING MOVEMENT ABBREVIATIONS

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EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

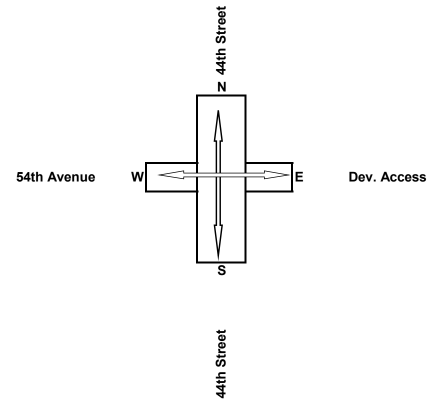
SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	44	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	44	

D&A PAULICHUK CONSULTING LTD.

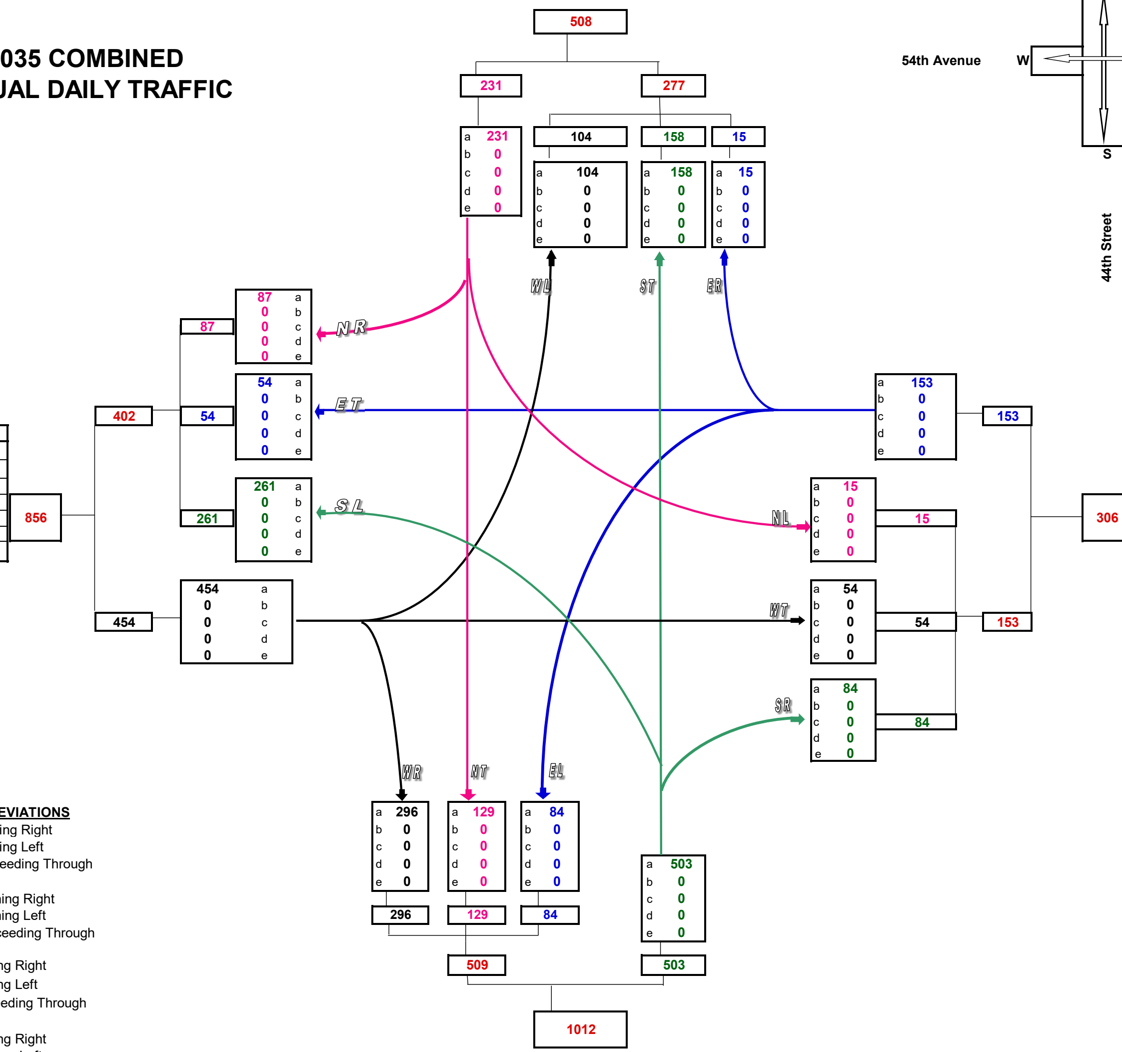
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	508	-
B - Recreational Vehicle	0	-
C - Bus	0	-
D - Single Unit Truck	0	-
E - Tractor Trailer Unit	0	-
Total	508	

2035 COMBINED
ANNUAL DAILY TRAFFIC



WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	856	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	856	



EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	306	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	306	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
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EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Taffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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ASDT: Average Summer Daily Traffic
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SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1012	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	1012	

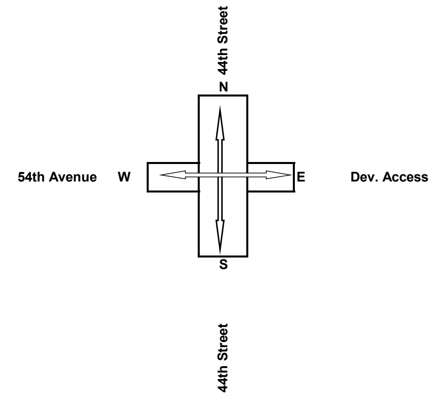
2035
2019
16

D&A PAULICHUK CONSULTING LTD.

