Bylaw 2020-29
Appendix A

SHIPWAY

AREA STRUCTURE PLAN

TOWN OF MILLET

November 2020

HELIX Engineering Ltd.

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Table of Contents

1. INTRODUCTION

The Town of Millet requires an Area Structure Plan (ASP) for the industrial yard development proposed by Mr. Robert Shipway. For this purpose, Helix Engineering Ltd. has been retained to complete the ASP in compliance with the Town of Millet requirements.

This ASP describes how the subject land will be developed, both in terms of land uses and infrastructure while following the policies, bylaws and standards of the municipality. The plan will illustrate the how the area fits in and connects to the existing and future development within the Town of Millet.

The ASP has been developed in compliance with Section 633 of the Municipal Government Act.

1.1. Purpose of the ASP

The purpose of the Shipway ASP is to provide a plan consistent with other statutory plans and to provide a land use concept for industrial development within the plan area. The plan will establish an implementation strategy based on the development phasing.

1.2. Site Location

The plan area is located within the Town of Millet. The proposed development is entirely contained within the N.W. 1/4 SEC. 28-47-24-W4M as shown in Figure 1 "Site Location Plan". The area is bounded by:

- On the North: Township Road 475 (also known as Highway 616)
- On the West: Range Road 244
- On the East: N.E. ¼ SEC. 28-47-24-W4M
- On the South: S.W. ¼ SEC. 28-47-24-W4M

1.3. Land Ownership

The project area, which is approximately 59.71 ha (147.54 ac), is owned by Shipway Farms Ltd.

1.4. Current and Adjacent Land Uses

Current adjacent land uses are presented in Figure 2. The quarter section contains 3 parcels outside of the balance. There are two country residential parcels with CR zoning, a waste transfer station zoned IN, and the remainder of the quarter zoned IN. Lands to the south are Country Residential.

1.5 Purpose of the Development

The purpose of the development is to provide industrial lands for development within the Town of Millet. Subdivision and development of the land will follow the framework of the ASP. The final lot layout will be subject to subdivision. The development concept is shown on Figure 3. This figure also shows possible phasing of the development. Ultimate phasing will be subject to market demand at the time of subdivision but will generally progress in the manner shown.

Phase 1 is the existing pipe storage yard in the north west corner of the development. Subdivision of this phase is eminent. Phase 2 is also an existing pipe storage yard. The existing storage yard is a discretionary in

the Industrial District of the land use bylaw. As part of this ASP, pipe storage yards area a permitted use. The remainder of the lands are subject to the permitted and discretionary uses.

1.2 Site Land Use Statistics

Total area of the current Shipway development plan is 59.75 ha (147.64 ac). The MGA allows the Town of Millet to require up to ten percent (10%) of the area be dedicated as Municipal Reserve (MR). This can be taken in the form of land, cash in lieu of land, or a combination thereof. This development will require MR in the amount of 5.975 ha. The Town of Millet will require cash in lieu of land for Industrial developments.

Table 3

Land Use Summary			
	Pt. NW28-47-24-W4M		
Land Use	**ha**	**ac**	**%**
Net Developable Area	**59.75**	**147.58**	**100.0%**
Industrial	**46.71**	**115.37**	**78.2%**
M Zoning	46.71	115.37	78.2%
Roads	**5.65**	**13.96**	**9.4%**
Road Widening	0.62	1.53	1.0%
Internal Roads	5.03	12.42	8.4%
Utilities	**7.39**	**3.51**	**12.4%**
PUL's	1.42	3.51	2.4%
Storm Water Management	5.97	14.75	10.0%

2. STATUTORY FRAMEWORK

2.1. Town of Millet Municipal Development Plan (MDP) #2014-10

The Municipal Development Plan (MDP) outlines the vision and guiding principles forming the framework for future growth and development within the Town. The area considered for this ASP has been annexed since the creation of the MDP. The plan designates the land adjacent to and west of the ASP area as industrial which aligns well with the proposed ASP. Further, the MDP lists seven (7) goals related to industrial development. The ASP aligns with these goals.

2.2. Intermunicipal Development Plan, Town of Millet Bylaw #201706

The Town of Millet and the County of Wetaskiwin created an Intermunicipal Development Plan for the area of the County that abuts and surrounds the Town. The IDP designates the subject lands as a short-term annexation area. This annexation has since occurred. The IDP further designates the subject lands as future industrial. The proposed ASP aligns with IDP.

2.3. Town of Millet Land Use Bylaw #2018-11

The Town of Millet's Land Use Bylaw controls development of lands within the ASP. The existing land use is IN, essentially an industrial holding district for annexation lands. The ASP will designate the lands M-Industrial District. The M district has a list of permitted and discretionary uses. It is intended the area contained in Phase 1 and Phase 2 continue to provide outside storage as a primary use, consistent with the existing development. Subsequent phases will be subject to the terms of the Land Use Bylaw.

3. THE APPROVAL PROCESS

The Town of Millet has Municipal Planning Commission (MPC). The ASP will be reviewed by administration, and then presented to MPC. MPC will recommend adoption to Council. Council will hold a public hearing and adopt the ASP as a bylaw.

Following approval of the ASP, a land use bylaw amendment will re-zone the land to M – Industrial. Following re-zoning, the first and subsequent subdivisions can be processed.

3.1. Public Input

Public input for this project was collected in coordination with the County of Wetaskiwin as the land was in that jurisdiction at the time. Since that time, the land has been annexed by the Town .

- An open house was scheduled with adjacent land owners and other stakeholders 9 people attended, a list of the attendees is enclosed in Appendix F and their comments.

- The open house was held on Thursday February 4, 2016 from (6:00PM to 9:00PM) in the Hugo Witt Room in the Town of Millet Banquet Facilities (5290 45 Avenue). Main issue is they wanted Berms and Trees installed in the M.R. that was previously shown on Figure 3. The Berm on the south side is part of the DP13/159 and will have to be completed prior to any new development. All outstanding conditions on DP13/159 will have to be completed. *All* Berms required including the berm north of Block A will be constructed by client prior to any future development.

The references to MR and DP13/159, while accurate at the time of the meeting, are no longer valid. Buffering between residential and industrial uses remains a concern. This is addressed in Section 5.3.

3.2. Technical Reports

A number of technical reports have been prepared in support of the Area Structure Plan. These reports, as listed below, are included in the Appendices.

- Historical Resources Application (Appendix B)
- Geotechnical and groundwater percolation report (Appendix C)
- Stormwater management (Appendix D and E)
- Traffic Impact Assessment (Appendix F)

4. EXISTING CONDITIONS AND DEVELOPMENT CONSIDERATIONS

4.1. Topography and Vegetation Conditions

The study area is relatively flat. The surface has a gradual natural slope from east to west and north to south as shown on Figure 4, Existing Features.

The Shipway property currently has a storm water retention pond and ditches which convey storm water to the pond for Phase 1and 2. The site mainly consists of a hay field with a rolling terrain. The natural ground surface elevation of the section changes from 761.25 meters in the NE corner of the lot to 748.95 meters in the SW corner. Over approximately 1382 meters, this results in an average slope of 0.89%

4.2. Archeological Concerns

No historical resource has been identified in the development area according to the site visits and correspondence done with Alberta Historical Resource. The result of that correspondence is attached in Appendix B, “Historical Resource Application”.

4.3. Environmental Concerns

According to a Joint Economic Development Initiative report which has been prepared by Stantec in March 2011, the subject land is located in Area C and does not contain Environmentally Significant Areas (ESA). At the subdivision stage further analysis may be required by a qualified Geotechnical/ Environmental Engineer to ensure no environmental concerns have occurred on the proposed development. As Shown on Figure 4 the existing transfer station / storage site means a waste management facility, where waste, other than hazardous waste is stored, sorted, processed and is collected and held for removal to another waste management facility. Food establishments cannot be within 300m of the Transfer station unless approvals from the minster has been granted. The 300m radius from the abandoned landfill on the adjacent property to the north is also shown of Figure4. No food establishment can be within the 300m of the abandoned landfill.

4.4. Soil Conditions

A geotechnical evaluation and soil investigation report has been prepared by Shelby Engineering Ltd. for the pond area only and is submitted separately. Based on that report, a layer of topsoil (175mm to 300mm) overlying sand (0.6m below the grade) and silt or clay till (0.9m to 1.0m below the grade) underlain by shallow bedrock exists. Clay shale and sandstone extend to the maximum drilling depth and no particular sloughing or ground water has been observed at less than 2.25 meters depth.

Details of the geotechnical study and the report can be found in Appendix C.

4.5. Storm Water Management

Area Consulting Inc. prepared a design brief for the Storm Water Management (SWM) facilities. The brief is included in Appendix E. The proposed SWM system will consist of surface drainage system directing runoff to ponds using existing and proposed ditches. The pond will be discharge to the existing public ditch at the southwest corner of the site The system is proposed to meet the requirements of the Town of Millet and Alberta Environment and has been previously approved and registered under No. 330707-00-00 and name of Mr. Robert Shipway (Appendix D) for phases 1 and 2.

The system is designed to control the post-development runoff rates to pre-development rates. The SWM facility and performance of the pond is based on runoff rates resulting from a 1 in 100 year design rainfall event.

Alberta Environment notifications and approvals will be required with any expansion or construction of new ponds.

4.6. Traffic and Transportation

A Traffic Impact Assessment (TIA) has been prepared by AREA Consulting Inc. for the proposed development to determine the required treatments to accommodate existing and future traffic volumes pattern with horizon year of 2035. The detailed report can be found in Appendix F.

4.6.1. Circulations and Access

The site is bounded by Highway 616 (TWP RD 475 also known as 45 Avenue) to the north and Range Road 244 to the west as shown on Figure 5. HWY 2A (also known as 50 street) intersects HWY 616 approximately 350 m east of the site, shown as intersection 2 in Figure 5.

The site currently has two driveway accesses from HWY 616. The west access will be removed and the east access will become a public road intersection in the future, aligning with the requirements of the Railside ASP to the north.

The site currently has two driveway accesses from RR 244. The north access will remain as a driveway access to a future lot. The south access will be removed and a new road intersection will be provided.

The developer is willing to contribute one half ½ to the intersection treatment on TWP 475 and the main access in conjunction with Railside development. The developer will also contribute to upgrading RR from intersection 1 (in Figure 5) towards the proposed access on west side of the quarter section.

4.6.2. Traffic Study

Based on the outcome of the traffic study, the proposed intersection of the site road and HWY 616 will be a Type 1A with a stop sign. The study also indicates that traffic growth may warrant the HWY 616 and HWY 2A intersection be upgraded to signals. Details of the analysis and calculation are presented in TIA, attached as Appendix F.

4.6.3. Road Construction

All road design and construction will be in accordance with Town of Millet – Policy #51, Minimum Design Standards. Servicing and Existing Utilities

4.7. Servicing

4.7.1. Servicing Objectives

- Existing utilities are shown in Figure 6. Currently there are deep services available for the proposed site. Offsite levies must be paid prior to connecting to the municipal services.
- To provide appropriate servicing in a rural development context in accordance with the servicing concept.
- To utilize storm water management areas in the plan as amenity areas and maximize visual connections from internal streets.

- To recognize and accommodate existing and future underground utilities.

4.7.2. Servicing Policies:

- Water Service: water supply network is available from the Town of Millet once offsite levies have been paid. There is no need for a new potable water system at this time and will be required once the land gets subdivided in the future.
- Wastewater Services: sanitary services are available from the Town of Millet once offsite levies have been paid. If required, the owner will be responsible for a temporary sanitary facility in accordance with the Alberta Private Sewage Regulation.
- Storm water servicing: as outlined in the past and revised stormwater management report in Appendix E. Alberta Environment will be contacted to obtain new approvals.

4.7.3. Shallow Utilities

The owner will coordinate the servicing of all shallow utilities with the service providers in the area (for example Telus, Fortis, etc.)

- According to the Alberta Energy and Utilities Board, there are no sour gas wells or major oil/gas pipelines in the vicinity of the proposed development. See Figure 7.
- There is a Telus communication network on the north and west border of the quarter section.
- There is a Fortis power line on the north and west side of the quarter section.
- There is Co-op Gas pipeline located in Parts A and B of Phase 1 development, but it is not affected by the new development.

4.8. Fire protection

Fire protection can be provided with a hydrant connection to the existing and proposed storm ponds. Development permits will be subject to the requirements of the latest Fire Underwriters Survey.

5 IMPLEMENTATION STRATEGY

5.1 Area Structure Plan Approval

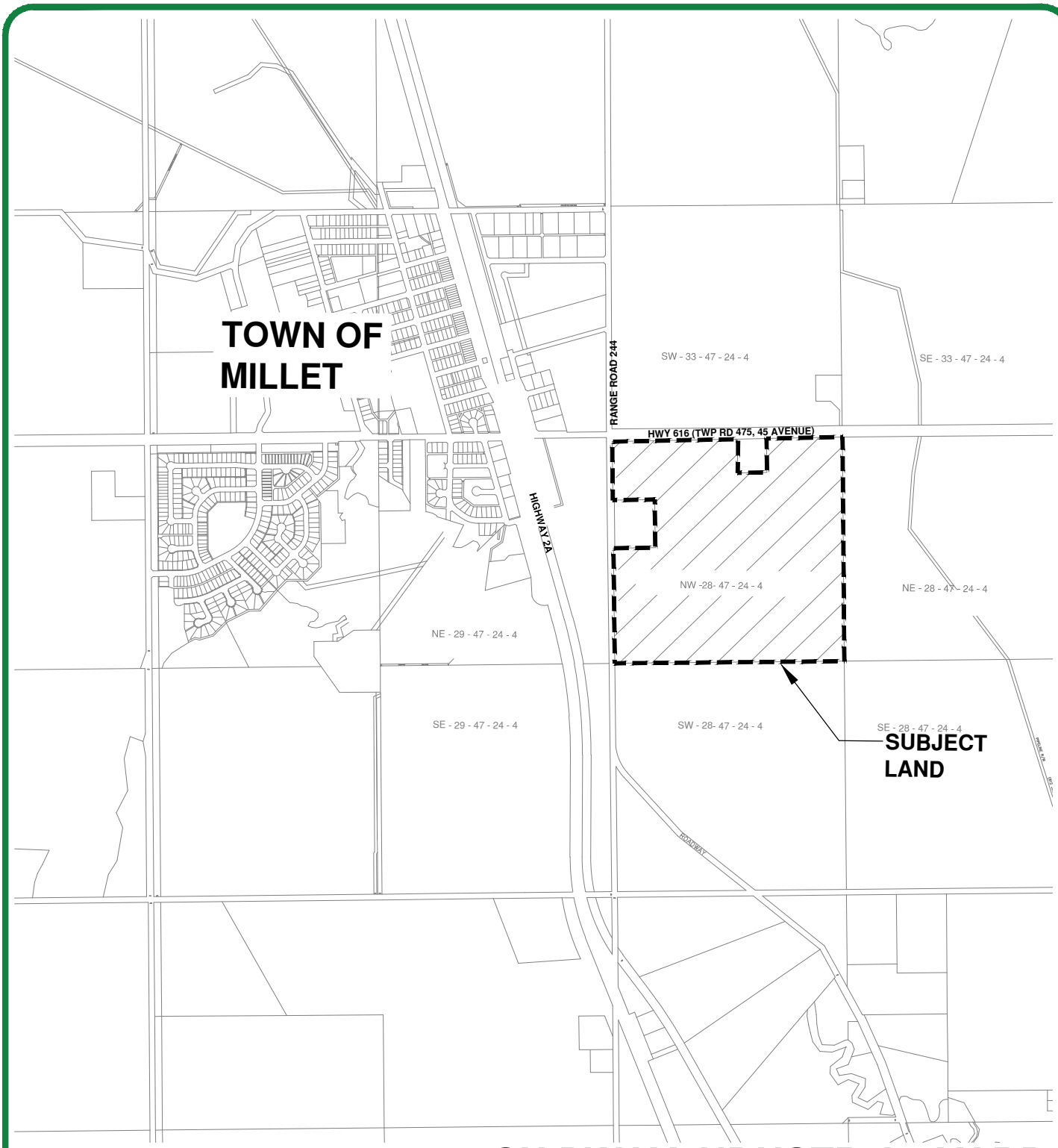
The first step for the implementation of the proposed development is the approval of the Area Structure Plan by the Town of Millet as a bylaw to ensure the goals, objectives and policies are met and satisfied.

5.2 Development Staging

The development staging is shown on Figure 3. All levies and cash in lieu of MR attributed to this plan area shall be calculated and paid on a per subdivision basis as part of the associated development agreement.

5.3 Land Use Buffering

Proposed Industrial developments within the plan area that are adjacent to the existing residential districts will provide on-site buffering and screening. A minimum width of 5m will be required. The buffer may include fencing, berms and landscaping. The requirement will be determined at the time of subdivision and the buffer will be attached to the land title.



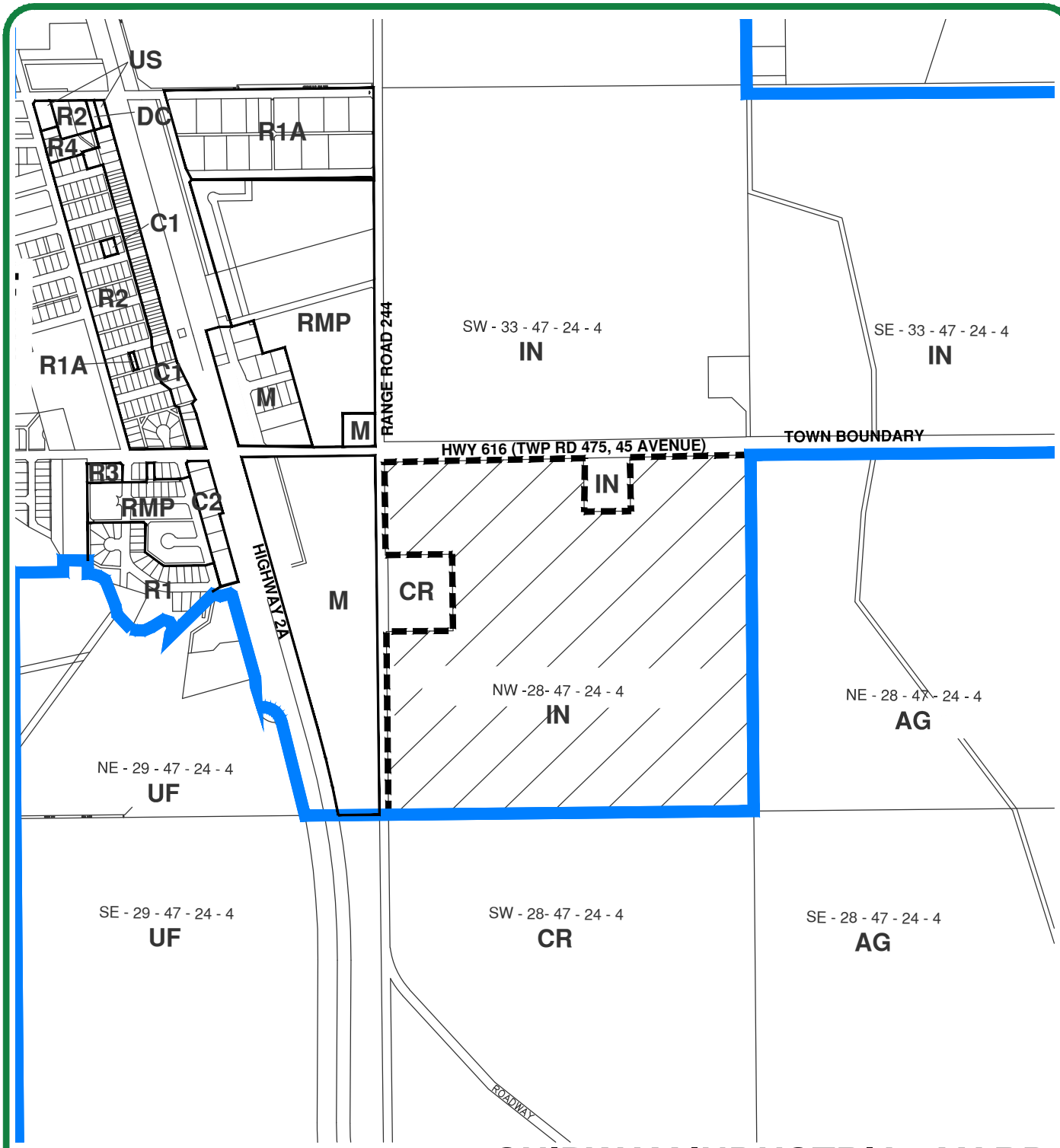
SHIPWAY INDUSTRIAL YARD

SHIPWAY FARMS
TOWN OF MILLET

FIGURE 1
SITE LOCATION PLAN

HELIX Engineering Ltd.

2470-001-ASP-FIG1.DWG Oct. 28, 2020 4:40 PM



Regular Districts

R1A	Residential Redevelopment District
R2	Low Density Residential District
R3	Medium Density Residential District
R4	High Density Residential District
RMP	Manufactured Home Park District
C1	Downtown Commercial District
C2	Highway Commercial District
M	Industrial District
US	Urban Service and Open Space District
DC	Direct Control District

Annexed Lands Districts

CR	Country Residential District
IN	Industrial District
UF	Urban Fringe District

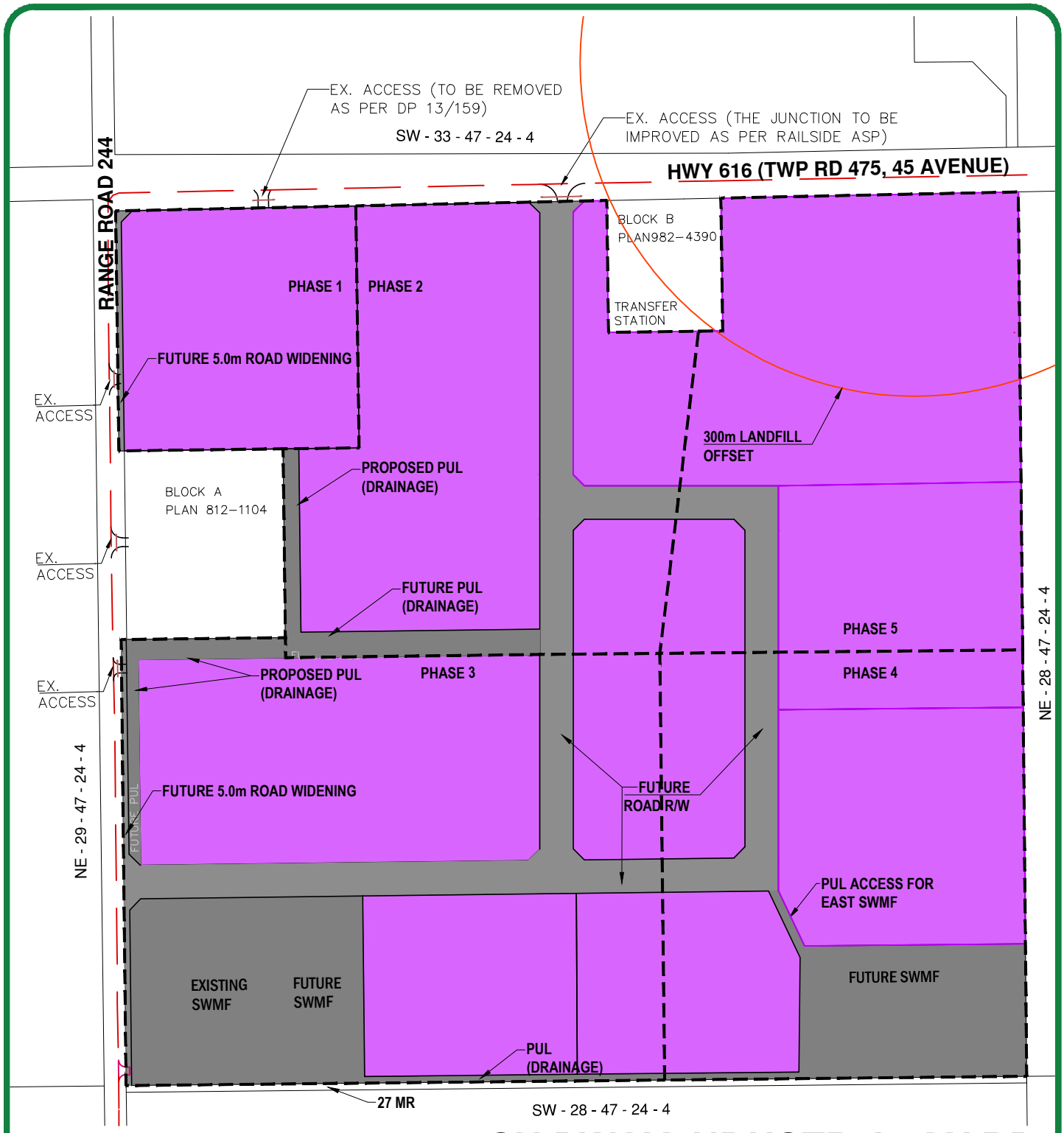
SHIPWAY INDUSTRIAL YARD

SHIPWAY FARMS
TOWN OF MILLET

FIGURE 2
EXISTING LAND USE

HELIX Engineering Ltd.

2470-001-ASP-FIG1.DWG Oct. 29, 2020 8:40 AM



SHIPWAY INDUSTRIAL YARD

M-INDUSTRIAL

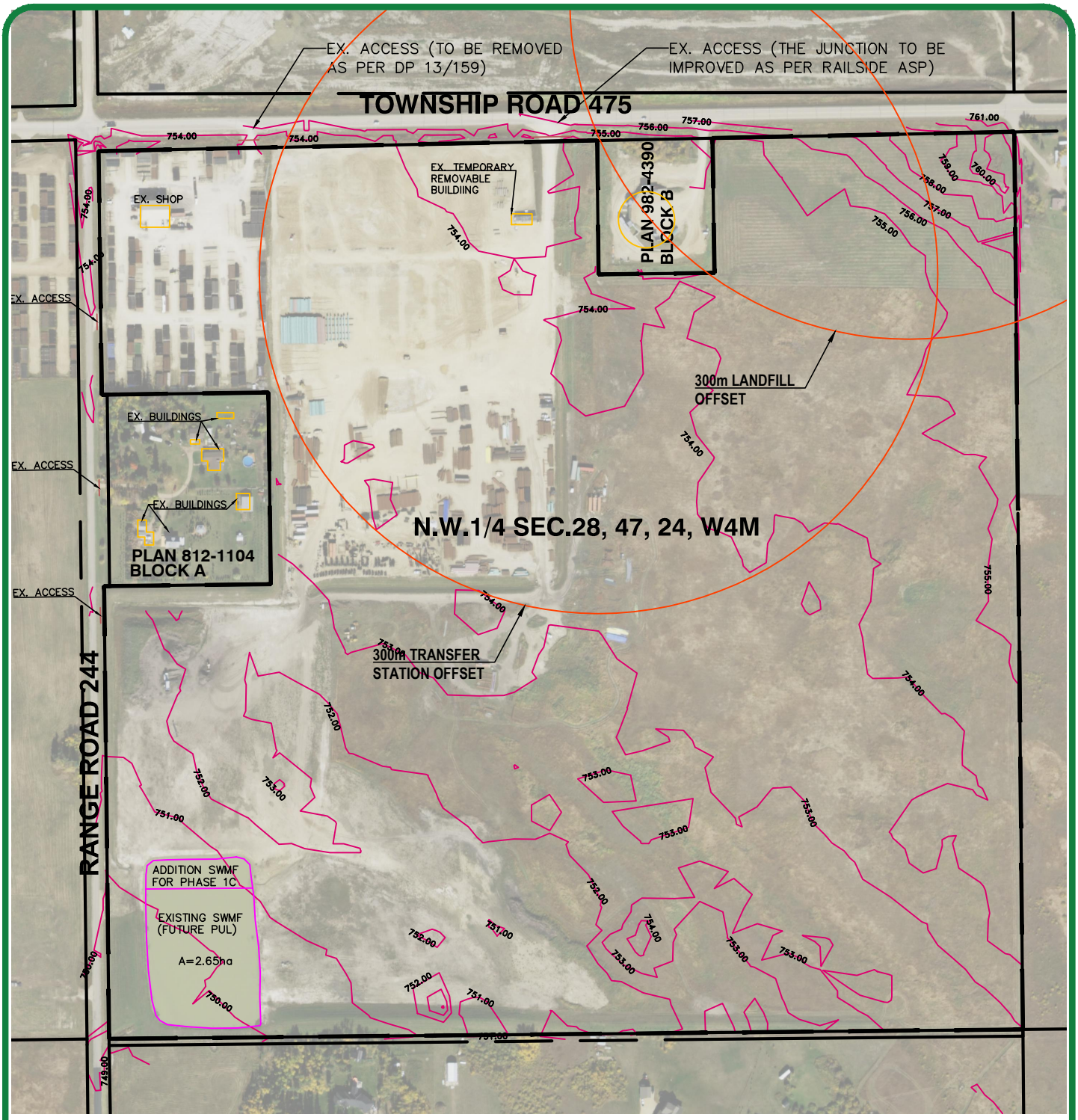
US-URBAN SERVICE AND OPEN SPACE

SHIPWAY FARMS
TOWN OF MILLET

FIGURE 3
PROPOSED LAND USE

HELIX Engineering Ltd.

2470-001-ASP-FIG3.DWG Oct. 29, 2020 8:44 AM



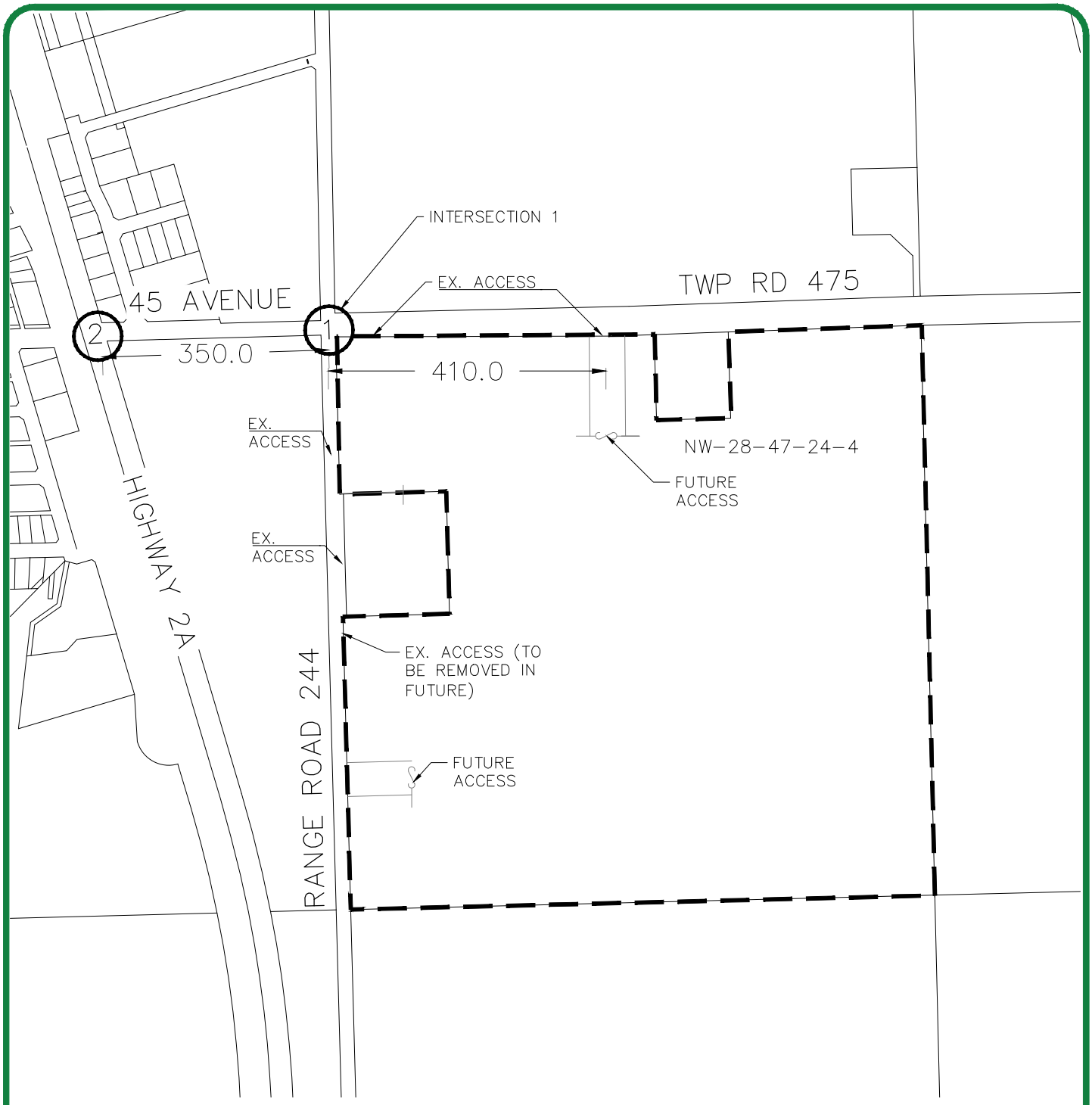
SHIPWAY INDUSTRIAL YARD

SHIPWAY FARMS
TOWN OF MILLET

FIGURE 4
EXISTING FEATURES

HELIX Engineering Ltd.

2470-001-ASP-FIG5.DWG Oct. 28, 2020 5:16 PM



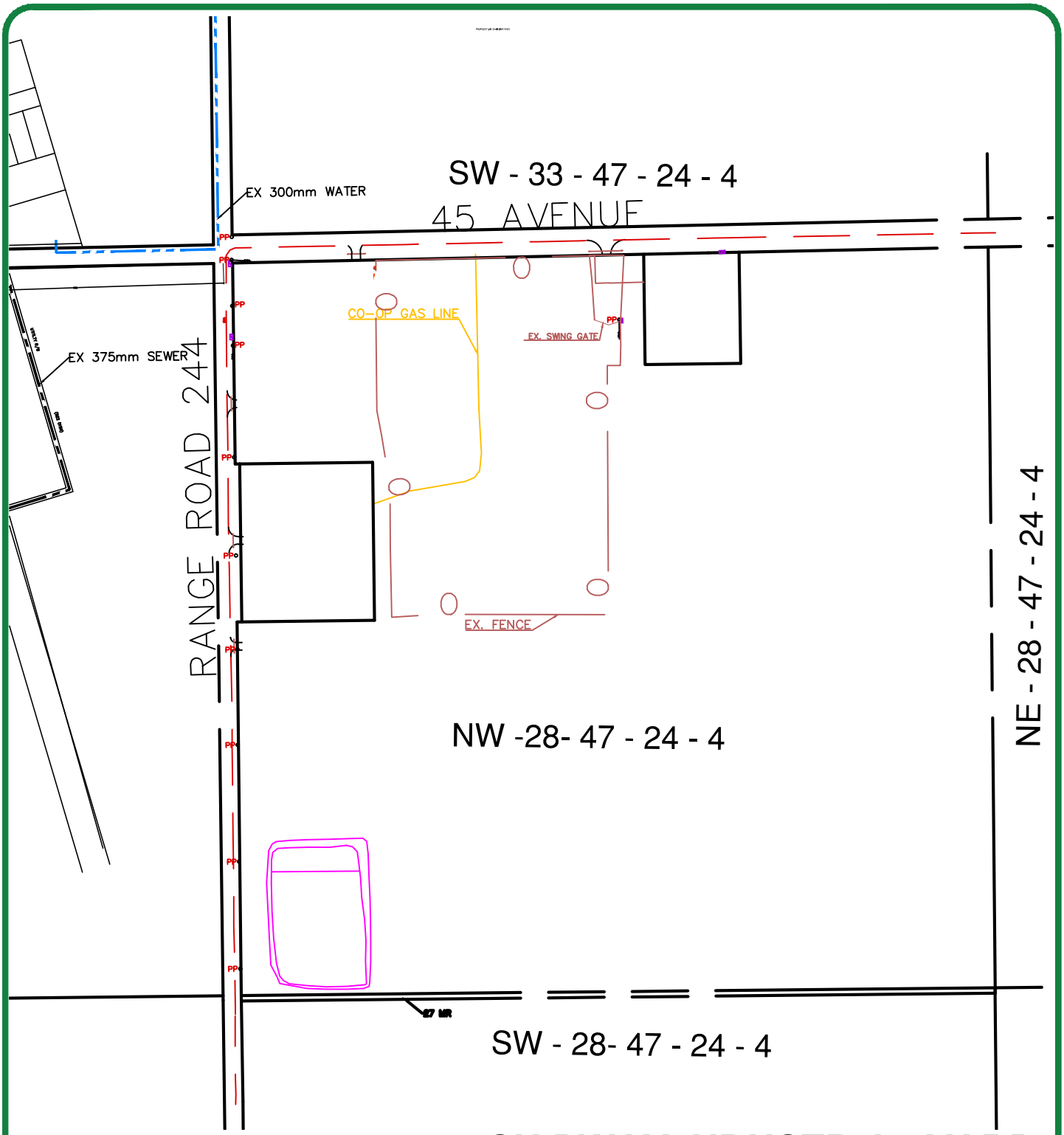
SHIPWAY INDUSTRIAL YARD

SHIPWAY FARMS
TOWN OF MILLET

FIGURE 5
ACCESS LOCATIONS

HELIX Engineering Ltd.

2470-001-ASP-FIG6.DWG Oct. 28, 2020 5:24 PM



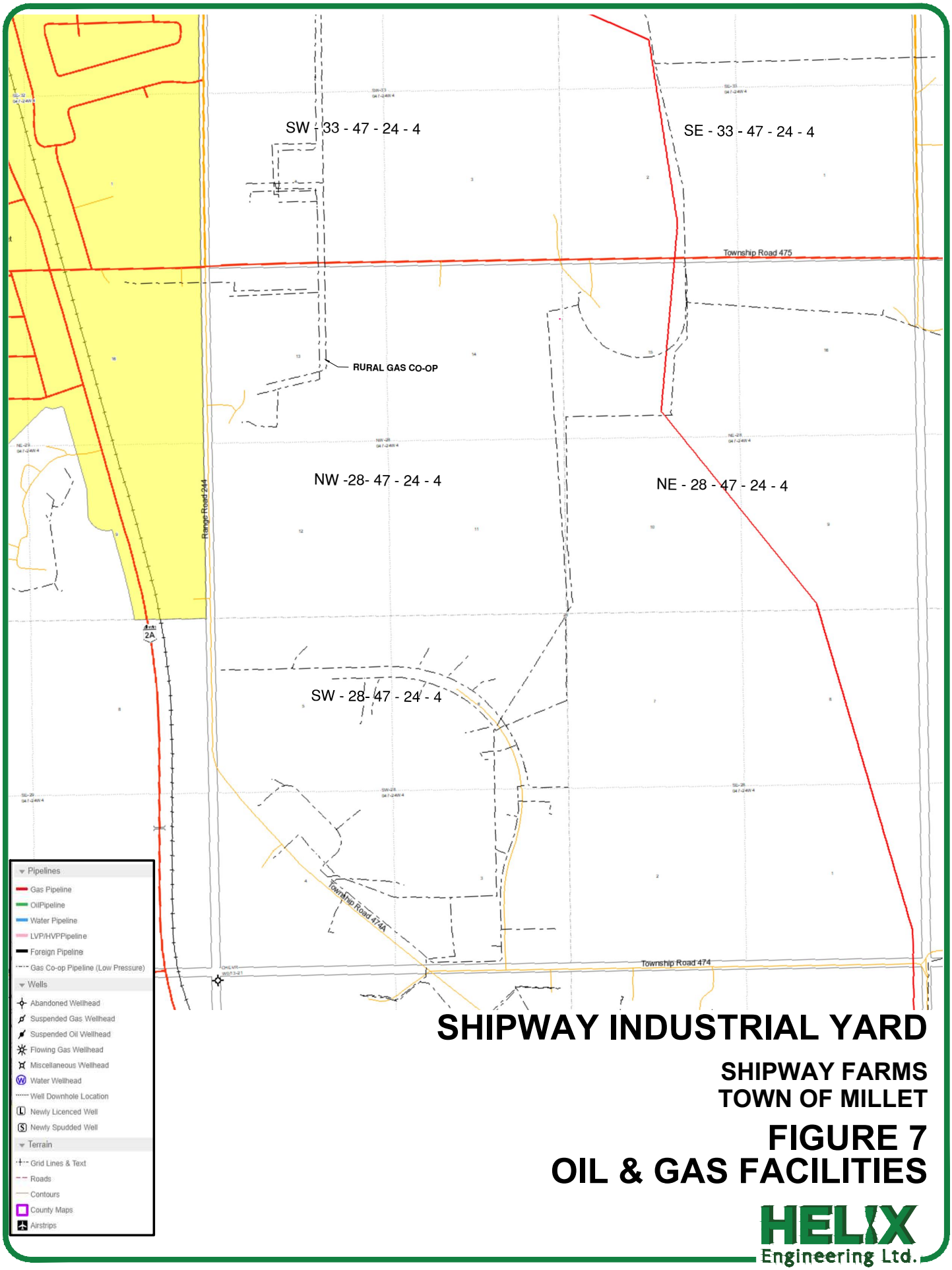
SHIPWAY INDUSTRIAL YARD

SHIPWAY FARMS
TOWN OF MILLET

FIGURE 6
EXISTING UTILITIES

HELIX Engineering Ltd.

2470-001-ASP-FIG7.DWG Oct. 29, 2020 9:00 AM



SHIPWAY INDUSTRIAL YARD

SHIPWAY FARMS
TOWN OF MILLET

FIGURE 7
OIL & GAS FACILITIES

HELIX Engineering Ltd.

