The City of Edmonton

41 Avenue SW Concept Planning Study
50 Street to 170 Street

volume two

appendicies

January 2011

THE CITY OF Edmonton

Associated Engineering

A Appendix A - Site Photos

41 Avenue between 50 Street and 66 Street – Looking West

41 Avenue between 50 Street and 66 Street – Looking West

41 Avenue between 66 Street and 91 Street – Looking West

41 Avenue between 66 Street and 91 Street – Looking West

41 Avenue between 91 Street and 101 Street – Looking West

41 Avenue between 91 Street and 101 Street – Looking East

41 Avenue between 101 Street and Highway 2 – Looking West

41 Avenue between 101 Street and Highway 2 – Looking West

41 Avenue between Highway 2 and 127 Street – Looking West

41 Avenue between Highway 2 and 127 Street – Looking East

41 Avenue between 127 Street and 141 Street – Looking West

41 Avenue between 127 Street and 141 Street – Looking East

41 Avenue at 141 Street – Looking West

41 Avenue between 141 Street and 156 Street – Looking East

41 Avenue at 156 Street – Looking East

41 Avenue between 156 Street and 170 Street – Looking West

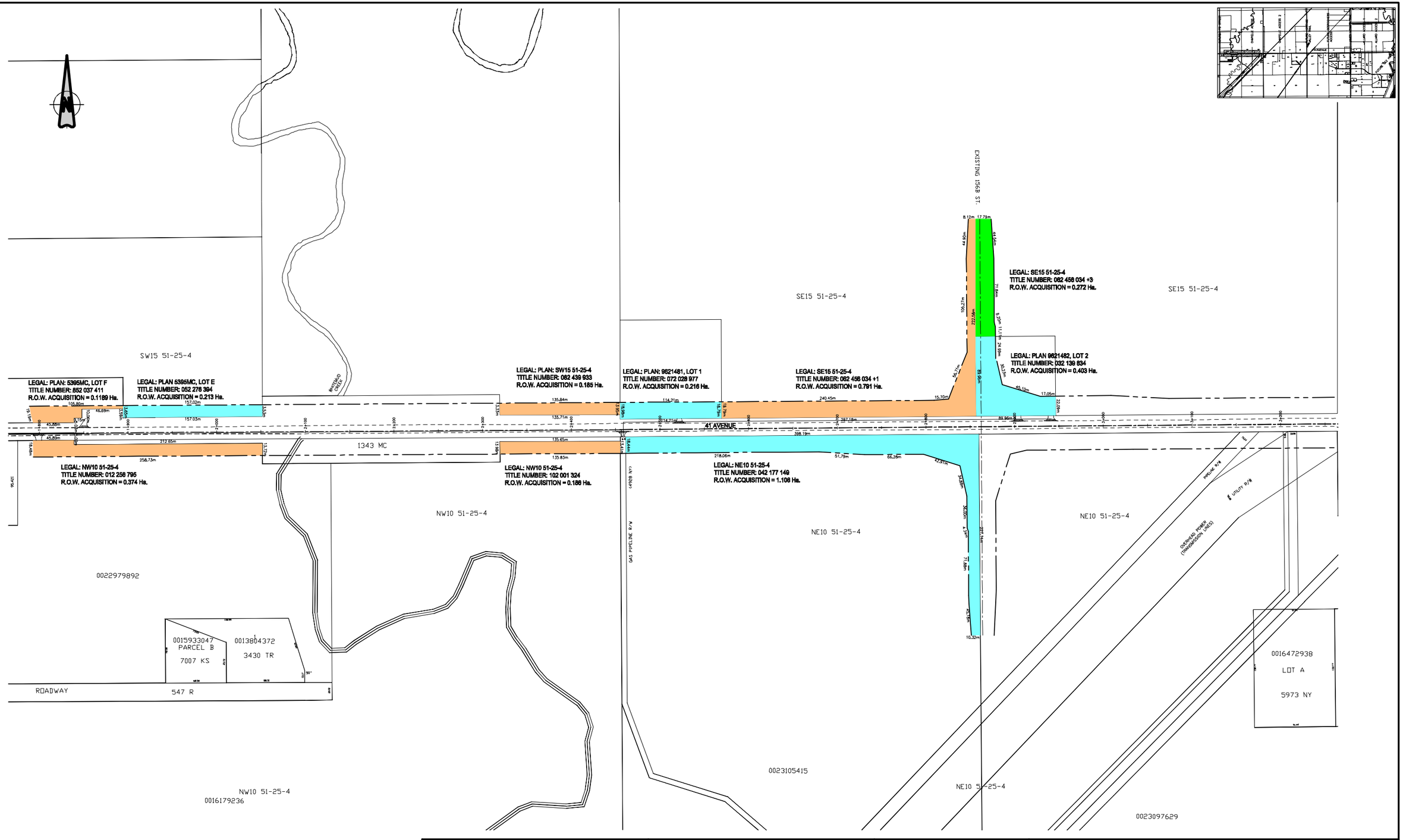
Pipelines between 156 Street and 170 Street