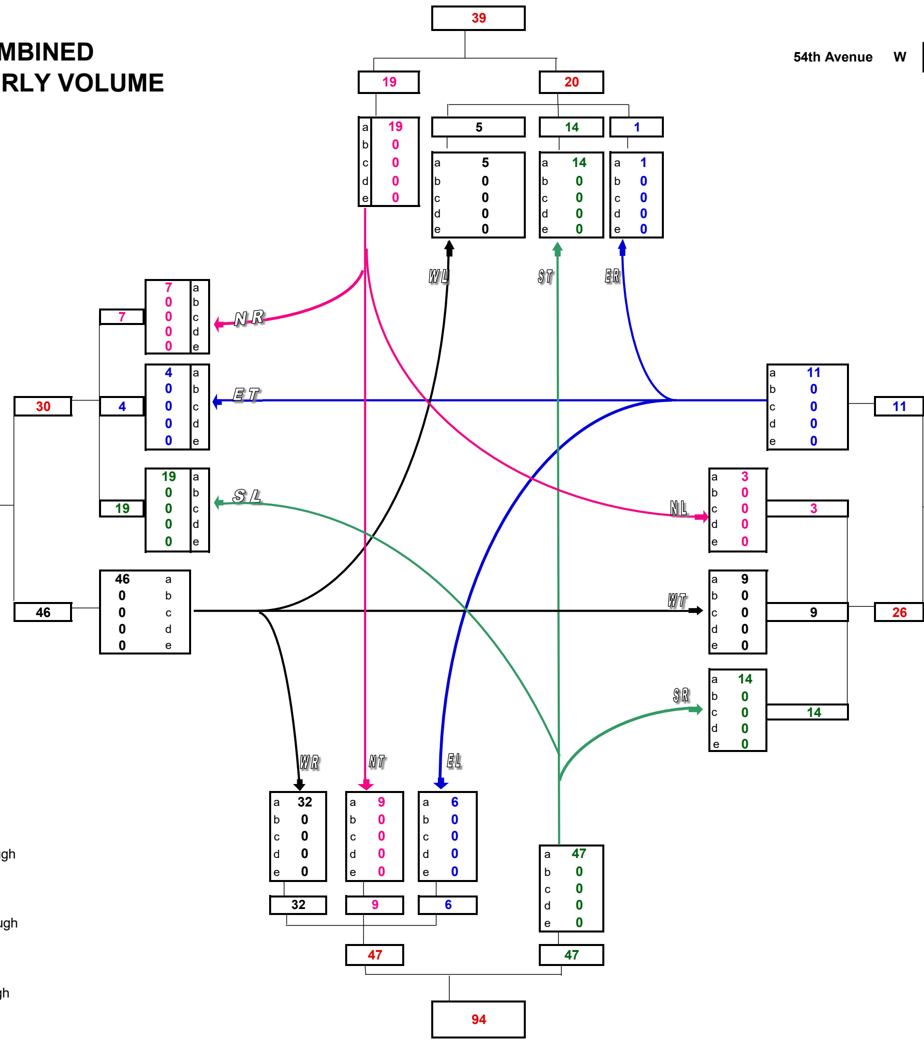
Turning Movement Summary Diagram

2035 COMBINED
AM PEAK HOURLY VOLUME

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	39	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	39	



WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	76	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	76	



EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	37	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	37	

TURNING MOVEMENT ABBREVIATIONS

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EL: Traffic from East Turning Left
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WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
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ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	94	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	94	

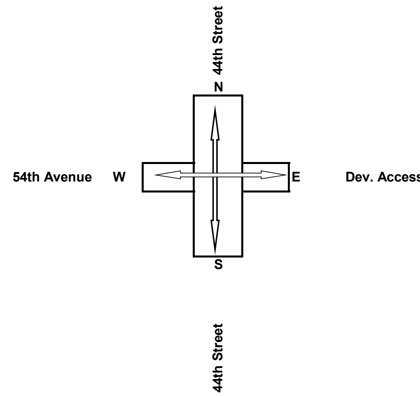
2035
2019
16

D&A PAULICHUK CONSULTING LTD.

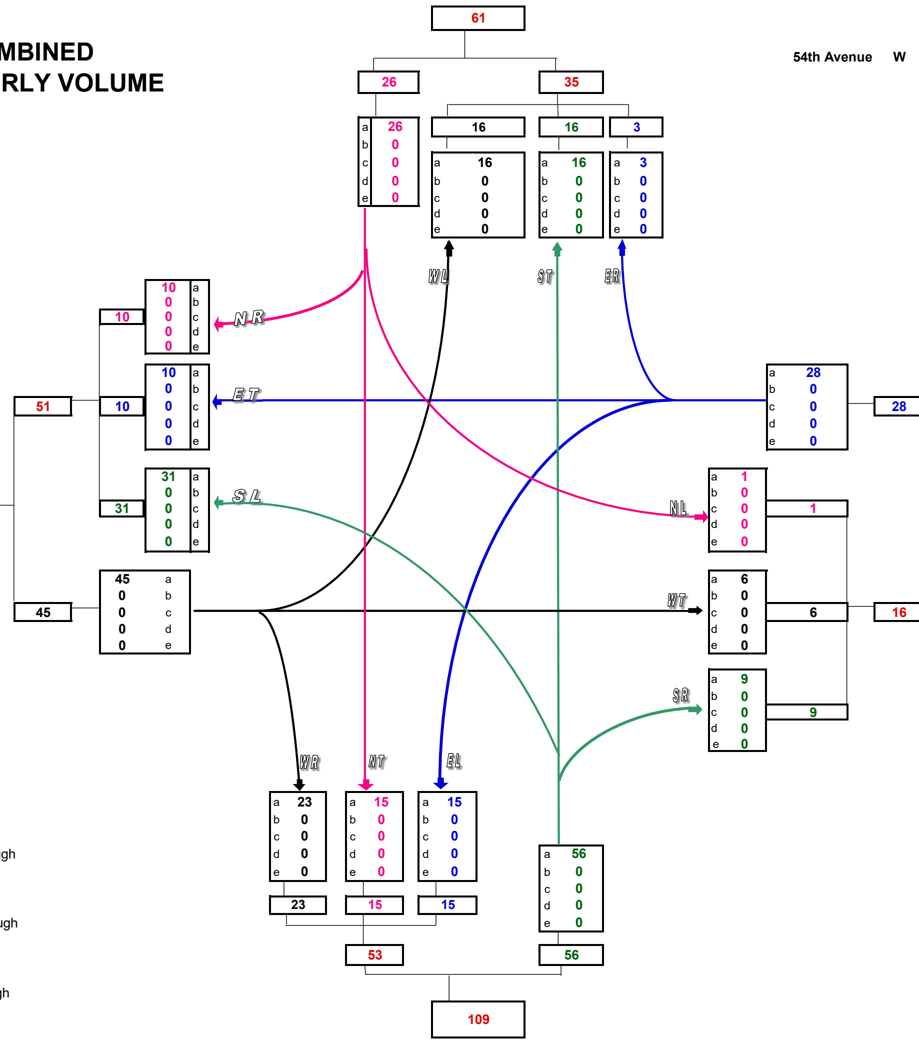
Turning Movement Summary Diagram

NORTH LEG ON		44th Street
Vehicle Type	Vol.	%
A - Passenger Vehicle	61	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	61	

2035 COMBINED
PM PEAK HOURLY VOLUME



WEST LEG ON		54th Avenue
Vehicle Type	Vol.	%
A - Passenger Vehicle	96	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	96	



EAST LEG ON		Dev. Access
Vehicle Type	Vol.	%
A - Passenger Vehicle	44	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	44	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

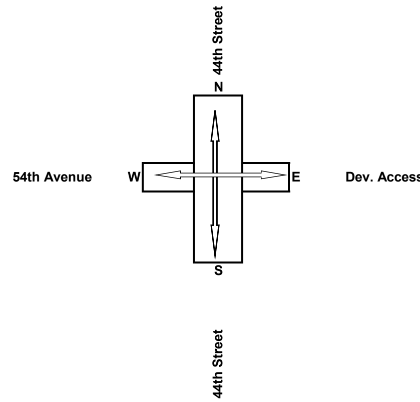
SOUTH LEG ON		44th Street
Vehicle Type	Vol.	%
A - Passenger Vehicle	109	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	109	

2035
2019
16

D&A PAULICHUK CONSULTING LTD.