2470-001-ASP-FIG7.DWG Oct. 29, 2020 9:12 AM

Appendix A

Land Titles

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0027 612 175	4;24;47;28;NW	162 272 550

LEGAL DESCRIPTION

THE NORTH WEST QUARTER OF SECTION TWENTY EIGHT (28)
TOWNSHIP FORTY SEVEN (47)
RANGE TWENTY FOUR (24)
WEST OF THE FOURTH MERIDIAN
CONTAINING 64.7 HECTARES (160 ACRES) MORE OR LESS.
EXCEPTING THEREOUT:

		HECTARES	(ACRES) MORE OR LESS
A) PLAN 3446NY	ROAD	0.421	1.04
B) PLAN 8121104	SUBDIVISION	2.50	6.18
C) PLAN 9422421	ROAD	0.805	1.99
D) PLAN 9824390	SUBDIVISION	1.22	3.01

EXCEPTING THEREOUT ALL MINES AND MINERALS

ESTATE: FEE SIMPLE

MUNICIPALITY: TOWN OF MILLET

REFERENCE NUMBER: 982 271 905 +1

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
162 272 550	29/09/2016	TRANSFER OF LAND	$230,000	$1

OWNERS

SHIPWAY FARMS LTD.
OF BOX 58
MILLET
ALBERTA T0C 1Z0

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
902 324 168	06/11/1990	UTILITY RIGHT OF WAY GRANTEE - ICG UTILITIES (ALBERTA) LTD.

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS

TOTAL INSTRUMENTS: 001

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 29 DAY OF OCTOBER, 2020 AT 10:58 A.M.

ORDER NUMBER: 40408098

CUSTOMER FILE NUMBER: 2470-001

END OF CERTIFICATE

Appendix B

Historical Resource Application

Alberta
Culture and Tourism

Historic Resources Application

Activity Administration

Date Received: October 20, 2015 HRA Number: 4835-15-0136-001

Project Category:	Subdivisions (4835)

Application Purpose:	☑	Requesting HRA Approval / Requirements
Lands Affected	☑	All New Lands

Project Type:	☑	Industrial Subdivision	ESRI Shapefiles are attached (yes/no)	no
			Approximate Project Area (ha)	59
			Lot, Block, Plan	NW SEC. 28-47-24-W4M

Project Name:	Shipway Industrial Yard ASP
Additional Name(s):	

Key Contact:	Ali Shmoury	Affiliation:	AREA Consulting Inc.
Address:	15524 47 Street	City / Province:	Edmonton, AB
Postal Code:	T5Y 3L8	Phone:	(780) 278-4834
E-mail:	Ali@areaconsulting.ca	Fax:	() -
		Your File Number:	

Proponent:	Shipway Farms Ltd.	Contact Name:	Robert Lyle rls Shipway
Address:	Box 58	City / Province:	Millet, AB
Postal Code:	T0C 1Z0	Phone:	(780) 831-1200
E-mail:	bshipway@provincialrentals.com	Fax:	() -

Proposed Development Area					Land Ownership			
MER	RGE	TWP	SEC	LSD List	FRH	SA	CU	CT
4	24	47	28	11-14	☑	☐	☐	☐

Historical Resources Impact Assessment:					
For archaeological resources:					
Has a HRIA been conducted?	☐	Yes	☑	No	Permit Number (if applicable):
For palaeontological resource:					
Has a HRIA been conducted?	☐	Yes	☑	No	Permit Number (if applicable):

Historical Resources Act approval is granted 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 the Listing of Historic Resources.

George Chabot

October 29, 2015

Date

Appendix C

Geotechnical Report

GEOTECHNICAL EVALUATION

PROPOSED STORM WATER RETENTION POND

NW 28-47-24-W4M

MILLET , ALBERTA

Prepared For:
BOB SHIPWAY

Prepared By:

SHELBY ENGINEERING LTD.
9632 - 54 Avenue
Edmonton, Alberta
T6E 5V1

Phone: (780) 438-2540
Fax: (780) 434-3089
email: contact@shelbyengineering.ca

File No. 1-16,538

DECEMBER 2012

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1.0 INTRODUCTION

Shelby Engineering Ltd. (Shelby) has completed a geotechnical evaluation for a proposed Storm Water Retention Pond (SWRP or pond) to be located in Millet, Alberta.

Mr. Bob Shipway authorized this evaluation on October 14, 2012. This report is subject to the Standard Terms and Conditions for the Provision of Services by Shelby Engineering Ltd. contained in Appendix II.

The project will consist of the construction of a 6,290 cubic metre SWRP, to be located on the east side of Range Road 244, approximately 400 metres south of 45 Avenue (Secondary Road 616) in Millet, AB. It is anticipated the base of the SWRP will be situated approximately 4.5 metres below current grade. A berm will be constructed around the perimeter of the pond.

The field drilling and sampling program was undertaken on October 31, 2012 and was comprised of five test holes to a maximum depth of 6.4 metres below grade, where auger refusal occurred.

2.0 SITE DESCRIPTION

The site is located within the quarter section legally described as NW 28-47-24-W4M, just outside the southeastern limits of the Town of Millet, Alberta. Currently, the site is mainly a hay field with a rolling terrain.

3.0 FIELD INVESTIGATION

The subsurface conditions were examined by drilling a total of five test holes within the footprint of the proposed SWRP. Test hole logs are enclosed as Drawings 1 to 5, Appendix I, and the locations of the test holes are indicated on the Site Plan, enclosed as Drawing 6, Appendix I.

Disturbed soil samples were obtained at 0.3 metres below existing grade and thence at regular depth intervals of 0.76 metres for moisture content determination. A continuous field log was maintained and all samples were returned to our laboratory for visual confirmation of our field logs and for pertinent laboratory testing.

Laboratory testing consisted of visual classifications, moisture contents, Atterberg limits, hydrometer tests, and a permeability test on a composite sample. All field and laboratory test results are contained in the test hole logs.

3.1 SUBSURFACE CONDITIONS

The general stratigraphy encountered at test hole locations was comprised of topsoil underlain by sand or clay till followed by bedrock. The reader is advised that the consistency of and the extent of the various soil strata evidenced at test hole locations will vary between test borings and in areas of the site that have not been explored.

3.1.1 Topsoil

Topsoil was initially encountered in all test holes extending to depths ranging from 175mm to 300mm below existing grade. The topsoil was described as black in colour, silty or clayey and contained traces of rootlets.

3.1.2 Sand

Sand was encountered beneath the topsoil in one test hole, TH-2, extending to a depth of 0.6 metres below grade. The sand was described as fine grained, containing traces of clay till, and dry with the moisture content of one sample being 7%.

3.1.3 Clay Till

Clay till was encountered beneath the topsoil in two test holes, TH-1 and TH-3, extending to depths ranging from 0.9 metres to 1.0 metres below grade. The clay till was described as brown in colour, silty, sandy and contained traces of gravel and oxides. Hydrometer test on one sample of the clay till determined that it contained 0.5% gravel, 40.8% sand, 28.3% silt and 30.4% clay. Atterberg limits on one selected sample determined the clay till to be high plastic with a liquid limit of 60 and a plastic limit of 19. The in situ moisture content of the clay till ranged from 11% to 14%.

3.1.4 Bedrock

Bedrock comprised of interbedded layers of clay shale and sandstone was encountered beneath the topsoil, clay till or sand in all test holes extending to the maximum depth of drilling. A hydrometer test on one sample of the clay shale determined that it contained 0.0% gravel, 3.3% sand, 61.3% silt and 35.4% clay. Atterberg limit testing on one selected sample determined the clay shale to be high plastic with a liquid limit of 54 and a plastic limit of 24. The in situ moisture content of clay shale ranged from 8% to 27%, while that of sandstone ranged from 10% to 28%. Atterberg limits on a composite sample of clay shale and sandstone determined it to be medium plastic with a liquid limit of 35 and a plastic limit of 18. A falling head permeability test conducted on the composite sample determined it to be practically impermeable, with a permeability of 2.0×10^{-9} cm/sec.

3.2 GROUNDWATER OBSERVATIONS

The slough and groundwater conditions encountered in the test holes on completion of field drilling and at 23 days subsequent to standpipe installation are summarized below:

Slough and Groundwater Observations

	Depth Below Existing Grade (metres)		
	On completion of drilling		Water Level
Location	Slough	Water	After 23 Days
TH-1	No	Dry	Dry to 3.05m
TH-2	No	Dry	--
TH-3	No	Dry	2.25
TH-4	No	Dry	--
TH-5	No	Dry	2.55

Slough and groundwater conditions encountered on completion of field drilling are also recorded on the test hole logs enclosed in Appendix I.

4.0 RECOMMENDATIONS

It is our understanding the project will consist of the construction of a 6,290 cubic metre SWRP. The base of the pond will be situated approximately 4.5 metres below grade.

4.1 MATERIALS

Medium to high plastic clay, clay till, clay shale or sandstone may be used to form the shape of the pond and to construct the berms. The native soils comprised of the medium to high plastic clay till, clay shale and sandstone are considered suitable construction materials for this project. Any organic soil or topsoil may be used for final landscaping only and not as part of the structure of the pond berms or liner.

4.2 SITE PREPARATION

The pond area, including regions that will be beneath the berms, should be stripped of all topsoil, roots, or organic matter associated with any vegetation. These materials should be removed from the site and not used for the construction of berms or liner. The topsoil may be utilized on the exterior of the berms for landscaping purposes only.

The groundwater elevation ranged from 2.25 to over 3.05 metres below grade. The groundwater elevation will fluctuate both seasonally and annually with the highest elevation being recorded in the spring and early summer.

A 400 mm sand layer was encountered in TH-2. The sand should be over-excavated and removed from the site. Sand is not considered suitable material for construction of the berms or the liner.

4.3 COMPACTION

4.3.1 Berms

The clay till, clay shale and/or sandstone used to construct the berms should be placed and compacted in 200 mm thick lifts (prior to compaction) and compacted to 95 percent of Standard Proctor Maximum Dry density. The slopes of the interior and exterior sides of the pond should not exceed 1 vertical to 3 horizontal. Vegetation should be encouraged on the exterior sides, top and on the interior above the projected high water level of the pond to prevent erosion. A minimum top width of 3 metres and freeboard of 1 metre is recommended.

4.3.2 Clay Liner

The pond liner, which is constructed on the interior slope of the pond, should be comprised of medium to high plastic clayey material and should be placed in 150mm thick lifts and compacted to 95 percent of Standard Proctor maximum dry density at 2% to 4% over optimum moisture content. A minimum liner total thickness of 600 mm is recommended. The clayey soils for clay liners must be compacted to achieve a saturated hydraulic conductivity less than $1x10^{-7}$ cm/sec.

Testing should be undertaken during construction to ensure that the compaction specified is achieved.

The native clayey material (clay till, clay shale and a composite sample of clay shale and sandstone) was evaluated against the following minimum recommended requirements:

a) Soil must be a Unified Soil Classification of CI or CH
b) Soil must contain a minimum of 50% by weight which passes the No. 200 (0.075 mm) sieve
c) Soil must have a clay content of 20% (less than or equal to 0.002 mm) by weight or greater
d) Soil must have a plasticity index of 10 or greater
e) Soil must be a well graded material

Atterberg limits conducted on three samples (clay till, clay shale and composite clay shale/sandstone) determined that the native soils range from medium to high plastic, with plasticity indices ranging from 17 to 42, and therefore meet requirements a) and d) above.

Two hydrometer tests conducted on samples of clay till and clay shale determined that the clay/silt (grain sizes less than 0.075mm) content ranged from 58.7% to 96.7%, with clay contents ranging from 30.4% to 35.4%. The results also determined that the materials were well graded and will therefore meet requirements b), c) and e) above.

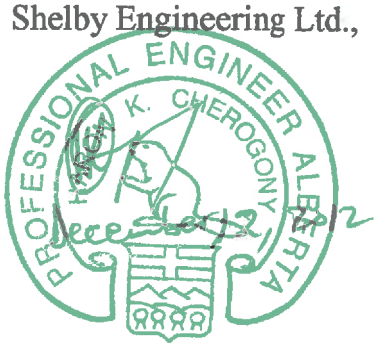
To assess the hydraulic conductivity of the soil at the site, a falling head permeability test was conducted on a composite sample of clay shale and sandstone obtained from the test holes at depths exceeding 2.95 metres below grade. The results indicated that the hydraulic conductivity of the soil was 2.0×10^{-9} cm/sec (i.e. practically impermeable) and will therefore be suitable for use as a clay liner.

5.0 CLOSURE

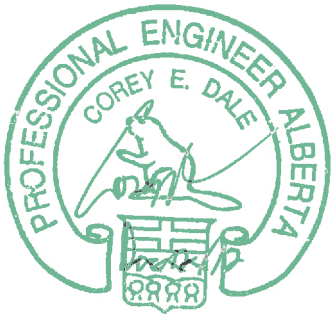
All services provided by Shelby Engineering Ltd. are subject to our Standard Terms and Conditions, which are attached in Appendix II.

Respectfully Submitted,

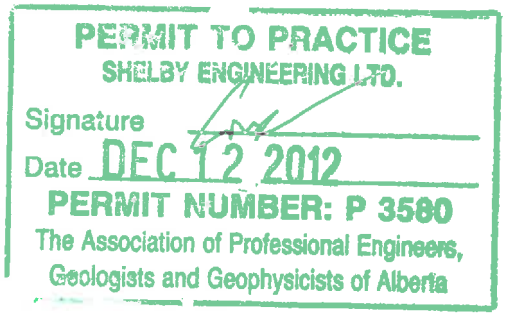
Shelby Engineering Ltd.,



Haron K. Cherogony, P. Eng.,



Corey E. Dale, P. Eng.

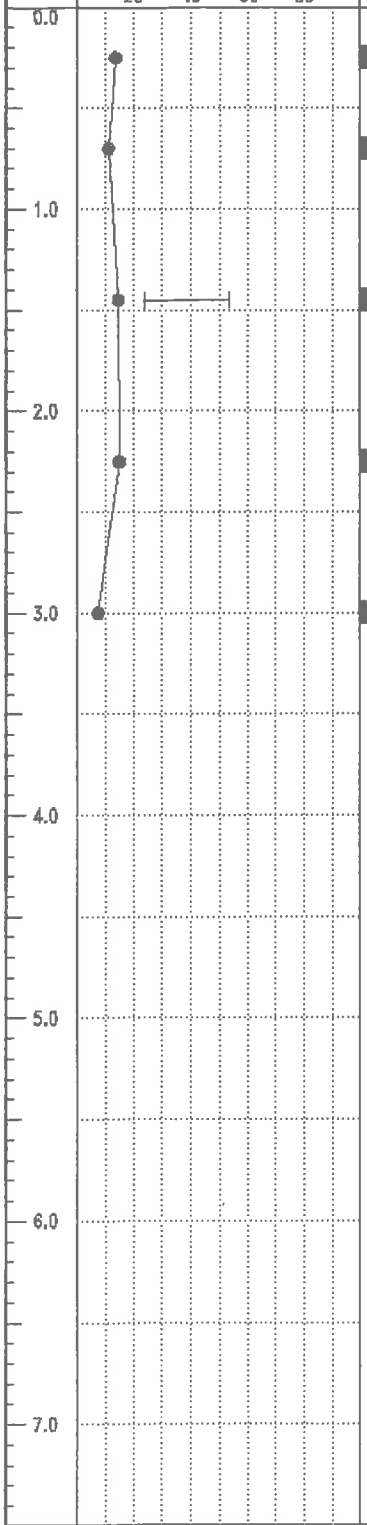


HC/CD: ab/Encl.
File #1-16,538
December, 2012

APPENDIX I

STORM WATER RETENTION POND	BOB SHIPWAY	TEST HOLE NO: TH-1
NW 28-47-24 W4	START DATE: 31/10/12	PROJECT NO: 1916538
PROJECT ENGINEER: HC	SOLID STEM AUGERS	ELEVATION: 99.12 m

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT | NO RECOVERY | HOLLOW STEM | SOLID STEM



SOIL DESCRIPTION

USC	SOIL SYMBOL	DESCRIPTION	ADDITIONAL TESTING	ELEVATION(m)
				99.0
OL		TOPSOIL: Black, silty, trace gravel, dry to 300mm depth.		
CH		CLAY TILL: Brown, silty, sandy, high plastic, very stiff, trace gravel, oxides white deposits.		98.0
		CLAY SHALE: Light bluish grey, hard, dry.	Grain Size Analysis Report	
CS		-whitish grey, very hard.		97.0
		AUGER REFUSAL @ 3.05 METERS. DRY ON COMPLETION. NO SLOUGH. STANDPIPE INSTALLED.	Dry after 23 days	96.0
				95.0
				94.0
				93.0
				92.0

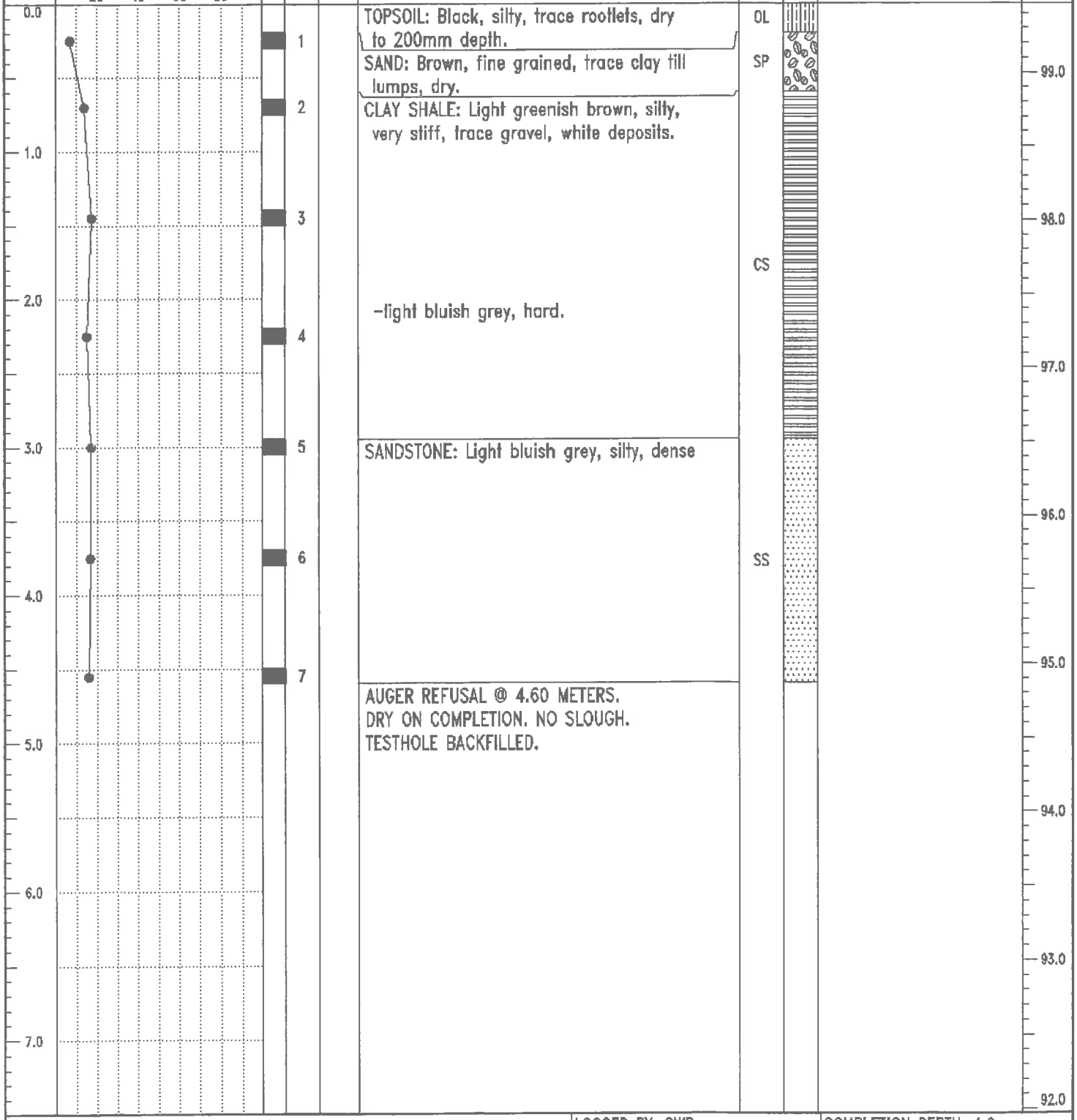
SHELBY ENGINEERING LTD.
Edmonton, Alberta

LOGGED BY: GWD	COMPLETION DEPTH: 3.05 m
REVIEWED BY: JPD	COMPLETE: 31/10/12
Fig. No: 1	Page 1 of 1

12/12/07 11:00AM (7.5H)

STORM WATER RETENTION POND	BOB SHIPWAY	TEST HOLE NO: TH-2
NW 28-47-24 W4	START DATE: 31/10/12	PROJECT NO: 1916538
PROJECT ENGINEER: HC	SOLID STEM AUGERS	ELEVATION: 99.47 m

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT | NO RECOVERY | HOLLOW STEM | SOLID STEM

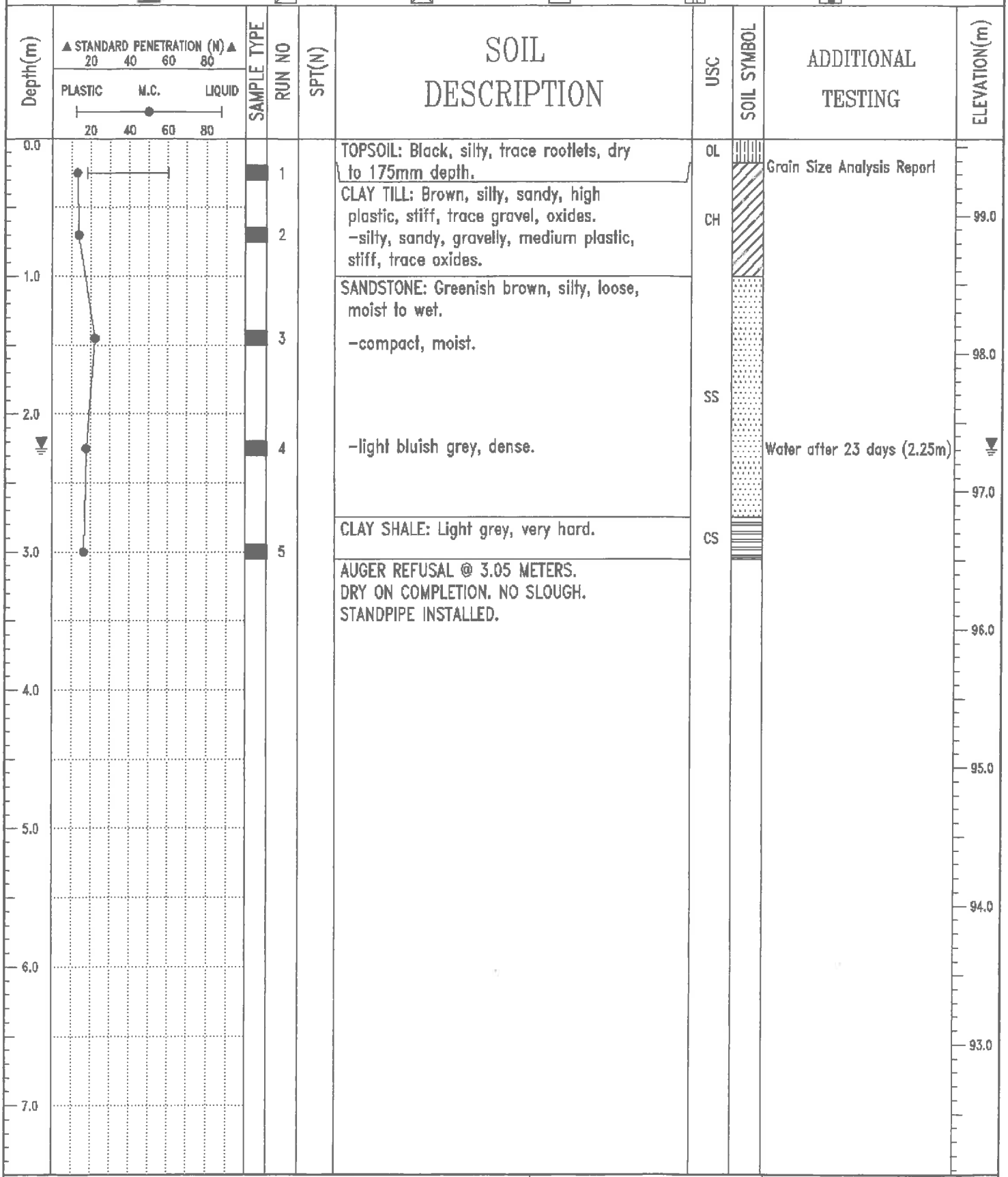


SHELBY ENGINEERING LTD. Edmonton, Alberta	LOGGED BY: GWD	COMPLETION DEPTH: 4.6 m
	REVIEWED BY: JPD	COMPLETE: 31/10/12
	Fig. No: 2	Page 1 of 1

12/12/07 11:00AM (7.5M)

STORM WATER RETENTION POND	BOB SHIPWAY	TEST HOLE NO: TH-3
NW 28-47-24 W4	START DATE: 31/10/12	PROJECT NO: 1916538
PROJECT ENGINEER: HC	SOLID STEM AUGERS	ELEVATION: 99.56 m

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT | NO RECOVERY | HOLLOW STEM | SOLID STEM

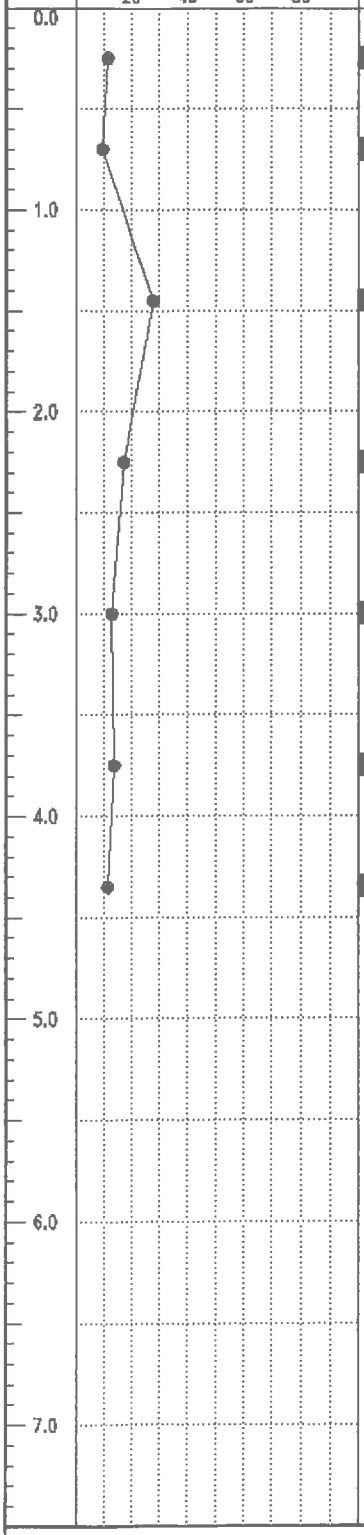


SHELBY ENGINEERING LTD. Edmonton, Alberta	LOGGED BY: GWD	COMPLETION DEPTH: 3.05 m
	REVIEWED BY: JPD	COMPLETE: 31/10/12
	Fig. No: 3	Page 1 of 1

12/12/07 11:00AM (7.5M)

STORM WATER RETENTION POND	BOB SHIPWAY	TEST HOLE NO: TH-4
NW 28-47-24 W4	START DATE: 31/10/12	PROJECT NO: 1916538
PROJECT ENGINEER: HC	SOLID STEM AUGERS	ELEVATION: 99.96 m

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT | NO RECOVERY | HOLLOW STEM | SOLID STEM



SAMPLE TYPE	RUN NO	SPT(N)	SOIL DESCRIPTION	USC	SOIL SYMBOL	ADDITIONAL TESTING	ELEVATION(m)
	1		TOPSOIL: Black, clayey, trace rootlets, dry to 250mm depth.	OL			
	2		SANDSTONE: Brown, silty, compact, trace oxides, moist.	SS			99.0
	3		-some clay shale lenses, trace oxides.	SS/CS			98.0
	4		CLAY SHALE: Light bluish grey, hard.				
	5		-light brown, hard.	CS			97.0
	6						96.0
	7		SANDTONE: Light grey, very dense.	SS			95.0
			AUGER REFUSAL @ 4.40 METERS. DRY ON COMPLETION. NO SLOUGH. TESTHOLE BACKFILLED.				94.0
							93.0

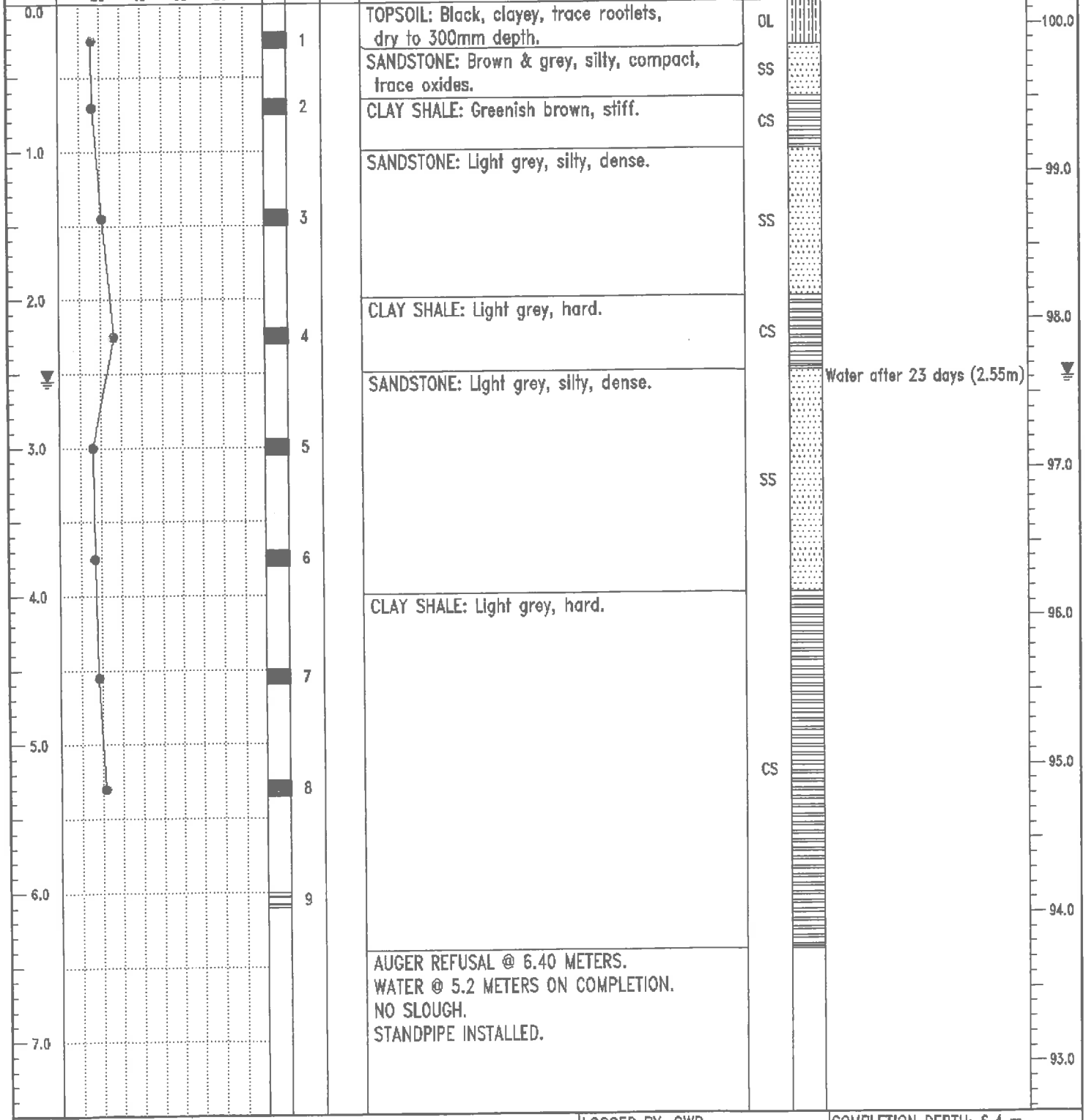
SHELBY ENGINEERING LTD.
Edmonton, Alberta

LOGGED BY: GWD	COMPLETION DEPTH: 4.4 m
REVIEWED BY: JPD	COMPLETE: 31/10/12
Fig. No: 4	Page 1 of 1

12/12/07 10:21AM (7.5M)

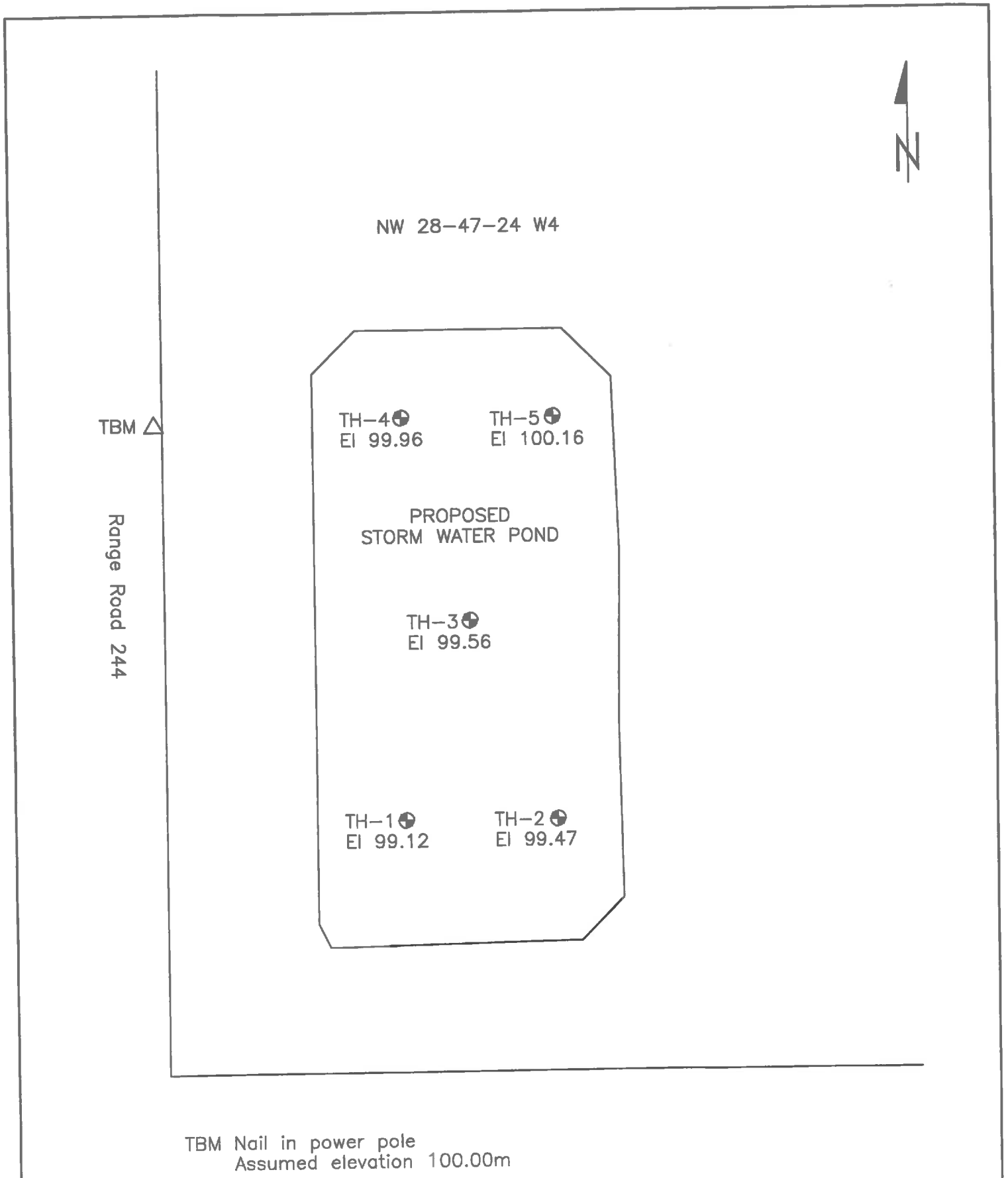
STORM WATER RETENTION POND	BOB SHIPWAY	TEST HOLE NO: TH-5
NW 28-47-24 W4	START DATE: 31/10/12	PROJECT NO: 1916538
PROJECT ENGINEER: HC	SOLID STEM AUGERS	ELEVATION: 100.16 m

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT | NO RECOVERY | HOLLOW STEM | SOLID STEM



SHELBY ENGINEERING LTD. Edmonton, Alberta	LOGGED BY: GWD	COMPLETION DEPTH: 6.4 m
	REVIEWED BY: JPD	COMPLETE: 31/10/12
	Fig. No: 5	Page 1 of 1

12/12/07 10:21AM (7.5M)



TBM Nail in power pole
Assumed elevation 100.00m

SHELBY ENGINEERING LTD.	JOB NO.: 1-16538	DATE: November 2012	
	SCALE: 1:1000	DWN BY: GWD	DWG NO: 6

SHELBY ENGINEERING LTD

GRAIN-SIZE ANALYSIS REPORT #7

By ASTM D422 Procedure

Client:	Bob Shipway
Attn:	

Plate No.:	
Job Number:	1-16538
Project:	Storm Water Retention Pond
Report Dist.:	

Date Sampled: Oct. 30, 2012 **Sample Time:** N/A

Sampled Location: TH 1 @ 5.0' **Sampled By:** GD

Date Tested: Nov. 14, 2012 **Tested By:** MM

Moisture Content: 10.6% **Crush Count:** N/A

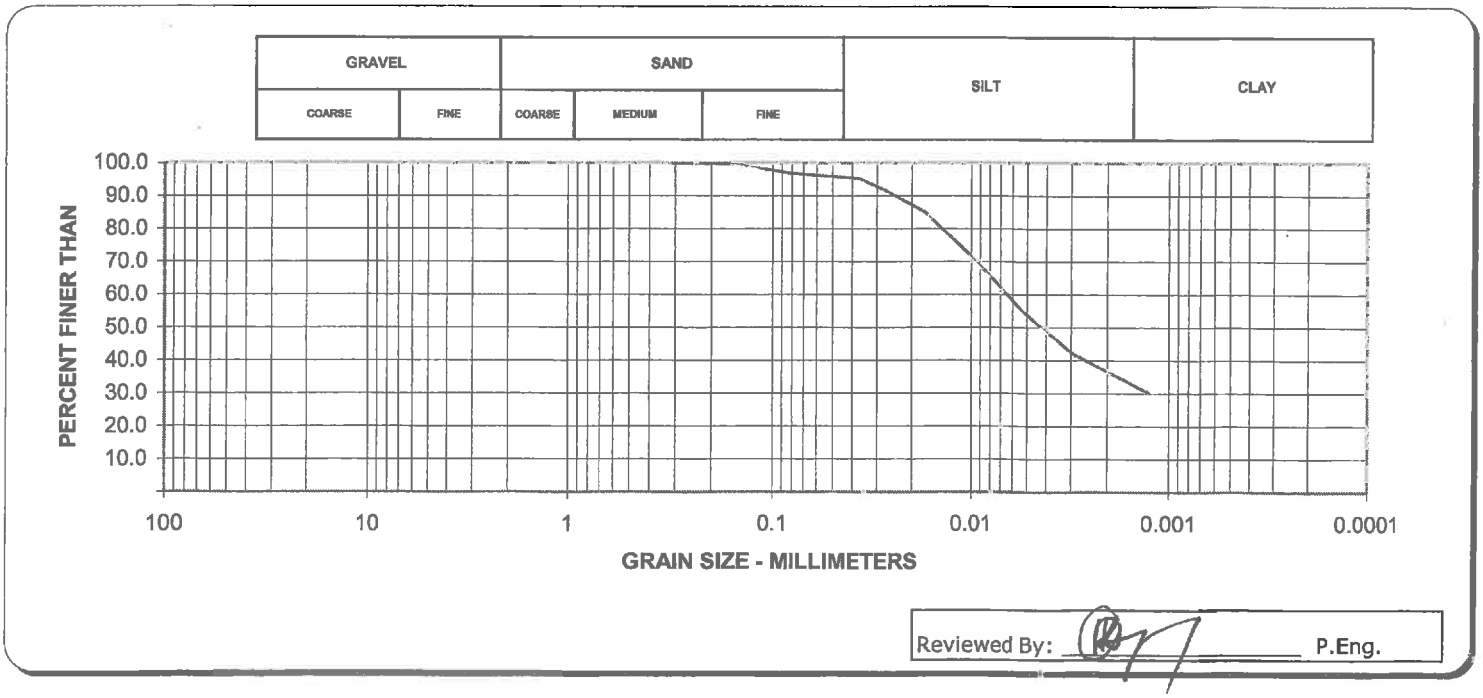
Sample Description: Clay shale, Green, silty.

Comments:

Distribution of Material:

% Gravel:	0.0%	% Silt:	61.3%
% Sand:	3.3%	% Clay:	35.4%

	Sieve Size (mm)	Percent Passing
Sieve Analysis		
	0.315	100.0
	0.16	99.8
	0.08	96.9
Hydrometer	0.0367	95.3
	0.0265	91.2
	0.0172	85.1
	0.0105	72.8
	0.0077	64.6
	0.0056	56.4
	0.0029	42.0
	0.0012	30.1



Reviewed By: _____ P.Eng.