41 Avenue at Whitemud Creek – Looking West

Whitemud Creek – Looking Northeast

41 Avenue West of Whitemud Creek – Looking East

B Appendix B - Right-of-Way Plans



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CONCEPT PLAN - SUBJECT TO PRELIMINARY DESIGN

41 AVENUE SW CONCEPT PLANNING STUDY

RIGHT OF WAY PLAN

NOTE: ALL DIMENSIONS ARE IN METRES

SCALE: 1:2000

PLAN NO. A041-0950

Date: Nov. 02, 2010 Time: 2:16pm
File: P:\20073483\00_CIS_41_Arch Working_Dwgs\100_Civil\073483_PLAN_PROFILES.dwg by
Xrefs: 30807B01_TITLEBLOCK1, utilities, legal

EXISTING 156 ST.

SE15 51-25-4

SW14 51-25-4

SE14 51-25-4

EXISTING 166 STREET

RANGE ROAD 252

41 AVENUE

LEGAL: SE15 51-25-4
TITLE NUMBER: 062 456 034 +3
R.O.W. ACQUISITION = 0.617 Ha.

LEGAL: SW14 51-25-4
TITLE NUMBER: 062 456 034
R.O.W. ACQUISITION = 2.109 Ha.

LEGAL: PLAN: 9621478, LOT1
TITLE NUMBER: 962 103 362R.O.W.
ACQUISITION = 0.188 Ha.

LEGAL: NE10 51-25-4
TITLE NUMBER: 052 114 735
R.O.W. ACQUISITION = 1.184 Ha.

LEGAL: PLAN: 4869HW, PARCEL A
TITLE NUMBER: 812 147 821
R.O.W. ACQUISITION = 0.159 Ha.

LEGAL: NW11 51-25-4
TITLE NUMBER: 872 263 784
R.O.W. ACQUISITION = 0.852 Ha.

LEGAL: PLAN: 0922651, BLOCK 1, LOT 1
TITLE NUMBER: 092 193 170
R.O.W. ACQUISITION = 0.198 Ha.

LEGAL: NE11 51-25-4
TITLE NUMBER: 922 147 316
R.O.W. ACQUISITION = 0.448 Ha.

LEGAL: NW11 51-25-4
TITLE NUMBER: 102 055 315
R.O.W. ACQUISITION = 1.080 Ha.

NE10 51-25-4

NW11 51-25-4

NE11 51-25-4

NE10 51-25-4

NW11 51-25-4

0017260910
4869 HW

0016472938
LOT A
5973 NY

0023097629

0018880526

0019192004

PIPELINE R/W

UTILITY R/W

OVERHEAD POWER TRANSMISSION (HES)