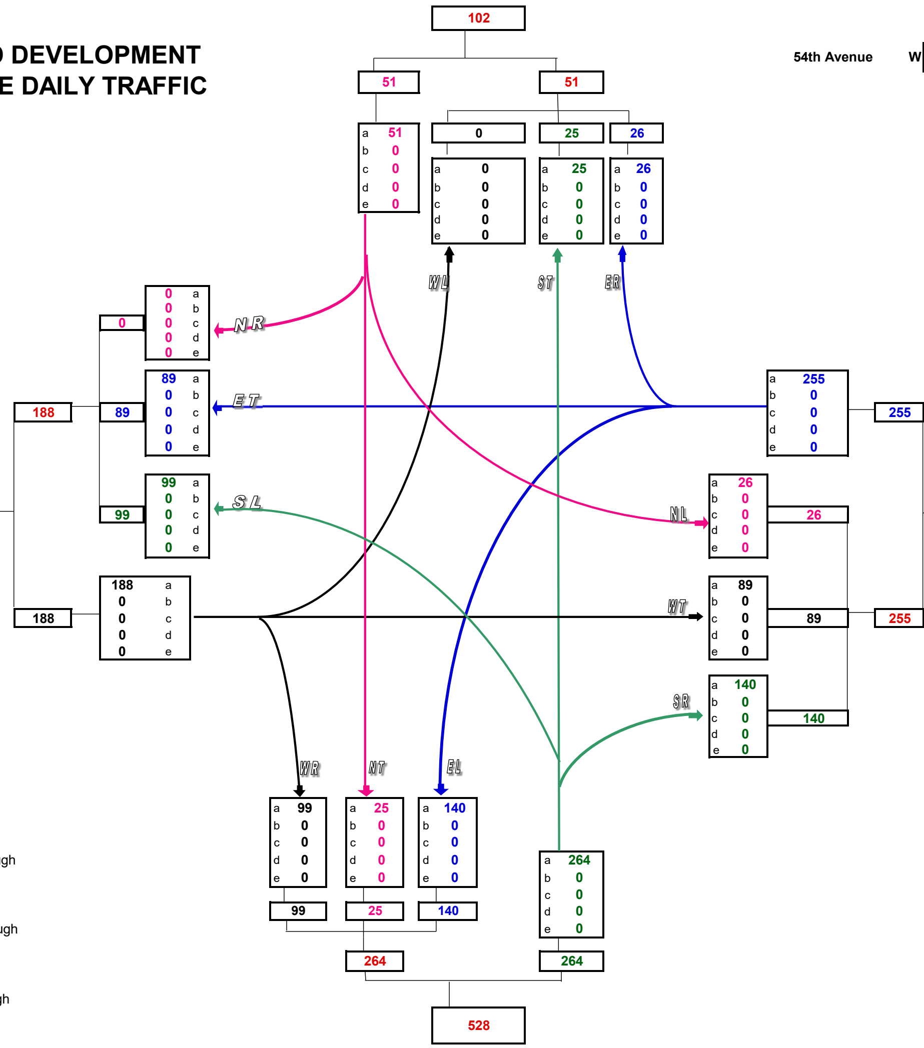
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	102	100.0%
B - Recreational Vehicle	0	0.0%
C - Bus	0	0.0%
D - Single Unit Truck	0	0.0%
E - Tractor Trailer Unit	0	0.0%
Total	102	



2045 PROJECTED DEVELOPMENT ANNUAL AVERAGE DAILY TRAFFIC

WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	376	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	376	



EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	510	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	510	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

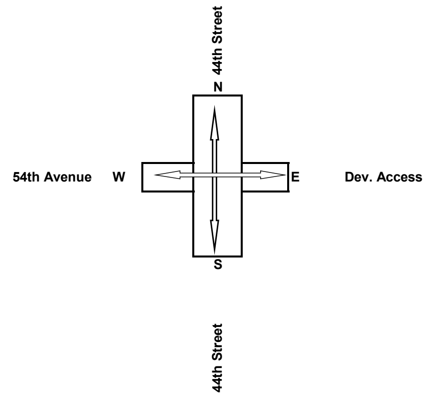
ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	528	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	528	

D&A PAULICHUK CONSULTING LTD.

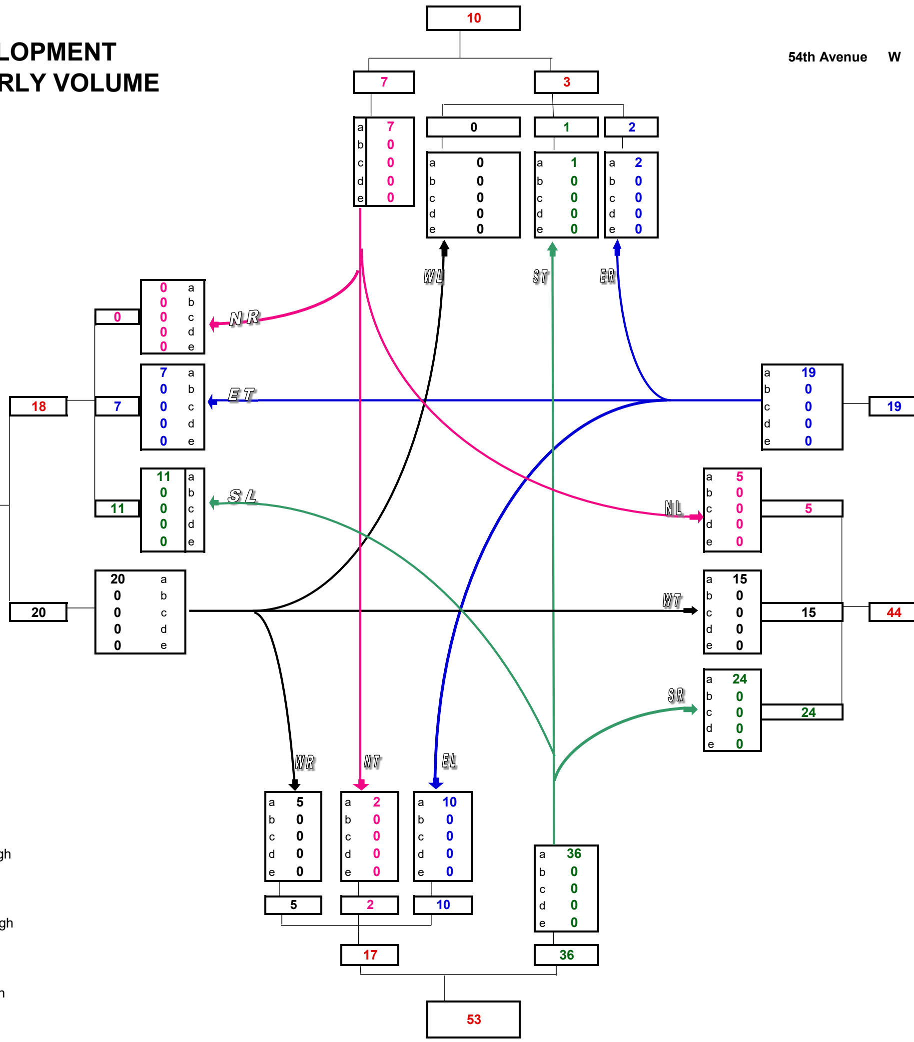
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	10	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	10	



2045 DEVELOPMENT
AM PEAK HOURLY VOLUME

WEST LEG ON	Hwy. 63:01	
Vehicle Type	Vol.	%
A - Passenger Vehicle	38	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	38	



EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	63	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	63	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

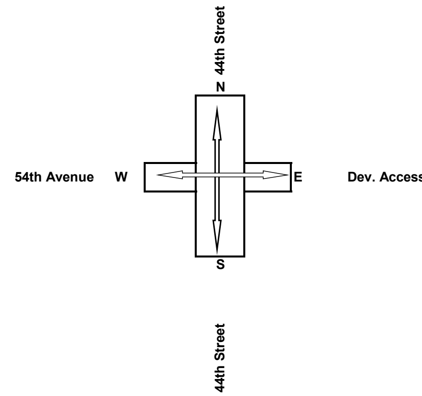
SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	53	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	53	

D&A PAULICHUK CONSULTING LTD.