Shelby Engineering Ltd.
Geotechnical and Materials Consultants

9632 - 54th Avenue
Edmonton, AB T6E 5V1

Phone: (780) 438-2540
Fax: (780) 434-3089

(Ver 07/2012)

SHELBY ENGINEERING LTD

#8

GRAIN-SIZE ANALYSIS REPORT

By ASTM D422 Procedure

Client:	Bob Shipway
Attn:	

Plate No.:	
Job Number:	1-16538
Project:	Storm Water Retention Pond
Report Dist.:	

Date Sampled: Oct. 30, 2012 **Sample Time:** N/A

Sampled Location: TH 3 @ 1.0' **Sampled By:** GD

Date Tested: Nov. 14, 2012 **Tested By:** MM

Moisture Content: 9.1% **Crush Count:** N/A

Sample Description: Clay till, Brown, CH, silty, sandy, trace gravel, oxides.

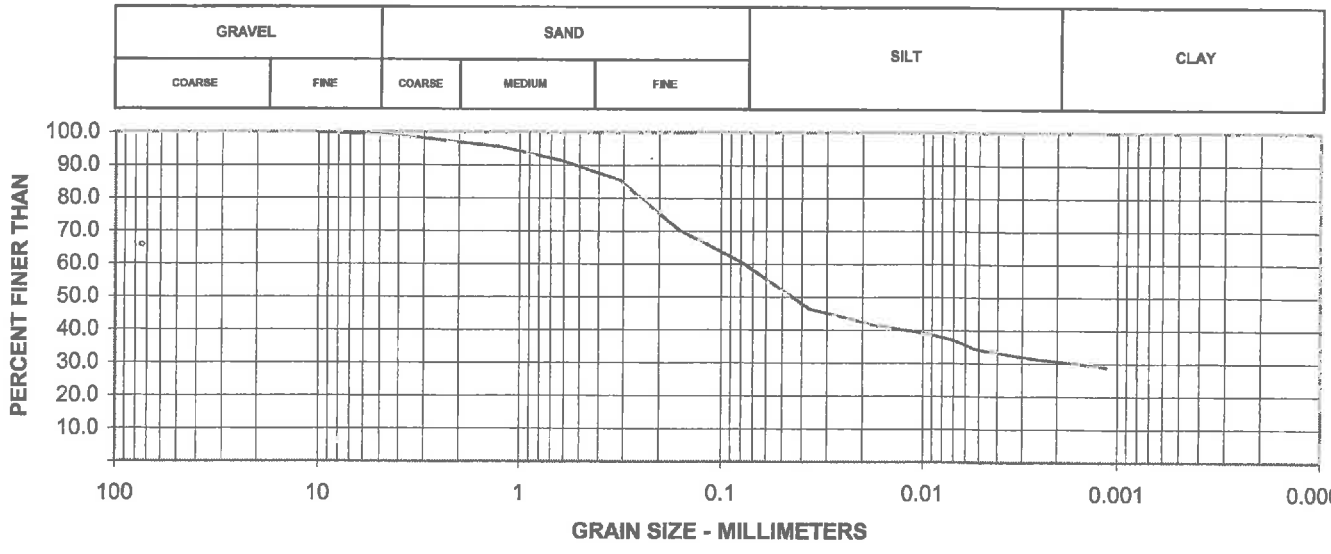
Comments:

Distribution of Material:

% Gravel: 0.5% **% Silt:** 28.3%

% Sand: 40.8% **% Clay:** 30.4%

	Sieve Size (mm)	Percent Passing
Sieve Analysis		
	10	100.0
	5	99.5
	2.5	97.8
	1.25	95.6
	0.63	91.5
	0.315	85.6
	0.16	70.3
	0.08	60.6
Hydrometer	0.0365	46.3
	0.0263	44.4
	0.0172	41.3
	0.0101	39.4
	0.0073	37.4
	0.0053	34.4
	0.0027	31.5
	0.0011	28.9



Reviewed By: _____ P.Eng.

Shelby Engineering Ltd.
Geotechnical and Materials Consultants

9632 - 54th Avenue
Edmonton, AB T6E 5V1

Phone: (780) 438-2540
Fax: (780) 434-3089

Coefficient of Permeability- Falling Head Method

Client	Bob Shipway	**Project**	Storm Water Retention Pond
Sampled By	GD	**Date**	10/30/2012 **File No.** 1-16538
Description of Sample	sandstone, some clayshale, trace sand		
Location	Combined THs from 10' below to perform test.		

Sample Data

Sample Thickness	3.94	cm	Sample & Mold	5176.2	g
Diameter	10.1	cm	Tare of Mold	4553.8	g
Area	79.21	cm^2	Sample Weight	622.40	g
Volume	312.40	cm^3			
Unit Weight	1691	kg/m^3	Actual % Compaction	98%	

Standpipe Data

Inside Diameter	0.6283	cm	
Area	0.31	cm	19/11/2012 8:27:00
Initial Head	198.80	cm^2	(after saturation)

Test Data

Date & Time	time(sec)	h_1 cm	h_2 cm	Δ h	Q	T °c	K_t	K_{20}
19/11/2012 15:49:00	26520	198.8	197.6	1.2	8.7E-08	22	3.5E-09	3.6E-09
20/11/2012 11:04:00	69300	197.6	195.3	2.3	1.2E-07	22	2.6E-09	2.7E-09
21/11/2012 7:52:00	74880	195.3	194.5	0.8	1.4E-08	22	8.4E-10	8.7E-10
22/11/2012 7:32:00	85200	194.5	189.8	4.7	4.3E-07	22	4.4E-09	4.5E-09
23/11/2012 7:43:00	87060	189.8	187	2.8	1.5E-07	22	2.6E-09	2.7E-09
26/11/2012 7:55:00	259920	187	180	7.0	3.3E-07	22	2.3E-09	2.3E-09
27/11/2012 7:49:00	86040	180	179	1.0	2.1E-08	22	1.0E-09	1.0E-09
28/11/2012 8:00:00	87060	179	176.1	2.9	1.7E-07	22	2.9E-09	3.0E-09
29/11/2012 8:30:00	88200	176.1	174.4	1.7	5.9E-08	22	1.7E-09	1.7E-09
30/11/2012 8:51:00	87660	174.4	173.5	0.9	1.7E-08	22	9.1E-10	9.3E-10
03/12/2012 8:31:00	258000	173.5	170.3	3.2	7.3E-08	22	1.1E-09	1.1E-09
04/12/2012 8:19:00	85680	170.3	169.4	0.9	1.8E-08	22	9.5E-10	9.8E-10
05/12/2012 9:16:00	89820	169.4	168.5	0.9	1.7E-08	22	9.1E-10	9.4E-10

SHELBY ENGINEERING LTD

Average K_t	2.0E-09	cm/sec
Average K_{20}	2.0E-09	cm/sec

SOIL CLASSIFCATION SYSTEM (MODIFIED U.S.C.)

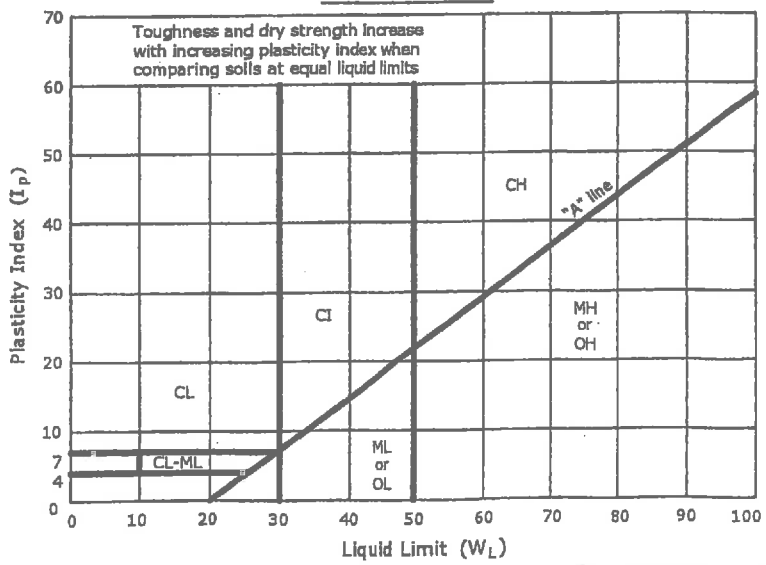
MAJOR DIVISION			GROUP SYMBOL	GRAPHIC SYMBOL	GROUP NAME	LABORATORY CLASSIFICATION CRITERIA
HIGHLY ORGANIC SOILS			PT		PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOR OR ODOR, AND OFTEN FIBROUS TEXTURE
COARSE-GRAINED SOILS (MORE THAN 50% RETAINED ON NO.200 SIEVE)	GRAVELS (MORE THAN 50% OF COARSE FRACTION RETAINED ON NO.4 SIEVE)	CLEAN GRAVELS (LESS THAN 5% FINES)	GW		WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, < 5% FINES	$Cu=\frac{D_{60}}{D_{10}}>4$ $\quad 1\le Cc=\frac{(D_{30})^2}{D_{10}\times D_{60}}\le 3$
			GP		POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, < 5% FINES	NOT MEETING ALL ABOVE REQUIREMENTS
		DIRTY GRAVELS (MORE THAN 12% FINES)	GM		SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, > 12% FINES	ATTERBERG LIMITS BELOW "A" LINE OR $I_p < 4$
			GC		CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, > 12% FINES	ATTERBERG LIMITS ABOVE "A" LINE OR $I_p > 7$
	SANDS (MORE THAN 50% OF COARSE FRACTION PASSES NO. 4 SIEVE)	CLEAN SANDS (LESS THAN 5% FINES)	SW		WELL-GRADED SANDS, GRAVELLY SANDS, < 5% FINES	$Cu>6$ and $1\le Cc\le 3$
			SP		POORLY-GRADED SANDS, OR GRAVELLY SANDS, < 5% FINES	NOT MEETING ALL ABOVE REQUIREMENTS
		DIRTY SANDS (MORE THAN 12% FINES)	SM		SILTY SANDS, SAND-SILT MIXTURES, > 12% FINES	ATTERBERG LIMITS BELOW "A" LINE OR $I_p < 4$
			SC		CLAYEY SANDS, SAND-CLAY MIXTURES, > 12% FINES	ATTERBERG LIMITS ABOVE "A" LINE OR $I_p > 7$
FINE-GRAINED SOILS (MORE THAN 50% PASSES NO. 200 SIEVE)	SILTS (BELOW "A" LINE ON PLASTICITY CHART; NEGLIGIBLE ORGANIC CONTENT)		ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	$W_L < 50$
			MH		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	$W_L > 50$
	CLAYS (ABOVE "A" LINE ON PLASTICITY CHART; NEGLIGIBLE ORGANIC CONTENT)		CL		INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS	$W_L < 30$
			CI		INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	$30 < W_L < 50$
			CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	$W_L > 50$
	ORGANIC SILTS AND ORGANIC CLAYS (BELOW "A" LINE ON PLASTICITY CHART)		OL		ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	$W_L < 50$
			OH		ORGANIC CLAYS OF HIGH PLASTICITY	$W_L > 50$

SEE PLASTICITY CHART BELOW

1. All sieve sizes mentioned on this chart are U.S. Standard, ASTM E11
2. Boundary classifications possessing characteristics of two groups are given combined group symbols. eg. GW-GC is a well-graded gravel-sand mixture with clay binder of between 5% and 12%.
3. Soil fractions and limiting textural boundaries are in accordance with the Unified Soil Classification System (ASTM D2487), except that an inorganic clay of medium plasticity (CI) is recognized.
4. The following adjectives may be employed to define pertentage ranges by weight of minor components (per ASTM D2488):

And -	36% to 50%
Some -	21% to 35%
Little -	11% to 20%
Trace -	1% to 10%

PLASTICITY CHART



SHELBY ENGINEERING LTD

SOIL CLASSIFICATION CHART

PLATE NO. 10

APPENDIX II

STANDARD TERMS AND CONDITIONS FOR THE PROVISION OF SERVICES BY SHELBY ENGINEERING LTD.

1. "The services ("the Services") performed for the client (the "Client") by Shelby Engineering Ltd. ("Shelby") described in the report to which these Standard Terms and Conditions are attached (the "Report") have been conducted in a manner consistent with the level of skill ordinarily exercised by members of the engineering profession currently practicing in the jurisdiction in which the Services have been provided."

2. In consideration of the provision of the Services, the Client agrees to the limitation of liability provisions herein contained, both on its own behalf, and as agent on behalf of its employees and principals.

3. The total amount of all claims the Client may have against Shelby with respect to the Services, including, without limitation, claims in tort or contract, shall be strictly limited to the amount of the fee charged to the Client by Shelby for the Services. Shelby shall not be liable for loss, injury or damage caused by delays beyond Shelby's control, or for any indirect, economic or consequential loss, injury or damage incurred by the Client, including, without limitation, claims for loss of profits, loss of contracts, loss of use, loss of production or business opportunity, loss of contracts or continued overhead expense. No claim shall be brought by the Client against Shelby more than two (2) years after completion of the Services or termination of the agreement to provide the Services.

4. The Client shall have no right to set off against any amounts owed to Shelby with respect to the Services.

5. The Client agrees that Shelby's employees and principals shall have no personal liability with respect to the Services and the Client shall make no claim or bring any proceedings of any kind whatsoever whether in contract, tort or any other cause of action in law or equity, against Shelby's employees and principals in their personal capacity.

6. The Client acknowledges that the Services entail an investigation which by its nature involves the risk that certain conditions between points investigated will not be detected, and that certain other conditions may change with time after provision of the written report of the Services. The Client acknowledges and accepts such risk and is aware that the Report can only provide for the conditions at the investigated points at the time of investigation. Extrapolation between the investigated points is at the Client's risk. If the Client requires additional or special investigations outside the scope of the Report, the Client must request such additional investigations from Shelby.

7. The Report has been prepared for a specific site and in light of the specific purposes communicated to Shelby by the Client. Shelby accepts no responsibility for the findings contained in the Report if applied to a different site, or if there is a material change in the purposes communicated to Shelby by the Client. The information and opinions described in the Report are provided solely for the benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THE WRITTEN CONSENT OF SHELBY. The Client shall maintain confidentiality of the Report and ensure that the Report is not distributed to third parties. The Client hereby agrees to indemnify Shelby for any claims brought against Shelby by third parties and arising out of the Client's failure to maintain the confidentiality required under this paragraph 7.

8. Except as stipulated in the Report, Shelby has not been retained to address, investigate or consider, and has not addressed, investigated or considered environmental or regulatory issues with respect to the site on which the Services have been performed. Notwithstanding the foregoing, Shelby may be required to disclose to regulatory bodies certain hazardous conditions discovered through provision of the Services, and the Client shall not make any claim against Shelby for such disclosure.

Appendix D

Stormwater Management Approval

Alberta Environment and Sustainable Resource Development

Provincial Programs
Regulatory Approvals Centre
Main Floor, Oxbridge Place
9820 – 106 Street
Edmonton, Alberta T5K 2J6
Canada
Telephone: (780) 427-6311
Fax: (780) 422-0154
www.environment.alberta.ca

August 1, 2013

County of Wetaskiwin No. 10
BOX 6960
WETASKIWIN AB T9A 2G5

Dear Sirs:

Re: Millet Storm Drainage System
Application No. 001-330704

Due to the implementation of the Storm Drainage Regulations, storm drainage systems have changed from requiring an approval to requiring a registration. As a result, the storm drainage system connected with your wastewater system has now been registered as 330704-00-00 and is enclosed.

It is your responsibility to obtain any approvals, permits or licences that are required from other agencies.

All licences, authorizations, registrations and approvals issued by Alberta Environment under the Alberta *Environmental Protection and Enhancement Act* or the *Water Act* should not be taken to mean the proponent (applicant) has complied with federal legislation. Proponents should contact Fisheries and Oceans, Habitat Management, 4253 - 97 Street, Edmonton, Alberta, T6E 5Y7, telephone (780) 495-4220, fax number (780) 495-8606 in relation to the application of federal laws relating to the *Fisheries Act (Canada)* and the Navigable Water Protection Program, Transport Canada, Canada Place, 1100, 9700 Jasper Avenue, Edmonton, Alberta, T5J 4E6, telephone (780) 495-8215, relating to the *Navigable Waters Protection Act*.

If you have any questions, please contact me at (780) 427-9539.

Yours truly,

Elaine Lawrence
Remediation Certificate Coordinator

Enclosure

cc: Win Tun, Central Region – Camrose
Robert Shipway

Government of Alberta

Environment

REGISTRATION

PROVINCE OF ALBERTA

ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT
R.S.A. 2000, c.E-12, as amended

REGISTRATION NO. 330704-00-00

APPLICATION NO. 001-330704

EFFECTIVE DATE: June 17, 2013

REGISTRATION HOLDER Hamlet of Millet

County of Wetaskiwin

Registration is issued for the following activity:

ACTIVITY: Construction, operation or reclamation of a storm drainage system for storm drainage in the Hamlet of Millet, as described in the attached Appendix.

Designated Director under the Act

Date Signed June 17, 2013

APPENDIX ATTACHED TO REGISTRATION

The storm drainage system in the Hamlet of Millet consists of:

Storm Drainage

(a) storm drainage management facility that includes:

STORMWATER DETENTION PONDS		
#	***Location***	***Receiving Stream***
1	*Shipway Development Strom Water Management Facility located in NW ¼ Sec 28-47-24 W4M*	*County ditch*

Appendix E

Stormwater Management Report

AREA Consulting Inc.

STORMWATER MANAGEMENT REPORT

Shipway Development N.W.1/4 Sec., 28-47-24-W4M

Submitted to:

Bob Shipway
Box 58
Millet, Alberta
T0C 1Z0

Submitted by:

AREA Consulting Inc.
15524 - 47 Street
Edmonton, AB T5Y-3L8
Tel (780) 278-4834
Fax (780) 478-4834

October 31, 2011

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APPENDIX A (Figure 1 Location Plan, Figure 2 Pre-development Storm Basin Plan, Figure 3 Post/Future Storm Basin Development Plan)

APPENDIX B (Hydrologic Parameters, Email From Alberta Environment For Predevelopment Requirements)

APPENDIX C (SWMM5 Dynamic Wave Routing Results)

AREA Consulting Inc.

October 18, 2012

Bob Shipway
Box 58
Millet, Alberta
T0C 1Z0

Attention:_____

Subject: Shipway Development N.W. ¼ Sec., 28-47-24-W4M
Stormwater Management Design Report

1.0 INTRODUCTION

Area Consulting has been commissioned Mr. Bob Shipway, to develop a Stormwater Management Report (SWMR) for a portion of land within NW ¼ Sec 28 Twp 47 Range 24 W4th directly east of the Town of Millet, Alberta. The proposed development will be located east of Range Road 244 and South of Township Road 475, west of Block B Plan 982-4390, south boundary directly east of the south boundary of Block A Plan 812-1104 as shown on Figure 1, Location Plan in Appendix A.

This report presents the design of the proposed SWMR for approval by the County of Wetaskiwin No. 10, and Alberta Environment under the Water Act and Environmental Protection and Enhancement Act. The report includes system design methodology as well as the overall design drawings for review for the proposed development only and adjacent areas.

1.1 System Overview

The proposed 9.88 ha development is located within NW ¼ Sec 28 Twp 47 Range 24 W4th directly east of the Town of Millet, Alberta. The proposed development will be located east of Range Road 244 from the south east corner boundary of Block A Plan 812-1104 and South of Township Road 475, the east boundary of the proposed development is approximately 41 m west of Block B Plan 982-4390. The total site area of the proposed gravel yard is approximately 9.88 ha. The site is currently undeveloped. The plan is to use a stormwater

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management facility to control the post-development runoff rates to pre-development rates.

This report identifies and describes drainage issues and provides a conceptual drainage plan including recommended locations and approximate sizing of stormwater management facilities to control the post-development runoff rates. Design of the stormwater management facility is based on runoff rates resulting from a 1 in 100 year design rainfall event. All system design is based on 1 in 100 year design storm event. Alberta Environment regulations require that the post-development flow rates do not exceed the pre-development flow rates for the 100 year rainfall event.

2.0 PRE-DEVELOPMENT SURFACE DRAINAGE

The natural topography of the proposed subdivision in its pre-development condition has been split into 5 different storm basins. This report will only address Basins 1, 4, and 5. Basins 2 and 3 are beyond the scope of this report.

The natural topography of Storm Basin 5 slopes in a northwest direction at about 0.3-0.4%. The drainage ditch adjacent to Township 475 conveys the runoff into an existing culvert crossing Range Road 244. The natural topography of Storm Basin 1 slopes in a southwest direction at about 1.1-1.6%. The drainage ditch adjacent to Range Road 244 collects sheet flow from storm basin 1. The natural slope of basin 4 from elevation 755.25 m at the north east corner to elevation 753.25 m at the northeast corner of Block A Plan 812-1104 is about 0.3-0.4% excluding the steep drop at the northeast corner. The site is drained by a manmade swale that runs adjacent to Block A to Range Road 244 ditch see enclosed Figure 2 in Appendix A. The drainage ditch adjacent to Range Road 244 conveys the flow into an existing 600 mm diameter culvert east of Range Road 244. It then backs onto Range Road ditch where it crosses Range Road 244. Flow from the existing 600 mm culvert crossing Range Road 244 ends up in a bush on the east side of Pipestone Creek then into the Creek, see enclosed Figure 2 pre-development storm basin plan in Appendix A.

All surface runoff from the proposed development and adjacent subdivision to the south end up in the Pipestone Creek.

The pre-development surface runoff was not estimated for this report as a standard for limiting post-development peak runoff rates. Rather a pre-development release rate of 2.25 L/s/ha was adopted, being the recommended pre-development release rate by Alberta Environment for the proposed development, see enclosed email in Appendix B.

2.1 Post-Development Surface Drainage

The grading plan of the proposed site in Basin 1 drains into the adjacent ditches. The proposed development drains in all four directions, an adjacent ditch is designed to pick up all major flows during minor and major storm events. Storm drainage from Basin 5 has been re-routed to drain south to future Basin 1 pond. From our discussions with the County of Wetaskiwin planning and development staff, it was mentioned that there were some ponding issues with the drainage system northwest of the intersection of Range Road 244 and Township Road 475, storm Basin 5 was was re-routed to minimize the impact of flooding to the northwest drainage system. See enclosed Appendix 1, Figure 3 – Post/Future Storm Basin Development Plan, shows the overall grading concept and storm pond for the proposed development.

Rainfall runoff from minor or major events will be conveyed by a ditch system and directed to the stormwater management facility located in the lowest part of the property, in the southwest corner of the above mentioned corner section. The collected runoff will be detained temporarily in the wet pond, treated and released at a controlled rate to the existing ditches eventually ending up in Pipestone creek.

Post-development runoff will be managed (detained, treated and released at a controlled rate) by the stormwater management facility. The Pond manages runoff from a larger portion of Proposed Storm Basin 1 and Future Basin 1, approximately 21.3 ha of the total site area, 9.88 ha is for the proposed site development. The pond will be sized to handle flows as a result of the development.

Surface runoff quantities and peak flow rates were determined for each catchment using SWMM5. The detailed results of the simulations of the 1 in 100 year design storm event are included in Appendix C.

3.0 HYDROLOGIC ANALYSIS OBJECTIVES

Alberta Environment's stormwater management criteria require that post-development off-site discharges do not exceed pre-development discharges. Post-development flows must be stored or otherwise attenuated to the pre-development rates to be released once the peak runoff event has subsided. Rainfall-runoff relationships were developed for both the pre-development and post-development scenarios.

3.1 Design Rainfall Event

The 1 in 100 year, 24-hour duration design storm event for the Edmonton Municipal Airport was used for runoff simulations in accordance with the County of Wetaskiwin Engineering Servicing Standards. The 1 in 100 year rainfall depth is approximately 127 mm based on an Intensity Duration Frequency (IDF) curve data for the period from 1914-1995 with 63 years of record. The 24-hour duration design storm event is based on the Huff distribution (First-Quartile 50% Probability) and the peak intensity of the 1 in 100 year event is 18.6 mm/hr.

A long-duration storm was selected based on the recommendations found in the AENV Stormwater Management Guidelines (1999) suggesting that such storms provide a better representation of runoff for rural areas and also for the sizing of stormwater detention facilities.

Refer to Appendix B for the Hydrologic Parameters for post development.

3.2 Hydrologic Analysis

Catchment areas were delineated based on the grading plan for the proposed subdivision. Hydrologic response parameters were estimated for the catchments including percentage imperviousness, surface slopes and infiltration parameters. The percentage imperviousness used in determining runoff coefficients for the different catchments is in accordance with the relation:

$$C = 0.95(\%Impervious) + 0.05(1 - \%Impervious)$$

A common surface slope of 1.2% was assigned to most catchments. Other common hydrologic response parameters are shown in Table 3-1 below. The depression storage values used for modelling in Table 3-1 are very conservative values which will produce the maximum amount of runoff for the respective sub-areas.

Table 3-1 Pervious and Impervious Sub-Area Loss and Runoff Parameters

Parameter		Typical Range of Values	Selected Parameter Value	Comments On Selected Value
Depression Storage (mm)				
	Pervious sub-area	2.5 - 7.6	2.54	Low end of Lawn
	Impervious sub-area	1.3 - 2.5	1.3	Low end for Impervious surfaces
Manning's n for overland flow				
	Pervious sub-area	0.05 - 0.80	0.15	Short prairie grass
	Impervious sub-area	0.011-0.030	0.029	Gravel Surface

Infiltration was modelled using the Green-Ampt formulation with the parameters shown in Table 3-2 representing silt loam soils typical of surficial soils in and around the greater Edmonton region the proposed site. If required the pond will be lined with a 1m deep clay liner that meet the standards of Alberta Environment. The geotechnical recommendation will determine if a liner is required. A copy of the geotechnical report will be submitted as soon as it becomes available. The Green-Ampt formulation is a physically-based infiltration model used widely and is consistent with other applications in SWMM including subsurface flow for Low Impact Development (LID) applications modelling.

Table 3-2 Green-Ampt Infiltration Parameters

Parameter	SWMM Input File Name	Typical Range of Values	Selected Parameter Value	Comments On Selected Value
Soil capillary suction (mm)	Suction	49 - 320	170	Silt Loam
Soil saturated hydraulic conductivity (mm/hr)	Conduct	0.25 - 120	6.6	Silt Loam
Initial soil moisture deficit	InitDef	0 - 1	0	Saturated

The land use represented in the SWMM model of the proposed site with their assigned runoff coefficients (% imperviousness in SWMM) are presented in Table 3-3. The percentage imperviousness assigned for the different land uses are very conservative to account for the higher runoff expected for the rare 1 in 100 year storm event. This resulted in an overall average percentage imperviousness of 65%, a value that will not underestimate the potential runoff to be generated by the development of the proposed site.

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Table 3-3 Characteristics of Different Land Uses Represented In the Proposed Development Site Plan

Land use	Total Area (ha)	% Imperviousness
Grassed Area	0.4	20
Graveled Area	9.48	65
Pond Surfaces	0.9	85
Total	**10.78**	

3.3 Rainfall-Runoff Model Results

The performance of the stormwater management facility (pond) was tested with the SWMM simulations of the 1 in 100 year design storm event. The simulated peak discharge rate from the pond is presented in Table 3-4. The release rate from the pond was modeled by orifice flow from the pond via a welded plate to the corrugated steel pipe. The orifice was sized to limit the peak release rate of runoff from the pond to 2.25 L/s/ha for maximum depth of water in the pond at the High Water Level (HWL).

Table 3-4 Pond Characteristics and Computed Peak Discharges from the Ponds

Pond	Drainage Area (ha)	Peak Discharge (m^3/s)	Orifice size (mm)	NWL	HWL	Spillway Elevation (m)
Southwest SWMF	10.78	0.025	105	748.28	749.34	749.65

The simulated 1 in 100 year flood elevation and drawdown is shown in Figure 3-1 and Figure 3-1-1 respectively. The peak flood elevation in the Southwest pond is 749.48 m that is 0.31 m below the emergency spillway elevation. The peak release rate from the pond is 0.025 m^3/s or 2.32 L/s/ha just above the maximum allowable. The southwest Pond is near or slightly under capacity, peaking just below the emergency spillway elevation by 0.31 m.

61% of the pond volume is available 96 hours from the start of the storm event. In general, engineering standards in Alberta specify that 90% of the active storage volume of the facility should be available within 96 hours. To achieve this, a bigger orifice size will have to be used, but that will let the release rate of the Pond in particular exceed the allowable unit peak discharge of 2.25 L/s/ha.

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Figure 3-1-1 Simulated 1 in 100 Year Discharge - Southwest Pond

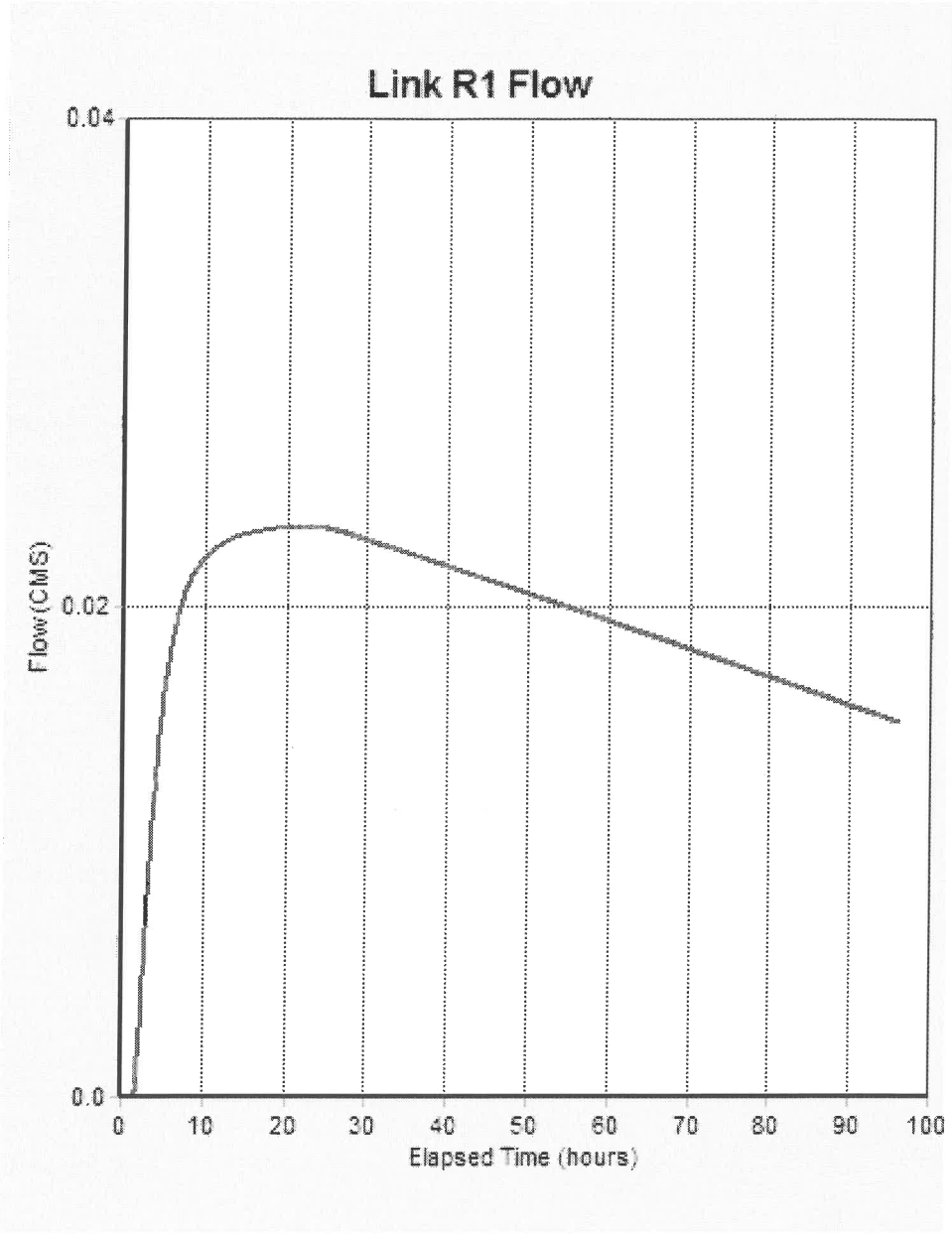

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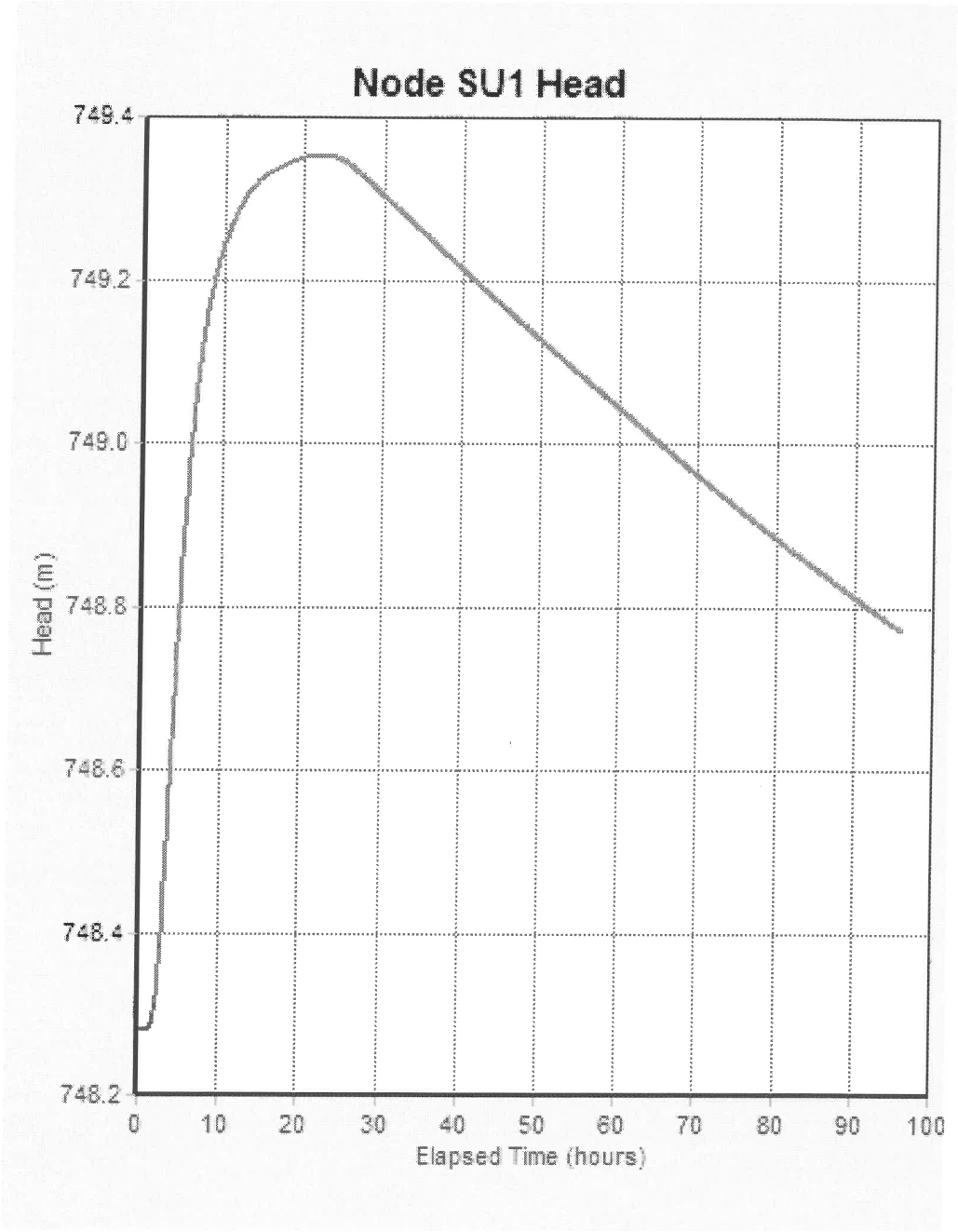
Figure 3-1 Simulated 1 in 100 Year Flood Elevation Soutwest Pond



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3.3.1 Runoff Volumes

The total runoff volumes received by the Soutwest pond from the 1 in 100 year design storm event and the maximum percentage utilization of the pond is presented in Table 3-4. With controlled releases from the pond, the maximum utilization of the pond is 87% of total active storage volume between normal water level (NWL) and the spillway elevation provided. Thus the pond is adequately sized to handle the runoff volumes generated by the 1 in 100 year design storm event. Sedimentation will decrease the capacity of the pond over time, but with regular maintenance of the pond including de-silting, the pond should be able to detain runoff volumes from the 1 in 100 year design storm event and release at controlled rate not exceeding the maximum allowable rate of 2.25 L/s/ha without overtopping.

Table 3-4 Maximum Percentage Utilization of Ponds during the 1 in 100 year Design Storm Event

Pond	Total Runoff Volume (m^3)	Maximum Stored Runoff Volume (m^3)	Maximum Active Storage Volume HWL - NWL (m^3)	Maximum % Utilization (%)
Southwest Pond	10,446	8,614	9,899	87

3.3.2 Runoff Rates

The proposed development increases peak runoff rates during storm events owing to decreased areas for infiltration of stormwater. The peak runoff rates from the development catchments will increase above that of the pre-development conditions for the same catchments. The development increases peak runoff rates and volumes from the upstream catchments, the release rate from the site is controlled by the use of the stormwater management facility. The pond has been sized to capture the excess runoff volumes produced by the site development of the catchments, detain the runoff and release at controlled rates not exceeding the peak allowable release rate of 2.25 L/s/ha. The total volume of runoff released from the site from the pond will however exceed pre-development runoff volumes, a condition which is not required to be met.

4.0 CLOSURE

This report has been prepared for the exclusive use of Mr. Bob Shipway. This report is based on, and limited by, the interpretation of data, circumstances, and conditions available at the time of completion of the work as referenced throughout the report. It has been prepared in accordance with generally accepted engineering practices. No other warranty, express or implied, is made.

Please do not hesitate to contact us if you require clarification or have any questions. Area Consulting Inc is prepared to work with you on any further refinements on this conceptual stormwater management plan.

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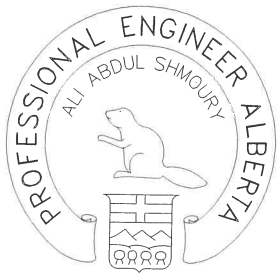
CORPORATE AUTHORIZATION

This document entitled Stormwater Management Report was prepared by AREA Consulting Inc. for Mr. Bob Shipway. The material in it reflects AREA Consulting Inc.'s best judgment in light of the information available to it at the time of preparation. Any such use a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. AREA Consulting Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

P09833
Corporate Permit



Engineer: Ali Shmoury, P. Eng

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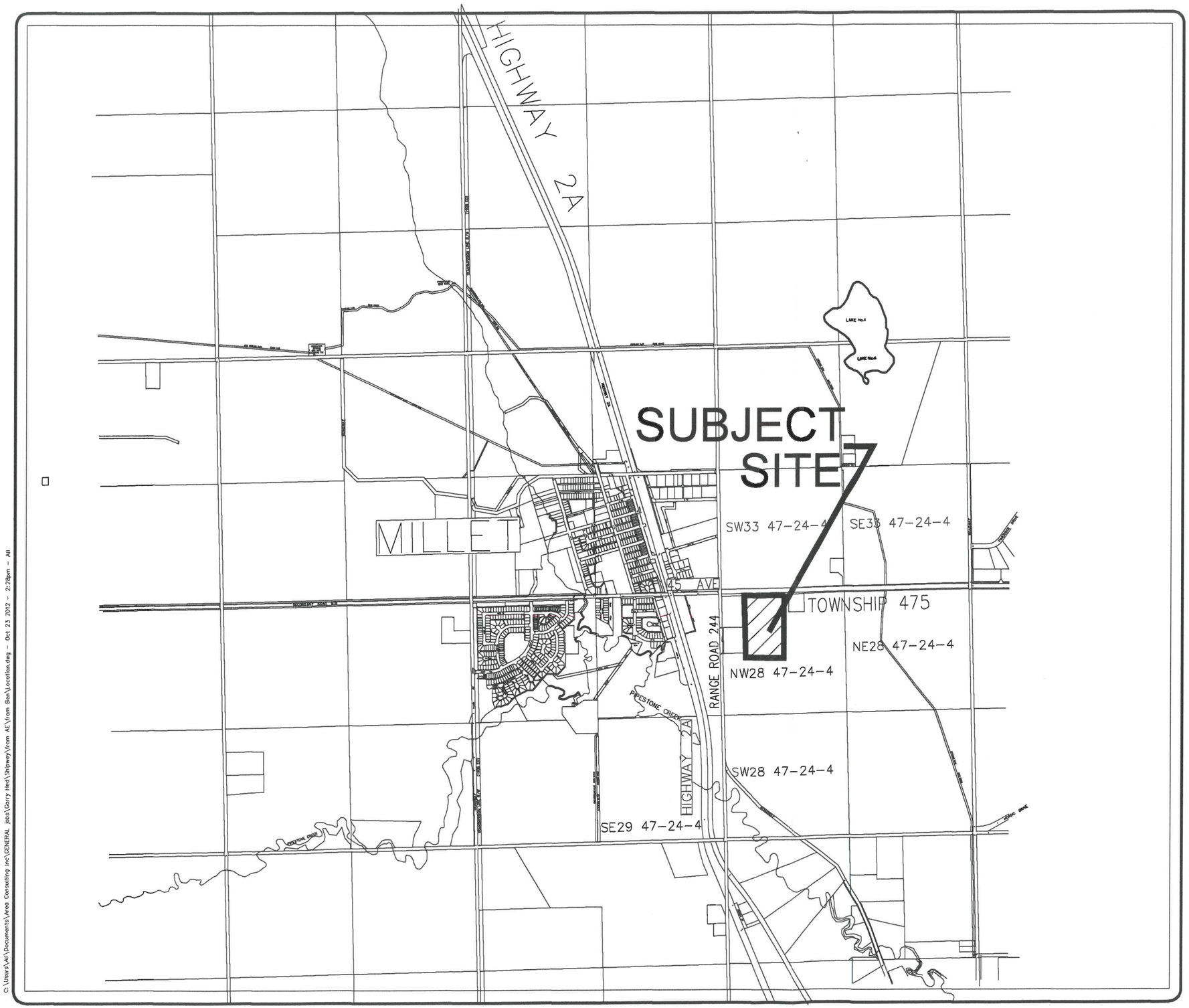
APPENDIX A



C:\Users\Alf\Documents\Area Consulting Inc\GENERAL Jobs\Carry Heel\Shipway\from AE\from Ben\Location.dwg - Oct 23 2012 - 2:28pm - Alf

AREA Consulting Inc.		October 22, 2012
DRAWN BY: A.A.S.	SCALE: NTS	PROJECT No.: 27-082012

LEGEND:

Location

BOB SHIPWAY

PROJECT:

SHIPWAY STORMWATER MANAGEMENT

LOCATION:

COUNTY OF WETASKIWIN, ALBERTA

TITLE:

Location Plan

APPENDIX B

From: Terry Chamulak <Terry.Chamulak@gov.ab.ca>
Sent: Friday, August 31, 2012 2:17 PM
To: 'ali.shmoury@telus.net'
Subject: RE: MILLET
Attachments: Millet_1in100_Pre-Development.pdf

Hello Ali,

We are currently developing the 1:100 year pre-development basin runoff rate for Central
Region. Although we are not quite done we focused our efforts in the Millet region as a result of your
request. The recommended 1:100 year pre-development runoff rate for Millet, interpolated from the
attached preliminary chart, is 2.25 l/s/ha.