FUTURE 166A STREET

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CONCEPT PLAN - SUBJECT TO PRELIMINARY DESIGN

41 AVENUE SW CONCEPT PLANNING STUDY

RIGHT OF WAY PLAN

NOTE:
ALL DIMENSIONS
ARE IN METRES

SCALE: 1:2000

PLAN NO.
A041-0951

Date: Nov. 02, 2010 Time: 2:17pm
File: P:\20073483\00_JCE_41_Ave\Working_Dwgs\100_Civil\073483_PLAN_PROFILES.dwg by
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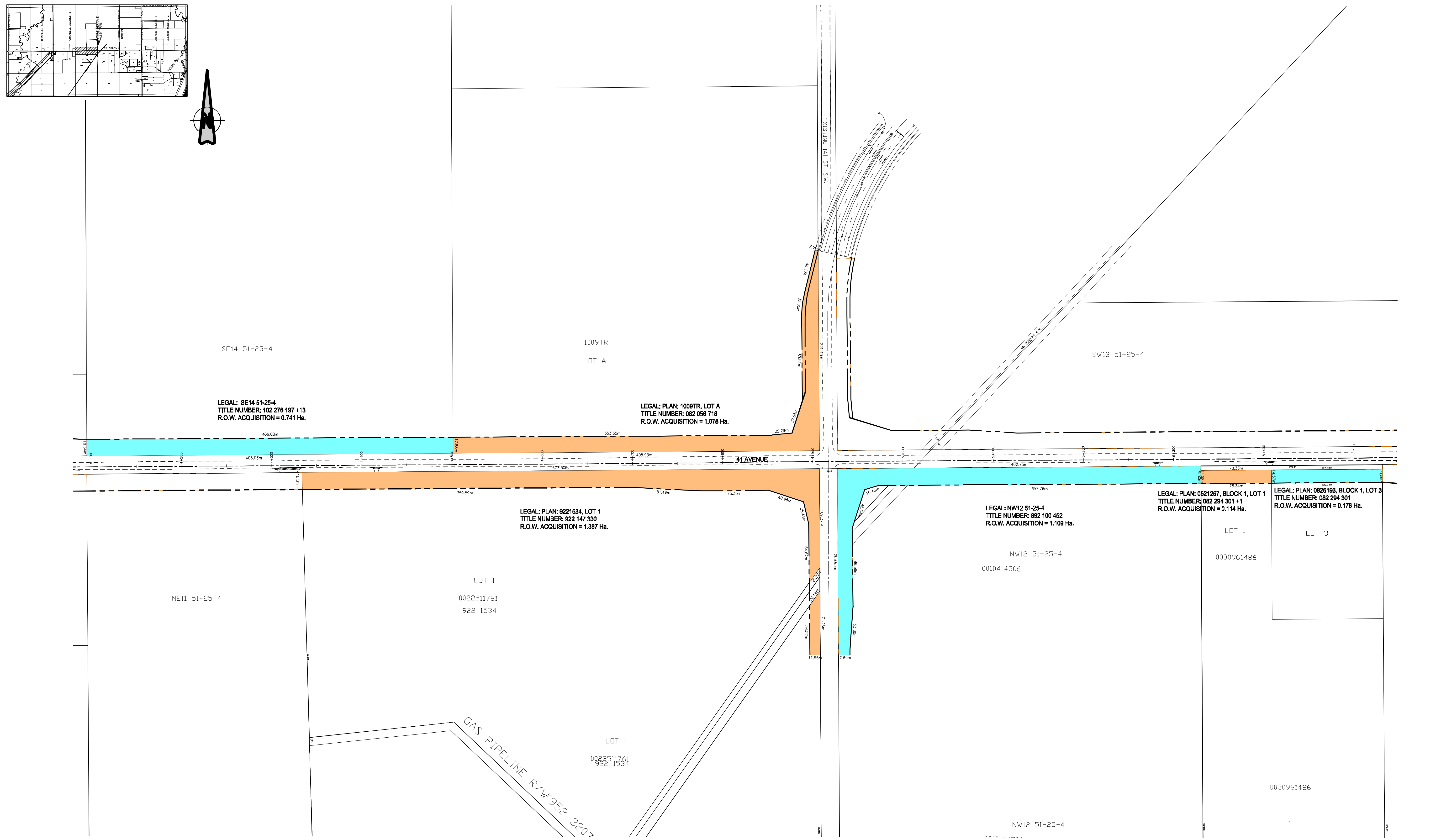