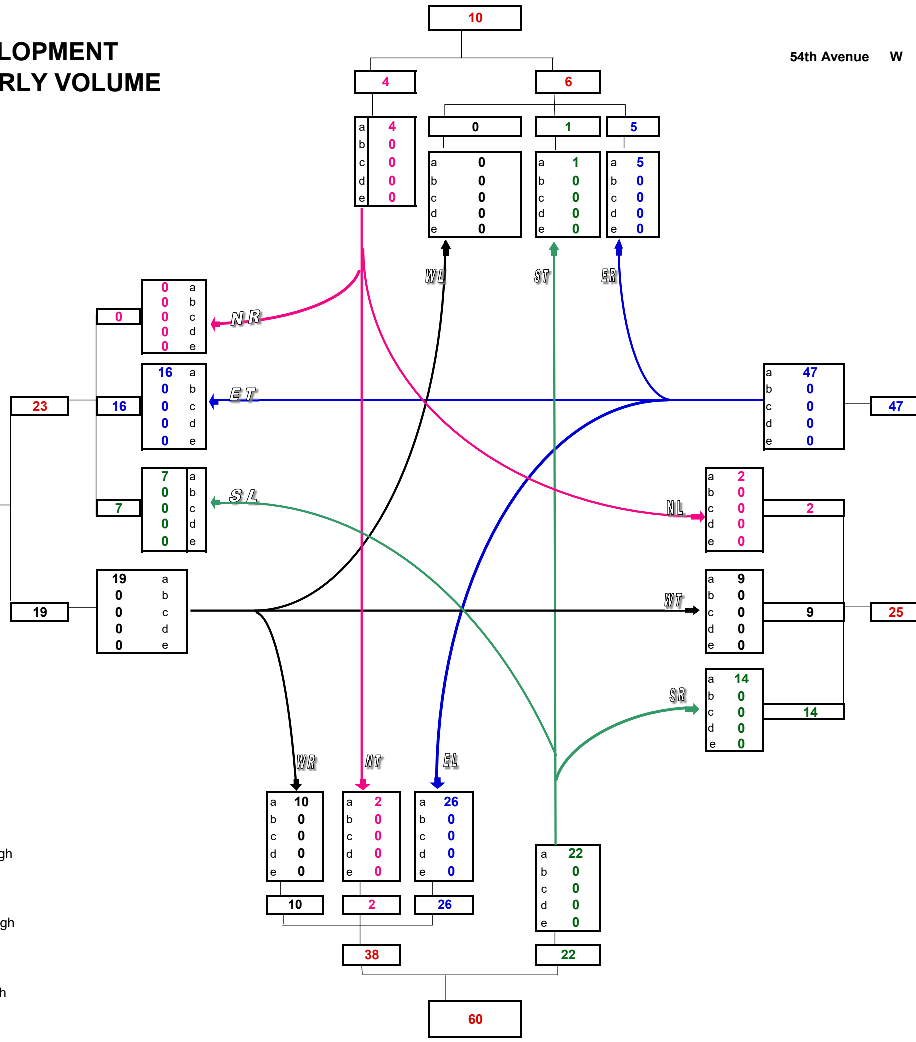
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	10	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	10	

2045 DEVELOPMENT
PM PEAK HOURLY VOLUME



WEST LEG ON	Hwy. 63:01	
Vehicle Type	Vol.	%
A - Passenger Vehicle	42	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	42	



EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	72	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	72	

TURNING MOVEMENT ABBREVIATIONS

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NL: Traffic from North Turning Left
NT: Traffic from North Proceeding Through

SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

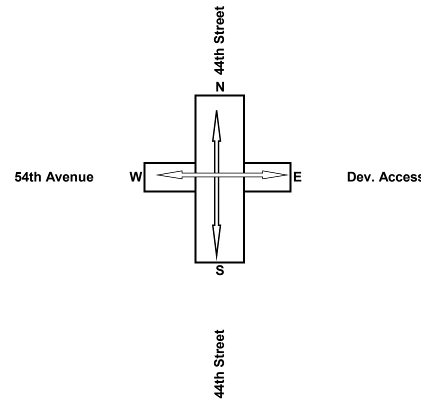
SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	60	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	60	

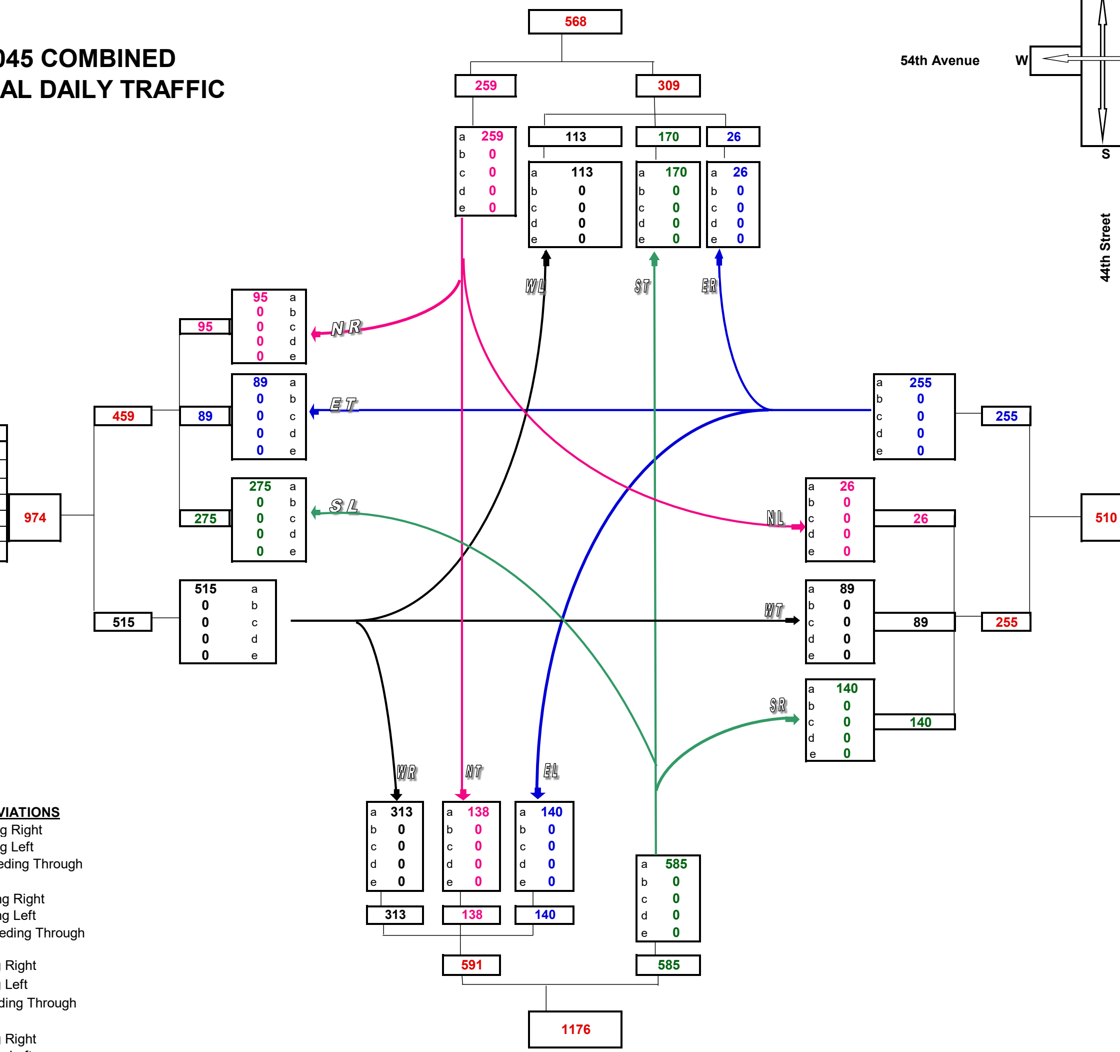
D&A PAULICHUK CONSULTING LTD.