TERRY H. CHAMULAK, P. Eng.
Hydrologist, Science Team
Central Region, Alberta Environment and Water
#304, 4920 - 51 Street
Red Deer, Alberta T4N 6K8

Phone: (403) 340-7737
Cell: (403) 304-7737
Fax: (403) 340-5022
Email: Terry.Chamulak@gov.ab.ca

From: Andrew Patton
Sent: August 21, 2012 8:47 AM
To: Terry Chamulak
Subject: FW: MILLET

Hi Terry,

When you have a moment, do you have a number?

If not just ignore and let me know.

Thanks,

Andrew

From: Ali Shmoury [mailto:ali.shmoury@telus.net]
Sent: Monday, August 20, 2012 2:35 AM
To: Andrew Patton
Subject: MILLET
Hi Andrew,

Our client is looking to develop a parcel of land approximately 10 ha. The location is in Millet (N.W.1/4
SEC28, 47, 24, W4M). What is an acceptable predevelopment release rate. Look forward for your
comments.

Thanks

Ali Shmoury P. Eng.
Project Manager
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Post-development Conditions: Huff Distribution 1:100yr Storm Event

```
[TITLE]
Post-development Conditions: Huff Distribution 1:100yr Storm Event

[OPTIONS]
FLOW_UNITS           CMS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         DYNWAVE
START_DATE           06/01/2001
START_TIME           00:00:00
REPORT_START_DATE    06/01/2001
REPORT_START_TIME    00:00:00
END_DATE             06/05/2001
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:05:00
WET_STEP             00:00:01
DRY_STEP             01:00:00
ROUTING_STEP         0:00:01
ALLOW_PONDING        NO
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  H-W
LINK_OFFSETS         DEPTH
MIN_SLOPE            0

[EVAPORATION]
;;Type       Parameters
;;---------- ----------
CONSTANT     0.0
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
;Huff
Huff_gage        INTENSITY 0:15   1.0    TIMESERIES Huff

[SUBCATCHMENTS]
;;                                                  Total     Pcnt.             Pcnt.     Curb      Snow
;;Name           Raingage          Outlet           Area      Imperv    Width   Slope     Length    Pack
;;-------------- ----------------- ---------------- --------- --------- ------- --------- --------- ---------
SC16             Huff_gage         j1               .68       65        100     1.2       0
SC17             Huff_gage         j5               .63       65        100     1.2       0
SC18             Huff_gage         j2               2.29      65        145     1.2       0
SC19             Huff_gage         j6               1.9       65        140     1.2       0
SC20             Huff_gage         j3               1.8       65        140     1.2       0
SC21             Huff_gage         j7               1.18      65        120     1.2       0
SC22             Huff_gage         j9               .5        65        100     3         0
SC23             Huff_gage         j4               .9        65        100     3         0
SC24             Huff_gage         j7               0         50        140     .4        0
SC25             Huff_gage         j11              0.9       85        250     1.2       0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
SC16             .029       0.15       1.27       2.54       25         OUTLET
SC17             .029       0.15       1.27       2.54       25         OUTLET
SC18             .029       0.15       1.27       2.54       25         OUTLET
SC19             .029       0.15       1.27       2.54       25         OUTLET
SC20             .029       0.15       1.27       2.54       25         OUTLET
SC21             .029       0.15       1.27       2.54       25         OUTLET
SC22             .029       0.15       1.27       2.54       25         OUTLET
SC23             .029       0.15       1.27       2.54       25         OUTLET
SC24             0.011      0.15       1.27       2.54       25         OUTLET
SC25             0.011      0.15       1.27       2.54       25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    HydCon     IMDmax
;;-------------- ---------- ---------- ----------
SC16             170        6.6        0
SC17             170        6.6        0
SC18             170        6.6        0
SC19             170        6.6        0
SC20             170        6.6        0
SC21             170        6.6        0
```

SC22	170	6.6	0
SC23	170	6.6	0
SC24	170	6.6	0
SC25	170	6.6	0

[JUNCTIONS]

;;Name	Invert Elev.	Max. Depth	Init. Depth	Surcharge Depth	Ponded Area
J1	753.11	0.6	0	0	0
J2	752.24	0.6	0	0	0
J3	751.57	0.6	0	0	0
J4	751.28	0.6	0	0	0
J5	753.28	.6	0	0	0
J6	752.76	.6	0	0	0
J7	752.40	.6	0	0	0
J8	752.25	.6	0	0	0
J9	751.90	.6	0	0	0
J10	750.72	.6	0	0	0
J11	749.62	.6	0	0	0
J12	748.25	1.22	0	0	0

[OUTFALLS]

;;Name	Invert Elev.	Outfall Type	Stage/Table Time Series	Tide Gate
Out1	748.20	FREE		NO

[STORAGE]

;;Name	Invert Elev.	Max. Depth	Init. Depth	Storage Curve	Curve Params			Ponded Area	Evap. Frac.	Infiltrat
SU1	748.28	1.22	0	TABULAR	swpond			0	0	

[CONDUITS]

;;Name	Inlet Node	Outlet Node	Length	Manning N	Inlet Offset	Outlet Offset	Init. Flow	Max Flo
C1	J12	Out1	12	.013	0	0	0	0
C2	SU1	J11	29.3	.03	0	0	0	0
C3	J11	J10	281.2	.03	0	0	0	0
C4	J10	J4	143	.03	0	0	0	0
C5	J4	J3	52.25	.03	0	0	0	0
C6	J3	J2	119.5	.03	0	0	0	0
C7	J2	J1	165	.03	0	0	0	0
C8	J4	J9	158.5	.03	0	0	0	0
C9	J9	J8	90	.03	0	0	0	0
C10	J8	J7	52.15	.03	0	0	0	0
C11	J7	J6	119.62	.03	0	0	0	0
C12	J6	J5	166.71	.03	0	0	0	0

[ORIFICES]

;;Name	Inlet Node	Outlet Node	Orifice Type	Crest Height	Disch. Coeff.	Flap Gate	Open/Close Time
R1	SU1	J12	BOTTOM	0	0.65	NO	0

[XSECTIONS]

;;Link	Shape	Geom1	Geom2	Geom3	Geom4	Barrels
C1	CIRCULAR	.5	0	0	0	1
C2	TRAPEZOIDAL	.6	1	3	3	1
C3	TRAPEZOIDAL	.6	1	3	3	1
C4	TRAPEZOIDAL	.6	1	3	3	1
C5	TRAPEZOIDAL	.6	1	3	3	1
C6	TRAPEZOIDAL	.6	1	3	3	1
C7	TRAPEZOIDAL	.6	1	3	3	1
C8	TRAPEZOIDAL	.6	1	3	3	1
C9	TRAPEZOIDAL	.6	1	3	3	1
C10	TRAPEZOIDAL	.6	1	3	3	1
C11	TRAPEZOIDAL	.6	1	3	3	1
C12	TRAPEZOIDAL	.6	1	3	3	1
R1	CIRCULAR	0.102	0	0	0	

[LOSSES]

;;Link	Inlet	Outlet	Average	Flap Gate
C1	.2	1	0	NO
C2	.2	1	0	NO
C3	.2	1	0	NO
C4	.2	1	0	NO
C5	.2	1	0	NO

Post-development Conditions: Huff Distribution 1:100yr Storm Event

```
C6               .2          1           0           NO
C7               .2          1           0           NO
C8               .2          1           0           NO
C9               .2          1           0           NO
C10              .2          1           0           NO
C11              .2          1           0           NO
C12              .2          1           0           NO

[CURVES]
;;Name           Type        X-Value     Y-Value
;;-------------- ----------  ----------  ----------
swpond           Storage     0           7354
swpond                       .5          8051
swpond                       1           8779
swpond                       1.22        9101

[TIMESERIES]
;;Name           Date        Time        Value
;;-------------- ----------  ----------  ----------
;Huff Time Series for Lake Drawdown analysis
Huff             1/1/2001    0:00        0
Huff                         0:15        0.359
Huff                         0:30        0.717
Huff                         0:45        1.08
Huff                         1:00        1.43
Huff                         1:15        1.91
Huff                         1:30        2.87
Huff                         1:45        3.82
Huff                         2:00        4.78
Huff                         2:15        5.74
Huff                         2:30        6.38
Huff                         2:45        6.55
Huff                         3:00        6.72
Huff                         3:15        6.89
Huff                         3:30        7.06
Huff                         3:45        6.96
Huff                         4:00        6.67
Huff                         4:15        6.38
Huff                         4:30        6.09
Huff                         4:45        5.8
Huff                         5:00        5.49
Huff                         5:15        5.18
Huff                         5:30        4.88
Huff                         5:45        4.57
Huff                         6:00        4.26
Huff                         6:15        4.01
Huff                         6:30        3.75
Huff                         6:45        3.49
Huff                         7:00        3.24
Huff                         7:15        3
Huff                         7:30        2.81
Huff                         7:45        2.62
Huff                         8:00        2.43
Huff                         8:15        2.24
Huff                         8:30        2.1
Huff                         8:45        2.02
Huff                         9:00        1.95
Huff                         9:15        1.87
Huff                         9:30        1.79
Huff                         9:45        1.72
Huff                         10:00       1.64
Huff                         10:15       1.57
Huff                         10:30       1.5
Huff                         10:45       1.42
Huff                         11:00       1.35
Huff                         11:15       1.29
Huff                         11:30       1.22
Huff                         11:45       1.16
Huff                         12:00       1.09
Huff                         12:15       1.06
Huff                         12:30       1.02
Huff                         12:45       0.982
Huff                         13:00       0.944
Huff                         13:15       0.907
Huff                         13:30       0.867
Huff                         13:45       0.828
Huff                         14:00       0.788
Huff                         14:15       0.748
Huff                         14:30       0.721
Huff                         14:45       0.712
Huff                         15:00       0.703
Huff                         15:15       0.694
```

Huff		15:30	0.685
Huff		15:45	0.676
Huff		16:00	0.668
Huff		16:15	0.66
Huff		16:30	0.652
Huff		16:45	0.644
Huff		17:00	0.636
Huff		17:15	0.628
Huff		17:30	0.619
Huff		17:45	0.611
Huff		18:00	0.602
Huff		18:15	0.594
Huff		18:30	0.586
Huff		18:45	0.577
Huff		19:00	0.569
Huff		19:15	0.558
Huff		19:30	0.537
Huff		19:45	0.516
Huff		20:00	0.496
Huff		20:15	0.475
Huff		20:30	0.458
Huff		20:45	0.447
Huff		21:00	0.436
Huff		21:15	0.425
Huff		21:30	0.414
Huff		21:45	0.4
Huff		22:00	0.382
Huff		22:15	0.365
Huff		22:30	0.348
Huff		22:45	0.331
Huff		23:00	0.314
Huff		23:15	0.297
Huff		23:30	0.28
Huff		23:45	0.263
Huff	1/2/2001	0:00	0.246
Huff	2/1/2001	0:00	0
Huff		0:15	0.516
Huff		0:30	1.03
Huff		0:45	1.55
Huff		1:00	2.06
Huff		1:15	2.75
Huff		1:30	4.12
Huff		1:45	5.5
Huff		2:00	6.87
Huff		2:15	8.25
Huff		2:30	9.17
Huff		2:45	9.42
Huff		3:00	9.66
Huff		3:15	9.91
Huff		3:30	10.2
Huff		3:45	10
Huff		4:00	9.58
Huff		4:15	9.17
Huff		4:30	8.75
Huff		4:45	8.33
Huff		5:00	7.89
Huff		5:15	7.45
Huff		5:30	7.01
Huff		5:45	6.57
Huff		6:00	6.13
Huff		6:15	5.76
Huff		6:30	5.39
Huff		6:45	5.02
Huff		7:00	4.65
Huff		7:15	4.31
Huff		7:30	4.04
Huff		7:45	3.77
Huff		8:00	3.5
Huff		8:15	3.23
Huff		8:30	3.02
Huff		8:45	2.91
Huff		9:00	2.8
Huff		9:15	2.69
Huff		9:30	2.58
Huff		9:45	2.47
Huff		10:00	2.36
Huff		10:15	2.26
Huff		10:30	2.15
Huff		10:45	2.04
Huff		11:00	1.95
Huff		11:15	1.85
Huff		11:30	1.76

Post-development Conditions: Huff Distribution 1:100yr Storm Event

Huff		11:45	1.67
Huff		12:00	1.57
Huff		12:15	1.52
Huff		12:30	1.46
Huff		12:45	1.41
Huff		13:00	1.36
Huff		13:15	1.3
Huff		13:30	1.25
Huff		13:45	1.19
Huff		14:00	1.13
Huff		14:15	1.08
Huff		14:30	1.04
Huff		14:45	1.02
Huff		15:00	1.01
Huff		15:15	1
Huff		15:30	0.984
Huff		15:45	0.972
Huff		16:00	0.961
Huff		16:15	0.949
Huff		16:30	0.938
Huff		16:45	0.926
Huff		17:00	0.914
Huff		17:15	0.902
Huff		17:30	0.89
Huff		17:45	0.878
Huff		18:00	0.866
Huff		18:15	0.854
Huff		18:30	0.842
Huff		18:45	0.83
Huff		19:00	0.818
Huff		19:15	0.802
Huff		19:30	0.772
Huff		19:45	0.742
Huff		20:00	0.712
Huff		20:15	0.683
Huff		20:30	0.658
Huff		20:45	0.643
Huff		21:00	0.627
Huff		21:15	0.611
Huff		21:30	0.595
Huff		21:45	0.574
Huff		22:00	0.55
Huff		22:15	0.525
Huff		22:30	0.501
Huff		22:45	0.476
Huff		23:00	0.452
Huff		23:15	0.427
Huff		23:30	0.403
Huff		23:45	0.378
Huff	2/2/2001	0:00	0.353
Huff	3/1/2001	0:00	0
Huff		0:15	0.619
Huff		0:30	1.24
Huff		0:45	1.86
Huff		1:00	2.48
Huff		1:15	3.3
Huff		1:30	4.96
Huff		1:45	6.61
Huff		2:00	8.26
Huff		2:15	9.91
Huff		2:30	11
Huff		2:45	11.3
Huff		3:00	11.6
Huff		3:15	11.9
Huff		3:30	12.2
Huff		3:45	12
Huff		4:00	11.5
Huff		4:15	11
Huff		4:30	10.5
Huff		4:45	10
Huff		5:00	9.49
Huff		5:15	8.95
Huff		5:30	8.42
Huff		5:45	7.89
Huff		6:00	7.36
Huff		6:15	6.92
Huff		6:30	6.48
Huff		6:45	6.03
Huff		7:00	5.59
Huff		7:15	5.17
Huff		7:30	4.85
Huff		7:45	4.52

Huff		8:00	4.2
Huff		8:15	3.88
Huff		8:30	3.63
Huff		8:45	3.5
Huff		9:00	3.36
Huff		9:15	3.23
Huff		9:30	3.1
Huff		9:45	2.97
Huff		10:00	2.84
Huff		10:15	2.71
Huff		10:30	2.58
Huff		10:45	2.45
Huff		11:00	2.34
Huff		11:15	2.23
Huff		11:30	2.11
Huff		11:45	2
Huff		12:00	1.89
Huff		12:15	1.82
Huff		12:30	1.76
Huff		12:45	1.7
Huff		13:00	1.63
Huff		13:15	1.57
Huff		13:30	1.5
Huff		13:45	1.43
Huff		14:00	1.36
Huff		14:15	1.29
Huff		14:30	1.25
Huff		14:45	1.23
Huff		15:00	1.21
Huff		15:15	1.2
Huff		15:30	1.18
Huff		15:45	1.17
Huff		16:00	1.15
Huff		16:15	1.14
Huff		16:30	1.13
Huff		16:45	1.11
Huff		17:00	1.1
Huff		17:15	1.08
Huff		17:30	1.07
Huff		17:45	1.06
Huff		18:00	1.04
Huff		18:15	1.03
Huff		18:30	1.01
Huff		18:45	1
Huff		19:00	0.983
Huff		19:15	0.964
Huff		19:30	0.928
Huff		19:45	0.892
Huff		20:00	0.856
Huff		20:15	0.82
Huff		20:30	0.791
Huff		20:45	0.772
Huff		21:00	0.753
Huff		21:15	0.734
Huff		21:30	0.715
Huff		21:45	0.69
Huff		22:00	0.661
Huff		22:15	0.631
Huff		22:30	0.602
Huff		22:45	0.572
Huff		23:00	0.543
Huff		23:15	0.513
Huff		23:30	0.484
Huff		23:45	0.454
Huff	3/2/2001	0:00	0.425
Huff	4/1/2001	0:00	0
Huff		0:15	0.751
Huff		0:30	1.5
Huff		0:45	2.25
Huff		1:00	3
Huff		1:15	4
Huff		1:30	6
Huff		1:45	8.01
Huff		2:00	10
Huff		2:15	12
Huff		2:30	13.4
Huff		2:45	13.7
Huff		3:00	14.1
Huff		3:15	14.4
Huff		3:30	14.8
Huff		3:45	14.6
Huff		4:00	14

Post-development Conditions: Huff Distribution 1:100yr Storm Event

Huff		4:15	13.3
Huff		4:30	12.7
Huff		4:45	12.1
Huff		5:00	11.5
Huff		5:15	10.9
Huff		5:30	10.2
Huff		5:45	9.56
Huff		6:00	8.92
Huff		6:15	8.39
Huff		6:30	7.85
Huff		6:45	7.31
Huff		7:00	6.78
Huff		7:15	6.27
Huff		7:30	5.88
Huff		7:45	5.48
Huff		8:00	5.09
Huff		8:15	4.7
Huff		8:30	4.4
Huff		8:45	4.24
Huff		9:00	4.08
Huff		9:15	3.92
Huff		9:30	3.75
Huff		9:45	3.6
Huff		10:00	3.44
Huff		10:15	3.29
Huff		10:30	3.13
Huff		10:45	2.97
Huff		11:00	2.83
Huff		11:15	2.7
Huff		11:30	2.56
Huff		11:45	2.42
Huff		12:00	2.29
Huff		12:15	2.21
Huff		12:30	2.13
Huff		12:45	2.05
Huff		13:00	1.98
Huff		13:15	1.9
Huff		13:30	1.82
Huff		13:45	1.73
Huff		14:00	1.65
Huff		14:15	1.57
Huff		14:30	1.51
Huff		14:45	1.49
Huff		15:00	1.47
Huff		15:15	1.45
Huff		15:30	1.43
Huff		15:45	1.42
Huff		16:00	1.4
Huff		16:15	1.38
Huff		16:30	1.37
Huff		16:45	1.35
Huff		17:00	1.33
Huff		17:15	1.31
Huff		17:30	1.3
Huff		17:45	1.28
Huff		18:00	1.26
Huff		18:15	1.24
Huff		18:30	1.23
Huff		18:45	1.21
Huff		19:00	1.19
Huff		19:15	1.17
Huff		19:30	1.12
Huff		19:45	1.08
Huff		20:00	1.04
Huff		20:15	0.994
Huff		20:30	0.959
Huff		20:45	0.936
Huff		21:00	0.913
Huff		21:15	0.89
Huff		21:30	0.867
Huff		21:45	0.836
Huff		22:00	0.801
Huff		22:15	0.765
Huff		22:30	0.729
Huff		22:45	0.693
Huff		23:00	0.658
Huff		23:15	0.622
Huff		23:30	0.586
Huff		23:45	0.55
Huff	4/2/2001	0:00	0.515
Huff	5/1/2001	0:00	0
Huff		0:15	0.848

Post-development Conditions: Huff Distribution 1:100yr Storm Event

Huff	0:30	1.7
Huff	0:45	2.54
Huff	1:00	3.39
Huff	1:15	4.52
Huff	1:30	6.78
Huff	1:45	9.04
Huff	2:00	11.3
Huff	2:15	13.6
Huff	2:30	15.1
Huff	2:45	15.5
Huff	3:00	15.9
Huff	3:15	16.3
Huff	3:30	16.7
Huff	3:45	16.5
Huff	4:00	15.8
Huff	4:15	15.1
Huff	4:30	14.4
Huff	4:45	13.7
Huff	5:00	13
Huff	5:15	12.3
Huff	5:30	11.5
Huff	5:45	10.8
Huff	6:00	10.1
Huff	6:15	9.47
Huff	6:30	8.87
Huff	6:45	8.26
Huff	7:00	7.66
Huff	7:15	7.08
Huff	7:30	6.64
Huff	7:45	6.19
Huff	8:00	5.75
Huff	8:15	5.31
Huff	8:30	4.97
Huff	8:45	4.79
Huff	9:00	4.6
Huff	9:15	4.42
Huff	9:30	4.24
Huff	9:45	4.06
Huff	10:00	3.89
Huff	10:15	3.71
Huff	10:30	3.54
Huff	10:45	3.36
Huff	11:00	3.2
Huff	11:15	3.05
Huff	11:30	2.89
Huff	11:45	2.74
Huff	12:00	2.59
Huff	12:15	2.5
Huff	12:30	2.41
Huff	12:45	2.32
Huff	13:00	2.23
Huff	13:15	2.14
Huff	13:30	2.05
Huff	13:45	1.96
Huff	14:00	1.86
Huff	14:15	1.77
Huff	14:30	1.7
Huff	14:45	1.68
Huff	15:00	1.66
Huff	15:15	1.64
Huff	15:30	1.62
Huff	15:45	1.6
Huff	16:00	1.58
Huff	16:15	1.56
Huff	16:30	1.54
Huff	16:45	1.52
Huff	17:00	1.5
Huff	17:15	1.48
Huff	17:30	1.46
Huff	17:45	1.44
Huff	18:00	1.42
Huff	18:15	1.4
Huff	18:30	1.39
Huff	18:45	1.37
Huff	19:00	1.35
Huff	19:15	1.32
Huff	19:30	1.27
Huff	19:45	1.22
Huff	20:00	1.17
Huff	20:15	1.12
Huff	20:30	1.08
Huff	20:45	1.06

Huff		21:00	1.03
Huff		21:15	1.01
Huff		21:30	0.979
Huff		21:45	0.945
Huff		22:00	0.904
Huff		22:15	0.864
Huff		22:30	0.824
Huff		22:45	0.783
Huff		23:00	0.743
Huff		23:15	0.703
Huff		23:30	0.662
Huff		23:45	0.622
Huff	5/2/2001	0:00	0.581
Huff	6/1/2001	0:00	0
Huff		0:15	0.945
Huff		0:30	1.89
Huff		0:45	2.83
Huff		1:00	3.78
Huff		1:15	5.04
Huff		1:30	7.56
Huff		1:45	10.1
Huff		2:00	12.6
Huff		2:15	15.1
Huff		2:30	16.8
Huff		2:45	17.3
Huff		3:00	17.7
Huff		3:15	18.2
Huff		3:30	18.6
Huff		3:45	18.3
Huff		4:00	17.6
Huff		4:15	16.8
Huff		4:30	16
Huff		4:45	15.3
Huff		5:00	14.5
Huff		5:15	13.7
Huff		5:30	12.8
Huff		5:45	12
Huff		6:00	11.2
Huff		6:15	10.6
Huff		6:30	9.88
Huff		6:45	9.2
Huff		7:00	8.53
Huff		7:15	7.89
Huff		7:30	7.39
Huff		7:45	6.9
Huff		8:00	6.41
Huff		8:15	5.91
Huff		8:30	5.53
Huff		8:45	5.33
Huff		9:00	5.13
Huff		9:15	4.93
Huff		9:30	4.72
Huff		9:45	4.53
Huff		10:00	4.33
Huff		10:15	4.13
Huff		10:30	3.94
Huff		10:45	3.74
Huff		11:00	3.57
Huff		11:15	3.39
Huff		11:30	3.22
Huff		11:45	3.05
Huff		12:00	2.88
Huff		12:15	2.78
Huff		12:30	2.68
Huff		12:45	2.59
Huff		13:00	2.49
Huff		13:15	2.39
Huff		13:30	2.28
Huff		13:45	2.18
Huff		14:00	2.08
Huff		14:15	1.97
Huff		14:30	1.9
Huff		14:45	1.88
Huff		15:00	1.85
Huff		15:15	1.83
Huff		15:30	1.8
Huff		15:45	1.78
Huff		16:00	1.76
Huff		16:15	1.74
Huff		16:30	1.72
Huff		16:45	1.7
Huff		17:00	1.68

Huff		17:15	1.65
Huff		17:30	1.63
Huff		17:45	1.61
Huff		18:00	1.59
Huff		18:15	1.56
Huff		18:30	1.54
Huff		18:45	1.52
Huff		19:00	1.5
Huff		19:15	1.47
Huff		19:30	1.42
Huff		19:45	1.36
Huff		20:00	1.31
Huff		20:15	1.25
Huff		20:30	1.21
Huff		20:45	1.18
Huff		21:00	1.15
Huff		21:15	1.12
Huff		21:30	1.09
Huff		21:45	1.05
Huff		22:00	1.01
Huff		22:15	0.963
Huff		22:30	0.918
Huff		22:45	0.873
Huff		23:00	0.828
Huff		23:15	0.783
Huff		23:30	0.738
Huff		23:45	0.693
Huff	6/2/2001	0:00	0.648
Huff	7/1/2001	0:00	0
Huff		0:15	1.04
Huff		0:30	2.08
Huff		0:45	3.12
Huff		1:00	4.16
Huff		1:15	5.55
Huff		1:30	8.33
Huff		1:45	11.1
Huff		2:00	13.9
Huff		2:15	16.7
Huff		2:30	18.5
Huff		2:45	19
Huff		3:00	19.5
Huff		3:15	20
Huff		3:30	20.5
Huff		3:45	20.2
Huff		4:00	19.4
Huff		4:15	18.5
Huff		4:30	17.7
Huff		4:45	16.8
Huff		5:00	15.9
Huff		5:15	15
Huff		5:30	14.2
Huff		5:45	13.3
Huff		6:00	12.4
Huff		6:15	11.6
Huff		6:30	10.9
Huff		6:45	10.1
Huff		7:00	9.4
Huff		7:15	8.69
Huff		7:30	8.15
Huff		7:45	7.6
Huff		8:00	7.06
Huff		8:15	6.51
Huff		8:30	6.1
Huff		8:45	5.87
Huff		9:00	5.65
Huff		9:15	5.43
Huff		9:30	5.21
Huff		9:45	4.99
Huff		10:00	4.77
Huff		10:15	4.56
Huff		10:30	4.34
Huff		10:45	4.12
Huff		11:00	3.93
Huff		11:15	3.74
Huff		11:30	3.55
Huff		11:45	3.36
Huff		12:00	3.17
Huff		12:15	3.07
Huff		12:30	2.96
Huff		12:45	2.85
Huff		13:00	2.74
Huff		13:15	2.63

```
Huff                        13:30      2.52
Huff                        13:45      2.4
Huff                        14:00      2.29
Huff                        14:15      2.17
Huff                        14:30      2.09
Huff                        14:45      2.07
Huff                        15:00      2.04
Huff                        15:15      2.01
Huff                        15:30      1.99
Huff                        15:45      1.96
Huff                        16:00      1.94
Huff                        16:15      1.92
Huff                        16:30      1.89
Huff                        16:45      1.87
Huff                        17:00      1.85
Huff                        17:15      1.82
Huff                        17:30      1.8
Huff                        17:45      1.77
Huff                        18:00      1.75
Huff                        18:15      1.72
Huff                        18:30      1.7
Huff                        18:45      1.68
Huff                        19:00      1.65
Huff                        19:15      1.62
Huff                        19:30      1.56
Huff                        19:45      1.5
Huff                        20:00      1.44
Huff                        20:15      1.38
Huff                        20:30      1.33
Huff                        20:45      1.3
Huff                        21:00      1.27
Huff                        21:15      1.23
Huff                        21:30      1.2
Huff                        21:45      1.16
Huff                        22:00      1.11
Huff                        22:15      1.06
Huff                        22:30      1.01
Huff                        22:45      0.962
Huff                        23:00      0.912
Huff                        23:15      0.862
Huff                        23:30      0.813
Huff                        23:45      0.763
Huff            7/2/2001    0:00       0.714

[REPORT]
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 3400.093 5377.225 5678.267 8712.692
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
J1               3962.119           8325.472
J2               4002.587           7708.346
J3               4002.587           7253.090
J4               4038.271           7039.166
J5               5038.588           8352.083
J6               5058.126           7703.439
J7               5069.848           7277.523
J8               5069.848           7054.796
J9               4683.007           7027.443
J10              3600.632           7023.536
J11              3616.262           6144.350
J12              3815.544           5749.694
Out1             3588.909           5585.579
SU1              3756.931           5964.606

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
C6               4003.103           7687.809

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
```

```
;;-------------- ------------------ ------------------
SC16             4063.288           8548.041
SC16             4073.404           8325.472
SC16             4579.245           8355.822
SC16             4548.894           8558.158
SC16             4063.288           8537.925
SC17             4556.099           8539.001
SC17             4581.859           8358.686
SC17             5012.408           8351.326
SC17             5008.728           8561.080
SC17             4545.060           8546.361
SC18             4059.312           8325.566
SC18             4563.459           8351.326
SC18             4614.978           7725.742
SC18             4066.672           7714.702
SC18             4059.312           8332.926
SC19             4567.139           8351.326
SC19             4618.658           7725.742
SC19             5027.127           7707.342
SC19             5008.728           8351.326
SC19             4567.139           8351.326
SC20             4618.658           7714.702
SC20             4062.992           7707.342
SC20             4074.032           7262.073
SC20             4692.256           7273.113
SC20             4611.298           7725.742
SC21             4618.658           7718.382
SC21             4699.616           7273.113
SC21             5027.127           7269.433
SC21             5027.127           7707.342
SC21             4618.658           7722.062
SC22             4699.616           7269.433
SC22             4681.216           7055.999
SC22             5034.487           7067.038
SC22             5034.487           7273.113
SC22             4699.616           7269.433
SC23             4077.712           7262.073
SC23             4695.936           7273.113
SC23             4677.536           7048.639
SC23             4070.352           7048.639
SC23             4074.032           7265.753
SC24             5048.487           7049.740
SC24             5022.728           8547.462
SC24             5574.714           8554.822
SC24             5574.714           8098.514
SC24             5387.039           8098.514
SC24             5390.719           7053.420
SC24             5048.487           7057.100
SC25             4074.032           7041.279
SC25             4066.672           7026.559
SC25             3739.160           7030.239
SC25             3746.520           6949.281
SC25             3871.637           6827.844
SC25             3875.317           6607.050
SC25             3956.275           6555.531
SC25             4246.987           6191.220
SC25             4364.744           6172.821
SC25             4364.744           6003.545
SC25             4633.377           5863.709
SC25             4662.817           5554.596
SC25             3525.725           5528.837
SC25             3503.646           7081.758
SC25             4070.352           7044.959

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
```

APPENDIX C

Post-development Conditions: Huff Distribution 1:100yr Storm Event

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.022)
--------------------------------------------------------------

Post-development Conditions: Huff Distribution 1:100yr Storm Event

*****************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*****************************************************

****************
Analysis Options
****************
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date ..... JUN-01-2001 00:00:00
Ending Date ..... JUN-05-2001 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:05:00
Wet Time Step ..... 00:00:01
Dry Time Step ..... 01:00:00
Routing Time Step ..... 1.00 sec


*************
Element Count
*************
Number of rain gages ..... 1
Number of subcatchments ... 10
Number of nodes ..... 14
Number of links ..... 13
Number of pollutants ..... 0
Number of land uses ..... 0


****************
Raingage Summary
****************
                                  Data        Recording
Name              Data Source     Type        Interval
-----------------------------------------------------------
Huff_gage         Huff            INTENSITY    15 min.


*******************
Subcatchment Summary
*******************
Name                  Area     Width   %Imperv    %Slope    Rain Gage          Outlet
-----------------------------------------------------------------------------------------
SC16                  0.68    100.00     65.00    1.2000    Huff_gage          J1
SC17                  0.63    100.00     65.00    1.2000    Huff_gage          J5
SC18                  2.29    145.00     65.00    1.2000    Huff_gage          J2
SC19                  1.90    140.00     65.00    1.2000    Huff_gage          J6
SC20                  1.80    140.00     65.00    1.2000    Huff_gage          J3
SC21                  1.18    120.00     65.00    1.2000    Huff_gage          J7
SC22                  0.50    100.00     65.00    3.0000    Huff_gage          J9
SC23                  0.90    100.00     65.00    3.0000    Huff_gage          J4
SC24                  0.00    140.00     50.00    0.4000    Huff_gage          J7
SC25                  0.90    250.00     85.00    1.2000    Huff_gage          J11