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CONCEPT PLAN - SUBJECT TO PRELIMINARY DESIGN

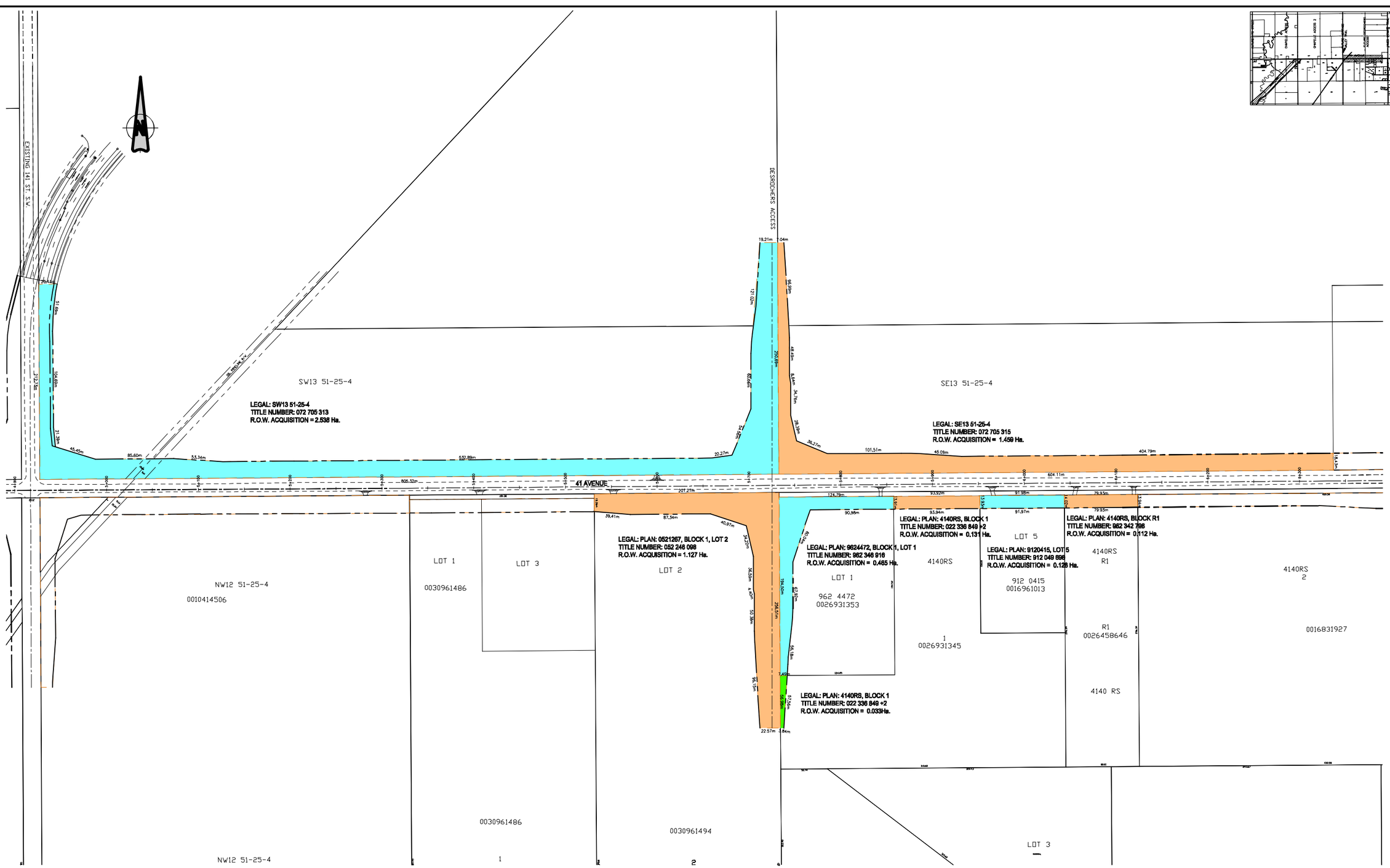
41 AVENUE SW CONCEPT PLANNING STUDY

RIGHT OF WAY PLAN

NOTE: ALL DIMENSIONS ARE IN METRES

SCALE: 1:2000

PLAN NO. A041-0952



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CONCEPT PLAN - SUBJECT TO PRELIMINARY DESIGN

41 AVENUE SW CONCEPT PLANNING STUDY

RIGHT OF WAY PLAN

NOTE: ALL DIMENSIONS ARE IN METRES

SCALE: 1:2000

PLAN NO. A041-0953

Date: Nov 02, 2010 Time: 2:19pm
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Xrefs: 30807B01_TITLEBLOCK1, utilities, legal

EXISTING 127 ST.

ALLARD ACCESS 1

ALLARD ACCESS 2

41 AVENUE

LEGAL: SE13 51-25-4
TITLE NUMBER: 072 705 315
R.O.W. ACQUISITION = 0.172 Ha.

LEGAL: PLAN: 9824939, LOT 1
TITLE NUMBER: 072 291 520
R.O.W. ACQUISITION = 0.871 Ha.

LEGAL: SW18 51-24-4
TITLE NUMBER: 092 181 418 +1
R.O.W. ACQUISITION = 0.703 Ha.

LEGAL: PLAN: 0926061, BLOCK 1, LOT 1
TITLE NUMBER: 092 232 325
R.O.W. ACQUISITION = 0.027 Ha.

LEGAL: SW18 51-24-4
TITLE NUMBER: 092 181 418 +1
R.O.W. ACQUISITION = 1.904 Ha.

LEGAL: PLAN: 4140RS, BLOCK 2
TITLE NUMBER: 822 140 108
R.O.W. ACQUISITION = 0.798 Ha.

LEGAL: PLAN: 4687RS, LOT B
TITLE NUMBER: 902 104 390
R.O.W. ACQUISITION = 0.711 Ha.

LEGAL: PLAN: 4687RS, LOT R
TITLE NUMBER: 842 047 557
R.O.W. ACQUISITION = 0.140 Ha.

LEGAL: PLAN: 9120080, LOT 1
TITLE NUMBER: 912 107 844
R.O.W. ACQUISITION = 1.077 Ha.

LEGAL: PLAN: 9120080, LOT 2
TITLE NUMBER: 912 107 857
R.O.W. ACQUISITION = 0.681 Ha.

LEGAL: PLAN: 9120080, LOT 3
TITLE NUMBER: 912 107 862
R.O.W. ACQUISITION = 0.248 Ha.