Turning Movement Summary Diagram

2045 COMBINED ANNUAL DAILY TRAFFIC

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	568	-
B - Recreational Vehicle	0	-
C - Bus	0	-
D - Single Unit Truck	0	-
E - Tractor Trailer Unit	0	-
Total	568	





WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	974	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	974	

EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	510	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	510	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	1176	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	1176	

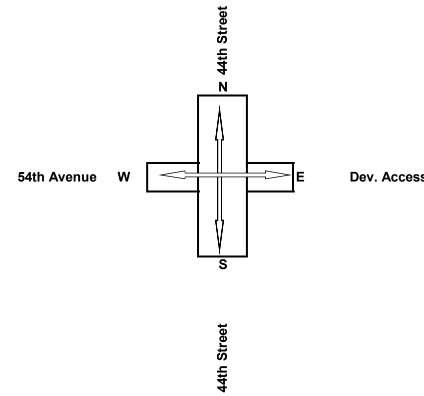
2045
2019
26

D&A PAULICHUK CONSULTING LTD.

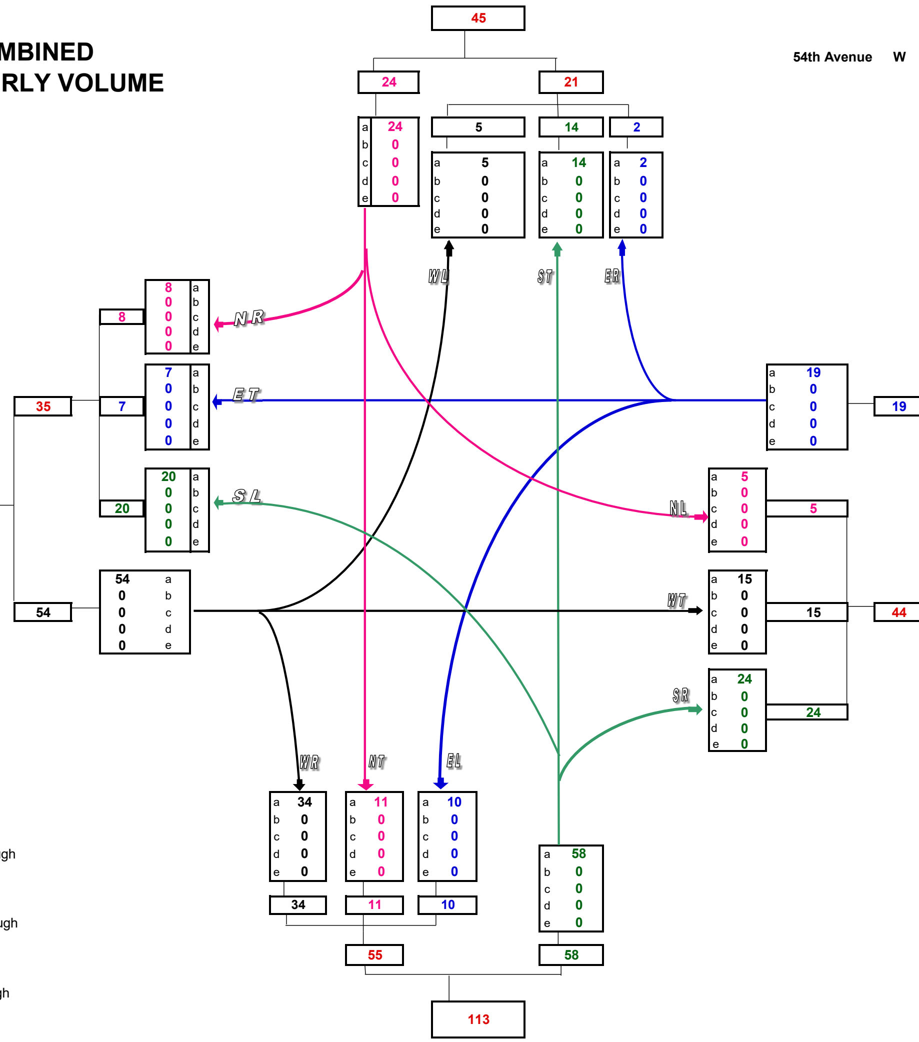
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	45	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	45	

2045 COMBINED
AM PEAK HOURLY VOLUME



WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	89	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	89	



EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	63	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	63	

TURNING MOVEMENT ABBREVIATIONS

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SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

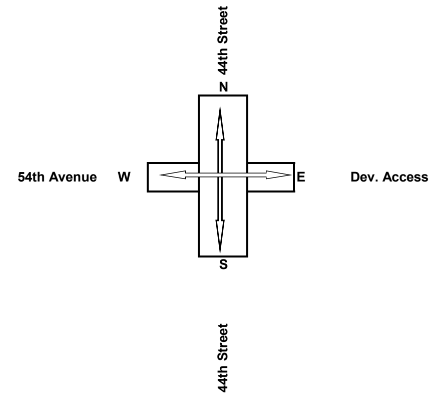
SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	113	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	113	

2045
2019
26

D&A PAULICHUK CONSULTING LTD.