************
Node Summary
************
                                  Invert      Max.     Ponded    External
Name              Type             Elev.     Depth      Area     Inflow
-----------------------------------------------------------------------
J1                JUNCTION        753.11      0.60       0.0
J2                JUNCTION        752.24      0.60       0.0
J3                JUNCTION        751.57      0.60       0.0
J4                JUNCTION        751.28      0.60       0.0
J5                JUNCTION        753.28      0.60       0.0
```

J6	JUNCTION	752.76	0.60	0.0
J7	JUNCTION	752.40	0.60	0.0
J8	JUNCTION	752.25	0.60	0.0
J9	JUNCTION	751.90	0.60	0.0
J10	JUNCTION	750.72	0.60	0.0
J11	JUNCTION	749.62	0.60	0.0
J12	JUNCTION	748.25	1.22	0.0
Out1	OUTFALL	748.20	0.50	0.0
SU1	STORAGE	748.28	1.22	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J12	Out1	CONDUIT	12.0	0.4167	0.0130
C2	J11	SU1	CONDUIT	29.3	4.5782	0.0300
C3	J10	J11	CONDUIT	281.2	0.3912	0.0300
C4	J4	J10	CONDUIT	143.0	0.3916	0.0300
C5	J3	J4	CONDUIT	52.3	0.5550	0.0300
C6	J2	J3	CONDUIT	119.5	0.5607	0.0300
C7	J1	J2	CONDUIT	165.0	0.5273	0.0300
C8	J9	J4	CONDUIT	158.5	0.3912	0.0300
C9	J8	J9	CONDUIT	90.0	0.3889	0.0300
C10	J7	J8	CONDUIT	52.1	0.2876	0.0300
C11	J6	J7	CONDUIT	119.6	0.3010	0.0300
C12	J5	J6	CONDUIT	166.7	0.3119	0.0300
R1	SU1	J12	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.50	0.20	0.12	0.50	1	0.24
C2	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	5.96
C3	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	1.74
C4	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	1.74
C5	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	2.07
C6	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	2.08
C7	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	2.02
C8	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	1.74
C9	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	1.74
C10	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	1.49
C11	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	1.53
C12	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	1.55

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	1.365	126.629
Evaporation Loss	0.000	0.000
Infiltration Loss	0.314	29.111
Surface Runoff	1.044	96.883
Final Surface Storage	0.007	0.636
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	1.044	10.444
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.693	6.933
Internal Outflow	0.000	0.000
Storage Losses	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.351	3.511
Continuity Error (%)	-0.008	

****
Time-Step Critical Elements
****

None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 1.00 sec
Average Time Step : 1.00 sec
Maximum Time Step : 1.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 2.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
SC16	126.63	0.00	0.00	30.47	95.54	0.65	0.03	0.755
SC17	126.63	0.00	0.00	30.45	95.56	0.60	0.03	0.755
SC18	126.63	0.00	0.00	30.69	95.32	2.18	0.10	0.753
SC19	126.63	0.00	0.00	30.64	95.37	1.81	0.08	0.753
SC20	126.63	0.00	0.00	30.62	95.39	1.72	0.08	0.753
SC21	126.63	0.00	0.00	30.54	95.46	1.13	0.05	0.754
SC22	126.63	0.00	0.00	30.36	95.65	0.48	0.02	0.755
SC23	126.63	0.00	0.00	30.44	95.57	0.86	0.04	0.755
SC25	126.63	0.00	0.00	12.99	112.83	1.02	0.04	0.891

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min
J1	JUNCTION	0.01	0.07	753.18	0 03:46
J2	JUNCTION	0.02	0.15	752.39	0 03:51
J3	JUNCTION	0.02	0.20	751.77	0 03:51
J4	JUNCTION	0.03	0.31	751.59	0 03:59
J5	JUNCTION	0.01	0.08	753.36	0 03:46
J6	JUNCTION	0.02	0.17	752.93	0 03:51
J7	JUNCTION	0.02	0.22	752.62	0 03:51
J8	JUNCTION	0.02	0.19	752.44	0 03:53
J9	JUNCTION	0.02	0.20	752.10	0 03:56
J10	JUNCTION	0.05	0.41	751.13	0 04:02
J11	JUNCTION	0.02	0.18	749.80	0 04:00
J12	JUNCTION	0.11	0.12	748.37	0 21:27
Out1	OUTFALL	0.09	0.10	748.30	0 21:27
SU1	STORAGE	0.76	1.06	749.34	0 21:27

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr
J1	JUNCTION	0.031	0.031	0 03:44	0.650	0.650
J2	JUNCTION	0.101	0.132	0 03:45	2.183	2.833
J3	JUNCTION	0.080	0.211	0 03:49	1.717	4.550
J4	JUNCTION	0.041	0.439	0 03:54	0.860	9.428
J5	JUNCTION	0.028	0.028	0 03:44	0.602	0.602
J6	JUNCTION	0.084	0.113	0 03:45	1.812	2.414
J7	JUNCTION	0.053	0.165	0 03:48	1.126	3.541
J8	JUNCTION	0.000	0.165	0 03:51	0.000	3.541

Post-development Conditions: Huff Distribution 1:100yr Storm Event

J9	JUNCTION	0.023	0.187	0	03:53	0.478	4.019
J10	JUNCTION	0.000	0.439	0	03:59	0.000	9.430
J11	JUNCTION	0.044	0.481	0	03:59	1.015	10.442
J12	JUNCTION	0.000	0.025	0	21:27	0.000	6.934
Out1	OUTFALL	0.000	0.025	0	21:27	0.000	6.933
SU1	STORAGE	0.000	0.481	0	04:00	0.000	10.446

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
SU1	STORAGE	71.19	0.463	0.157

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	E&I Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	6.039	60	0	8.614	86	0 21:27	0.025

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CMS	Max. Flow CMS	Total Volume 10^6 ltr
Out1	98.48	0.020	0.025	6.933
System	98.48	0.020	0.025	6.933

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.025	0 21:27	0.73	0.10	0.23
C2	CONDUIT	0.481	0 04:00	1.92	0.08	0.63
C3	CONDUIT	0.438	0 04:01	0.80	0.25	0.49
C4	CONDUIT	0.439	0 03:59	0.58	0.25	0.60
C5	CONDUIT	0.211	0 03:51	0.47	0.10	0.43
C6	CONDUIT	0.132	0 03:51	0.49	0.06	0.29
C7	CONDUIT	0.031	0 03:46	0.21	0.02	0.19
C8	CONDUIT	0.187	0 03:56	0.41	0.11	0.43
C9	CONDUIT	0.165	0 03:53	0.53	0.10	0.33
C10	CONDUIT	0.165	0 03:51	0.50	0.11	0.34
C11	CONDUIT	0.112	0 03:51	0.37	0.07	0.32
C12	CONDUIT	0.028	0 03:46	0.17	0.02	0.20
R1	ORIFICE	0.025	0 21:27			

****
Flow Classification Summary
****

Post-development Conditions: Huff Distribution 1:100yr Storm Event

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Avg. Froude Number	Avg. Flow Change
C1	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.82	0.0000
C2	1.00	0.00	0.00	0.00	0.96	0.03	0.00	0.00	0.09	0.0000
C3	1.00	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0.26	0.0000
C4	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.17	0.0000
C5	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.17	0.0000
C6	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.21	0.0000
C7	1.00	0.00	0.15	0.00	0.85	0.00	0.00	0.00	0.07	0.0000
C8	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.15	0.0000
C9	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.21	0.0000
C10	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.20	0.0000
C11	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.16	0.0000
C12	1.00	0.00	0.13	0.00	0.87	0.00	0.00	0.00	0.06	0.0000

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Sun Oct 21 21:10:14 2012
Analysis ended on: Sun Oct 21 21:10:21 2012
Total elapsed time: 00:00:07

Government of Alberta

Application under the *Water Act* for Approvals and/or Licences

This application form is for activities regulated under the *Water Act*.

Check one or more of the following to indicate type of application

Licence for Diversion of Water	☒	Renewal of Diversion Licence	☐	Approval for Constructing Works	☒
Licence Amendment	☐	Approval Amendment	☐	Preliminary Certificate Amendment	☐
Water Act File No. (if applicable)					

Applicant

Name or Business Name:	Bob Shipway	Business Contact:	780-831-1200
Address: (include city, province and postal code)	Box 58 Millet, AB T0C 1Z0	Cell No.:	780-831-1200
		Phone No.:	
		Fax No.:	
		E-mail:	
Are you the owner of the land or undertaking?		◉ Yes ○ No	
Authorized Representative*		☒ Same as Applicant	

Project Description

Tentative Construction Start Date:	17-May-2013	Duration of Construction:	11-Jul-2013
Tentative Water Diversion Start Date:	17-May-2013	Duration of Water Diversion/Use:	28/5/13

Provide a detailed description, including location of works and activities, relating to the project and attach plans:

Bob Shipway is planning to develop approximately 10.78ha of land in the N.W.1/4 Sec., 28-47-24-W4M. The Parcel will be developed for pipe storage, the surface will be graveled. The development is located in N.W.1/4 Sec., 28-47-24-W4M, south of township 475 and east of Range Road 244. One storm water pond will be constructed to provide storm water management. The pond location is shown on attached drawing in the report. The storage pond will hold storage for the 1:100 yr 24hr post-development flow. A pre-development release rate of 2.25 l/s/ha is used for this proposed development.

Water Sources (Location of Works and Activities): (●) Surface Water ( ) Groundwater

Surface Water - Point of Diversion or Activity
(if constructing works only, complete the first three columns)

	Water Body e.g. lake, stream, or name of source, if known	Water Diversion/Activity Location					Is Construction Required?	Annual Volume of Water Required (cubic metres)	Maximum Pumping Rate (show units)	Purpose (for diversion only)
		1/4	Sec	Twp	Rge	M				
+										
x										
	Plan/Block/Lot						UTM Coordinates	Zone:	Easting (m)	Northing (m)

+ - add additional row
x - remove current row

**Indicate the `Point of Use** 'if different than the `Water Diversion Location(s)' ☐ same location as source(s)

	1/4	Sec	Twp	Rge	M	or provide a general description of where the water will be used (below)
+						
x						

To ensure your application is complete, please refer to the `Guidelines for Licensing Water Diversion Projects' (http://environment.alberta.ca/03222.html).

Statement of Confirmation:
The information given on this form is true to the best of my knowledge.

If you wish to sign the form with an electronic signature you are bound with the same force as though you had a fixed signature on paper.

Signature	Date of Signing	Printed Name	Company Name

Return the completed form to the Alberta Environment Regulatory Approvals Centre:

Regulatory Approvals Centre Main Floor Oxbridge Place 9820 106 Street Edmonton Alberta T5K 2J6 Telephone: 780-427-6311 Fax: 780-422-0154	Northern Region E-mail address AENV.NorthWaterApprovals@gov.ab.ca Central Region E-mail address AENV.CentralWaterApprovals@gov.ab.ca Southern Region E-mail address AENV.SouthWaterApprovals@gov.ab.ca	Submit application for Northern Region Submit application for Central Region Submit application for Southern Region

PERSONAL INFORMATION COLLECTION AND USE NOTIFICATION

Personal information on this form is collected under the authority of section 33(c) of the Freedom of Information and Protection of Privacy (FOIP) Act and will be used to administer the Water Act and its associated regulations. ***This form is a public record and is available to anyone****. All information contained on this form (including personal information) is disclosed by Alberta Environment and Water to anyone requesting a copy in accordance with Section 15(1)(a) of the Water (Ministerial) Regulation. For further information about the collection and use of this information, please contact Alberta Environment and Water's Regulatory Approvals Centre at RAC.Environment@gov.ab.ca or call (780) 427-6311.*

WATER (MINISTERIAL) REGULATION **- REQUEST FOR CONFIDENTIALITY**

As identified in Section 15(4) of the *Water (Ministerial) Regulation,* If the applicant wishes that a trade secret, process or technical information in the application be kept confidential, the applicant may make a written request to the Director within 30 days after the information is submitted, identifying the information, and requesting that the information be kept confidential and not be disclosed. The written request must identify the specifics of the information to be kept confidential and not to be disclosed. Ultimately, it is the Director who makes the decision regarding the confidentiality of the identified information.

If you are submitting a request to assure confidentiality of certain information such as a trade secret, process or technical information for the Directors consideration, ***submit this information in a separate attachment to the application form.***

Protect Fields

Alberta Environment and Sustainable Resource Development

Environmental Operations
Room 304, Provincial Building
4920 51 Street
Red Deer, Alberta T4N 6K8
Telephone: 403-340-7052
Fax: 403-340-5022
www.alberta.ca

November 27, 2012

File: 00319385

Bob Shipway
P.O. Box 58
Millet AB T0C 1Z0

Dear Sir:

Re: Shipway Development
Application under the Water Act for an Approval
To Construct, Operate and Maintain Storm Water Management Works
located in NW 28-47-24-W4M

This is further to your October 23, 2012 *Water Act* application submission. Based on the information provided, the proposed activity does not require a *Water Act* approval.

We will proceed with the cancellation of this application and the closure of this file.

Enclosed for your information is a weblink to the *Water Act* Code of Practice for Outfall Structures on Water Bodies which maybe required for the works http://www.environment.alberta.ca/1398.html .

Please noted, future development may require as part of the application a wetland assessment and wetland mitigation / compensation. For your convenience the following are web links located on our website:

Provincial Wetland Restoration/Compensation Fact Sheet
http://www3.gov.ab.ca/env/water/reports/Prov_Wetland_Rest_Comp_factsheet.pdf
Provincial Wetland Restoration/Compensation Guide February 2007
http://www3.gov.ab.ca/env/water/reports/Prov_Wetland_Rest_Comp_Guide.pdf
Administrative Guide for Approvals to Protect Surface Water Bodies under the Water Act
http://environment.gov.ab.ca/info/library/6208.pdf
Alberta Water Resources Commission's Wetland Management in the Settled Area of Alberta - An Interim Policy:
http://www3.gov.ab.ca/env/water/reports/1wmsa.pdf.

Please note, that a ground water licence maybe required for the development. Please contact Laura Partridge, Groundwater technologist regarding this licence.

Environmental Protection and Enhancement Act (EPEA) Registrations Required for the Waterworks, Wastewater and Storm Water Works

The development will require an EPEA approval, registration, or authorization under the *Environmental Protection and Enhancement Act* (EPEA) for the construction, operation or reclamation of municipal water, storm water or wastewater systems. Please contact Julian Huang, Municipal Engineer, Alberta Environment, regarding these items.

This should not be taken to mean that you have an authority under federal legislation. Please contact the following offices relating to the application of federal laws:

Fisheries Act (Canada)
Fisheries and Oceans
Habitat Management
Central and Arctic Region
Prairies Area, Calgary District
7646 - 8 St NE
Calgary, Alberta T2E 8X4
Telephone: 403-292-5160
Fax: 403-292-5173

780-495-4220

Navigable Waters Protection Act (Canada)
Transport Canada
Navigable Waters Protection
Prairies and Northern Region - Marine
Canada Place
1100 9700 Jasper Avenue
Edmonton, Alberta T5J 4E6
Telephone: 780-495-6325
Fax: 780-495-8607

If you have any questions or comments please contact us at 403-340-7052.

Sincerely,

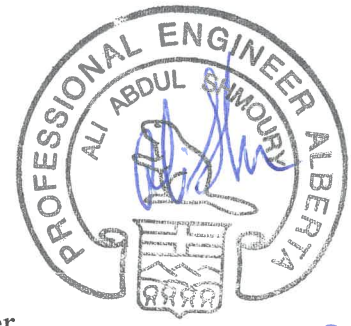
Andrew Patton, P. Eng.
Water Administration Engineer

cc: Ali Shimoury, AREA Consulting, Edmonton
County of Wetaskiwin

REGISTRATION/LETTER OF AUTHORIZATION
For
STORM DRAINAGE DETENTION/TREATMENT FACILITIES

Project Name	**Shipway Stormwater Management**
Location	**N.W.1/4 Sec., 28-47-24-W4M**
Municipality	**County of Wetaskiwin**

I acknowledge that I have reviewed the *Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems*, January 2006, as well as the *Stormwater Management Guidelines for the Province of Alberta*, January 1999 and certify that the design of the above noted project complies with all of the requirements specified for the construction of the stormwater management facilities.



May 14, 2013

SIGNED AND STAMPED by a professional engineer.
NAME: Ali Shmoury, P.Eng.
COMPANY: Area Consulting Inc.

Designs that are found to not be in accordance with the Standards and Guidelines may result in enforcement action and/or referral to APEGGA.
For projects that do not comply with all of the Standards and Guidelines please submit a detailed explanation of the deficiency and why it is, in your professional opinion, necessary.

Alberta Environment Central Region
Approval Process Improvement Pilot Project

Questionnaire Regarding Required Submissions for

Applications of Stormwater Drainage Registrations or Letters of Authorization

This questionnaire outlines minimum information submission requirements listed in the attached "Application Form"". This questionnaire will be used to determine submission deficiencies and to streamline Environment & SRD approval process in Central Region under EPEA.

Name of the proposed storm drainage facility: Shipway development N.W.1/4 Sec.,28-47-24-W4M

Question 1: Stormwater Management Report and Engineering Drawings
Yes (X) No ( ) _____ Have you provided a stormwater management report/plan or letter that contains information required in the attached "Application Form" and is signed and stamped by a Professional Engineer, and; engineering drawings that are signed and stamped by a Professional Engineer?

Question 2: Review on Design Details
Yes (X) No () ____ Have you compared the design with AENV Guideline requirements listed in the attached "Application Form" Appendix B (also in AENV Guidelines) for wet ponds and dry ponds? If there are deviations from the noted AENV Guideline requirements, please refer to Question 4.

Question 3: Statement on Complying with AENV Guidelines
Yes (X) No () _____ Have you provided a statement page indicating whether design of the project complies with Alberta Environment Guidelines and that is signed and stamped by a Professional Engineer? Refer to attached 'Application Form" Table 1.

Question 4: Justification for Design Deviation
Yes ( ) No ( ) Have you provided justifications for AENV review (to be attached to the Statement in Question 2) for any design deviations from AENV Guidelines? Refer to Question 3 and page 2 of this questionnaire.

Question 5: Information on Agreement with the Municipality
Yes (X) No ( ) _____ Does local municipality know about the project and have no objection to the construction of the pond? Refer to attached "Application Form" section 4.1(d).

Question 6: System Water Quality Performance
Please refer to the attached "Application Form" section 4.1(a).
Yes (X) No ( ) ____ Is predicted system water quality performance equal to or higher than 85 % removal of sediments of particle size 75 μm and greater?
Yes (X) No ( ) ____ If you have concluded that predicted system water quality performance of 85% removal of sediments is not necessary for the project, have you provided justifications for AENV review? Refer to page 2 of this questionnaire.

Company:
Signature: __Area Consulting Inc._____ (to be signed by a Professional Engineer)

Name and title of the professional engineer: Ali Shmoury, Manager

PROFESSIONAL ENGINEER ALBERTA
ALI ABDUL SHMOURY
May 11, 2013

Justifications on Design Deviations Required by Question 4:

Alberta Environment and Sustainable Resource Development

APPLICATION FORM AND GUIDE FOR REGISTRATION TO CONSTRUCT AND OPERATE A MUNICIPAL STORM DRAINAGE SYSTEM

INTRODUCTION

The attached form and guidelines outline the information required for an application to obtain a Registration to construct and operate a storm drainage system. The application is to be prepared in accordance with the *Environmental Protection and Enhancement Act* (EPEA) and Approval Procedure Regulation 113/93. Please ensure that each section of the application is completed in a concise and clear manner.

It should be noted that a Registration will be issued for storm drainage systems. This Registration will cover the storm drainage collection system and storm drainage treatment facilities. Please be aware that a separate application under the *Water Act* may also be required.

For your information, the general steps and procedures that are followed when reviewing and issuing a registration for storm drainage systems is illustrated by the attached flow chart (Figure 1). Because this is a registration, there is no requirement for public notice, but that the public via a Freedom of Information and Protection of Privacy (FOIP) request may view the application. It is therefore important that the application for this registration contain all the information required and be formatted to facilitate public review.

This application must be completed and forwarded to Alberta Environment and Sustainable Resource Development (ESRD) at the following address:

Alberta Environment and Sustainable Resource Development
Regulatory Approvals Centre
Main Floor, Oxbridge Place
9820 - 106 Street
Edmonton, AB T5K 2J6

Phone: (780) 427-6311
Fax: (780) 422-0154

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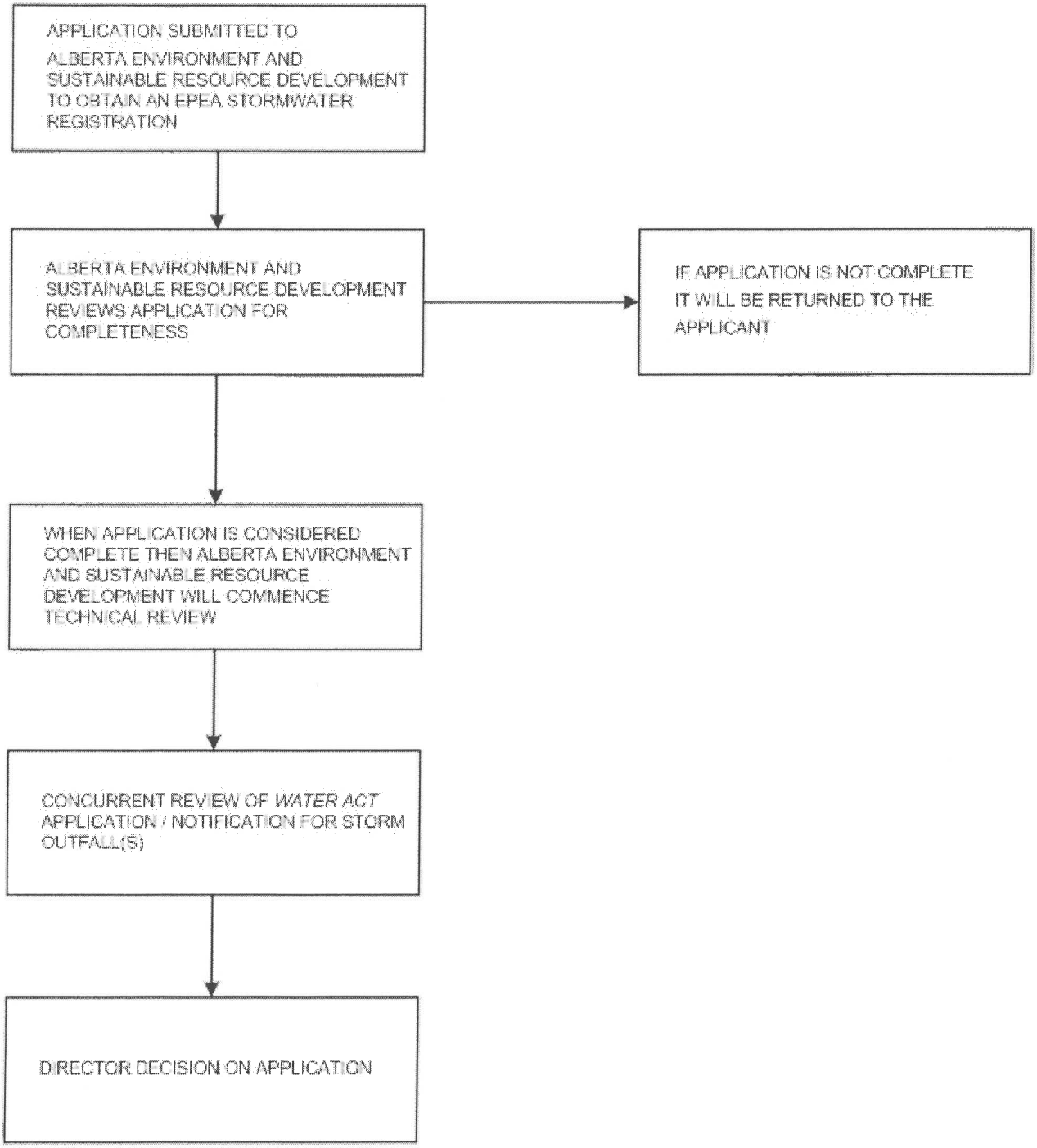
FIGURE 1 - THE REGISTRATION PROCEDURE FOR MUNICIPAL STORM DRAINAGE SYSTEMS



APPLICATION FORM AND GUIDE FOR REGISTRATION TO CONSTRUCT AND OPERATE A MUNICIPAL STORM DRAINAGE SYSTEM

1.0 Administrative Information

1.1 Name of stormwater system: Shipway development N.W.1/4 Sec.,28-47-24-W4M

1.2 Corporate Name/Address/Phone of person/owner responsible for this stormwater system

Corporate Name:	Bob Shipway	Contact Person:	Bob Shipway
Address:	P.O. Box 58 Millet AB T0C 1Z0	Position:	
		Phone No.:	780-237-5137
		Fax No.:	
		Email:	bdshipway@gmail.com

1.3 Proposed date for construction:

Master Drainage Plan

1.4 Do you have a Master Plan for the area? ○ Yes ◉ No

If yes, submit the Master Drainage Plan in support of this storm application
If no, what is the timeline for creation of a Master Drainage Plan?

Stormwater Management Plan

1.5 Do you have a Stormwater Management Plan for this development? ◉ Yes ○ No

If yes, submit the Stormwater Management Plan in support of this storm application

1.6 Are there any bylaws or other measures to control the quantity and/or quality of discharges into the stormwater system? ○ Yes ◉ No

If yes, provide a copy of bylaw(s).

2.0 Proposed Stormwater System Description

Surficial Drainage Collection System

2.1 Description (include map of surficial drainage):

pipe yard that drains into ditches then into a pond. See attaced

Piped Storm Drainage Collection System

2.2 Description (include signed and stamped engineering drawings of storm piping layout):

3.0 Stormwater Treatment

3.1 Storm Ponds:

(include signed and stamped engineering drawings of storm ponds) ☐ Not applicable to this application

	Storm Ponds	Legal Land Description					GPS Coordinates		Name of the drainage course to which the stormwater is discharged
+	Facility Designation/ Name	1/4	Sec	Twp	Rge	M	Latitude	Longitude	
x		NW	28	47	24	4			county ditch
	Location Description (street address, plan-block-lot)								
+	add another storm pond information row								
x	remove current row								

3.2 Storm Outfalls:

(include signed and stamped engineering drawings of storm outfalls) ☐ Not applicable to this application

	Storm Outfalls	Legal Land Description					GPS Coordinates		Name of the drainage course to which the stormwater is discharged
+	Facility Designation/ Name	1/4	Sec	Twp	Rge	M	Latitude	Longitude	
x		NW	28	47	24	4			county ditch
	Location Description (street address, plan-block-lot)								
+	add another storm outfall information row								
x	remove current row								

3.3 Permanent Snow Storage Sites:

☐ Not applicable to this application

	Permanent Snow Storage	Legal Land Description					GPS Coordinates		Name of the drainage course to which the stormwater is discharged
+	Facility Designation/ Name	1/4	Sec	Twp	Rge	M	Latitude	Longitude	
x									
	Location Description (street address, plan-block-lot)								
+	add another snow storage site information row								
x	remove current row								

3.4 Storm Pumping Station:

Does this storm system use any storm pumping stations? ○ Yes ◉ No

3.5 Chemical Use:

Are any chemicals used in the stormwater collection or in the storm ponds? ○ Yes ◉ No

3.6 Stormwater Security:

Are any storm ponds fenced? ○ Yes ◉ No

3.7 Adequate Outlet:

For a storm drainage discharge outlet to be considered an adequate outlet, the storm drainage system must NOT measurably:

- alter the natural peak flow or level of the water body receiving the storm drainage, whether temporarily or permanently;
- change or be capable of changing the location of the water or the direction of flow of water in the water body receiving the storm drainage;
- cause or be capable of causing the siltation or the erosion of any bed or shore of the receiving water body;
- cause or be capable of causing an adverse effect on the aquatic environment.

I hereby confirm that the proposed storm system discharge has an adequate outlet. Yes ☒

4.0 Overall Review

4.1 The information required on the attached Table must be submitted as part of the application to obtain a Registration in accordance with the *Environmental Protection and Enhancement Act*, Approvals Procedure Regulation 113/93.

It should be noted that the extent of information required will depend on the applicant's circumstance to ensure that they have adequately addressed each issue. However, as this application is a public document, it is important that it be as clear and concise as possible. Therefore, the suggested format for submission of the required information should be followed.

In addition to information required in Table 1, please include comments on the following specific technical information:

a) demonstration of 85% removal of particles sized greater than 75 um; (Municipal Policy and Procedures Manual, http://www.environment.gov.ab.ca/info/library/7278.pdf);

b) demonstration that post development stormwater flows equal pre-development (before the land was originally stripped) flows;

c) explain which Storm Drainage Best Management Practices (BMPs) from the *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems (2006)* will be used and how they will achieve the above targets. The standards and guidelines can be found at http://environment.gov.ab.ca/info/library/6979.pdf;

d) include the design documentation outlined in Appendix A;

e) confirmation by the municipality that they are in agreement with the project; and

f) comparison to watershed specific release rates and capture volumes, where applicable.[1]

[1] *For example, within the Nose Creek watershed, reference to how the applicable recommendations in the Draft Nose Creek Water Management Plan are being met, in particular the riparian buffers and release rates that are outlined within the plan. The plan can be found at*

http://nosecreekpartnership.com/

TABLE 1: REGISTRATION APPLICATION INFORMATION REQUIREMENTS

INFORMATION REQUIREMENT	COMMENTS AND SUGGESTED FORMAT
A general description of the storm drainage system should be provided.	It is suggested a map of the area be included showing: • all storm outfalls and the drainage serviced by each outfall; • any stormwater ponds or treatment works; and • location of immediate & ultimate discharge points.
A detailed description of the storm drainage system	The applicant must provide: • engineering drawings signed and stamped by a professional engineer; and • the designed hydraulic capacity of the system.
A brief description of how the system will be operated / maintained.	The applicant should provide an outline of its proposed operating and maintenance procedures and practices.
A description of projected quantity and quality of stormwater to be discharged to the environment, the receiving environment (watercourse) and the uses of these watercourses.	The applicant should provide information on the estimated quantity/quality of drainage system discharges and provide assessment/comments on the impact of these discharges on the environment and downstream land owners.
A statement stamped and signed by a professional engineer verifying complies of the design with AEW Standards and Guidelines.	Statement must indicate whether the design of the project complies with all design requirements of: • *Standards and Guidelines for Municipal Waterworks, Wastewater & Storm Drainage Systems, January 2006; and* • *Stormwater Management Guidelines for the Province of Alberta, January 1999* if a design requirement is not met, it must be clearly identified with the justification for the alternative design.
Any emergency response plans the applicant has to deal with any possible major problems/failures that could occur to the drainage system.	If the applicant has a formal emergency response plan a copy should be submitted with the application. In the absence of such a plan, the applicant should briefly outline the procedure that would be followed in the event of major problems with the drainage system.
A summary of any potential environmental related objections or concerns and the applicant's comments and/or proposed action to address these objections/concerns.	The applicant should attempt to proactively identify and address possible environmental objections/concerns regarding the drainage system.

Alberta Environment and Sustainable Resource Development

APPLICATION FORM AND GUIDE FOR REGISTRATION TO CONSTRUCT AND OPERATE A MUNICIPAL STORM DRAINAGE SYSTEM

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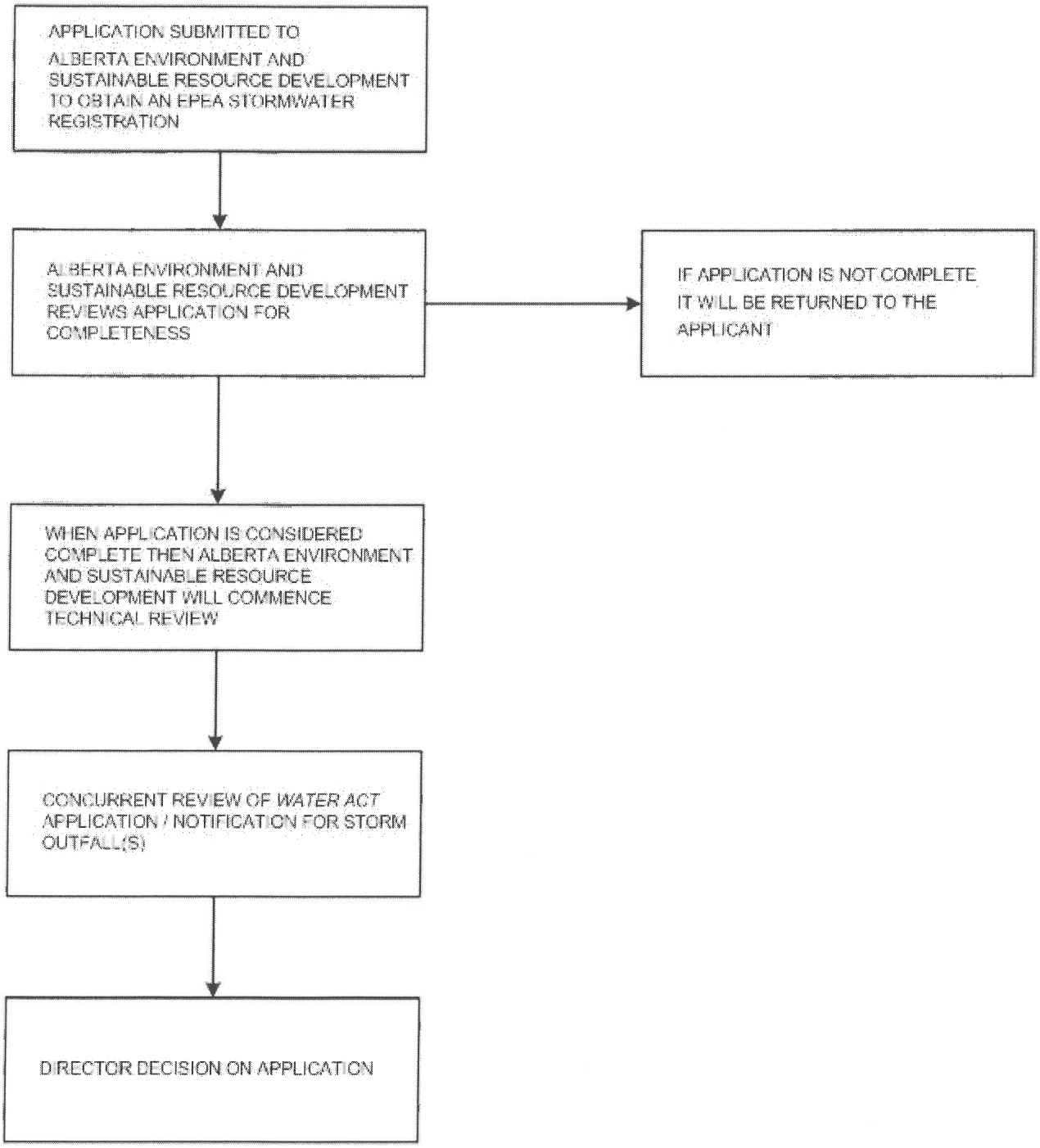

APPLICATION FORM AND GUIDE FOR REGISTRATION TO CONSTRUCT AND OPERATE A MUNICIPAL STORM DRAINAGE SYSTEM

1.0 Administrative Information

1.1 Name of stormwater system: Shipway development N.W.1/4 Sec.,28-47-24-W4M

1.2 Corporate Name/Address/Phone of person/owner responsible for this stormwater system

Corporate Name:	Bob Shipway	Contact Person:	Bob Shipway
Address:	P.O. Box 58 Millet AB T0C 1Z0	Position:	
		Phone No.:	780-237-5137
		Fax No.:	
		Email:	bdshipway@gmail.com

1.3 Proposed date for construction:

Master Drainage Plan

1.4 Do you have a Master Plan for the area? ○ Yes ◉ No

If yes, submit the Master Drainage Plan in support of this storm application
If no, what is the timeline for creation of a Master Drainage Plan?

Stormwater Management Plan

1.5 Do you have a Stormwater Management Plan for this development? ◉ Yes ○ No

If yes, submit the Stormwater Management Plan in support of this storm application

1.6 Are there any bylaws or other measures to control the quantity and/or quality of discharges into the stormwater system? ○ Yes ◉ No

If yes, provide a copy of bylaw(s).

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Surficial Drainage Collection System

2.1 Description (include map of surficial drainage):

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Piped Storm Drainage Collection System

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x		NW	28	47	24	4			county ditch
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	Location Description (street address, plan-block-lot)								
+	add another storm outfall information row								
x	remove current row								

3.3 Permanent Snow Storage Sites:

☐ Not applicable to this application

Permanent Snow Storage		Legal Land Description					GPS Coordinates		Name of the drainage course to which the stormwater is discharged
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x									
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d) include the design documentation outlined in Appendix A;

e) confirmation by the municipality that they are in agreement with the project; and

f) comparison to watershed specific release rates and capture volumes, where applicable.[1]

[1] *For example, within the Nose Creek watershed, reference to how the applicable recommendations in the Draft Nose Creek Water Management Plan are being met, in particular the riparian buffers and release rates that are outlined within the plan. The plan can be found at*

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A summary of any potential environmental related objections or concerns and the applicant's comments and/or proposed action to address these objections/concerns.	The applicant should attempt to proactively identify and address possible environmental objections/concerns regarding the drainage system.

5.0 Signature Page (Storm System Owner)

5.1 The *Environmental Protection and Enhancement Act* and Regulations, provide a specific definition for the "owner" and "person responsible for a wastewater system or storm drainage system". Therefore, the person(s) responsible/person signing this document should be well familiar with the *Environmental Protection and Enhancement Act* and the Regulations.

5.2 The sections of the *Environmental Protection and Enhancement Act* and Regulations that are of particular relevance to wastewater system and storm drainage system are:

a) *Environmental Protection and Enhancement Act*, Part 2, Division 2 (Approvals and Certificates); Part 4 (Release of Substances; Part 10 (Enforcement);

b) Wastewater and Storm Drainage Regulation 119/93;

c) Wastewater and Storm Drainage (Ministerial) Regulation 120/93;

d) Approvals Procedure Regulation 113/93

5.3 I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief, such information is true, complete and accurate.

Corporate Name:	Area Consulting Inc.
Position:	Manager
Corporate Address:	**15524 47 Street**
Postal Code:	T5Y 3L8
Corporate Telephone:	780-278-4834 Fax:
Date of Application:	May 8, 2013
Signature:	Ali Shmoury

Digitally signed by Ali Shmoury
DN: cn=Ali Shmoury, o, ou, email=ali.shmoury@telus.net, c=CA
Date: 2013.05.08 11:34:52 -06'00'

(SIGNED BY STORM SYSTEM OWNER)

Appendix A

Additional Design Documentation to be Included in the Application:

1. Please provide plan and elevation view drawings* of the stormwater management system / facilities with the details of:

   (a) inlet and outlet structure;

   (b) length to width ratio;

   (c) side slopes and bottom slopes;

   (d) the 1:100 year high water level;

   (e) comparisons of this 1:100 year high water level to the lowest elevation of basement footings in the development;

   (f) plan view drawing of watershed boundaries and catchment areas draining to each pond in question;

   (g) predicted water quality performance i.e. 85 % removal of sediments of particle size 75 m and greater

   * drawings must be stamped and signed by a professional engineer.

2. Please provide rationale and supporting documentation used to delineate the maximum flow rate and volumes during a major and minor storm event. Please provide information on the type of model used.

3. Verification that there is an adequate outlet.

4. Verification on whether this is a new or existing storm outfall.

5. Please provide a stamped statement certifying that the design meets the two sets of required AESRD Guidelines.

Appendix B

Minimum design features based on *Stormwater Management Guidelines for the Province of Alberta, January 1999*:

Refer to Section 6.5.1 Wet Ponds - Wet ponds can be designed to meet both flood control and water quality objectives.

General Design Considerations (section 6.5.1.7):

- Minimum water surface area of 2 ha
- Maximum side slopes above active storage zone are 4:1 to 5:1
- Maximum interior side slopes in active storage zone are 5:1 to 7:1
- Maximum exterior side slopes are 3:1
- Emergency Spillway for 1:100 yr

Water Quality Control Design Parameters:

- Permanent pool sized to store the volume of runoff from a 25-mm storm over the contributing area
- Detention time of 24 hours
- Length to width ratio shall be from 4:1 to 5:1
- Minimum permanent pool depth of 2.0 m
- Maximum permanent pool depth of 3.0 m
- Maximum water level is below adjacent house basement footings
- Maximum active detention storage depth of 2.0 m

Other:

- 1:100 year storm stored within 2m above the permanent pool
- Detention time of 24 hours

Forebay Design:

- Length to width ratio of 2:1 or greater
- Forebay surface area not to exceed one-third of the permanent pool surface area
- Forebay berm should be 0.15 to 0.3 m below the permanent pool elevation
- Refer to Figure 6.10

Refer to Section 6.5.2 Dry Ponds

General Design Considerations (section 6.5.2.7):

- Storage capacity for up to the 1 in 100 year storm
- Detention time of 24 hours
- Maximum storage depth of 1.0 to 1.5 m
- Maximum water level below adjacent house basement footings
- Maximum interior side slopes of 4:1 to 5:1
- Maximum exterior side slopes of 3:1
- Minimum freeboard of 0.6 m
- Minimum ratio of effective length to effective width of 4:1 to 5:1
- Minimum slope on the bottom of the pond of 1 percent (2 percent is preferred)
- Emergency Spillway for 1:100 yr
- Refer to Figure 6.11

Appendix F

Addendum to Stormwater Management Report

ADDENDUM TO
(STORMWATER MANAGEMENT REPORT
Shipway Development N.W.1/4 Sec., 28-47-24-W4M)

Submitted to:

Bob Shipway
Box 58
Millet, Alberta
T0C 1Z0

Submitted by:

AREA Consulting Inc.
13204 166 Avenue
Edmonton, AB T6V 0J4
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ali@areaconsulting.ca

November 5, 2015

Table of Contents

List of Figures

List of Tables

1.0 Introduction

Area Consulting Inc. has been commissioned Mr. Bob Shipway, to Update the existing Stormwater Management Report (SWMR) for the addition of 3.98 ha of industrial yard, directly east of the previously approved development portion of land within NW ¼ Sec 28 Twp 47 Range 24 W4th directly east of the Town of Millet, Alberta, as shown on Figure 1, Site Location Plan in Appendix A.

This Addendum presents the design of the proposed SWMR for approval by the County of Wetaskiwin No. 10, and Alberta Environment under the Water Act and Environmental Protection and Enhancement Act. The report includes system design methodology as well as the overall design drawings for review for the proposed development only.

1.1 System Overview

The proposed 3.98 ha development is located within NW ¼ Sec 28 Twp 47 Range 24 W4th directly east of the Town of Millet, Alberta. The site is currently undeveloped. The plan is to expand the existing stormwater management facility to control the post-development runoff rates to pre-development rates.

This addendum identifies the increase of stormwater management facility to control the post-development runoff rates for the additional area of 3.98ha. Design of the stormwater management facility is based on runoff rates resulting from a 1 in 100 year design rainfall event. All system design is based on 1 in 100yr design storm event. Alberta Environment regulations require that the post-development flow rates do not exceed the pre-development flow rates for the 100 year rainfall event.

1.2 Post-Development Surface Drainage

The existing drainage system remains unchanged. Surface runoff quantities and peak flow rates were determined for each catchment using SWMM5 including the 3.98ha. The detailed results of the simulations of the 1 in 100 year design storm event are included in Appendix B.

1.3 Hydrologic Analysis

Catchment areas were delineated based on the grading plan for the proposed subdivision and hydrologic parameters are taken from Alberta Environment for Predevelopment Requirements (Appendix B). Hydrologic response parameters were estimated for the catchments including percentage of imperviousness, surface slopes and infiltration parameters. The percentage imperviousness used in determining runoff coefficients for the different catchments is in accordance with the relation:

$$C = 0.95(\%Impervious) + 0.05(1 - \%Impervious)$$

A common surface slope of 1.2% was assigned to most catchments. Other common hydrologic response parameters are shown in below. The depression storage values used for modelling (Table 3-1) are very conservative values which will produce the maximum amount of runoff for the respective sub-areas.

Table 3-1. Pervious and Impervious Sub-Area Loss and Runoff Parameters

Parameter		Typical Range of Values	Selected Parameter Value	Comments On Selected Value
Depression Storage (mm)				
	Pervious sub-area	2.5 - 7.6	2.54	Low end of Lawn
	Impervious sub-area	1.3 - 2.5	1.7	Low end for Impervious surfaces
Manning's n for overland flow				
	Pervious sub-area	0.05 - 0.80	0.15	Short prairie grass
	Impervious sub-area	0.011-0.024	0.029	Gravel Surface

Infiltration was modelled using the Green-Ampt formulation with the parameters shown in Table 3-2 representing silt loam with clay soils typical of surficial soils near the proposed site. If required the pond will be lined with a 1m wide clay liner that meet the standards of Alberta Environment Standards. The geotechnical recommendation will determine if a liner is required. The Green-Ampt formulation is a physically-based

infiltration model used widely and consistent with other applications in SWMM including subsurface flow for groundwater Low Impact Development (LID) applications modelling.

Table 3-2. Green-Ampt Infiltration Parameters

Parameter	SWMM Input File Name	Typical Range of Values	Selected Parameter Value	Comments On Selected Value
Soil capillary suction (mm)	Suction	49 - 320	219.96	Loam sand with clay
Soil saturated hydraulic conductivity (mm/hr)	Conduct	0.25 - 120	1.524	Loam sand with clay
Initial soil moisture deficit	InitDef	0 - 1	0	Saturated

The land use represented in the SWMM model of the proposed site with their assigned runoff coefficients (% imperviousness in SWMM) are presented in Table 3-3. The percentage imperviousness assigned for the different land uses are very conservative to account for the higher runoff expected for the rare 1 in 100 year storm event. This resulted in an overall average percentage imperviousness of 65%, a value that will not underestimate the potential runoff to be generated by the development of the proposed site.

Table 3-3. Characteristics of Different Land Uses Represented In the Proposed Development Site Plan

Land use	Total Area (ha)	% Imperviousness
Graveled Area	13.86	65%
Pond Surfaces	0.9	85%
Total	**14.76**	

1.4 Rainfall-Runoff Model Results

The performance of the stormwater management facility (pond) was tested with the SWMM simulations of the 1 in 100 year design storm event. The simulated peak

discharge rate from the pond is presented in Table 3-4. The release rate from the pond was modeled by orifice flow the pond sized to limit the peak release rate of runoff from the pond to 2.25 L/s/ha for maximum depth of water in the pond at the High Water Level (HWL).

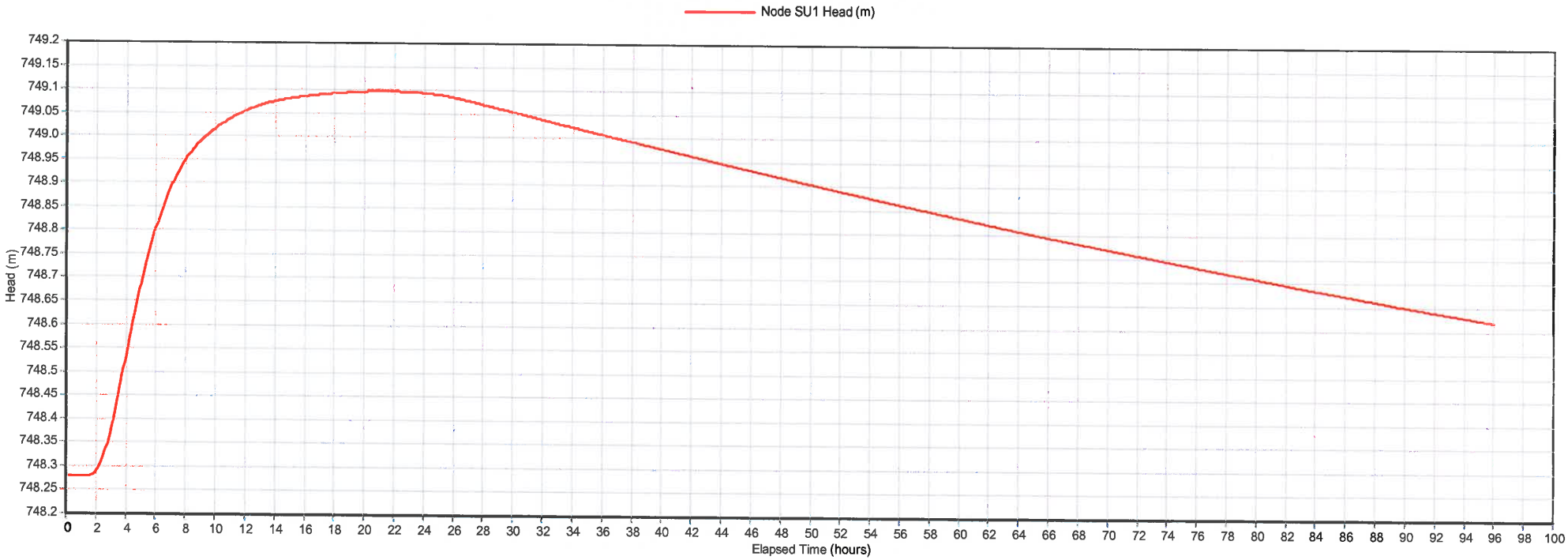
Table 3-4. Pond Characteristics and Computed Peak Discharges from the Ponds

Pond	Drainage Area (ha)	Peak Discharge (m^3/s)	Orifice size (mm)	NWL	HWL	Spillway Elevation (m)
Southwest SWMF	14.76	0.034	135	748.28	749.10	749.70

The simulated 1 in 100 year flood elevation is shown in Figure 3-1 and the Simulated 1 in 100 Year Discharge - Southwest Pond Rev (drawdown) is shown in Figure 3-1-1. Refer to next two pages for the above figures respectively.

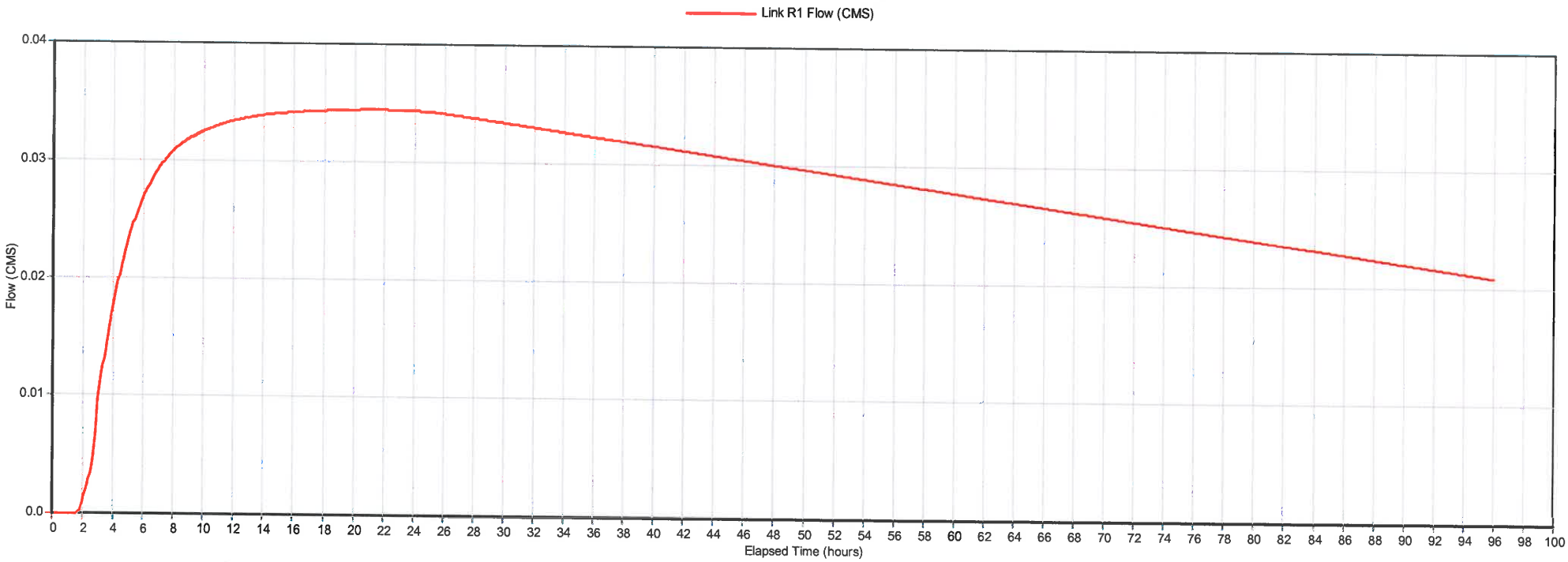
Post-development Conditions: Huff Distribution 1:100yr Storm Event

FIGURE 3-1 SIMULATED 1 IN 100 YEAR FLOOD ELEVATION SOUTHWEST POND REV



Post-development Conditions: Huff Distribution 1:100yr Storm Event

FIGURE 3-1-1 SIMULATED 1 IN 100 YEAR DISCHARGE - SOUTHWEST POND REV



The peak flood elevation in the Southwest pond is 749.10m that is 0.60 m below the emergency spillway elevation. The peak release rate from the pond is 0.034m³/s or 2.3 L/s/ha just above the maximum allowable. The southwest Pond is near or slightly under capacity, peaking below the emergency spillway elevation by 0.60 m. 60.78% of the pond volume is available 96 hours from the start of the storm event. Generally requirement that is required in engineering standards in Alberta, 90% of the active storage volume of the facility should be available within 96 hours. To achieve this, a bigger orifice size will have to be used, but that will let the release rate of the Pond in particular exceed the allowable unit peak discharge of 2.25 L/s/ha.

1.4.1 Runoff Volumes

The total runoff volumes received by the Southwest pond from the 1 in 100 year design storm event and the maximum percentage of utilization of the pond is presented in Table 3-5. With controlled releases from the pond, the maximum utilization of the pond is 74.71% of total active storage volume between normal water level (NWL) and the spillway elevation provided. Thus the pond is adequately sized to handle the runoff volumes generated by the 1 in 100 year design storm event. Sedimentation will decrease the capacity of the pond over time, but with regular maintenance of the pond including de-silting, the pond should be able to detain runoff volumes from the 1 in 100 year design storm event and release at controlled rate not exceeding the maximum allowable rate of 2.25 L/s/ha without overtopping.

Table 3-5. Maximum Percentage Utilization of Ponds during the 1 in 100 year Design Storm Event

Pond	Total Runoff Volume (m^3)	Maximum Stored Runoff Volume (m^3)	Maximum Active Storage Volume HWL - NWL (m^3)	Maximum % Utilization (%)
Southwest Pond	14,200	11,729	15,700	74.71

1.4.2 Runoff Rates

The proposed development increases peak runoff rates during storm events owing to decreased areas for infiltration of stormwater. The peak runoff rates from the development catchments will increase above that of the pre-development conditions for

the same catchments. The development increases peak runoff rates and volumes from the upstream catchments, the release rate from the site is controlled by the use of the stormwater management facilities. The pond has been sized to capture the excess runoff volumes produced by the site development of the catchments, detain the runoff and release at controlled rates not exceeding the peak allowable release rate of 2.5 L/s/ha. The total volume of runoff released from the site from the pond will however exceed pre-development runoff volumes, a condition which is not required to be met.

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2.0 Closure

This report has been prepared for the exclusive use of Mr. Bob Shipway. This report is based on, and limited by, the interpretation of data, circumstances, and conditions available at the time of completion of the work as referenced throughout the report. It has been prepared in accordance with generally accepted engineering practices. No other warranty, express or implied, is made.

Please do not hesitate to contact us if you require clarification or have any questions. Area Consulting Inc. is prepared to work with you on any further refinements on this conceptual stormwater management plan.

AREA CONSULTING INC.
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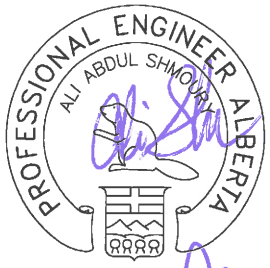
CORPORATE AUTHORIZATION

This document entitled Stormwater Management Report was prepared by AREA Consulting Inc. for Mr. Bob Shipway. The material in it reflects AREA Consulting Inc.'s best judgment in light of the information available to it at the time of preparation. Any such use a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. AREA Consulting Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

P09833
Corporate Permit



Dec., 16, 2015

Engineer: Ali Shmoury, P. Eng

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Appendix A.

Site Location Plan

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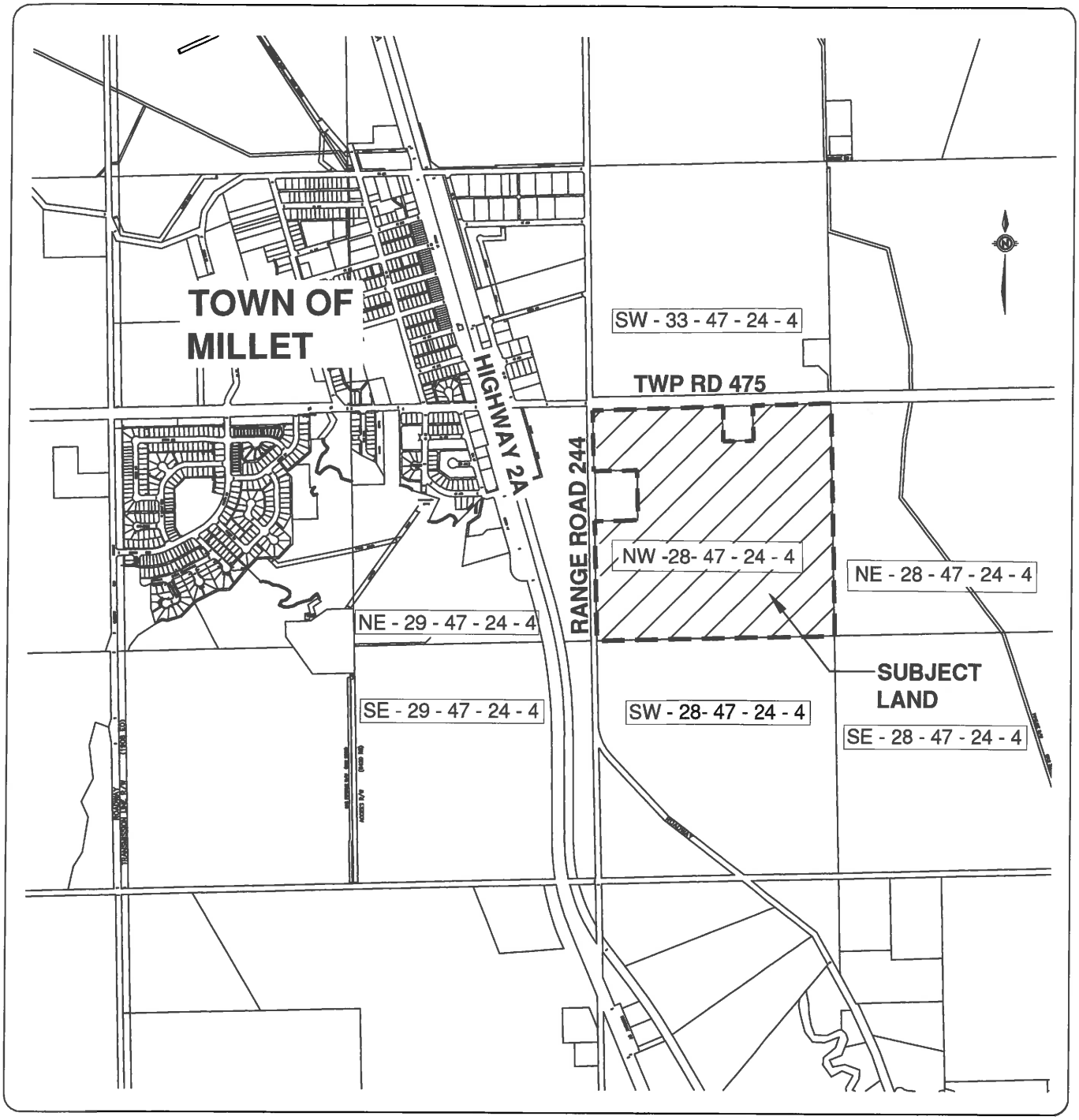

AREA Consulting Inc.	DECEMBER 20, 2015

LEGEND:

SITE BOUNDARY

SUBJECT LAND

DRAWN BY:	SCALE:	PROJECT No.:
R.S.	N.T.S.	

CLIENT: **MR. ROBERT L. SHIPWAY**

PROJECT: **SHIPWAY INDUSTRIAL YARD**

LOCATION: **TOWN OF MILLET**

TITLE:

FIGURE 1.0
SITE LOCATION PLAN

Appendix B.

SWMM5 Modeling Results

AREA CONSULTING INC.
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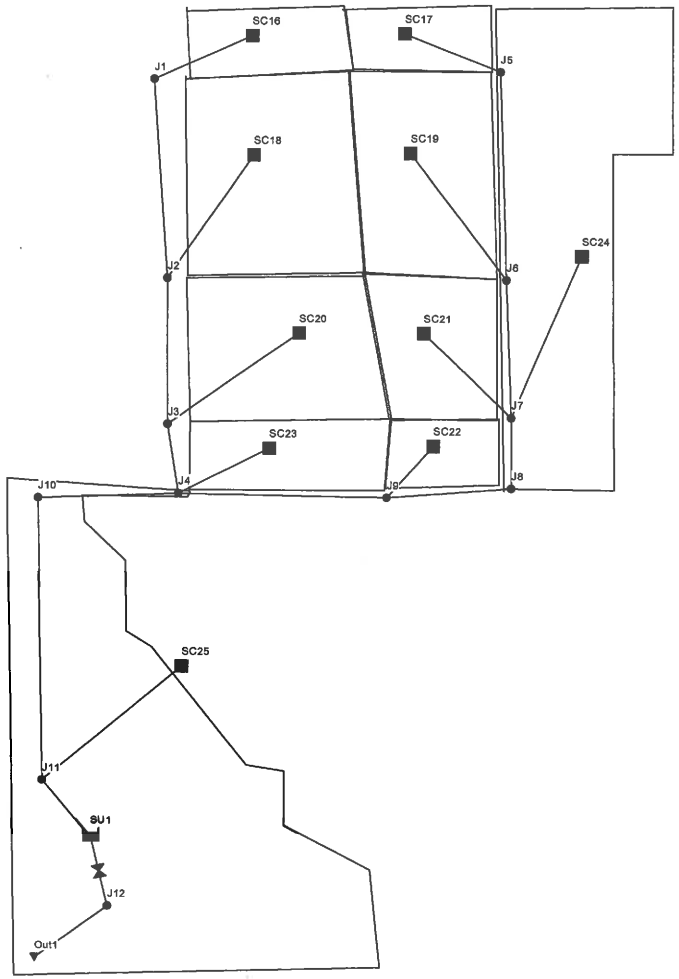
Post-development Conditions: Huff Distribution 1:100yr Storm Event REV

06/01/2001 00:05:00



Post-development Conditions: Huff Distribution 1:100yr Storm Event REV

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.009)

Post-development Conditions: Huff Distribution 1:100yr Storm Event

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 10
Number of nodes 14
Number of links 13
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Huff_gage	Huff	INTENSITY	15 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
SC16	0.68	100.00	65.00	1.2000	Huff_gage	J1
SC17	0.63	100.00	65.00	1.2000	Huff_gage	J5
SC18	2.29	145.00	65.00	1.2000	Huff_gage	J2
SC19	1.90	140.00	65.00	1.2000	Huff_gage	J6
SC20	1.80	140.00	65.00	1.2000	Huff_gage	J3
SC21	1.18	120.00	65.00	1.2000	Huff_gage	J7
SC22	0.50	100.00	65.00	3.0000	Huff_gage	J9
SC23	0.90	100.00	65.00	3.0000	Huff_gage	J4
SC24	3.98	198.00	65.00	1.2000	Huff_gage	J7
SC25	0.90	250.00	85.00	1.2000	Huff_gage	J11

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	753.11	0.60	0.0	
J2	JUNCTION	752.24	0.60	0.0	
J3	JUNCTION	751.57	0.60	0.0	
J4	JUNCTION	751.28	0.60	0.0	
J5	JUNCTION	753.28	0.60	0.0	
J6	JUNCTION	752.76	0.60	0.0	
J7	JUNCTION	752.40	0.60	0.0	
J8	JUNCTION	752.25	0.60	0.0	
J9	JUNCTION	751.90	0.60	0.0	
J10	JUNCTION	750.72	0.60	0.0	
J11	JUNCTION	749.62	0.60	0.0	
J12	JUNCTION	748.25	1.22	0.0	
Out1	OUTFALL	748.20	0.50	0.0	
SU1	STORAGE	748.28	1.22	0.0	

****

Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J12	Out1	CONDUIT	12.0	0.4167	0.0130
C2	SU1	J11	CONDUIT	29.3	-4.5782	0.0300
C3	J11	J10	CONDUIT	281.2	-0.3912	0.0300
C4	J10	J4	CONDUIT	143.0	-0.3916	0.0300
C5	J4	J3	CONDUIT	52.3	-0.5550	0.0300
C6	J3	J2	CONDUIT	119.5	-0.5607	0.0300
C7	J2	J1	CONDUIT	165.0	-0.5273	0.0300
C8	J4	J9	CONDUIT	158.5	-0.3912	0.0300
C9	J9	J8	CONDUIT	90.0	-0.3889	0.0300
C10	J8	J7	CONDUIT	52.1	-0.2876	0.0300
C11	J7	J6	CONDUIT	119.6	-0.3010	0.0300
C12	J6	J5	CONDUIT	166.7	-0.3119	0.0300
R1	SU1	J12	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.50	0.20	0.12	0.50	1	0.24
C2	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	5.96
C3	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	1.74
C4	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	1.74
C5	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	2.07
C6	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	2.08
C7	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	2.02
C8	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	1.74
C9	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	1.74
C10	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	1.49
C11	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	1.53
C12	TRAPEZOIDAL	0.60	1.68	0.35	4.60	1	1.55

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Starting Date JUN-01-2001 00:00:00
Ending Date JUN-05-2001 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Wet Time Step 00:00:01
Dry Time Step 01:00:00