SW18 51-25-4

LOT 1

SW18 51-25-4

5

4140RS
R1

4140RS
2

0016831927

4140 RS

R1
0026458646

415
013

4687RS

0013380878
LOT B

4687RS

LOT R
0017437906

0016524945

LOT 1

912 0080

LOT 2

0016524960

LOT 3

JT 3

LOT B
0016960783

LOT 6
0027116870

972 2422

PARCEL A
0016472920

5973 HW

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CONCEPT PLAN - SUBJECT TO PRELIMINARY DESIGN

41 AVENUE SW CONCEPT PLANNING STUDY

RIGHT OF WAY PLAN

NOTE:
ALL DIMENSIONS ARE IN METRES

SCALE: 1:2000

PLAN NO.
A041-0954

Date: Nov 02, 2016 Time: 2:19pm
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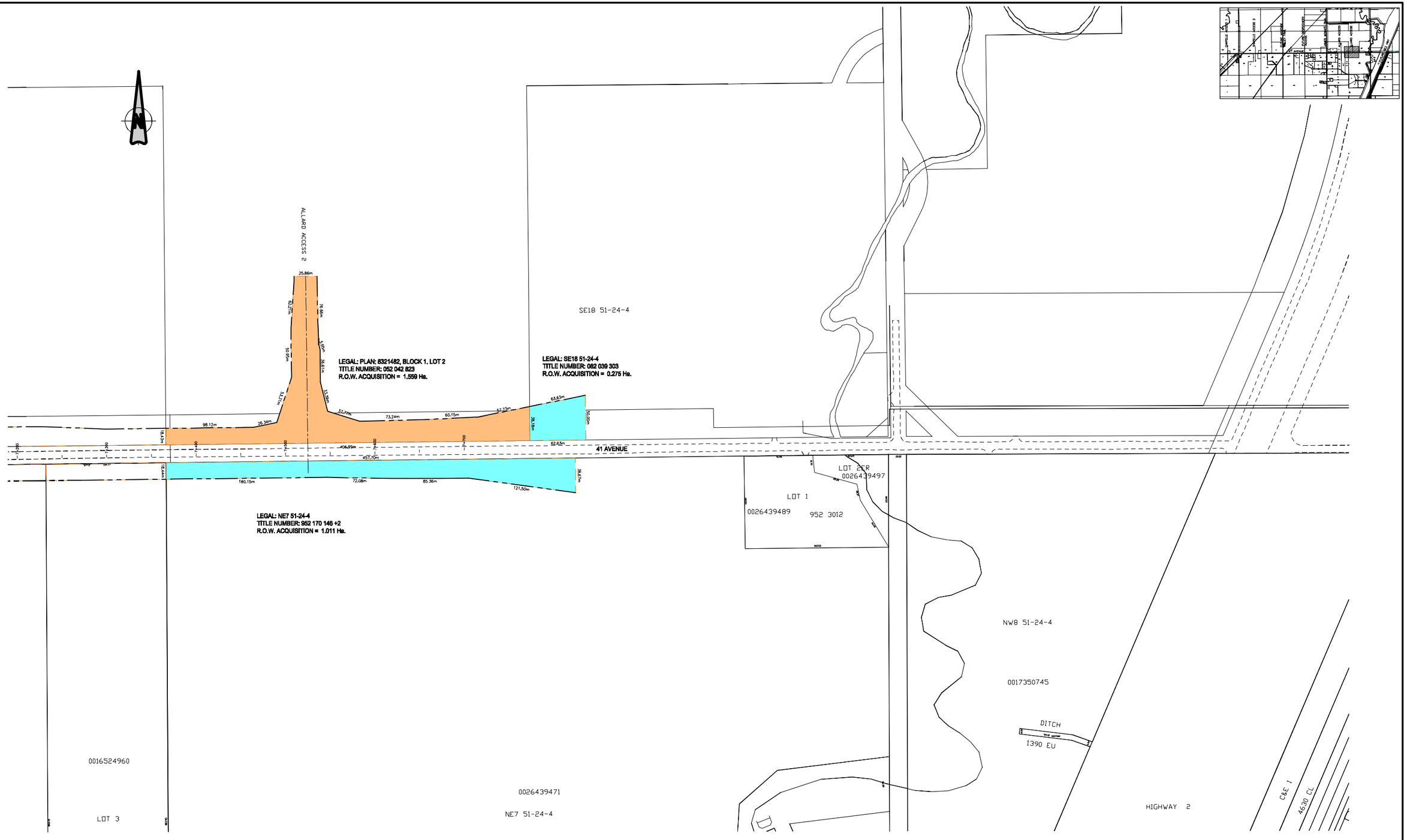

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41 AVENUE SW CONCEPT PLANNING STUDY

RIGHT OF WAY PLAN

NOTE: ALL DIMENSIONS ARE IN METRES

SCALE: 1:2000

PLAN NO. A041-0955

Date: Nov. 02, 2010 Time: 2:07pm
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Xrefs: 30807B01_TITLEBLOCK1, utilities, legal

LEGAL: SE17 51-24-4
TITLE NUMBER: 042 014 589
R.O.W. ACQUISITION = 0.482 Ha.

LEGAL: SE17 51-24-4
TITLE NUMBER: 072 578 190
R.O.W. ACQUISITION = 0.173 Ha.

LEGAL: SE17 51-24-4
TITLE NUMBER: 042 014 589
R.O.W. ACQUISITION = 0.847 Ha.

LEGAL: SW16 51-24-4
TITLE NUMBER: 072 693 663
R.O.W. ACQUISITION = 1.846 Ha.

SW16 51-24-4

EXISTING 101 ST.

41 AVENUE

LEGAL: NE18 51-24-4
TITLE NUMBER: 062 182 854
R.O.W. ACQUISITION = 0.796 Ha.

(5301 MC)

LEGAL: PLAN: 5301MC, RW 61
TITLE NUMBER: 114I199
R.O.W. ACQUISITION = 0.174 Ha.