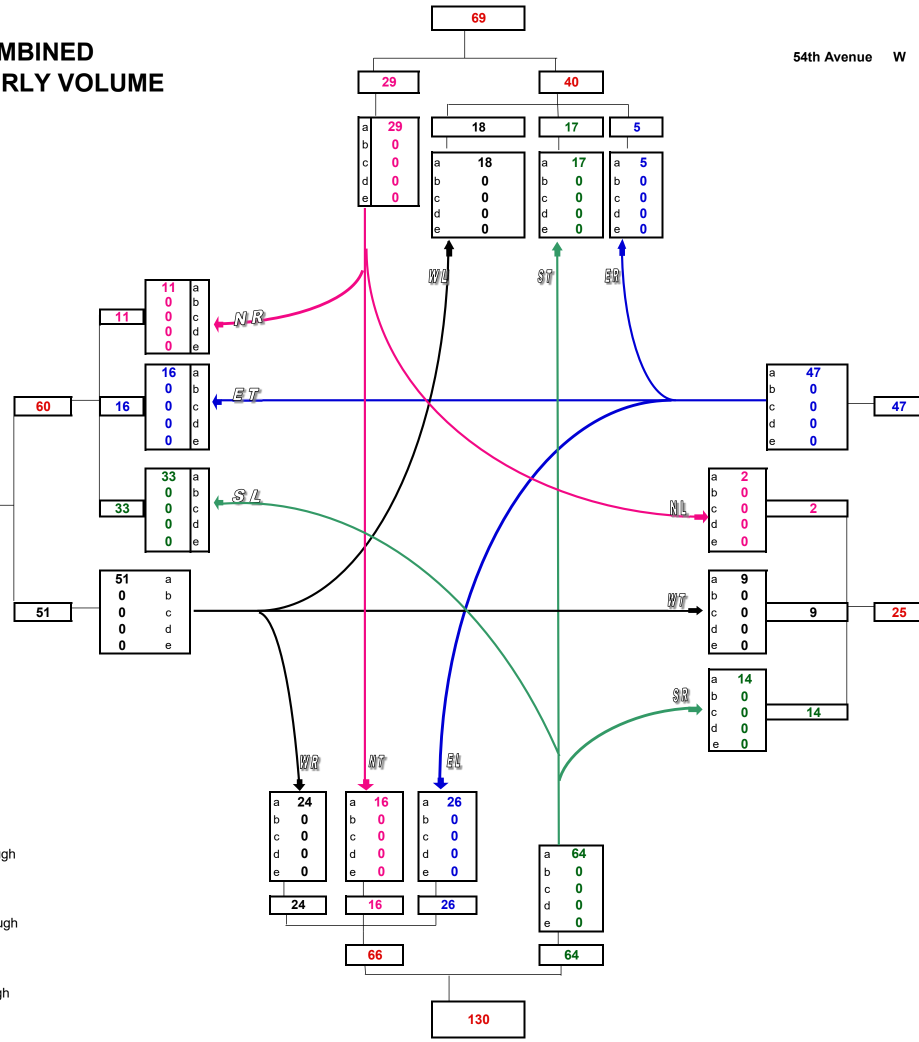
Turning Movement Summary Diagram

NORTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	69	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	69	



2045 COMBINED
PM PEAK HOURLY VOLUME

WEST LEG ON	54th Avenue	
Vehicle Type	Vol.	%
A - Passenger Vehicle	111	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	111	



EAST LEG ON	Dev. Access	
Vehicle Type	Vol.	%
A - Passenger Vehicle	72	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	72	

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic from North Turning Right
NL: Traffic from North Turning Left
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SR: Traffic from South Turning Right
SL: Traffic from South Turning Left
ST: Traffic from South Proceeding Through

ER: Traffic from East Turning Right
EL: Traffic from East Turning Left
ET: Traffic from East Proceeding Through

WR: Taffic from West Turning Right
WL: Traffic from West Turning Left
WT: Traffic from West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehilces per day for period of May 1 to September 30 (153 days)

SOUTH LEG ON	44th Street	
Vehicle Type	Vol.	%
A - Passenger Vehicle	130	100.0
B - Recreational Vehicle	0	0.0
C - Bus	0	0.0
D - Single Unit Truck	0	0.0
E - Tractor Trailer Unit	0	0.0
Total	130	

2045
2019
26

Illumination of Isolated Rural Intersections

LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

44th Street	Main Road	**Date**	December 28, 2020
54th Avenue	Minor Road	**Other**	Year 2045 with Proposed Development using 2% Growth Rate
Redwater	City/Town		

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	4		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	100		5		OK	
Channelization Factor					OK	20
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**26**

OPERATIONAL FACTORS

	Value	Rating	Weight	Comments	Check	Score
Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	1311	1	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	10
AADT on Minor Road (2-way)	1098	2	20		OK	40
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	0	5	Refer to Table 1(B) for ratings.	OK	0
Operating Speed or Posted Speed on Major Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
					Operational Factors Subtotal	**50**

ENVIRONMENTAL FACTOR

	Value	Rating	Weight	Comments	Check	Score
Lighted Developments within 150 m radius of intersection	0	0	5	Maximum of 4 quadrants	OK	0
					Environmental Factor Subtotal	**0**

COLLISION HISTORY

	Value	Rating	Weight	Comments	Check	Score
Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
					Collision History Subtotal	**0**

Check Intersection Signalization:
Intersection is not Signalized

Geometric Factors Subtotal	26
Operational Factor Subtotal	50
Environmental Factor Subtotal	0
Collision History Subtotal	0
TOTAL POINTS	**76**

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Volume (veh/h)	4	0	23	0	0	0	7	10	0	0	7	6
Future Volume (Veh/h)	4	0	23	0	0	0	7	10	0	0	7	6
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	4	0	24	0	0	0	7	11	0	0	7	6
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	0			0			30	20	12	26	8	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			30	20	12	26	8	0
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	100			100			99	99	100	100	99	99
cM capacity (veh/h)	1604			1604			946	856	1046	954	869	1062

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	28	0	18	13
Volume Left	4	0	7	0
Volume Right	24	0	0	6
cSH	1604	1700	889	949
Volume to Capacity	0.00	0.00	0.02	0.01
Queue Length 95th (m)	0.1	0.0	0.5	0.3
Control Delay (s)	1.1	0.0	9.1	8.8
Lane LOS	A		A	A
Approach Delay (s)	1.1	0.0	9.1	8.8
Approach LOS			A	A

Intersection Summary			
Average Delay	5.2		
Intersection Capacity Utilization	17.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Volume (veh/h)	14	0	11	0	0	0	21	13	0	0	11	9
Future Volume (Veh/h)	14	0	11	0	0	0	21	13	0	0	11	9
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	15	0	12	0	0	0	22	14	0	0	12	9
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	0			0			51	36	6	43	30	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			51	36	6	43	30	0
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	99			100			98	98	100	100	99	99
cM capacity (veh/h)	1604			1604			904	833	1054	921	839	1062

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	27	0	36	21
Volume Left	15	0	22	0
Volume Right	12	0	0	9
cSH	1604	1700	875	922
Volume to Capacity	0.01	0.00	0.04	0.02
Queue Length 95th (m)	0.2	0.0	1.0	0.6
Control Delay (s)	4.1	0.0	9.3	9.0
Lane LOS	A		A	A
Approach Delay (s)	4.1	0.0	9.3	9.0
Approach LOS			A	A

Intersection Summary			
Average Delay	7.5		
Intersection Capacity Utilization	19.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	5	29	3	2	1	18	13	7	1	8	6
Future Volume (Veh/h)	4	5	29	3	2	1	18	13	7	1	8	6
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	4	5	31	3	2	1	19	14	7	1	8	6
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	3			5			47	38	20	51	22	2
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	3			5			47	38	20	51	22	2
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	100			100			98	98	99	100	99	99
cM capacity (veh/h)	1600			1597			919	836	1034	908	853	1059