```
Routing Time Step ........ 1.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001524 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	1.869	126.629
Evaporation Loss	0.000	0.000
Infiltration Loss	0.436	29.564
Surface Runoff	1.423	96.434
Final Storage	0.009	0.632
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	1.423	14.233
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.956	9.562
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.467	4.671
Continuity Error (%)	-0.004	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	1.00 sec
Maximum Time Step	:	1.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS

SC16	126.63	0.00	0.00	30.47	95.54	0.65	0.03
SC17	126.63	0.00	0.00	30.45	95.56	0.60	0.03
SC18	126.63	0.00	0.00	30.69	95.32	2.18	0.10
SC19	126.63	0.00	0.00	30.64	95.37	1.81	0.08
SC20	126.63	0.00	0.00	30.62	95.39	1.72	0.08
SC21	126.63	0.00	0.00	30.54	95.46	1.13	0.05
SC22	126.63	0.00	0.00	30.36	95.65	0.48	0.02
SC23	126.63	0.00	0.00	30.44	95.57	0.86	0.04
SC24	126.63	0.00	0.00	30.79	95.22	3.79	0.17
SC25	126.63	0.00	0.00	12.99	112.83	1.02	0.04

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.07	753.18	0 03:46	0.02
J2	JUNCTION	0.02	0.15	752.39	0 03:51	0.05
J3	JUNCTION	0.02	0.20	751.77	0 03:51	0.06
J4	JUNCTION	0.04	0.37	751.65	0 04:00	0.11
J5	JUNCTION	0.01	0.08	753.36	0 03:46	0.02
J6	JUNCTION	0.02	0.17	752.93	0 03:51	0.05
J7	JUNCTION	0.03	0.31	752.71	0 04:00	0.09
J8	JUNCTION	0.03	0.28	752.53	0 04:00	0.09
J9	JUNCTION	0.03	0.28	752.18	0 04:00	0.09
J10	JUNCTION	0.06	0.47	751.19	0 04:05	0.14
J11	JUNCTION	0.02	0.21	749.83	0 03:34	0.07
J12	JUNCTION	0.13	0.15	748.40	0 21:13	0.05
Out1	OUTFALL	0.11	0.12	748.32	0 21:13	0.04
SU1	STORAGE	0.58	0.82	749.10	0 21:13	0.25

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.031	0.031	0 03:45	0.65	0.65	0.000
J2	JUNCTION	0.101	0.132	0 03:45	2.18	2.83	0.003
J3	JUNCTION	0.080	0.211	0 03:49	1.72	4.55	-0.002
J4	JUNCTION	0.041	0.613	0 04:00	0.86	13.2	-0.017
J5	JUNCTION	0.028	0.028	0 03:45	0.602	0.602	0.000
J6	JUNCTION	0.084	0.113	0 03:45	1.81	2.41	0.004
J7	JUNCTION	0.227	0.340	0 04:00	4.92	7.33	-0.001
J8	JUNCTION	0.000	0.340	0 04:00	0	7.33	-0.002
J9	JUNCTION	0.023	0.362	0 04:00	0.478	7.81	0.004
J10	JUNCTION	0.000	0.613	0 04:00	0	13.2	0.037
J11	JUNCTION	0.044	0.654	0 04:00	1.02	14.2	-0.035
J12	JUNCTION	0.000	0.034	0 21:13	0	9.56	0.003
Out1	OUTFALL	0.000	0.034	0 21:13	0	9.56	0.000
SU1	STORAGE	0.000	0.656	0 04:00	0	14.2	0.085

****
Node Surcharge Summary

****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
SU1	STORAGE	46.72	0.217	0.403

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	8.164	45	0	0	11.729	65	0 21:13	0.034

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
Out1	98.38	0.028	0.034	9.562
System	98.38	0.028	0.034	9.562

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.034	0 21:13	0.79	0.14	0.27
C2	CONDUIT	0.656	0 04:00	2.39	0.11	0.62
C3	CONDUIT	0.611	0 04:03	0.89	0.35	0.57
C4	CONDUIT	0.613	0 04:00	0.65	0.35	0.70
C5	CONDUIT	0.211	0 03:51	0.40	0.10	0.47
C6	CONDUIT	0.132	0 03:51	0.49	0.06	0.29
C7	CONDUIT	0.031	0 03:46	0.21	0.02	0.19
C8	CONDUIT	0.362	0 04:00	0.56	0.21	0.54
C9	CONDUIT	0.340	0 04:00	0.65	0.20	0.47
C10	CONDUIT	0.340	0 04:00	0.61	0.23	0.49
C11	CONDUIT	0.112	0 03:51	0.27	0.07	0.40
C12	CONDUIT	0.028	0 03:46	0.17	0.02	0.20
R1	ORIFICE	0.034	0 21:13			

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00
C2	1.00	0.00	0.00	0.00	0.96	0.04	0.00	0.00	0.96	0.00
C3	1.00	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0.01	0.00
C4	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.98	0.00
C5	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.99	0.00
C6	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
C7	1.00	0.00	0.15	0.00	0.85	0.00	0.00	0.00	0.99	0.00
C8	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.99	0.00
C9	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.93	0.00
C10	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C11	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
C12	1.00	0.00	0.13	0.00	0.87	0.00	0.00	0.00	0.99	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C2	0.01	0.01	46.72	0.01	0.01

Analysis begun on: Tue Oct 20 11:38:47 2015
Analysis ended on: Tue Oct 20 11:38:54 2015
Total elapsed time: 00:00:07

Post-development Conditions: Huff Distribution 1:100yr Storm Event REV

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
SC16	126.63	0.00	0.00	30.47	95.54	0.65	0.03	0.755
SC17	126.63	0.00	0.00	30.45	95.56	0.60	0.03	0.755
SC18	126.63	0.00	0.00	30.69	95.32	2.18	0.10	0.753
SC19	126.63	0.00	0.00	30.64	95.37	1.81	0.08	0.753
SC20	126.63	0.00	0.00	30.62	95.39	1.72	0.08	0.753
SC21	126.63	0.00	0.00	30.54	95.46	1.13	0.05	0.754
SC22	126.63	0.00	0.00	30.36	95.65	0.48	0.02	0.755
SC23	126.63	0.00	0.00	30.44	95.57	0.86	0.04	0.755
SC24	126.63	0.00	0.00	30.79	95.22	3.79	0.17	0.752
SC25	126.63	0.00	0.00	12.99	112.83	1.02	0.04	0.891

Post-development Conditions: Huff Distribution 1:100yr Storm Event REV

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Day of Maximum Depth	Hour of Maximum Depth	Maximum Reported Depth Meters
J1	JUNCTION	0.01	0.07	753.18	0	03:46	0.02
J2	JUNCTION	0.02	0.15	752.39	0	03:51	0.05
J3	JUNCTION	0.02	0.20	751.77	0	03:51	0.06
J4	JUNCTION	0.04	0.37	751.65	0	04:00	0.11
J5	JUNCTION	0.01	0.08	753.36	0	03:46	0.02
J6	JUNCTION	0.02	0.17	752.93	0	03:51	0.05
J7	JUNCTION	0.03	0.31	752.71	0	04:00	0.09
J8	JUNCTION	0.03	0.28	752.53	0	04:00	0.09
J9	JUNCTION	0.03	0.28	752.18	0	04:00	0.09
J10	JUNCTION	0.06	0.47	751.19	0	04:05	0.14
J11	JUNCTION	0.02	0.21	749.83	0	03:34	0.07
J12	JUNCTION	0.13	0.15	748.40	0	21:13	0.05
Out1	OUTFALL	0.11	0.12	748.32	0	21:13	0.04
SU1	STORAGE	0.58	0.82	749.10	0	21:13	0.25

Post-development Conditions: Huff Distribution 1:100yr Storm Event REV

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.031	0.031	0	03:45	0.65	0.65	0.000
J2	JUNCTION	0.101	0.132	0	03:45	2.18	2.83	0.003
J3	JUNCTION	0.080	0.211	0	03:49	1.72	4.55	-0.002
J4	JUNCTION	0.041	0.613	0	04:00	0.86	13.2	-0.017
J5	JUNCTION	0.028	0.028	0	03:45	0.602	0.602	0.000
J6	JUNCTION	0.084	0.113	0	03:45	1.81	2.41	0.004
J7	JUNCTION	0.227	0.340	0	04:00	4.92	7.33	-0.001
J8	JUNCTION	0.000	0.340	0	04:00	0	7.33	-0.002
J9	JUNCTION	0.023	0.362	0	04:00	0.478	7.81	0.004
J10	JUNCTION	0.000	0.613	0	04:00	0	13.2	0.037
J11	JUNCTION	0.044	0.654	0	04:00	1.02	14.2	-0.035
J12	JUNCTION	0.000	0.034	0	21:13	0	9.56	0.003
Out1	OUTFALL	0.000	0.034	0	21:13	0	9.56	0.000
SU1	STORAGE	0.000	0.656	0	04:00	0	14.2	0.085

Post-development Conditions: Huff Distribution 1:100yr Storm Event REV

Node Surcharge Summary

Node	Type	Hours Surcharged	Max Height Above Crown Meters	Min Depth Below Rim Meters
SU1	STORAGE	46.72	0.217	0.403

Post-development Conditions: Huff Distribution 1:100yr Storm Event REV

Storage Volume Summary

Storage Unit	Average Volume 1000 m3	Average Percent Full	Evap Percent Loss	Exfil Percent Loss	Maximum Volume 1000 m3	Maximum Percent Full	Day of Maximum Volume	Hour of Maximum Volume	Maximum Outflow CMS
SU1	8.164	45	0	0	11.729	65	0	21:13	0.034

Post-development Conditions: Huff Distribution 1:100yr Storm Event REV

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CMS	Max. Flow CMS	Total Volume 10^6 ltr
Out1	98.38	0.028	0.034	9.562

Post-development Conditions: Huff Distribution 1:100yr Storm Event REV

Link Flow Summary

Link	Type	Maximum |Flow| CMS	Day of Maximum Flow	Hour of Maximum Flow	Maximum |Velocity| m/sec	Max / Full Flow	Max / Full Depth
C1	CONDUIT	0.034	0	21:13	0.79	0.14	0.27
C2	CONDUIT	0.656	0	04:00	2.39	0.11	0.62
C3	CONDUIT	0.611	0	04:03	0.89	0.35	0.57
C4	CONDUIT	0.613	0	04:00	0.65	0.35	0.70
C5	CONDUIT	0.211	0	03:51	0.40	0.10	0.47
C6	CONDUIT	0.132	0	03:51	0.49	0.06	0.29
C7	CONDUIT	0.031	0	03:46	0.21	0.02	0.19
C8	CONDUIT	0.362	0	04:00	0.56	0.21	0.54
C9	CONDUIT	0.340	0	04:00	0.65	0.20	0.47
C10	CONDUIT	0.340	0	04:00	0.61	0.23	0.49
C11	CONDUIT	0.112	0	03:51	0.27	0.07	0.40
C12	CONDUIT	0.028	0	03:46	0.17	0.02	0.20
R1	ORIFICE	0.034	0	21:13			

Post-development Conditions: Huff Distribution 1:100yr Storm Event REV

Flow Classification Summary

Conduit	Adjusted/ Actual Length	Fully Dry	Upstrm Dry	Dnstrm Dry	Sub Critical	Super Critical	Upstrm Critical	Dnstrm Critical	Normal Flow Limited
C1	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.00
C2	1.00	0.00	0.00	0.00	0.96	0.04	0.00	0.00	0.96
C3	1.00	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0.01
C4	1.00	0.00	0.00	.0.00	1.00	0.00	0.00	0.00	0.98
C5	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.99
C6	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00
C7	1.00	0.00	0.15	0.00	0.85	0.00	0.00	0.00	0.99
C8	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.99
C9	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.93
C10	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
C11	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00
C12	1.00	0.00	0.13	0.00	0.87	0.00	0.00	0.00	0.99

Flow Classification Summary

Conduit	Inlet Control
C1	0.00
C2	0.00
C3	0.00
C4	0.00
C5	0.00
C6	0.00
C7	0.00
C8	0.00
C9	0.00
C10	0.00
C11	0.00
C12	0.00

Post-development Conditions: Huff Distribution 1:100yr Storm Event REV

Conduit Surcharge Summary

Conduit	Hours Both Ends Full	Hours Upstream Full	Hours Dnstream Full	Hours Above Normal Flow	Hours Capacity Limited
C2	0.01	0.01	46.72	0.01	0.01

Appendix G

Traffic Impact Assessment

October 25, 2015

Bob Shipway
Box 58
Millet, Alberta
T0C 1Z0

Subject: **Addition to Shipway Industrial Yard N.W. ¼ Sec., 28-47-24-W4M**
Traffic Impact Assessment

Area Consulting was retained by Shipway Industrial Yard to prepare a Traffic Impact Assessment for the proposed addition (Phase 1C) to existing development. The development is located within NW ¼ Sec 28 Twp 47 Range 24 W4th directly east of the Town of Millet, Alberta. The developing area is approximately 3.98 ha.

The development is bounded by east of Range Road 244 and South of Township Road 475, west of Block B Plan 982-4390, south boundary directly east of the south boundary of Block A Plan 812-1104 as shown on Figure 1, Location Plan.

The overall purpose of the traffic study is to access the intersection improvements needs under future traffic projection for the horizon years of 2020 and 2035. The 2020 and 2035 were selected as intermediate and ultimate needs of the intersection.

EXISITNG CONDITION

1.1 Existing Roadway

Highway 2A:26 is a provincial two-lane undivided secondary highway primarily running in a north-south orientation. This highway has a paved surface with an average pavement width of 17.8 meter (m), consisting of 3.7m lanes and 1.5m shoulders. Highway 2A serves about 6940 vehicles per day (2011 WAADT). The posted speed on highway is 50 kilometers per hour (km/h) at the intersection with Highway 616 (Twp. Rd 475).

Township Road 475 (Highway 616) is a provincial two-lane undivided secondary highway running in an east-west orientation. The Highway has a paved surface with an average pavement width of 9.4m consisting of 3.7m lanes plus 1.0m shoulder. The road serves about 1570vpd (2011 WAADT). The posted speed is 50km/h.

The existing intersection of Highway 2A/Twp. Rd 475 is a modified Type 3c intersection treatment. The intersection has unconventional acceleration lanes on the shoulder side for right-turning vehicles entering Highway 2A from the intersecting roadways (i.e. Highway 616). Highway 616 intersects Highway 2A at a 90-degree angle and is controlled by a “STOP” sign condition. The intersection approaches have adequate sight distances in all directions.

Vehicular access to the development consists of one inbound lane and one outbound lane. The Access Road form south leg with Twp. Rd 475 and controlled by “STOP” sign.

1.2 Background Traffic Volumes

The 2014 existing turning movement count was obtained from Alberta Transportation (AT) website, including Average Annual Daily Traffic (AADT) volumes and morning (a.m.) and afternoon (p.m.) peak hour volumes. The existing turning movement diagrams are included in Appendix A.

FIGURE 1
Location Plan

ADDITION TO SHIPWAY DEVELOPMENT
County of Wetaskiwin

SCALE NTS
DATE October 2015

AREA Consulting Inc.

1.3 Existing Development Traffic

The development existing traffic volumes was obtained from Traffic Impact Assessment (TIA) dated 2013 prepared by Area Consulting Inc. The traffic volumes of development are provided below.

Table 1: Development Traffic Volume

Parameters	ITE	Size[1]	Daily	Trip Generated			
				AM		PM	
				IN	OUT	IN	OUT
Shipway Industrial Yard							
High-Cube Warehouse	152	830	1394	63	28	31	69

Note: 1. Average land use in size of "1000 sq. feet Gross Floor Area (GFA)" as per ITE

DEVELOPMENT TRAFFIC

The proposed addition to existing facility is approximately 3.98 ha (9.8 acres) in size, and is currently vacant. Site Plan is attached is Appendix D.

2.1 Trip Generation and Assignment

The Institution of Transportation Engineers (ITE) Trip Generation 9th Edition is used to determine the number of trips generated from the proposed addition. For this section, this TIA has used ITE trip generation rate of General Light Industry (ITE 110).

Description of Land use, ITE code, unit size, trip generation rate and trip generation for peak hours are provided in Table 1. Appendix B provides all relevant charts.

Table 2: Trip Generation

Parameters	ITE	Size (Acres)	Trip Generation Rates			Daily	Trip Generated			
							AM		PM	
			AADT	AM	PM		IN	OUT	IN	OUT
General Light Industry	110	9.8	51.8	7.51	7.26	510	61	13	16	56

The trip distribution and assignment of traffic to and from the development is assumed to be similar to previous TIA dated 2013. The trip distribution and traffic assignment are shown in Exhibit 1 and Exhibit 2 in Appendix B.

FUTURE CONDITION

This section will describe the future growth projections, future improvements to the road network and future traffic volumes.

3.1 Projected Growth

The growth rate of 2.5% per year was assumed to reflect growth in background traffic volumes. The 2020 and 2035 projected traffic volumes are provided in Appendix A.

3.2 Anticipated Improvements

Based on the previous TIA dated August 2013, the following improvement is recommended:

- Signalized Intersection at Highway 2A and Township Road 475

3.3 Future Traffic Volume

The total traffic volume is the sum of proposed development traffic, existing development traffic and the forecasted background traffic. The resulting total traffic projections are provided in Exhibit 5.0 and 6.0 (See Appendix B).

INTERSECTION OPERATIONS

The 2020 and 2035 total traffic volumes for the study intersections are evaluated using the Synchro/Sim Traffic software which automates the procedures contained in the Highway Capacity Manual 2000.

For the intersection of Highway 2A and Twp. Rd 475, the signalized was assumed with existing intersection layout. The intersection of Twp. Rd 475 with Access Road is Type 1a with stop controlled on Access Road.

4.1 Future Traffic Operations with Improvements

The future peak hours analysis results are included in Table 3 and Table 4 and corresponding worksheets are included in Appendix C.

Table 3: 2020 Total Traffic Conditions – Level of Service

Intersection		A.M. Peak Hour			P.M. Peak Hour		
		LOS	v/c	Delay (sec)	LOS	v/c	Delay (sec)
Highway 2A and Twp. Rd 475 (Signalized)							
EB	LTR	B	0.63	19.9	B	0.25	16.6
WB	LTR	B	0.20	12.8	B	0.36	18.1
NB	LT	B	0.59	173	B	0.59	15.0
NB	R	B	0.03	10.8	A	0.02	8.0
SB	LT	B	0.45	15.1	B	0.68	17.0
SB	R	B	0.01	10.6	A	0.10	8.5
Overall LOS		**B**			**B**		
Twp. Rd. 475 and Access Road (Unsignalized)							
EB	TR	A	0.12	0.0	A	0.14	0.0
WB	TL	A	0.00	0.4	A	0.00	0.2
NB	LR	B	0.07	10.6	B	0.21	11.9
Overall LOS		**A**			**A**		

Note:
NB – Northbound SB – Southbound EB – Eastbound WB – Westbound LTR – Left/Through/Right turn

Table 4: 2035 Total Traffic Conditions – Level of Service

Intersection		A.M. Peak Hour			P.M. Peak Hour		
		LOS	v/c	Delay (sec)	LOS	v/c	Delay (sec)
Highway 2A and Twp. Rd 475 (Signalized)							
EB	LTR	C	0.83	29.7	B	0.37	19.6
WB	LTR	B	0.23	13.4	C	0.46	21.3
NB	LT	B	0.67	17.9	C	0.83	25.6
NB	R	A	0.04	9.7	A	0.03	7.1
SB	LT	B	0.53	15.3	C	0.86	28.9
SB	R	A	0.02	9.8	A	0.13	7.7
Overall LOS		**B**			**C**		
Twp. Rd. 475 and Access Road (Unsignalized)							
EB	TR	A	0.13	0.0	A	0.17	0.0
WB	TL	A	0.11	0.3	A	0.00	0.1
NB	LR	B	0.07	11.1	B	0.23	12.9
Overall LOS		**A**			**A**		

Note:
NB – Northbound SB – Southbound EB – Eastbound WB – Westbound LTR – Left/Through/Right turn

As indicated in Table 4 and 5, acceptable level of service A to C are expected at the two intersections. Thus, no further improvements are required from a traffic operations perspective. .

CONCLUSION

As a conclusion, in the 2020 and 2035 horizon, the intersection of Highway 2A and Township Road 475 should be signalized. The intersection of Twp. Rd. 475 with Access Road will be “T” intersection with stop controlled on Access Road. Access Road will have two lanes with one lane in each direction (i.e. Type 1a).

We trust that the above meets with your purpose. Should you have any questions, please do not hesitate to contact the undersigned.

Yours truly,

AREA CONSULTING

Reported by:

Ali Shmoury, P.Eng.