LEGAL: NE18 51-24-4
TITLE NUMBER: 062 182 854
R.O.W. ACQUISITION = 0.783 Ha.

LEGAL: NW9 51-24-4
TITLE NUMBER: 062 378 503
R.O.W. ACQUISITION = 2.216 Ha.

WAM ACCESS

NE8 51-24-4
0021909320

NW9 51-24-4
001010742

0021909320

NE8 51-24-4

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CONCEPT PLAN - SUBJECT TO PRELIMINARY DESIGN

41 AVENUE SW CONCEPT PLANNING STUDY

RIGHT OF WAY PLAN

NOTE:
ALL DIMENSIONS ARE IN METRES

SCALE: 1:2000

PLAN NO.
A041-0956

Date: Nov 02, 2010 Time: 2:21pm
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Xrefs: 30980TB01_TITLEBLOCK1, utilities, legal

LEGAL: 3186TR, LOT R-1
TITLE NUMBER: 842 042 298
R.O.W. ACQUISITION = 0.073 Ha.

LEGAL: 3186TR, LOT E
TITLE NUMBER: 072 185 888
R.O.W. ACQUISITION = 0.348 Ha.

LEGAL: 3186TR, LOT D
TITLE NUMBER: 072 488 604
R.O.W. ACQUISITION = 0.336 Ha.

LEGAL: 3186TR, LOT C
TITLE NUMBER: 032 114 899
R.O.W. ACQUISITION = 1.649 Ha.

LEGAL: PLAN: 0521074, BLOCK 1, LOT 1
TITLE NUMBER: 082 013 791
R.O.W. ACQUISITION = 0.348 Ha.

EXISTING 15 ST

41 AVENUE

LEGAL: PLAN: 8922964, LOT 1
TITLE NUMBER: 012 213 534
R.O.W. ACQUISITION = 0.153 Ha.

LEGAL: 2030RS, LOT C
TITLE NUMBER: 012 240 894
R.O.W. ACQUISITION = 0.236 Ha.

LEGAL: 2030RS, LOT B
TITLE NUMBER: 972 278 342
R.O.W. ACQUISITION = 0.395 Ha.

LEGAL: 2030RS, LOT A
TITLE NUMBER: 082 269 484
R.O.W. ACQUISITION = 1.471 Ha.

LEGAL: 1423RS, LOT 1
TITLE NUMBER: 072 835 505
R.O.W. ACQUISITION = 0.875 Ha.

LOT 1
892 2964
0011874690

LOT C
0011874682

LOT B
0020041927

2030 RS

LOT A
0017431222

LOT 1
0010354421

LOT 2
0015678858

1423 RS

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CONCEPT PLAN - SUBJECT TO PRELIMINARY DESIGN

41 AVENUE SW CONCEPT PLANNING STUDY

RIGHT OF WAY PLAN

NOTE:
ALL DIMENSIONS ARE IN METRES

SCALE: 1:2000

PLAN NO.
A041-0957

Date: Nov. 02, 2010 Time: 2:21pm
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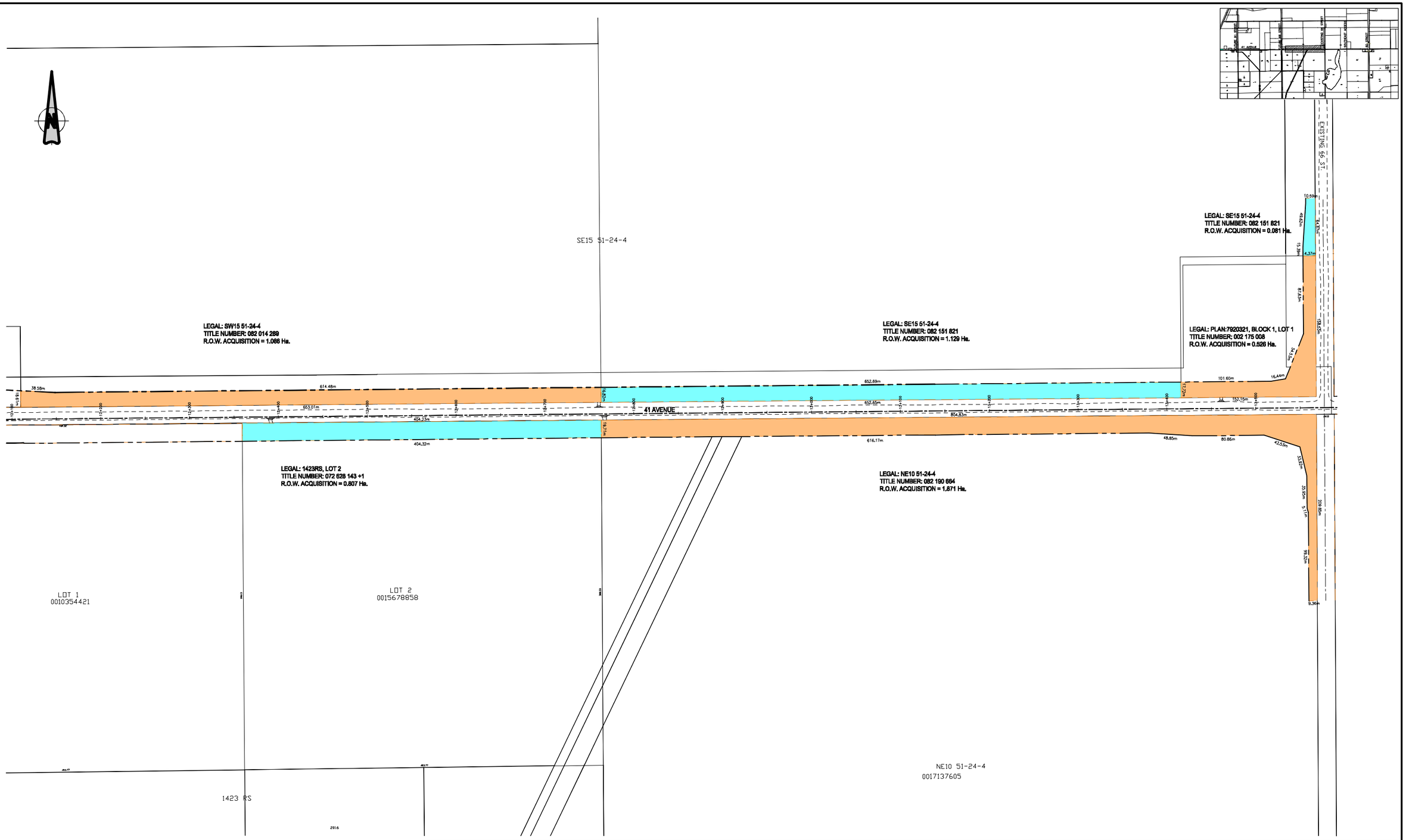