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	40	6	40	15
Volume Left	4	3	19	1
Volume Right	31	1	7	6
cSH	1600	1597	905	929
Volume to Capacity	0.00	0.00	0.04	0.02
Queue Length 95th (m)	0.1	0.0	1.1	0.4
Control Delay (s)	0.7	3.6	9.2	8.9
Lane LOS	A	A	A	A
Approach Delay (s)	0.7	3.6	9.2	8.9
Approach LOS			A	A

Intersection Summary			
Average Delay	5.5		
Intersection Capacity Utilization	19.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	3	22	8	5	1	29	15	6	1	14	10
Future Volume (Veh/h)	15	3	22	8	5	1	29	15	6	1	14	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	16	3	23	8	5	1	31	16	6	1	15	11
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	6			3			86	68	14	82	56	6
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	6			3			86	68	14	82	56	6
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	99			99			96	98	99	100	98	99
cM capacity (veh/h)	1595			1600			849	795	1042	858	807	1055

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	42	14	53	27
Volume Left	16	8	31	1
Volume Right	23	1	6	11
cSH	1595	1600	849	895
Volume to Capacity	0.01	0.01	0.06	0.03
Queue Length 95th (m)	0.2	0.1	1.6	0.7
Control Delay (s)	2.8	4.2	9.5	9.1
Lane LOS	A	A	A	A
Approach Delay (s)	2.8	4.2	9.5	9.1
Approach LOS			A	A

Intersection Summary			
Average Delay	6.8		
Intersection Capacity Utilization	20.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	9	32	6	4	1	19	14	14	3	9	7
Future Volume (Veh/h)	5	9	32	6	4	1	19	14	14	3	9	7
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	5	9	34	6	4	1	20	15	15	3	9	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	5			9			64	53	26	75	36	4
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	5			9			64	53	26	75	36	4
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	100			100			98	98	99	100	99	99
cM capacity (veh/h)	1597			1591			893	817	1027	866	836	1056

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	48	11	50	19
Volume Left	5	6	20	3
Volume Right	34	1	15	7
cSH	1597	1591	903	911
Volume to Capacity	0.00	0.00	0.06	0.02
Queue Length 95th (m)	0.1	0.1	1.4	0.5
Control Delay (s)	0.8	4.0	9.2	9.0
Lane LOS	A	A	A	A
Approach Delay (s)	0.8	4.0	9.2	9.0
Approach LOS			A	A

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	17.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: 44th Street & 54th Avenue/Proposed Development Access

01-01-2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	16	6	23	15	10	3	31	16	9	1	15	10
Future Volume (Veh/h)	16	6	23	15	10	3	31	16	9	1	15	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	17	6	24	16	11	3	33	17	9	1	16	11
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	14			6			116	98	18	114	84	12
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	14			6			116	98	18	114	84	12
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	99			99			96	98	99	100	98	99
cM capacity (veh/h)	1585			1595			808	761	1038	810	774	1045

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	47	30	59	28
Volume Left	17	16	33	1
Volume Right	24	3	9	11
cSH	1585	1595	821	864
Volume to Capacity	0.01	0.01	0.07	0.03
Queue Length 95th (m)	0.3	0.2	1.9	0.8
Control Delay (s)	2.7	3.9	9.7	9.3
Lane LOS	A	A	A	A
Approach Delay (s)	2.7	3.9	9.7	9.3
Approach LOS			A	A

Intersection Summary			
Average Delay	6.6		
Intersection Capacity Utilization	20.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: 44th Street & 54th Avenue/Proposed Development Access

01-01-2021

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	15	34	10	7	2	20	14	24	5	11	8
Future Volume (Veh/h)	5	15	34	10	7	2	20	14	24	5	11	8
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	5	16	36	11	7	2	21	15	25	5	12	8
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	9			16			88	75	34	106	56	8
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	9			16			88	75	34	106	56	8
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	100			99			98	98	98	99	99	99
cM capacity (veh/h)	1591			1582			855	792	1017	815	812	1051

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	57	20	61	25
Volume Left	5	11	21	5
Volume Right	36	2	25	8
cSH	1591	1582	896	876
Volume to Capacity	0.00	0.01	0.07	0.03
Queue Length 95th (m)	0.1	0.2	1.7	0.7
Control Delay (s)	0.7	4.0	9.3	9.2
Lane LOS	A	A	A	A
Approach Delay (s)	0.7	4.0	9.3	9.2
Approach LOS			A	A

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	18.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	9	24	26	16	5	33	17	14	2	16	11
Future Volume (Veh/h)	18	9	24	26	16	5	33	17	14	2	16	11
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	19	9	25	27	17	5	35	18	15	2	17	12
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	22			9			154	136	22	157	120	20
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	22			9			154	136	22	157	120	20
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	99			98			95	97	99	100	98	99
cM capacity (veh/h)	1574			1591			756	719	1033	748	733	1036

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	53	49	68	31
Volume Left	19	27	35	2
Volume Right	25	5	15	12
cSH	1574	1591	792	828
Volume to Capacity	0.01	0.02	0.09	0.04
Queue Length 95th (m)	0.3	0.4	2.2	0.9
Control Delay (s)	2.7	4.1	10.0	9.5
Lane LOS	A	A	A	A
Approach Delay (s)	2.7	4.1	10.0	9.5
Approach LOS			A	A

Intersection Summary			
Average Delay	6.5		
Intersection Capacity Utilization	22.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	15	40	10	7	2	22	16	24	5	13	9
Future Volume (Veh/h)	6	15	40	10	7	2	22	16	24	5	13	9
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	6	16	42	11	7	2	23	17	25	5	14	9
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	9			16			95	80	37	112	58	8
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	9			16			95	80	37	112	58	8
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	100			99			97	98	98	99	98	99
cM capacity (veh/h)	1591			1582			843	787	1013	805	809	1051

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	64	20	65	28
Volume Left	6	11	23	5
Volume Right	42	2	25	9
cSH	1591	1582	884	873
Volume to Capacity	0.00	0.01	0.07	0.03
Queue Length 95th (m)	0.1	0.2	1.9	0.8
Control Delay (s)	0.7	4.0	9.4	9.3
Lane LOS	A	A	A	A
Approach Delay (s)	0.7	4.0	9.4	9.3
Approach LOS			A	A

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	19.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	21	9	27	26	16	5	39	21	14	2	19	14
Future Volume (Veh/h)	21	9	27	26	16	5	39	21	14	2	19	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	22	9	28	27	17	5	41	22	15	2	20	15
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	22			9			166	143	23	166	126	20
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	22			9			166	143	23	166	126	20
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	99			98			94	97	99	100	97	99
cM capacity (veh/h)	1574			1591			736	711	1031	733	726	1036

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	59	49	78	37
Volume Left	22	27	41	2
Volume Right	28	5	15	15
cSH	1574	1591	771	827
Volume to Capacity	0.01	0.02	0.10	0.04
Queue Length 95th (m)	0.3	0.4	2.7	1.1
Control Delay (s)	2.8	4.1	10.2	9.6
Lane LOS	A	A	B	A
Approach Delay (s)	2.8	4.1	10.2	9.6
Approach LOS			B	A

Intersection Summary			
Average Delay	6.8		
Intersection Capacity Utilization	23.5%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix F

Certificate of Title

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0021 720 610	4;21;57;29;SW	162 145 728