Project Engineer

APPENDIX A

Background Traffic Data
And
Other Related Information

Turning Movement Summary Diagram

Reference No.: 997136

Intersection of:
2A & 616 MILLET SJ

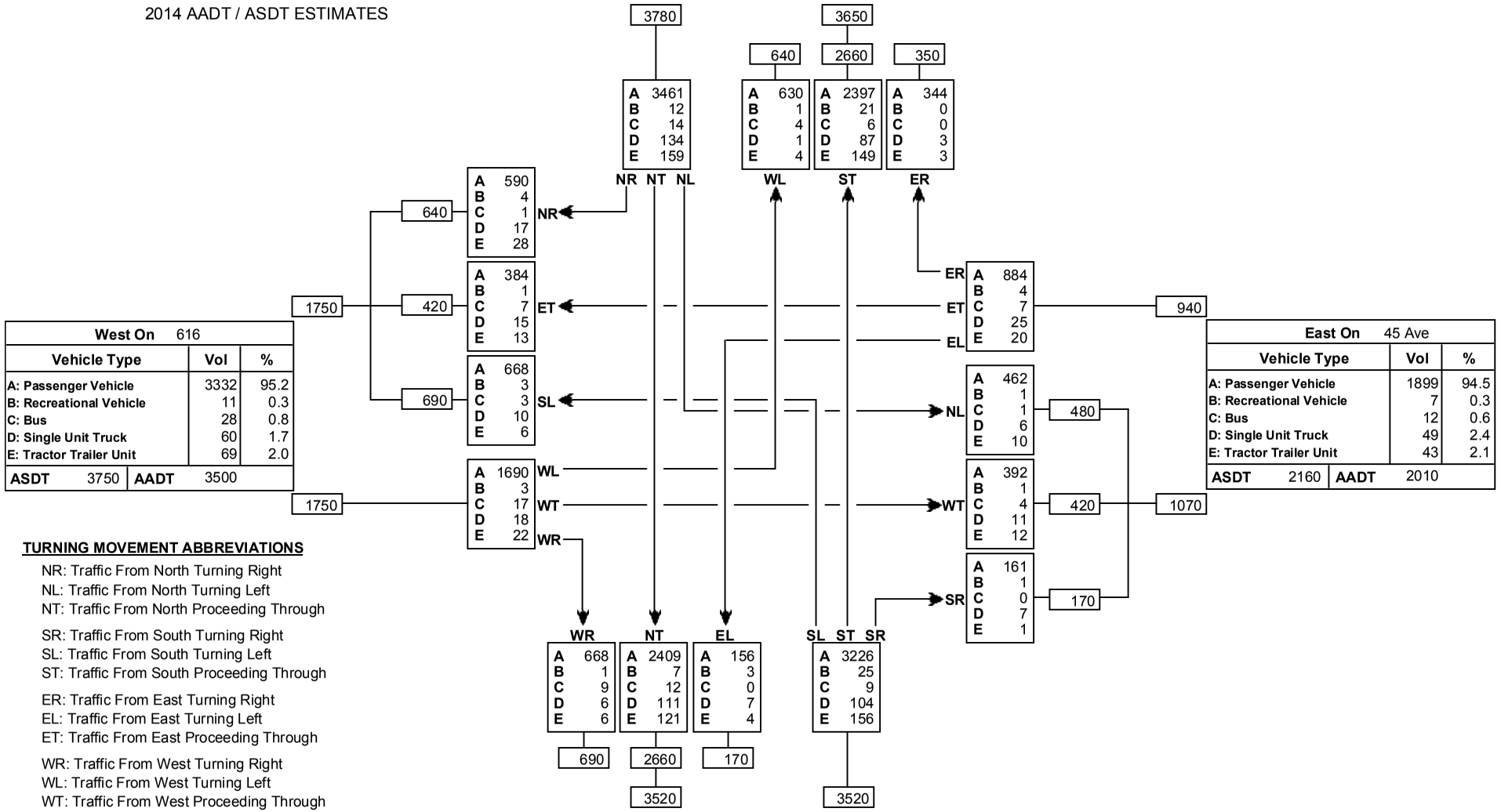
2014 AADT / ASDT ESTIMATES

North On 2A		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	6832	92.0
B: Recreational Vehicle	34	0.5
C: Bus	24	0.3
D: Single Unit Truck	225	3.0
E: Tractor Trailer Unit	315	4.2
ASDT 7970	**AADT** 7430	

West On 616		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	3332	95.2
B: Recreational Vehicle	11	0.3
C: Bus	28	0.8
D: Single Unit Truck	60	1.7
E: Tractor Trailer Unit	69	2.0
ASDT 3750	**AADT** 3500	

East On 45 Ave		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	1899	94.5
B: Recreational Vehicle	7	0.3
C: Bus	12	0.6
D: Single Unit Truck	49	2.4
E: Tractor Trailer Unit	43	2.1
ASDT 2160	**AADT** 2010	

South On 2A		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	6459	91.7
B: Recreational Vehicle	36	0.5
C: Bus	30	0.4
D: Single Unit Truck	228	3.2
E: Tractor Trailer Unit	287	4.1
ASDT 7550	**AADT** 7040	



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 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.: 997136

Intersection of:
2A & 616 MILLET SJ

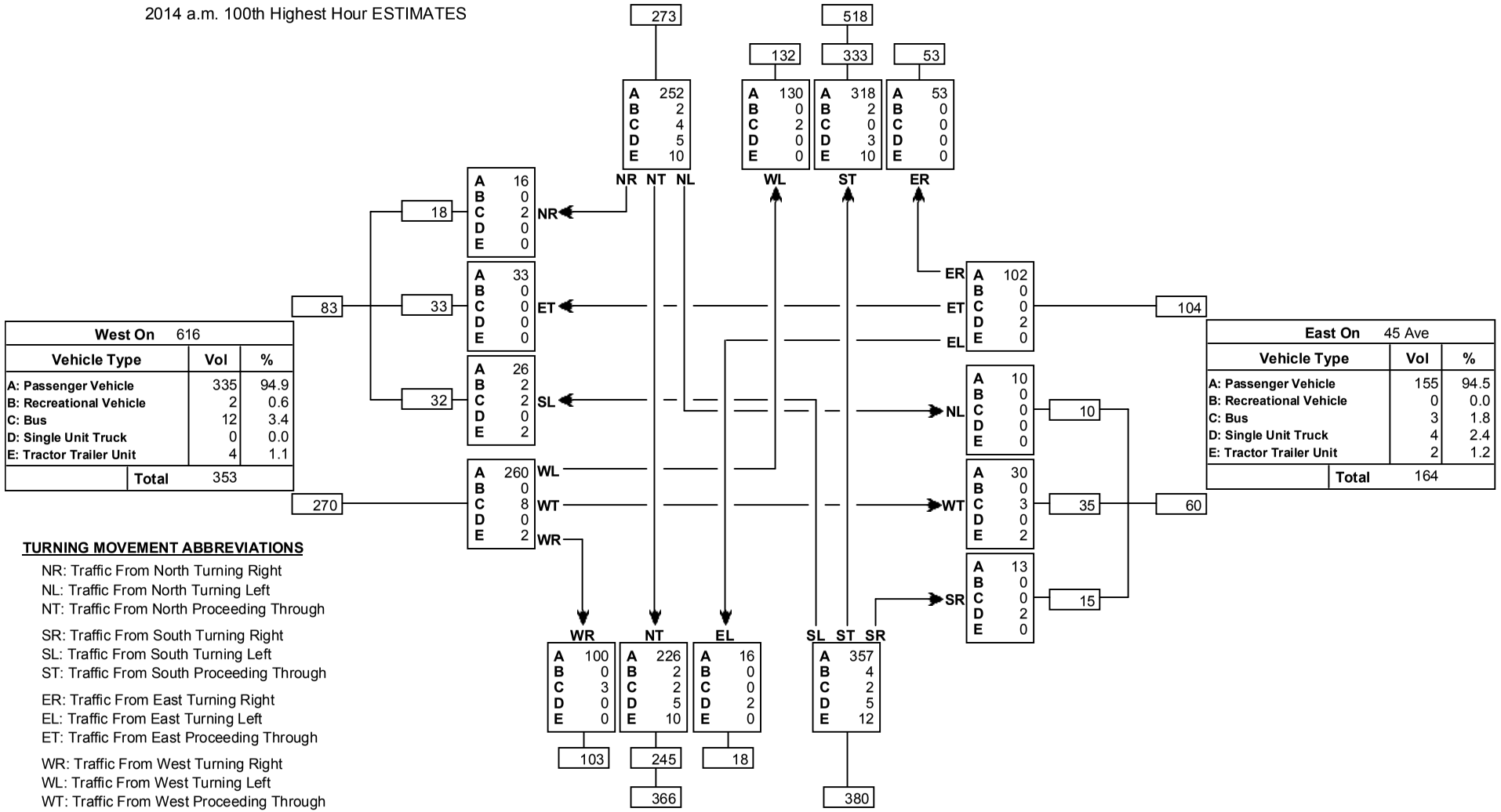
2014 a.m. 100th Highest Hour ESTIMATES

North On 2A		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	753	95.2
B: Recreational Vehicle	4	0.5
C: Bus	6	0.8
D: Single Unit Truck	8	1.0
E: Tractor Trailer Unit	20	2.5
Total	791	

West On 616		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	335	94.9
B: Recreational Vehicle	2	0.6
C: Bus	12	3.4
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	4	1.1
Total	353	

East On 45 Ave		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	155	94.5
B: Recreational Vehicle	0	0.0
C: Bus	3	1.8
D: Single Unit Truck	4	2.4
E: Tractor Trailer Unit	2	1.2
Total	164	

South On 2A		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	699	93.7
B: Recreational Vehicle	6	0.8
C: Bus	7	0.9
D: Single Unit Truck	12	1.6
E: Tractor Trailer Unit	22	2.9
Total	746	



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

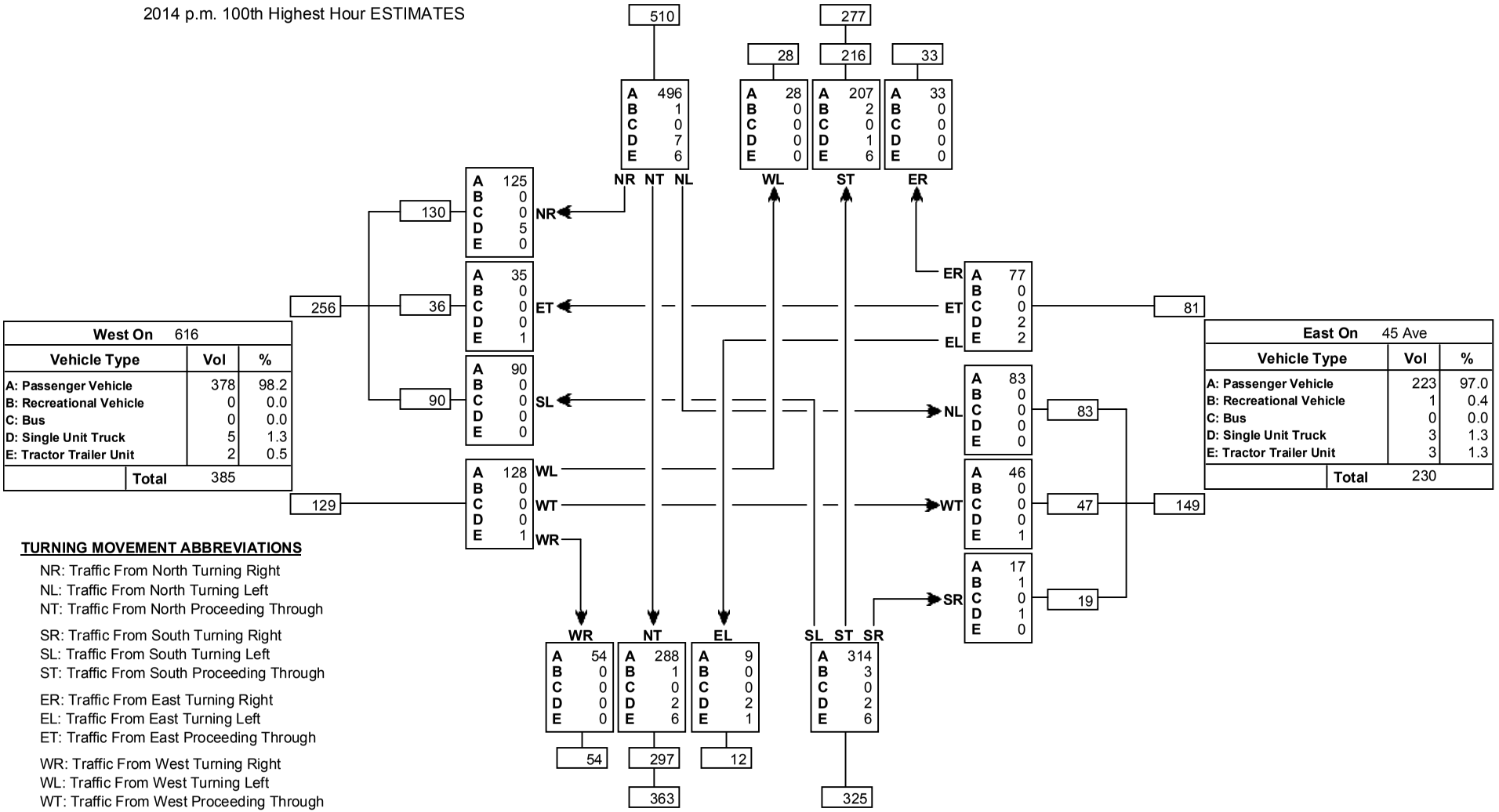
WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

Turning Movement Summary Diagram

Reference No.: 997136

Intersection of:
2A & 616 MILLET SJ

2014 p.m. 100th Highest Hour ESTIMATES



North On 2A		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	764	97.1
B: Recreational Vehicle	3	0.4
C: Bus	0	0.0
D: Single Unit Truck	8	1.0
E: Tractor Trailer Unit	12	1.5
Total	787	

West On 616		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	378	98.2
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	5	1.3
E: Tractor Trailer Unit	2	0.5
Total	385	

East On 45 Ave		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	223	97.0
B: Recreational Vehicle	1	0.4
C: Bus	0	0.0
D: Single Unit Truck	3	1.3
E: Tractor Trailer Unit	3	1.3
Total	230	

South On 2A		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	665	96.7
B: Recreational Vehicle	4	0.6
C: Bus	0	0.0
D: Single Unit Truck	6	0.9
E: Tractor Trailer Unit	13	1.9
Total	688	

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

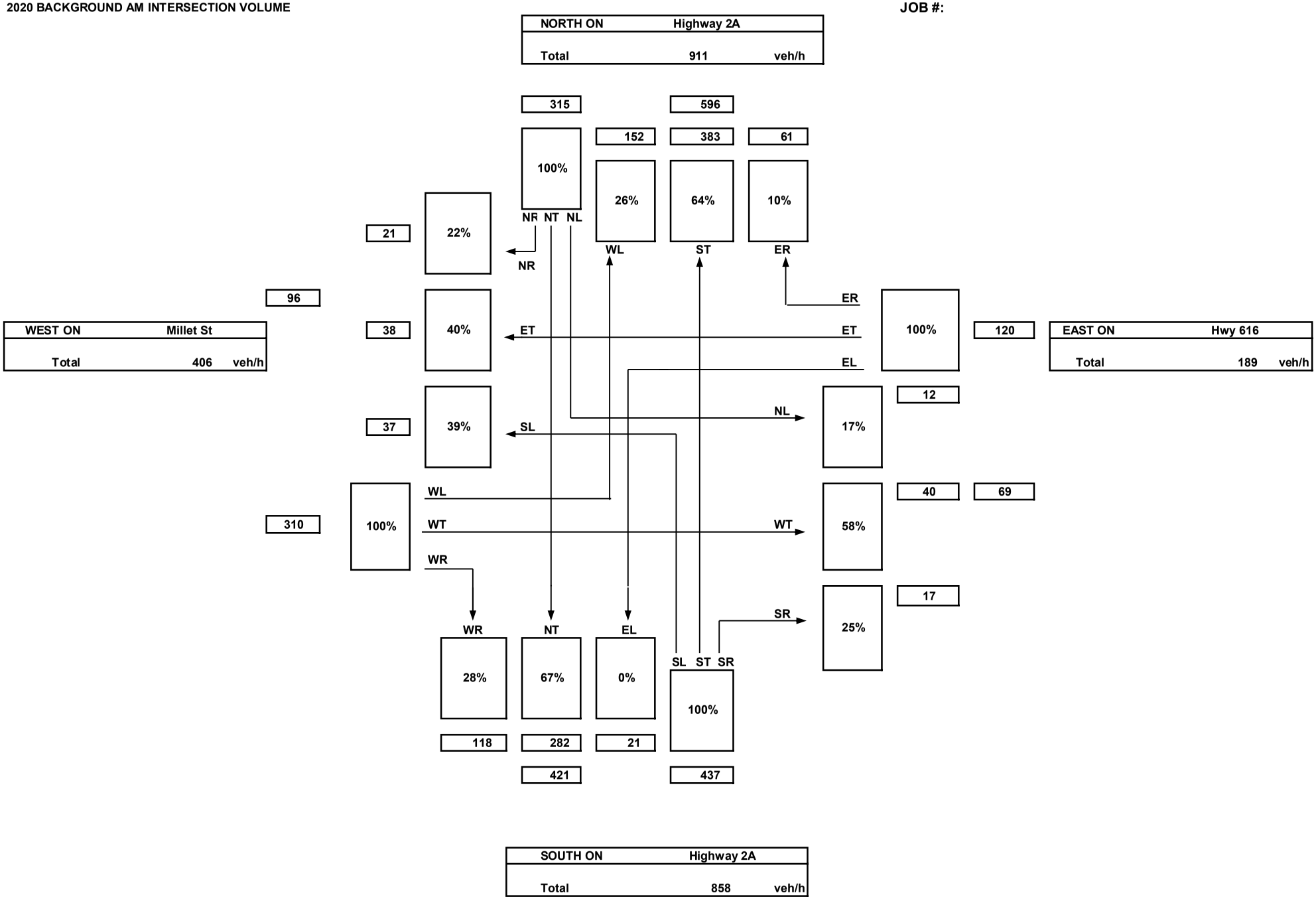
ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

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

TURNING MOVEMENT SUMMARY DIAGRAM

COUNTY/MD: County of Wetaskiwin
INTERSECTION OF: Hwy 2A & 616 Millet Street (Hwy 616)
COUNT TYPE: AM
JOB #:

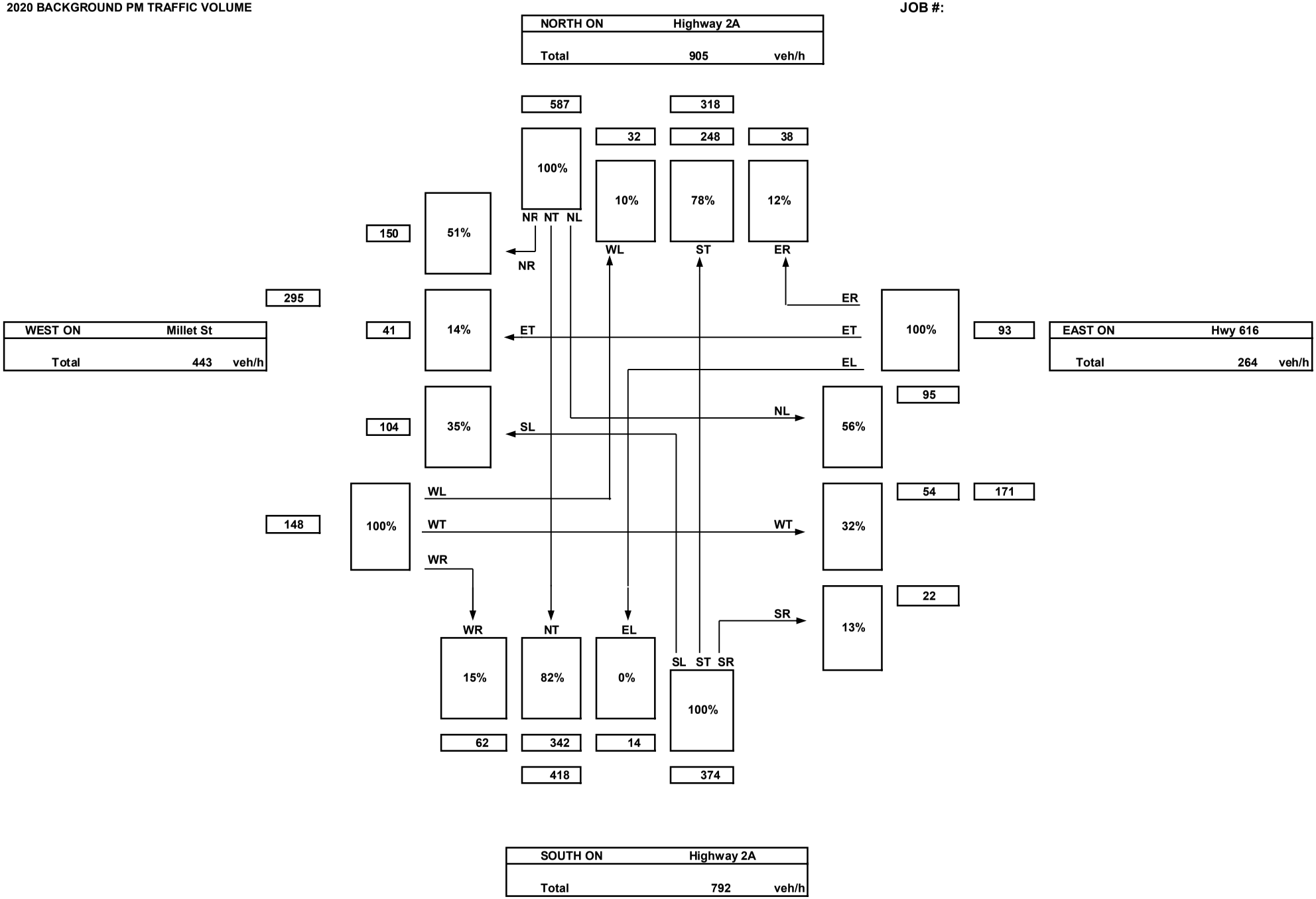
2020 BACKGROUND AM INTERSECTION VOLUME



TURNING MOVEMENT SUMMARY DIAGRAM

COUNTY/MD: County of Wetaskiwin
INTERSECTION OF: Hwy 2A & 616 Millet Street (Hwy 616)
COUNT TYPE: PM
JOB #:

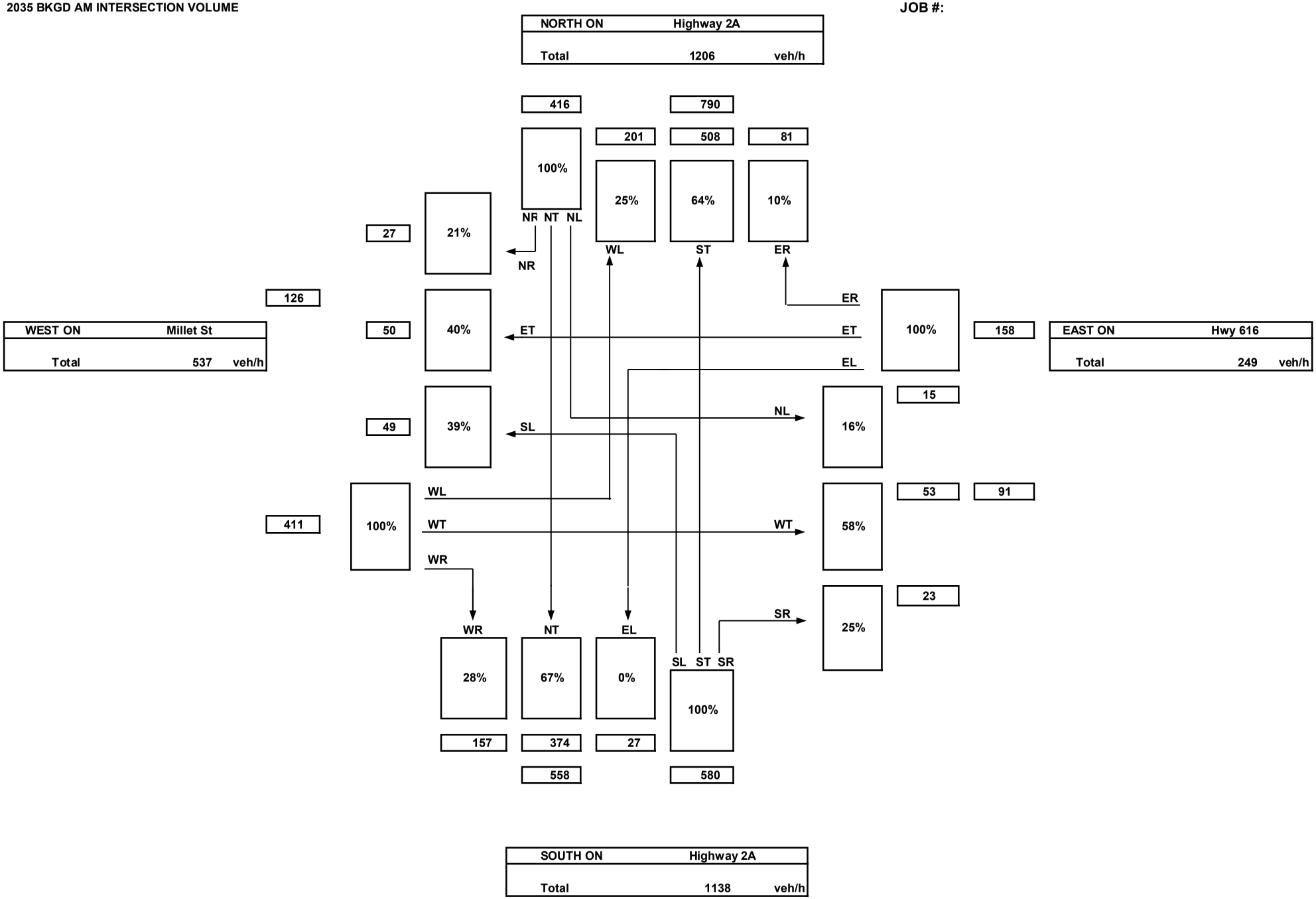
2020 BACKGROUND PM TRAFFIC VOLUME



TURNING MOVEMENT SUMMARY DIAGRAM

COUNTY/MD: County of Wetaskiwin
INTERSECTION OF: Hwy 2A & 616 Millet Street (Hwy 616)
COUNT TYPE: AM
JOB #:

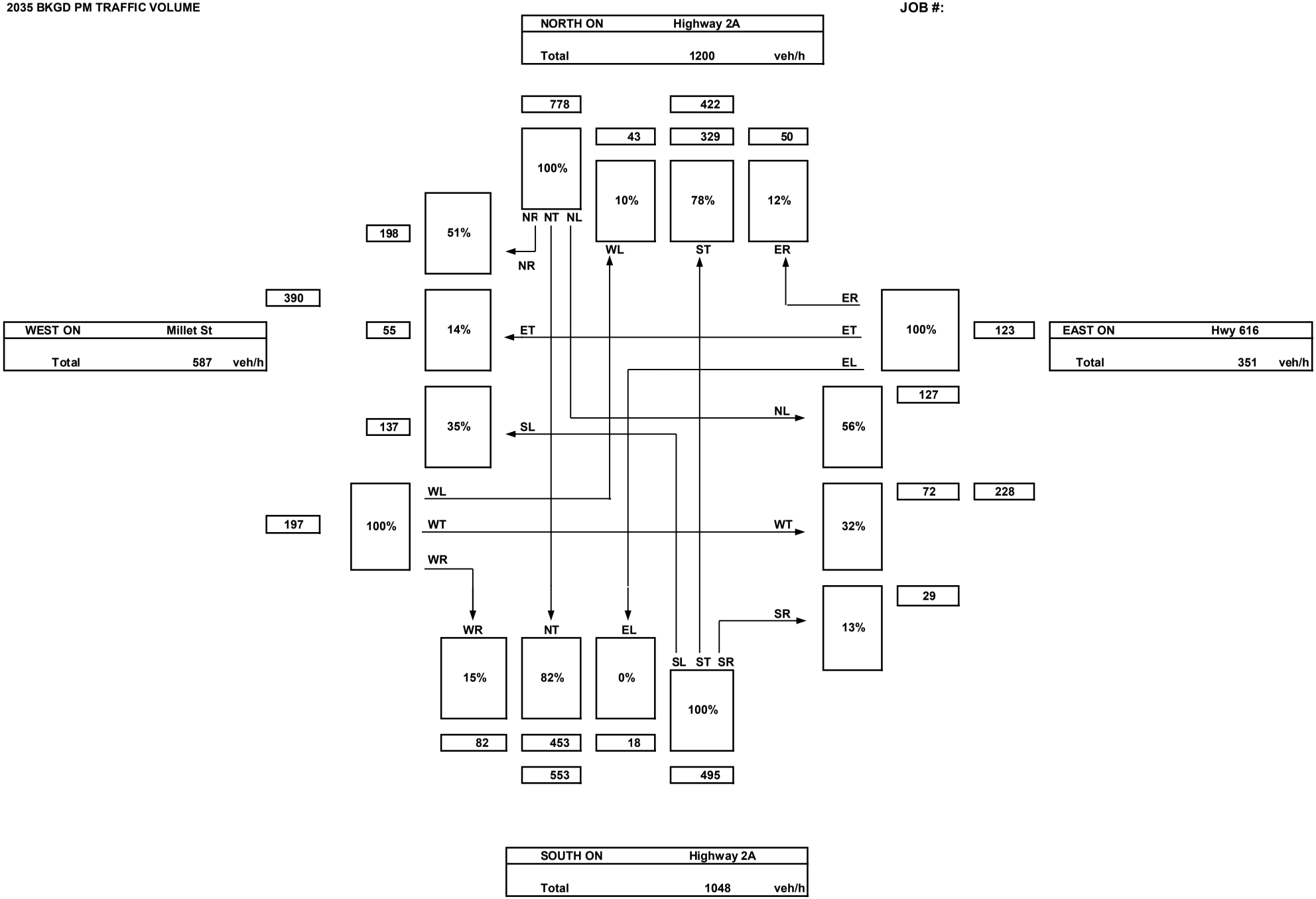
2035 BKGD AM INTERSECTION VOLUME



TURNING MOVEMENT SUMMARY DIAGRAM

COUNTY/MD: County of Wetaskiwin
INTERSECTION OF: Hwy 2A & 616 Millet Street (Hwy 616)
COUNT TYPE: PM
JOB #:

2035 BKGD PM TRAFFIC VOLUME



ALBERTA HIGHWAYS 1 TO 986
TRAFFIC VOLUME, VEHICLE CLASSIFICATION, TRAVEL and ESAL STATISTICS REPORT
2011

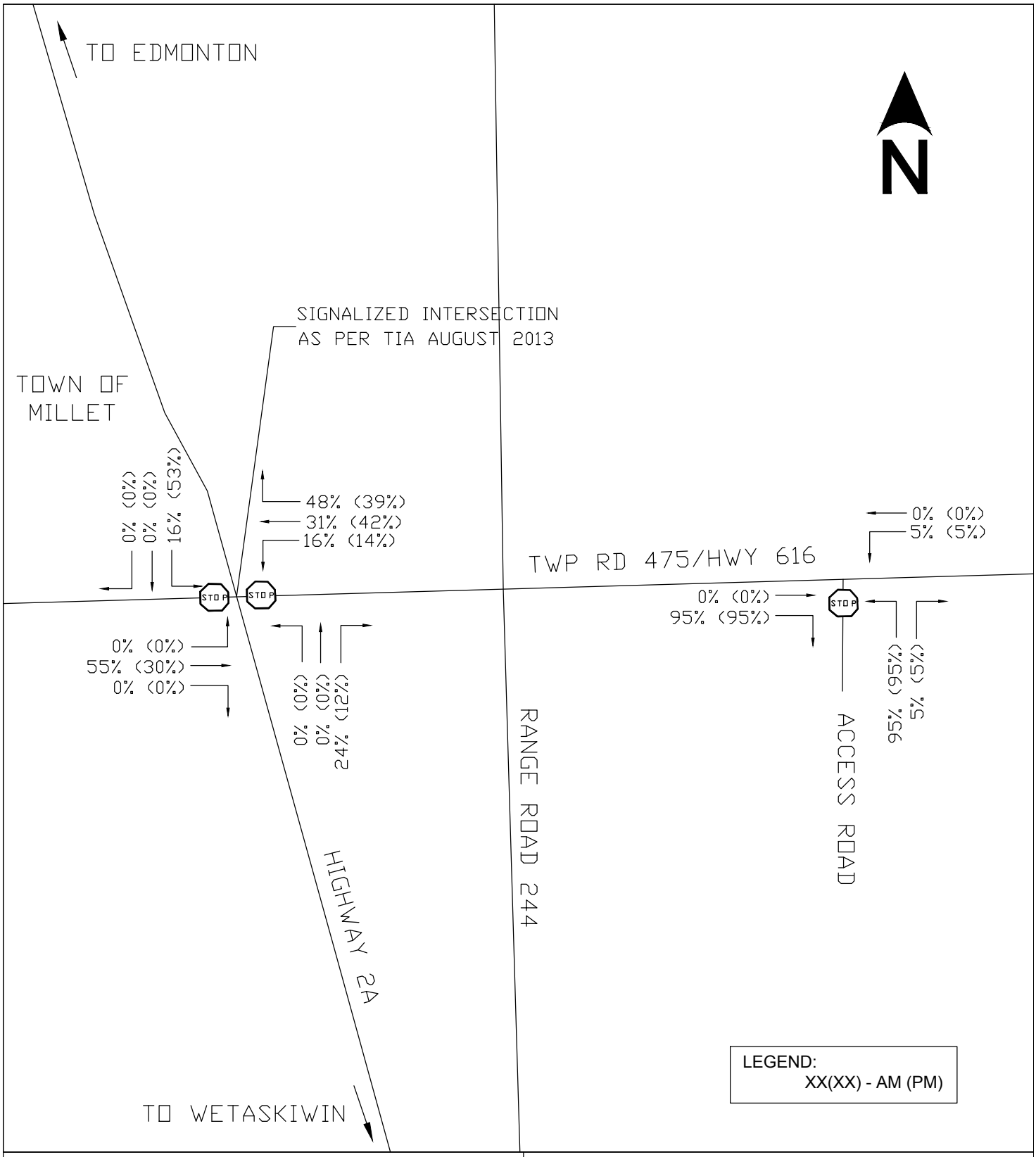
Alberta Transportation
Planning Branch
Strategic and Network Planning

Produced: 16-Feb-2012 By CornerStone Solutions Inc.

Hwy	CS	TCS	Muni	From	To	From Km	To Km	Length in Km	Volume WAADT	Volume WASDT	%PV	%RV	%BU	%SU	%TT	%CM	Travel MVKM Annual	Travel MVKM Summer	ESAL / Day / Dir SU	ESAL / Day / Dir TC	ESAL / Day / Dir Total
611	2	20	Weta	E OF 2 E OF USONA	W OF 2A N OF HOBBEMA NJ	48.480	62.175	13.695	1220	1300	91.6	1.0	0.9	3.4	3.1	7.4	6.1	2.8	18.3	39.2	57.5
611	2			E OF 20 AT HOADLEY	W OF 2A N OF HOBBEMA NJ			62.175	589	638	84.6	2.1	0.8	7.3	5.2	13.3	13.2	6.1	18.7	31.4	50.1
611	4	4	Pinka	E OF 2A S OF HOBBEMA SJ	W OF 822 E OF HOBBEMA WJ	0.000	12.960	12.960	2130	2360	91.5	0.2	3.5	2.6	2.2	8.5	10.1	4.7	24.4	48.6	73.0
611	4	8	Wetа	E OF 822 E OF HOBBEMA WJ	W OF 822 NW OF FERINTOSH EJ	12.960	19.460	6.500	710	860	83.5	1.0	1.4	11.0	23.3	35.7	1.7	0.9	34.4	171.5	205.9
611	4	12	Wetа	E OF 822 NW OF FERINTOSH EJ	W OF 21 S OF NEW NORWAY	19.460	34.103	14.643	520	630	74.3	1.2	0.3	11.9	12.3	24.5	2.8	1.4	27.3	66.3	93.6
611	4			E OF 2A S OF HOBBEMA SJ	W OF 21 S OF NEW NORWAY			34.103	1168	1331	84.9	0.5	2.6	5.4	6.6	14.6	14.5	6.9	27.8	79.9	107.7
611				**E OF 20 AT HOADLEY**	**W OF 21 S OF NEW NORWAY**			**98.278**	**790**	**883**	**84.8**	**1.3**	**1.7**	**6.3**	**5.9**	**13.9**	**27.8**	**13.0**	**21.9**	**48.3**	**70.2**
613	2	4	Wetа	WETASKIWIN E.C.L.	W OF 822 E OF WETASKIWIN WJ	0.000	6.040	6.040	1560	1770	84.4	1.0	0.2	8.0	8.4	14.6	3.4	1.6	41.2	135.8	177.0
613	2	8	Wetа	E OF 822 E OF WETASKIWIN WJ	W OF 822 S OF GWYNNE EJ	6.040	11.179	5.139	270	310	87.0	0.8	0.8	7.9	3.5	12.2	0.5	0.2	9.4	9.8	19.2
613	2			WETASKIWIN E.C.L.	W OF 822 S OF GWYNNE EJ			11.179	987	1099	84.7	1.0	0.3	8.2	7.8	14.3	3.9	1.9	26.4	78.2	104.6
613				**WETASKIWIN E.C.L.**	**W OF 822 S OF GWYNNE EJ**			**11.179**	**987**	**1099**	**84.7**	**1.0**	**0.3**	**8.2**	**7.8**	**14.3**	**3.9**	**1.9**	**26.4**	**78.2**	**104.6**
614	2	4	Wetа	E OF 41 N OF WAINWRIGHT	W OF 894 SW OF PARADISE VAL SJ	0.000	21.129	21.129	250	280	80.3	1.0	0.5	10.2	8.0	18.7	1.9	0.9	11.2	20.7	31.9
614	2			E OF 41 N OF WAINWRIGHT	W OF 894 SW OF PARADISE VAL SJ			21.129	250	280	80.3	1.0	0.5	10.2	8.0	18.7	1.9	0.9	11.2	20.7	31.9
614				**E OF 41 N OF WAINWRIGHT**	**W OF 894 SW OF PARADISE VAL SJ**			**21.129**	**250**	**280**	**80.3**	**1.0**	**0.5**	**10.2**	**8.0**	**18.7**	**1.9**	**0.9**	**11.2**	**20.7**	**31.9**
616	2	4	Braz	E OF AMOCO RD W OF BUCK CREEK	W OF 22 E OF BUCK CREEK	0.000	3.220	3.220	400	470	74.5	1.7	0.2	15.2	8.4	23.8	0.5	0.2	26.8	34.8	61.6
616	2	8	Braz	E OF 22 E OF BUCK CREEK	W OF 761 E OF BUCK CREEK	3.220	16.160	12.940	810	940	79.6	2.6	0.2	11.4	6.2	17.8	3.8	1.9	40.7	52.1	92.8
616	2	12	Braz	E OF 761 E OF BUCK CREEK	W OF 20 E OF BRETON	16.160	29.960	13.800	930	1040	84.8	2.3	0.4	7.5	5.0	12.9	4.7	2.2	30.7	48.2	78.9
616	2			E OF AMOCO RD W OF BUCK CREEK	W OF 20 E OF BRETON			29.960	821	938	82.0	2.4	0.3	9.8	5.7	15.6	9.0	4.3	34.7	48.5	83.2
616	4	4	Ledc	E OF 20 E OF BRETON	W OF 770 S OF WARBURG	0.000	9.690	9.690	770	840	81.5	3.4	0.2	10.9	4.0	15.1	2.7	1.2	37.0	31.9	68.9
616	4	8	Ledc	E OF 770 S OF WARBURG	W OF 771 S OF SUNNYBROOK	9.690	19.350	9.660	500	540	79.2	5.1	0.1	12.2	3.4	15.7	2.1	0.9	31.7	20.8	52.5
616	4	12	Ledc	E OF 771 S OF SUNNYBROOK	W OF 778 E OF ITASKA NJ	19.350	27.738	8.388	610	660	85.4	3.9	0.9	7.7	2.1	10.7	1.9	0.8	20.7	13.3	34.0
616	4			E OF 20 E OF BRETON	W OF 778 E OF ITASKA NJ			27.738	659	716	81.8	4.1	0.4	10.4	3.3	14.1	6.7	3.0	30.2	22.5	52.7
616	8	4	Wetа	E OF 778 E OF ITASKA SJ	W OF 780 E OF MULHURST	0.000	11.520	11.520	740	850	87.7	1.6	0.5	7.1	3.1	10.7	3.1	1.5	23.1	29.8	48.9
616	8	8	Wetа	E OF 780 E OF MULHURST	W OF 795 SW OF PIPESTONE SJ	11.520	19.689	8.169	1200	1380	88.7	1.9	0.6	6.9	3.9	11.4	3.6	1.7	36.5	48.5	85.0
616	8			E OF 778 E OF ITASKA SJ	W OF 795 SW OF PIPESTONE SJ			19.689	931	1070	87.1	1.8	0.6	7.0	3.5	11.1	6.7	3.2	28.7	33.8	62.5
616	8	4	Wetа	E OF 795 NW OF PIPESTONE NJ	W OF 2 W OF MILLET	0.000	13.880	13.880	1250	1410	87.5	2.3	0.9	5.5	3.8	10.2	6.2	3.0	29.8	46.4	76.2
616	8	8	Wetа	E OF 2 W OF MILLET	W OF 2A N OF MILLET SJ	13.880	22.507	8.627	1570	1720	89.1	1.3	1.0	4.1	4.5	9.6	4.9	2.3	28.4	73.2	101.6
616	8			E OF 795 NW OF PIPESTONE NJ	W OF 2A N OF MILLET SJ			22.507	1380	1529	88.2	1.9	0.9	4.9	4.1	9.9	11.2	5.3	29.4	57.8	87.2
616	10	2	Ledc	E OF 2A N OF MILLET NJ	W OF 814 NE OF MILLET	0.000	5.520	5.520	350	370	85.5	1.0	0.7	8.9	3.9	13.5	0.7	0.3	13.7	14.1	27.8
616	10	4	Ledc	E OF 814 NE OF MILLET	W OF 822 SW OF HAY LAKES	5.520	18.400	12.880	400	430	78.0	0.9	0.6	6.8	13.7	21.1	1.9	0.8	12.9	56.8	69.8
616	10	8	Camr	E OF 822 SW OF HAY LAKES	RR 224	18.400	21.600	3.200	200	230	78.7	0.7	2.2	9.0	9.4	20.6	0.2	0.1	7.9	19.5	27.4
616	10	10	Camr	RR 224	S OF 21 W OF HAY LAKES	21.600	35.608	14.008	200	230	83.1	0.4	1.3	8.5	6.7	16.5	1.0	0.5	7.5	13.9	21.4
616	10			E OF 2A N OF MILLET NJ	S OF 21 W OF HAY LAKES			35.608	266	324	80.7	0.8	0.9	7.8	9.8	18.5	3.8	1.8	10.2	30.1	40.3
616				**E OF AMOCO RD W OF BUCK CREEK**	**S OF 21 W OF HAY LAKES**			**135.500**	**755**	**848**	**84.6**	**2.3**	**0.6**	**7.7**	**4.8**	**13.1**	**37.3**	**17.6**	**25.6**	**37.6**	**63.2**
617	2	4	Camr	E OF 21 W OF HAY LAKES	W OF 823 E OF HAY LAKES	0.000	10.410	10.410	700	790	86.7	2.2	1.5	4.4	5.4	11.1	2.7	1.3	13.6	39.2	52.8
617	2	8	Camr	E OF 823 E OF HAY LAKES	W OF 833 SW OF KINGMAN	10.410	15.300	4.890	1200	1350	88.0	3.7	0.6	5.3	4.4	10.3	2.1	1.0	28.0	54.7	82.7
617	2	12	Camr	E OF 833 SW OF KINGMAN	W OF 834 NW OF ROUND HILL	15.300	28.319	13.019	510	570	84.6	3.7	3.0	6.0	2.7	11.7	2.4	1.1	13.5	14.3	27.8
617	2			E OF 21 W OF HAY LAKES	W OF 834 NW OF ROUND HILL			28.319	609	688	85.8	3.1	1.7	5.2	4.2	11.1	7.2	3.4	19.0	30.4	49.4

APPENDIX B

Total Traffic Volumes



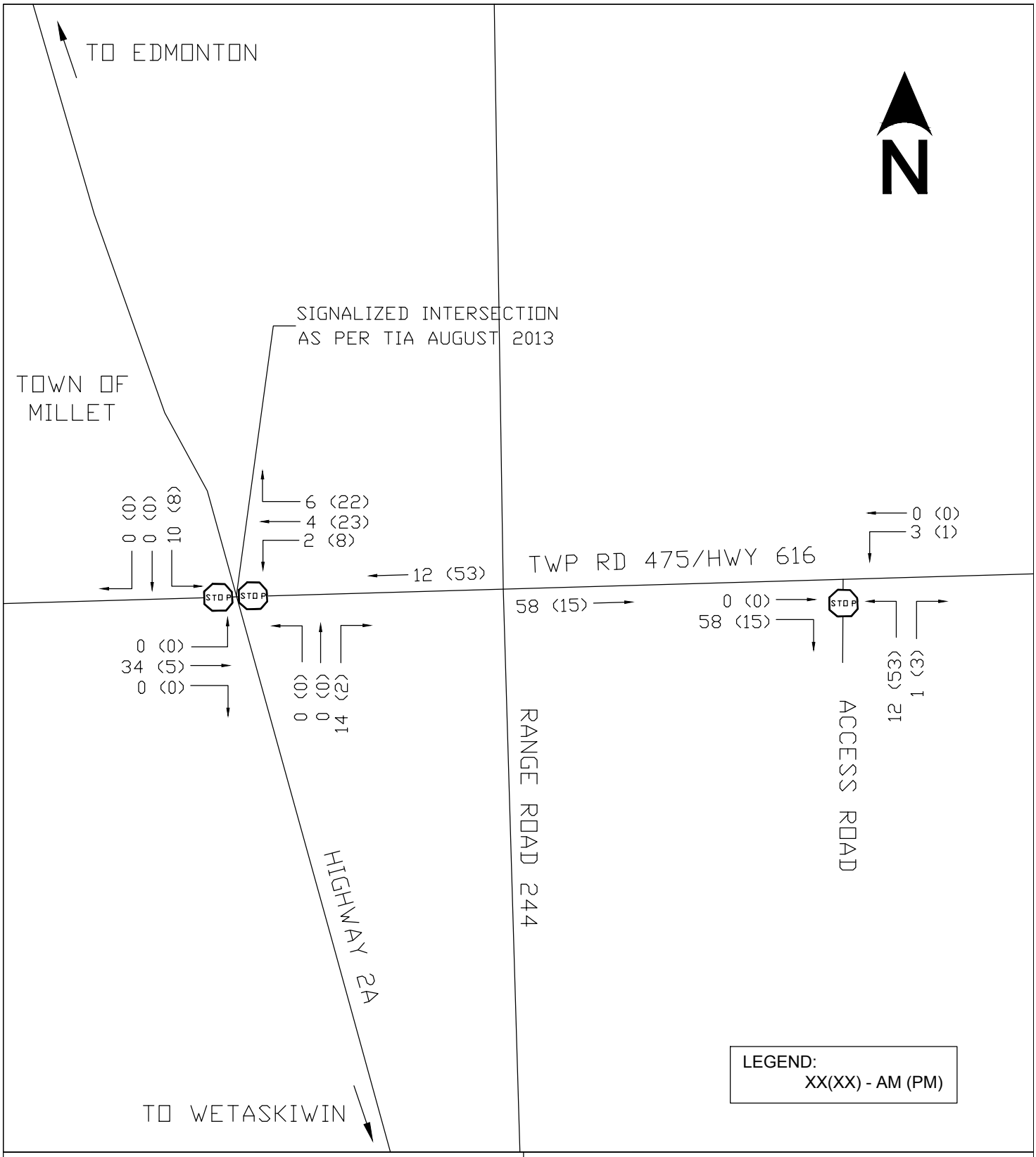
TRIP DISTRIBUTION

ADDITION TO SHIPWAY FARMS
County of Wetaskiwin, Alberta

AREA Consulting Inc.