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CONCEPT PLAN - SUBJECT TO PRELIMINARY DESIGN

41 AVENUE SW CONCEPT PLANNING STUDY

RIGHT OF WAY PLAN

NOTE: ALL DIMENSIONS ARE IN METRES

SCALE: 1:2000

PLAN NO. A041-0958

Date: Nov 02, 2010 Time: 2:22pm
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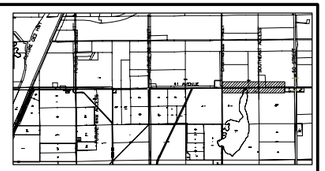

EXISTING 41 ST

SOUTHEAST ACCESS

SW14 51-24-4

LEGAL: SW14 51-24-4
TITLE NUMBER: 072 014 384
R.O.W. ACQUISITION = 1.308 Ha.

LEGAL: SW14 51-24-4
TITLE NUMBER: 062 212 463
R.O.W. ACQUISITION = 0.810 Ha.

LEGAL: SE14 51-24-4
TITLE NUMBER: 942 210 026
R.O.W. ACQUISITION = 0.916 Ha.

41 AVENUE

LEGAL: NW11 51-24-4, CROWN LAND
R.O.W. ACQUISITION = 1.266 Ha.

LEGAL: NW11 51-24-4
TITLE NUMBER: 062 124 194
R.O.W. ACQUISITION = 0.984 Ha.

0023214521

LEGAL: NE11 51-24-4
TITLE NUMBER: 062 124 194
R.O.W. ACQUISITION = 1.841 Ha.

CROWN

NW11 51-24-4

NE11 51-24-4

0031585039

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CONCEPT PLAN - SUBJECT TO PRELIMINARY DESIGN

41 AVENUE SW CONCEPT PLANNING STUDY

RIGHT OF WAY PLAN

NOTE:
ALL DIMENSIONS
ARE IN METRES

SCALE: 1:2000

PLAN NO.
A041-0959

Date: Nov 02, 2010 Time: 2:22pm
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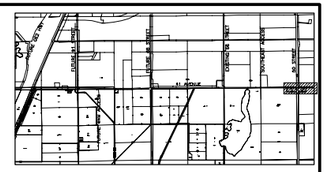

SOUTHEAST ACCESS

HWY 814/50 ST

41 AVENUE

LEGAL: SE14 51-24-4
TITLE NUMBER: 022 366 103
R.O.W. ACQUISITION = 1.591 Ha.

LEGAL: 5772MC, LOT A
TITLE NUMBER: 042 440 901
R.O.W. ACQUISITION = 0.530 Ha.

LEGAL: PLAN: 0620889, BLOCK 1, LOT 1
TITLE NUMBER: 062 387 348
R.O.W. ACQUISITION = 0.717 Ha.
062 0889

LOT A
0014936653

LEGAL: 3705TR, LOT A
TITLE NUMBER: 032 040 121
R.O.W. ACQUISITION = 0.361 Ha.
3705 TR

LEGAL: NW12 51-24-4
TITLE NUMBER: 942 170 414
R.O.W. ACQUISITION = 0.104 Ha.