LEGAL DESCRIPTION

MERIDIAN 4 RANGE 21 TOWNSHIP 57
SECTION 29
QUARTER SOUTH WEST
CONTAINING 64.7 HECTARES (160 ACRES) MORE OR LESS
EXCEPTING THEREOUT:
(A) 3.88 HECTARES (9.60 ACRES) MORE OR LESS SUBDIVIDED UNDER PLAN 3190HW
(B) ALL THAT PORTION DESCRIBED AS FOLLOWS: COMMENCING AT THE POINT OF INTERSECTION OF THE WEST BOUNDARY OF THE SAID QUARTER SECTION AND THE NORTH LIMIT OF NORTH AVENUE AS SHOWN ON SUBDIVISION PLAN 3190HW; THENCE EASTERLY ALONG THE SAID NORTH LIMIT AND ITS PRODUCTION EASTERLY FOUR HUNDRED AND FORTY (440) FEET; THENCE NORTHERLY AND PARALLEL TO THE SAID WEST BOUNDARY TWO HUNDRED AND EIGHT AND SEVENTY HUNDREDTHS (208.70) FEET; THENCE WESTERLY AND PARALLEL TO THE SAID NORTH LIMIT TO THE SAID WEST BOUNDARY; THENCE SOUTHERLY ALONG THE SAID WEST BOUNDARY TO THE POINT OF COMMENCEMENT, CONTAINING 0.849 HECTARES (2.10 ACRES) MORE OR LESS.
(C) 22.87 HECTARES (56.51 ACRES) MORE OR LESS AS SHOWN ON SUBDIVISION PLAN 8120796
(D) THE MOST EASTERLY TEN (10) METRES IN PERPENDICULAR WIDTH THROUGHOUT, LYING NORTH OF THE NORTH LIMIT OF RIGHT-OF-WAY PLAN 2316KS
EXCEPTING THEREOUT ALL MINES AND MINERALS

ESTATE: FEE SIMPLE

MUNICIPALITY: TOWN OF REDWATER

REFERENCE NUMBER: 162 145 727

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
162 145 728	02/06/2016	TRANSFER OF LAND	$2,500,000	$2,500,000

OWNERS

0974200 B.C. LTD.

(CONTINUED)

OF 4528-99 ST
EDMONTON
ALBERTA T6E 5H5

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
3004HL	19/01/1950	CAVEAT CAVEATOR - ARC RESOURCES LTD. 1200-308-4 AVE SW CALGARY ALBERTA T2P0H7 (DATA UPDATED BY: TRANSFER OF CAVEAT 142406429)
1173HN	17/02/1950	CAVEAT CAVEATOR - ARC RESOURCES LTD. 1200-308-4 AVE SW CALGARY ALBERTA T2P0H7 (DATA UPDATED BY: TRANSFER OF CAVEAT 142407148)
2597HR	18/10/1950	CAVEAT CAVEATOR - IMPERIAL OIL LIMITED.
3484KF	17/01/1956	CAVEAT CAVEATOR - ARC RESOURCES LTD. PO BOX 6776,STATION D CALGARY ALBERTA T2P2E7 (DATA UPDATED BY: TRANSFER OF CAVEAT 072517379) (DATA UPDATED BY: CHANGE OF ADDRESS 152105217)
2981TF	29/08/1972	CAVEAT CAVEATOR - IMPERIAL OIL LIMITED.
1126VA	20/08/1974	CAVEAT CAVEATOR - ARC RESOURCES LTD. PO BOX 6776,STATION D CALGARY ALBERTA T2P2E7 (DATA UPDATED BY: TRANSFER OF CAVEAT 072516592) (DATA UPDATED BY: CHANGE OF ADDRESS 152149325)
802 065 866	25/03/1980	CAVEAT CAVEATOR - ARC RESOURCES LTD.

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
		PO BOX 6776,STATION D CALGARY ALBERTA T2P2E7 (DATA UPDATED BY: TRANSFER OF CAVEAT 062528194) (DATA UPDATED BY: CHANGE OF ADDRESS 152145753)
802 106 564	13/05/1980	CAVEAT CAVEATOR - CAPITAL REGION NORTHEAST WATER SERVICES COMMISSION. 10005 - 102 STREET, FORT SASKATCHEWAN ALBERTA T8L2C5 "DATA UPDATED BY: TRANSFER OF CAVEAT #862046493"
812 078 423	07/04/1981	CAVEAT RE : DEFERRED RESERVE CAVEATOR - EDMONTON REGIONAL PLANNING COMMISSION.
822 036 232	18/02/1982	UTILITY RIGHT OF WAY GRANTEE - THE TOWN OF REDWATER. AS TO PORTION OR PLAN:8122954
042 472 904	28/10/2004	UTILITY RIGHT OF WAY GRANTEE - THE TOWN OF REDWATER. PO BOX 397 4924-47 STREET REDWATER ALBERTA T0A2W0 (DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY 042500224)
162 145 729	02/06/2016	MORTGAGE MORTGAGEE - HENRY YARMOLA C/O ENGELKING WOOD 403, 9426-51 AVE EDMONTON ALBERTA T6E5A6 ORIGINAL PRINCIPAL AMOUNT: $1,000,000

TOTAL INSTRUMENTS: 012

(CONTINUED)

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 6 DAY OF MAY, 2019 AT 03:08 P.M.

ORDER NUMBER: 37176221

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

Appendix G

HRA Clearance Letter

Alberta

HRA Number: 4835-20-0014-001

March 12, 2020

Historical Resources Act Approval

Proponent: TeckEra Civil Engineering Consultants
18130 105 Ave NW #100, Edmonton, AB T5S 2T4

Contact: Mr. Glen Pitt

Agent: Black Fly Environmental Ltd.

Contact: Annissa Robertson

Project Name: **Redwater Industrial Subdivision**

Project Components: Industrial Subdivision

Application Purpose: Requesting HRA Approval / Requirements

Historical Resources Act approval is granted for the activities described in this application and its attached plan(s)/sketch(es) subject to Section 31, "a person who discovers an historic resource in the course of making an excavation for a purpose other than for the purpose of seeking historic resources shall forthwith notify the Minister of the discovery." The chance discovery of historical resources is to be reported to the contacts identified within Standard Requirements under the *Historical Resources Act*: Reporting the Discovery of Historic Resources.

Martina Purdon
Manager, Regulatory Approvals
and Information Management
Alberta Culture, Multiculturalism
and Status of Women

Lands Affected: All New Lands

Proposed Development Area:

MER	RGE	TWP	SEC	LSD List
4	21	57	29	3-6

Documents Attached:

Document Name	Document Type
Illustration of phased construction	Review
Project footprint figure	Illustrative Material

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS
Coordinate System: NAD 1983 10TM AEP Resource
Projection: Transverse Mercator
Datum: North American 1983
Revison Date: November 30, 2018
Drawn By: Nadine Clifton

0 20 40 80 120 160 Meters

N

Current Wetland Extent

Field Work: October 10, 2018

Project Name: Red Water Wetlands
Legal Land Description: SW-29-57-21 W4

Figure Number: 1.0

Prepared By: BLACK FLY ENVIRONMENTAL

Prepared For: TECKERA civil engineering consultants