Date: October 2015

Exhibit 1



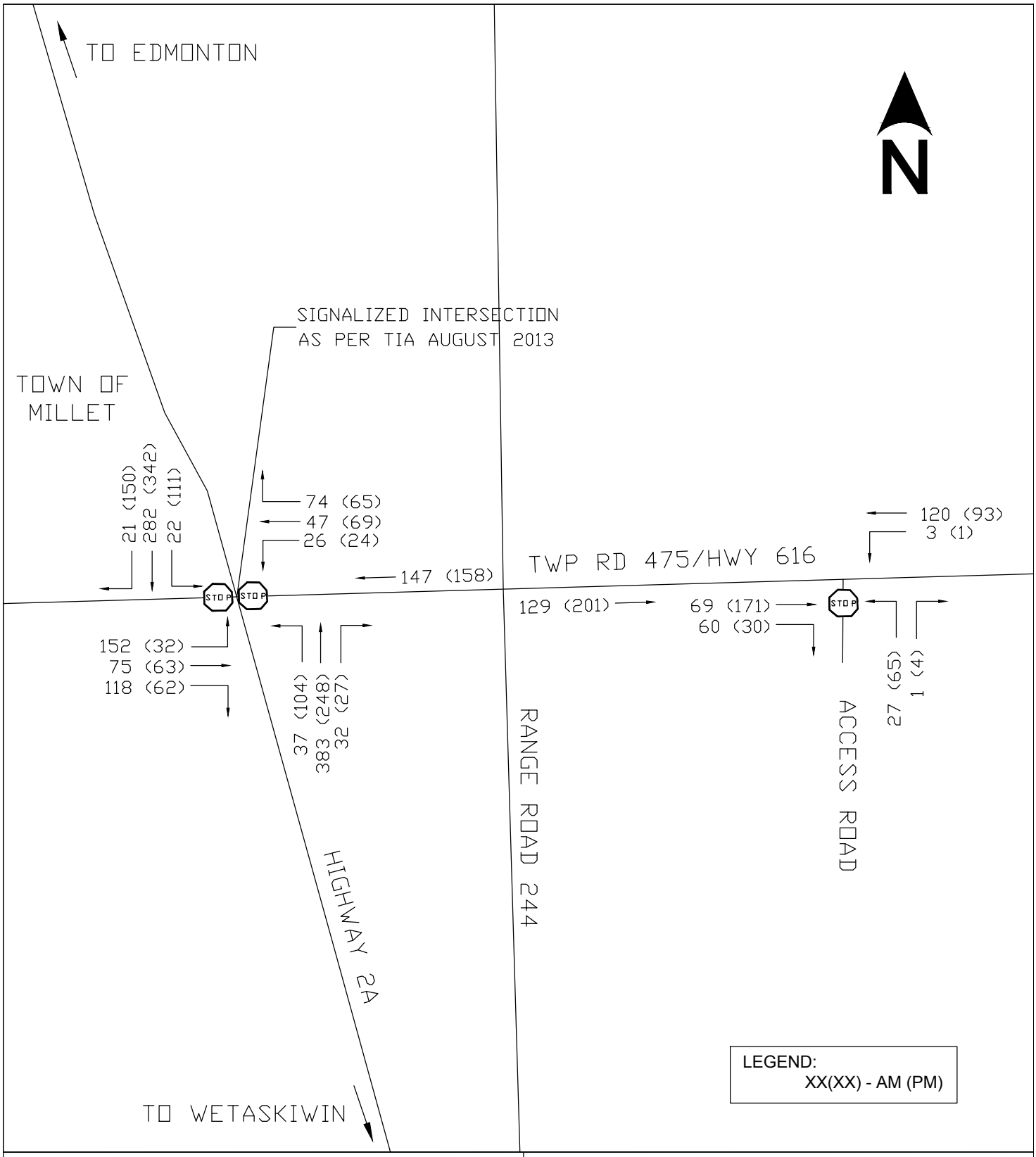
TRIP ASSIGNMENT

ADDITION TO SHIPWAY FARMS
County of Wetaskiwin, Alberta

AREA Consulting Inc.

Date: October 2015

Exhibit 2



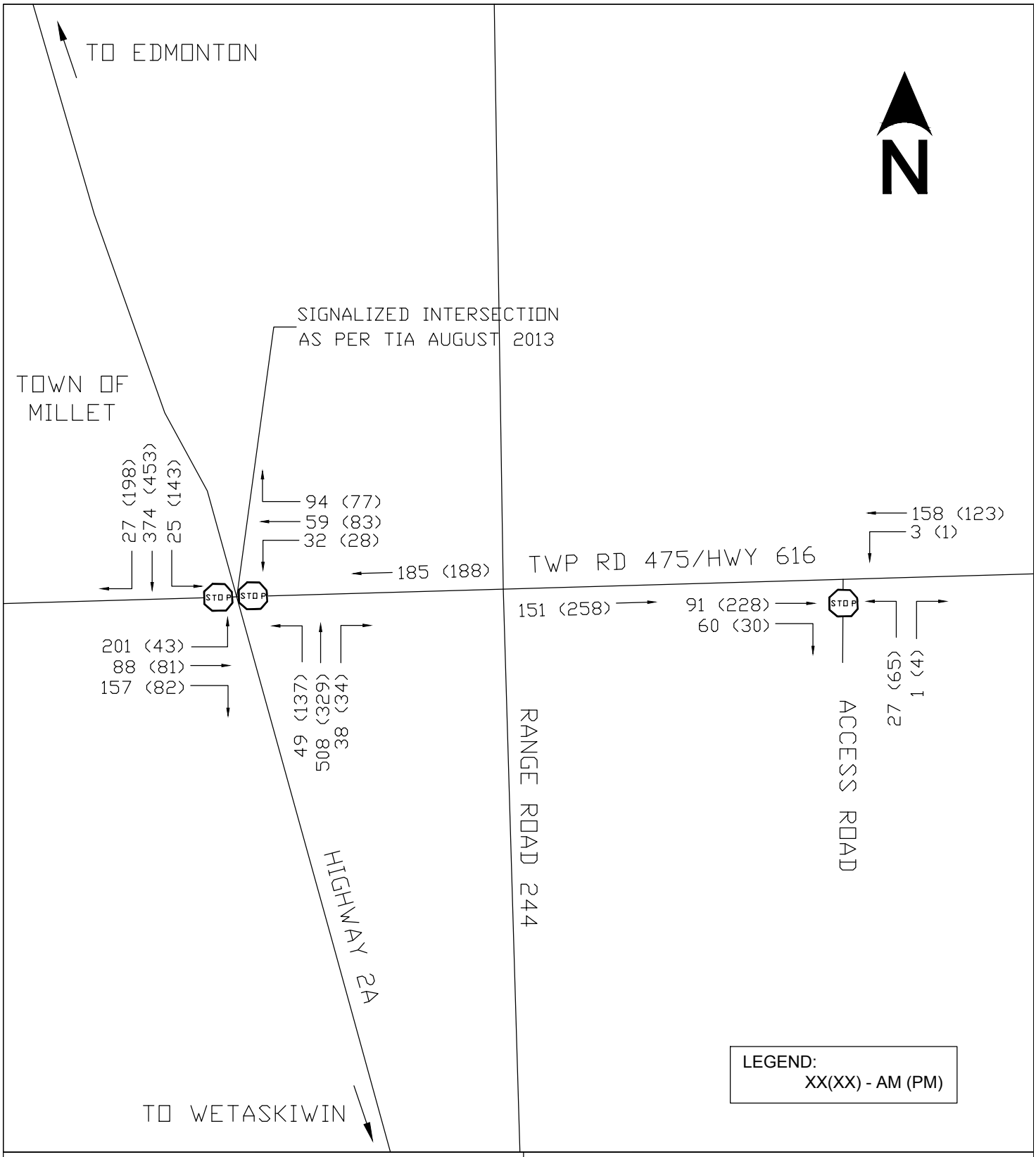
BACKGROUND TOTAL 2020
Traffic Volume

ADDITION TO SHIPWAY FARMS
County of Wetaskiwin, Alberta

AREA Consulting Inc.

Date: October 2015

Exhibit 3



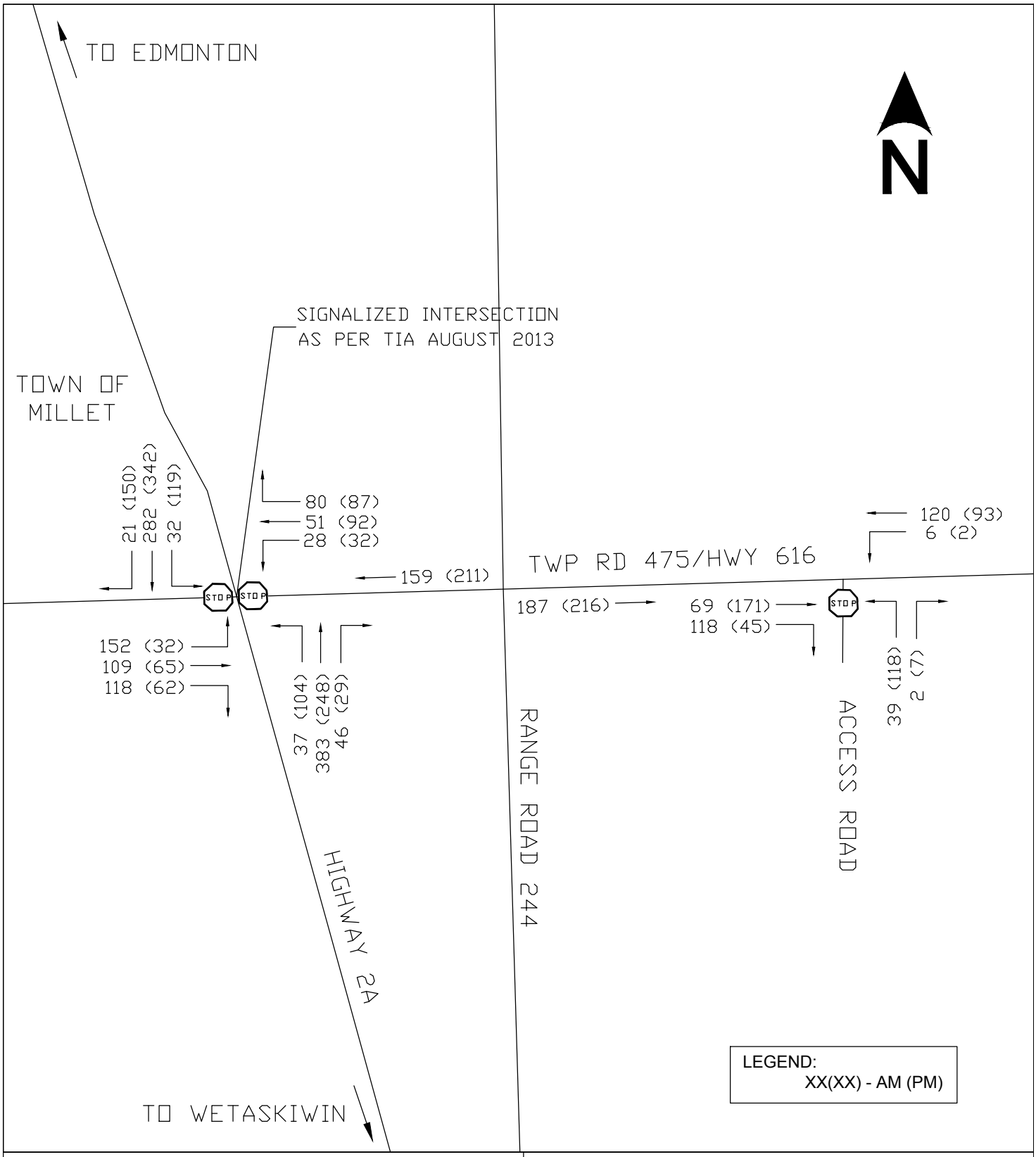
BACKGROUND TOTAL 2035
Traffic Volume

ADDITION TO SHIPWAY FARMS
County of Wetaskiwin, Alberta

AREA Consulting Inc.

Date: October 2015

Exhibit 4



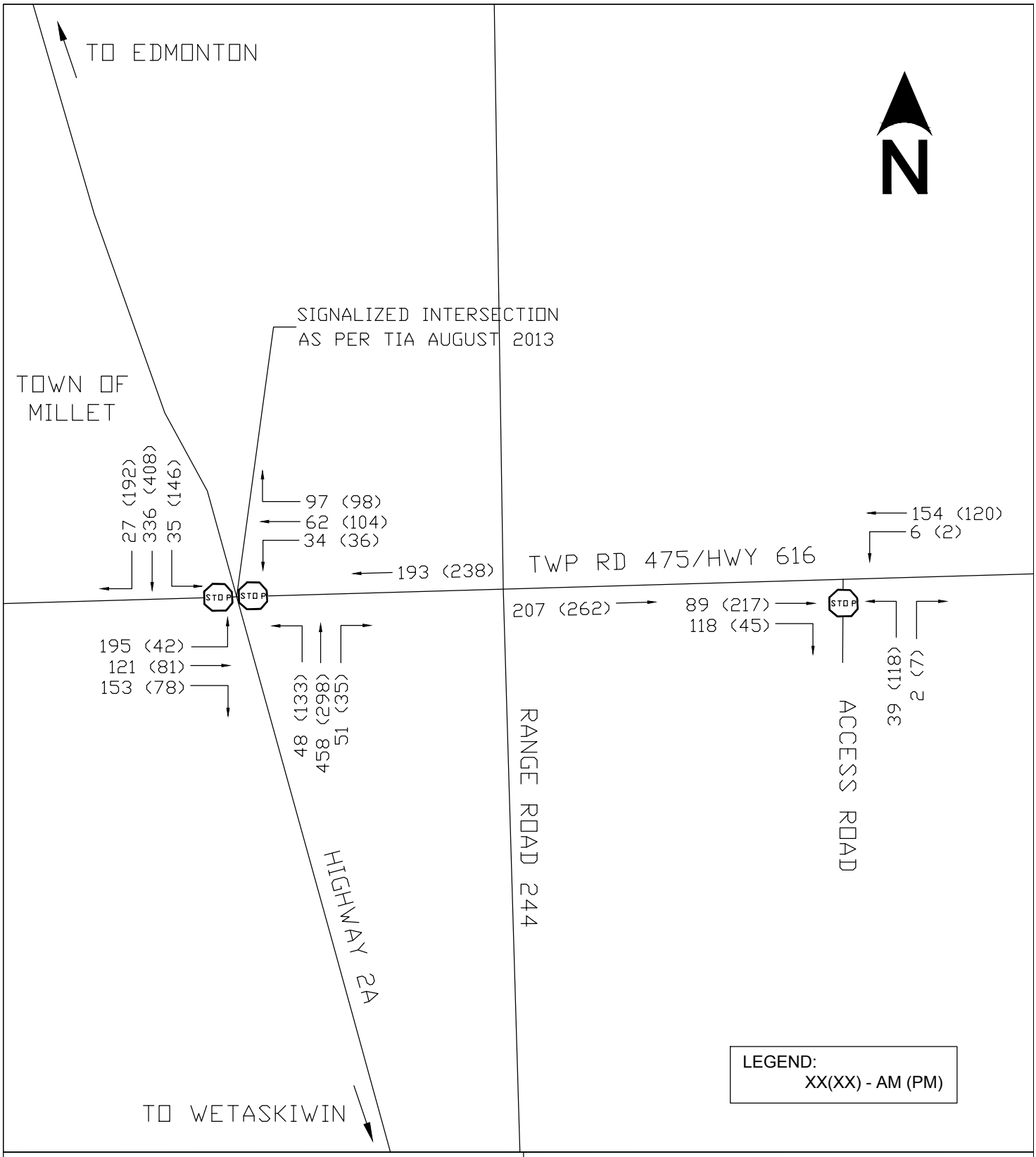
TOTAL 2020
Traffic Volume

ADDITION TO SHIPWAY FARMS
County of Wetaskiwin, Alberta

AREA Consulting Inc.

Date: October 2015

Exhibit 5



TOTAL 2035
Traffic Volume

ADDITION TO SHIPWAY FARMS
County of Wetaskiwin, Alberta

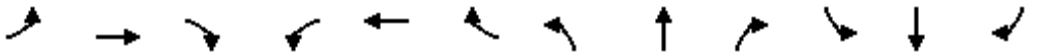
AREA Consulting Inc.

Date: October 2015

Exhibit 6

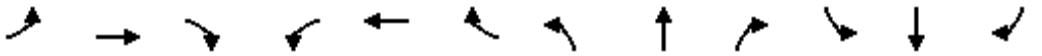
APPENDIX C

Capacity Analysis



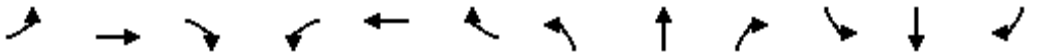
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	152	109	118	28	51	80	37	383	46	32	282	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0	5.0		5.0	5.0
Lane Util. Factor		1.00			1.00			1.00	1.00		1.00	1.00
Frt		0.96			0.93			1.00	0.85		1.00	0.85
Flt Protected		0.98			0.99			1.00	1.00		0.99	1.00
Satd. Flow (prot)		1788			1618			1896	1436		1870	1619
Flt Permitted		0.81			0.90			0.95	1.00		0.93	1.00
Satd. Flow (perm)		1479			1472			1806	1436		1749	1619
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	165	118	128	30	55	87	40	416	50	35	307	23
RTOR Reduction (vph)	0	25	0	0	51	0	0	0	28	0	0	13
Lane Group Flow (vph)	0	386	0	0	121	0	0	456	22	0	342	10
Heavy Vehicles (%)	2%	2%	2%	15%	2%	15%	2%	2%	15%	15%	2%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)		28.0			28.0			29.0	29.0		29.0	29.0
Effective Green, g (s)		27.0			27.0			28.0	28.0		28.0	28.0
Actuated g/C Ratio		0.42			0.42			0.43	0.43		0.43	0.43
Clearance Time (s)		4.0			4.0			4.0	4.0		4.0	4.0
Lane Grp Cap (vph)		614			611			778	619		753	697
v/s Ratio Prot												
v/s Ratio Perm		c0.26			0.08			c0.25	0.02		0.20	0.01
v/c Ratio		0.63			0.20			0.59	0.03		0.45	0.01
Uniform Delay, d1		15.0			12.1			14.1	10.7		13.1	10.6
Progression Factor		1.00			1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2		4.8			0.7			3.2	0.1		2.0	0.0
Delay (s)		19.9			12.8			17.3	10.8		15.1	10.6
Level of Service		B			B			B	B		B	B
Approach Delay (s)		19.9			12.8			16.7			14.8	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	16.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	86.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



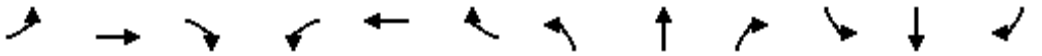
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	32	65	62	32	92	87	104	248	29	119	342	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0	5.0		5.0	5.0
Lane Util. Factor		1.00			1.00			1.00	1.00		1.00	1.00
Frt		0.95			0.94			1.00	0.85		1.00	0.85
Flt Protected		0.99			0.99			0.99	1.00		0.99	1.00
Satd. Flow (prot)		1787			1664			1876	1436		1820	1619
Flt Permitted		0.91			0.94			0.68	1.00		0.79	1.00
Satd. Flow (perm)		1643			1575			1291	1436		1452	1619
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	71	67	35	100	95	113	270	32	129	372	163
RTOR Reduction (vph)	0	35	0	0	39	0	0	0	16	0	0	80
Lane Group Flow (vph)	0	138	0	0	191	0	0	383	16	0	501	83
Heavy Vehicles (%)	2%	2%	2%	15%	2%	15%	2%	2%	15%	15%	2%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)		23.0			23.0			34.0	34.0		34.0	34.0
Effective Green, g (s)		22.0			22.0			33.0	33.0		33.0	33.0
Actuated g/C Ratio		0.34			0.34			0.51	0.51		0.51	0.51
Clearance Time (s)		4.0			4.0			4.0	4.0		4.0	4.0
Lane Grp Cap (vph)		556			533			655	729		737	822
v/s Ratio Prot												
v/s Ratio Perm		0.08			c0.12			0.30	0.01		c0.35	0.05
v/c Ratio		0.25			0.36			0.58	0.02		0.68	0.10
Uniform Delay, d1		15.5			16.2			11.2	8.0		12.0	8.3
Progression Factor		1.00			1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2		1.1			1.9			3.8	0.1		5.0	0.2
Delay (s)		16.6			18.1			15.0	8.0		17.0	8.5
Level of Service		B			B			B	A		B	A
Approach Delay (s)		16.6			18.1			14.5			15.0	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	15.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	70.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	195	121	153	34	62	97	48	458	51	35	336	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0	4.0		4.5	4.5
Lane Util. Factor		1.00			1.00			1.00	1.00		1.00	1.00
Frt		0.96			0.93			1.00	0.85		1.00	0.85
Flt Protected		0.98			0.99			1.00	1.00		1.00	1.00
Satd. Flow (prot)		1783			1619			1895	1436		1873	1619
Flt Permitted		0.77			0.89			0.94	1.00		0.90	1.00
Satd. Flow (perm)		1404			1456			1781	1436		1686	1619
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	212	132	166	37	67	105	52	498	55	38	365	29
RTOR Reduction (vph)	0	27	0	0	56	0	0	0	30	0	0	16
Lane Group Flow (vph)	0	483	0	0	153	0	0	550	25	0	403	13
Heavy Vehicles (%)	2%	2%	2%	15%	2%	15%	2%	2%	15%	15%	2%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)		27.0			27.0			30.0	30.0		29.5	29.5
Effective Green, g (s)		27.0			27.0			30.0	30.0		29.5	29.5
Actuated g/C Ratio		0.42			0.42			0.46	0.46		0.45	0.45
Clearance Time (s)		4.0			4.0			4.0	4.0		4.5	4.5
Lane Grp Cap (vph)		583			605			822	663		765	735
v/s Ratio Prot												
v/s Ratio Perm		c0.34			0.10			c0.31	0.02		0.24	0.01
v/c Ratio		0.83			0.25			0.67	0.04		0.53	0.02
Uniform Delay, d1		16.9			12.4			13.6	9.6		12.7	9.8
Progression Factor		1.00			1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2		12.8			1.0			4.3	0.1		2.6	0.0
Delay (s)		29.7			13.4			17.9	9.7		15.3	9.8
Level of Service		C			B			B	A		B	A
Approach Delay (s)		29.7			13.4			17.2			15.0	
Approach LOS		C			B			B			B	

Intersection Summary			
HCM Average Control Delay	19.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	97.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	42	81	78	36	104	98	133	298	35	146	408	192
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0	5.0		5.0	5.0
Lane Util. Factor		1.00			1.00			1.00	1.00		1.00	1.00
Frt		0.95			0.94			1.00	0.85		1.00	0.85
Flt Protected		0.99			0.99			0.98	1.00		0.99	1.00
Satd. Flow (prot)		1786			1665			1875	1436		1818	1619
Flt Permitted		0.90			0.93			0.55	1.00		0.69	1.00
Satd. Flow (perm)		1630			1557			1051	1436		1263	1619
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	88	85	39	113	107	145	324	38	159	443	209
RTOR Reduction (vph)	0	35	0	0	39	0	0	0	18	0	0	96
Lane Group Flow (vph)	0	184	0	0	220	0	0	469	20	0	602	113
Heavy Vehicles (%)	2%	2%	2%	15%	2%	15%	2%	2%	15%	15%	2%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)		21.0			21.0			36.0	36.0		36.0	36.0
Effective Green, g (s)		20.0			20.0			35.0	35.0		35.0	35.0
Actuated g/C Ratio		0.31			0.31			0.54	0.54		0.54	0.54
Clearance Time (s)		4.0			4.0			4.0	4.0		4.0	4.0
Lane Grp Cap (vph)		502			479			566	773		680	872
v/s Ratio Prot												
v/s Ratio Perm		0.11			c0.14			0.45	0.01		c0.48	0.07
v/c Ratio		0.37			0.46			0.83	0.03		0.89	0.13
Uniform Delay, d1		17.6			18.1			12.5	7.0		13.2	7.4
Progression Factor		1.00			1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2		2.1			3.2			13.1	0.1		15.7	0.3
Delay (s)		19.6			21.3			25.6	7.1		28.9	7.7
Level of Service		B			C			C	A		C	A
Approach Delay (s)		19.6			21.3			24.2			23.4	
Approach LOS		B			C			C			C	

Intersection Summary			
HCM Average Control Delay	22.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	82.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	69	118	6	120	39	2
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	75	128	7	130	42	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			203		283	139
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			203		283	139
tC, single (s)			4.1		6.5	6.4
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.4
p0 queue free %			100		94	100
cM capacity (veh/h)			1368		677	876

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	203	137	45
Volume Left	0	7	42
Volume Right	128	0	2
cSH	1700	1368	685
Volume to Capacity	0.12	0.00	0.07
Queue Length 95th (m)	0.0	0.1	1.6
Control Delay (s)	0.0	0.4	10.6
Lane LOS		A	B
Approach Delay (s)	0.0	0.4	10.6
Approach LOS			B

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	21.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	171	45	2	93	118	7
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	186	49	2	101	128	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			235		316	210
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			235		316	210
tC, single (s)			4.1		6.5	6.4
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.4
p0 queue free %			100		80	99
cM capacity (veh/h)			1333		650	798

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	235	103	136
Volume Left	0	2	128
Volume Right	49	0	8
cSH	1700	1333	657
Volume to Capacity	0.14	0.00	0.21
Queue Length 95th (m)	0.0	0.0	5.9
Control Delay (s)	0.0	0.2	11.9
Lane LOS		A	B
Approach Delay (s)	0.0	0.2	11.9
Approach LOS			B

Intersection Summary			
Average Delay		3.5	
Intersection Capacity Utilization		25.4%	ICU Level of Service
Analysis Period (min)		15	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	89	118	6	154	39	2
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	97	128	7	167	42	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			225		341	161
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			225		341	161
tC, single (s)			4.1		6.5	6.4
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.4
p0 queue free %			100		93	100
cM capacity (veh/h)			1344		626	851

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	225	174	45
Volume Left	0	7	42
Volume Right	128	0	2
cSH	1700	1344	634
Volume to Capacity	0.13	0.00	0.07
Queue Length 95th (m)	0.0	0.1	1.7
Control Delay (s)	0.0	0.3	11.1
Lane LOS		A	B
Approach Delay (s)	0.0	0.3	11.1
Approach LOS			B

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	23.0%	ICU Level of Service	A
Analysis Period (min)	15		

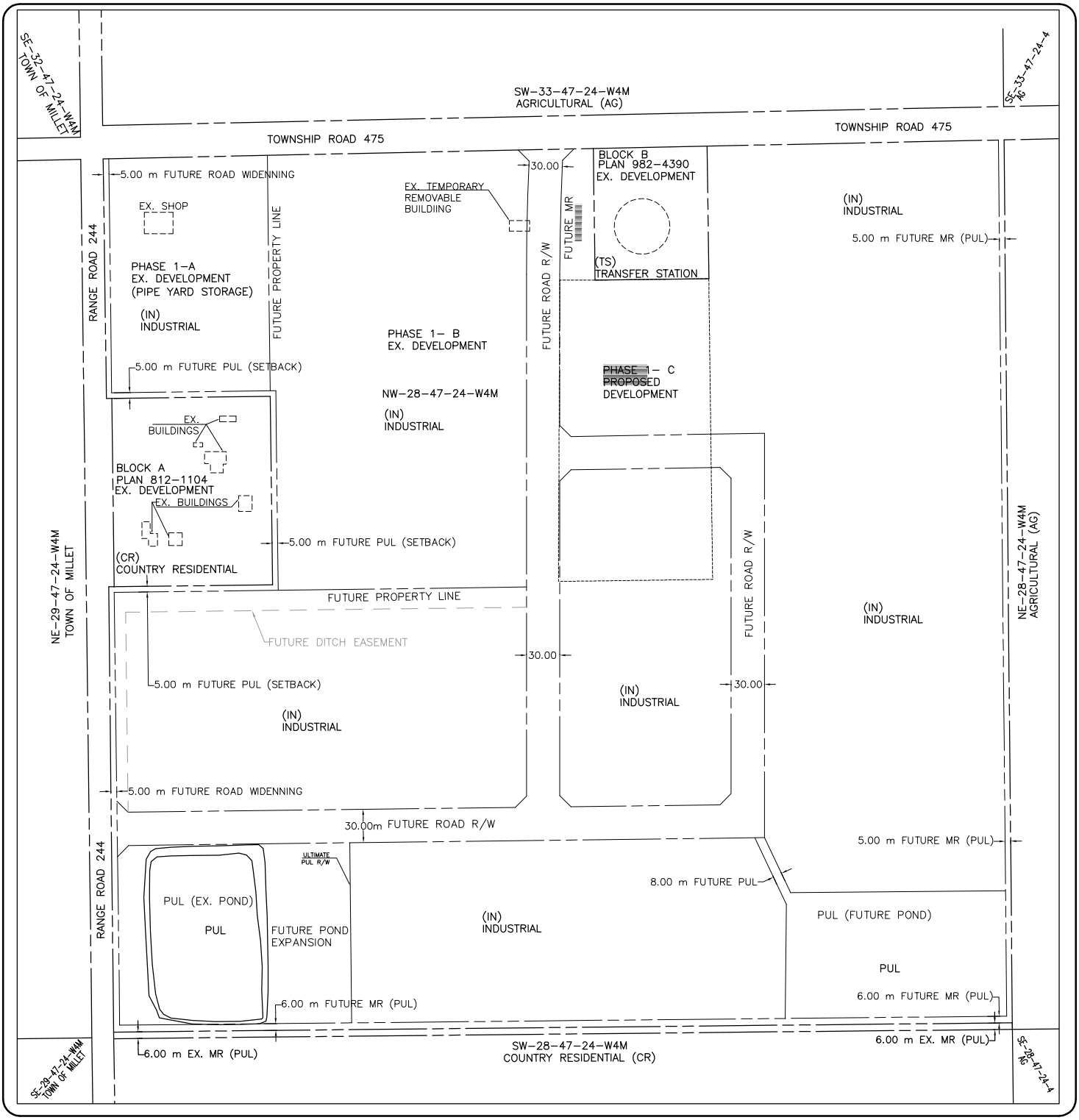
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	217	45	2	120	118	7
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	236	49	2	130	128	8
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			285		395	260
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			285		395	260
tC, single (s)			4.1		6.5	6.4
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.4
p0 queue free %			100		78	99
cM capacity (veh/h)			1277		584	748

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	285	133	136
Volume Left	0	2	128
Volume Right	49	0	8
cSH	1700	1277	592
Volume to Capacity	0.17	0.00	0.23
Queue Length 95th (m)	0.0	0.0	6.7
Control Delay (s)	0.0	0.1	12.9
Lane LOS		A	B
Approach Delay (s)	0.0	0.1	12.9
Approach LOS			B

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	27.8%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX D

Site Plans and Area Structural Plans



AREA Consulting Inc.

OCT., 15, 2007

LEGEND:

- EX. PROPERTY LINE
- FUTURE PROPERTY LINE
- EX. BUILDINGS/FACILITIES
- PROPOSED ROADWAY
- FUTURE DITCH EASEMENT
- EX. POND
- PROPOSED NEW POND

DRAWN BY:	SCALE:	PROJECT No.:
R.S.	N.T.S.	

PROJECT:

SHIPWAY INDUSTRIAL YARD

LOCATION:

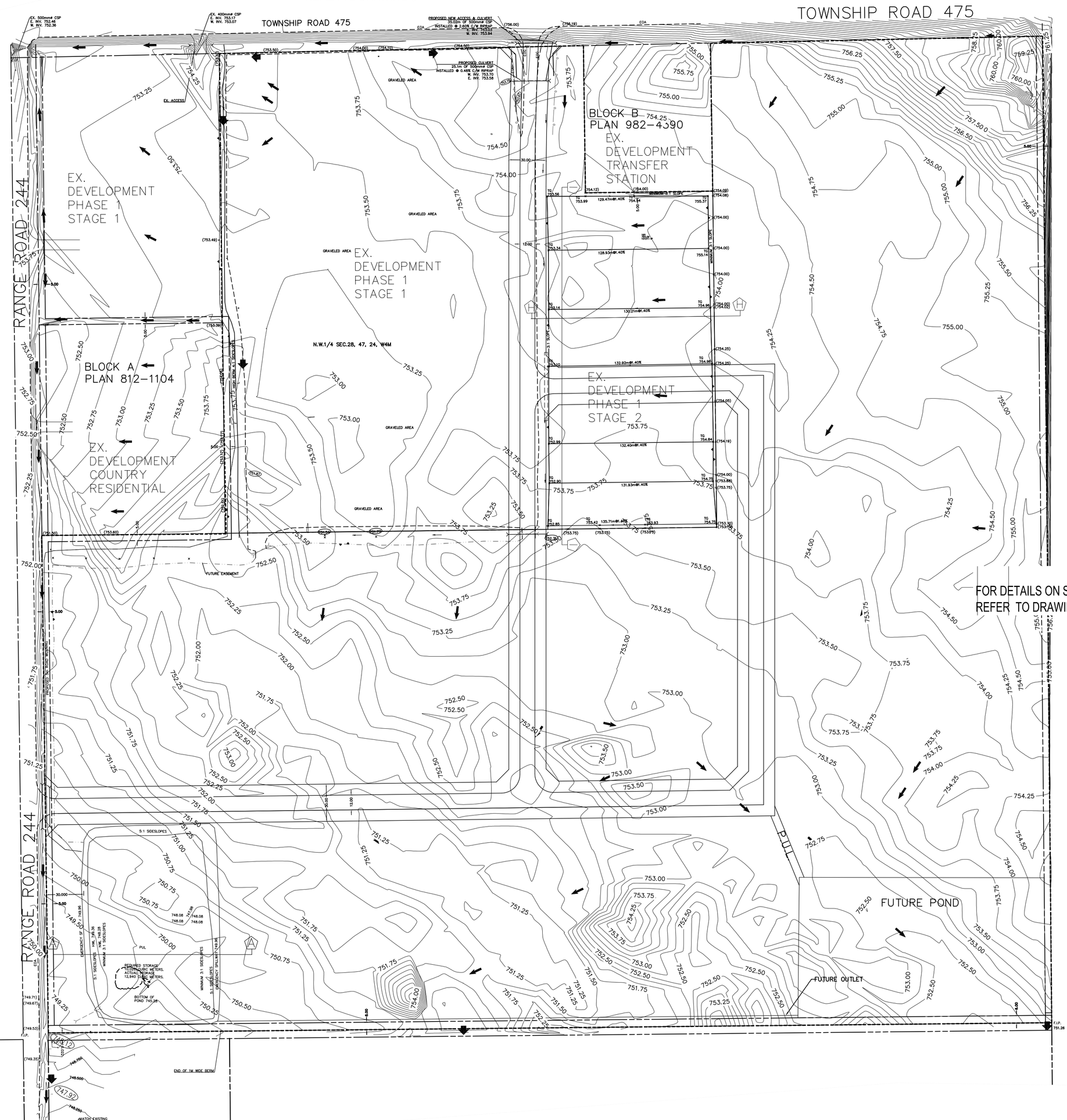
TOWN OF MILLET, ALBERTA

TITLE:

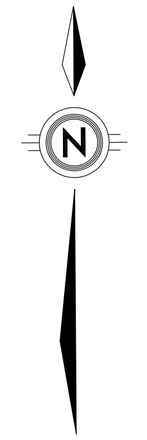
Figure 1.0
TENTATIVE MAP

F:\SHIPWAY OCT 5\TIA INFO\NEW LAST RECORDS asbuilt drawing shipway_Sep 18.dwg - Oct 09 2015 - 5:26pm - Ali

FOR DETAILS ON SECTION D
REFER TO DRAWING 6



FOR DETAILS ON SECTION E
REFER TO DRAWING 6



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Legend

- PROPOSED CENTERLINE OF DITCH
- EASEMENTS (for DRAINAGE, GAS, ETC.)
- PROPOSED PROPERTY LINE (P/L)
- EXISTING PROPERTY LINE (P/L)
- EXISTING PROPERTY LINE (P/L)
- PROPOSED EDGE OF ASPHALT (EOA)
- PROPOSED EDGE OF ASPHALT (EOA)
- PROPOSED EDGE OF GRAVEL (EOG)
- EXISTING EDGE OF GRAVEL (EOG)
- DRAINAGE FLOW
- EXISTING DRAINAGE FLOW
- F.I.P. — FOUND IRON PIN
- EXISTING CULVERT
- 29.0% @ 2.0% — PROPOSED DIRECTION OF FLOW AND GRADE
- (677.85) — EXISTING GROUND ELEVATION
- 677.85 — PROPOSED ELEVATION
- 698.14 — EXISTING SWALE ELEVATION
- 698.14 — PROPOSED SWALE ELEVATION
- EOG — PROPOSED EDGE OF GRAVEL
- EOA — PROPOSED EDGE OF ASPHALT
- TBS — TOP, BACK OF SLOPE
- TG — TOP OF GRAVEL
- F.I.P. — FOUND IRON PIN
- PROPOSED GRAVEL AREA (CURRENT PHASE)
- DEVELOPMENT BOUNDARY
- LIMIT OF CONSTRUCTION

NOTES:

DIMENSIONS ARE IN METERS AND DECIMALS THEREOF.
ALL DIMENSIONS AND AREAS ARE APPROXIMATE AND ARE TO BE CONFIRMED BY PLAN OF SURVEY.
THE OWNER/DEVELOPER MUST CONFORM TO THE REQUIREMENTS OF THE COUNTY OF WETASKIWIN EROSION AND SEDIMENTATION CONTROL GUIDELINES.

AREA CONSULTING INC HAS COMPLETED THE ONSITE DRAINAGE DESIGN BASED ON SURVEY INFORMATION PROVIDED BY OTHER. AREA CONSULTING INC ASSUMES NO RESPONSIBILITY FOR THE PAVEMENT STRUCTURE.

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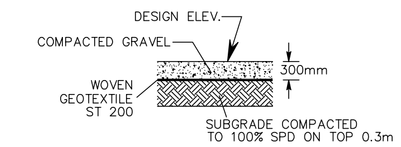

PROPOSED DESIGN TYPICAL
CROSS SECTION FOR GRAVEL AREA
N.T.S.

NO.	REVISION	DATE	BY	CK'D	APP'D
1	FOR APPROVALS	SEPTEMBER 15, 2015	R.S.	G.H.	A.A.S

SCALE	1:2000
DATE	15 SEPT., 2015
DESIGNED	R.S.
DRAWN	R.S.
CHECKED	A.A.S.
APPROVED	G.W.H.

CLIENT NAME: SHIPWAY FARMS

PROJECT NAME: SHIPWAY STORWATER MANAGEMENT N.W.$\frac{1}{4}$ SEC.,28-47-24-W4M

DRAWING TITLE: PROPOSED GRADING PLAN
COUNTY OF WETASKIWIN , ALBERTA

PROJECT NUMBER: 15-09-2015

DWG. NO. WETASKIWIN 15-09-2015

HCS Headrick Consulting Services
SHERWOOD PARK, AB, T8A-5K8
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