0023214521

0023210180

NE11 51-24-4

0031585039

NW12 51-24-4

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CONCEPT PLAN - SUBJECT TO PRELIMINARY DESIGN

41 AVENUE SW CONCEPT PLANNING STUDY

RIGHT OF WAY PLAN

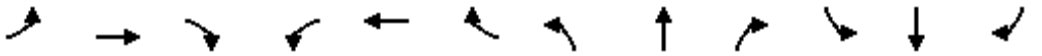
NOTE:
ALL DIMENSIONS ARE IN METRES

SCALE: 1:2000

PLAN NO.
A041-0960

Date: Nov 02, 2010 Time: 2:23pm
File: P:_20073483\00_CDE_41_Ave\Working_Dwgs\100_Civil\073483_PLAN_PROFILES.dwg by
Xrefs: 30807B01_TITLEBLOCK1, utilities, legal

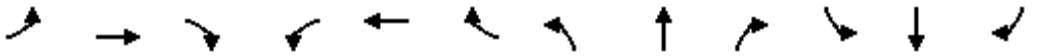
C Appendix C - Synchro Summaries



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	170	1030	570	880	2090	330	160	860	110	260	1470	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	*1.00	*1.00	*1.00	*1.00	*1.00	1.00	*1.00	*1.00	1.00	*1.00	*1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	3842	5763	1927	3842	5763	1921	3842	5763	1921	3842	5763	1921
Flt Permitted	0.12	1.00	1.00	0.12	1.00	1.00	0.13	1.00	1.00	0.17	1.00	1.00
Satd. Flow (perm)	445	5763	1927	449	5763	1921	488	5763	1921	664	5763	1921
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	177	1112	593	915	2257	343	166	894	114	270	1529	333
RTOR Reduction (vph)	0	0	133	0	0	75	0	0	84	0	0	75
Lane Group Flow (vph)	177	1112	460	915	2257	268	166	894	30	270	1529	258
Confl. Peds. (#/hr)	1030		570									
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	41.0	35.0	35.0	67.0	57.0	57.0	37.0	32.0	32.0	45.0	36.0	36.0
Effective Green, g (s)	40.0	34.5	34.5	66.5	56.5	56.5	36.0	31.5	31.5	44.0	35.5	35.5
Actuated g/C Ratio	0.33	0.29	0.29	0.55	0.47	0.47	0.30	0.26	0.26	0.37	0.30	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	304	1657	554	1026	2713	904	272	1513	504	469	1705	568
v/s Ratio Prot	0.03	0.19		c0.20	0.39		0.02	0.16		c0.04	c0.27	
v/s Ratio Perm	0.17		0.24	c0.29		0.14	0.16		0.02	0.17		0.13
v/c Ratio	0.58	0.67	0.83	0.89	0.83	0.30	0.61	0.59	0.06	0.58	0.90	0.45
Uniform Delay, d1	29.8	37.7	40.0	32.8	27.6	19.5	33.5	38.6	33.2	27.4	40.5	34.4
Progression Factor	0.96	1.08	1.18	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.1	2.0	12.3	11.7	3.2	0.8	9.8	1.7	0.2	5.1	7.8	2.6
Delay (s)	35.9	42.7	59.4	44.4	30.8	20.4	43.3	40.3	33.4	32.5	48.3	37.0
Level of Service	D	D	E	D	C	C	D	D	C	C	D	D
Approach Delay (s)		47.3			33.3			40.1			44.6	
Approach LOS		D			C			D			D	

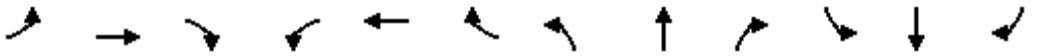
Intersection Summary			
HCM Average Control Delay	40.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	97.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	900	10	120	2310	570	80	490	160	580	190	280
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	*1.00	1.00	1.00	*1.00	1.00	1.00	*1.00	1.00	*1.00	*1.00	1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1921	5763	1921	1921	5763	1921	1921	3842	1921	3842	3842	1921
Flt Permitted	0.08	1.00	1.00	0.22	1.00	1.00	0.63	1.00	1.00	0.22	1.00	1.00
Satd. Flow (perm)	152	5763	1921	429	5763	1921	1217	3842	1921	834	3842	1921
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	10	972	10	125	2495	593	83	510	166	603	198	291
RTOR Reduction (vph)	0	0	6	0	0	242	0	0	118	0	0	1
Lane Group Flow (vph)	10	972	4	125	2495	351	83	510	48	603	198	290
Turn Type	Perm		Perm	pm+pt		Perm	Perm		Perm	pm+pt		Perm
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	51.0	51.0	51.0	63.0	63.0	63.0	25.0	25.0	25.0	49.0	49.0	49.0
Effective Green, g (s)	50.5	50.5	50.5	62.5	62.5	62.5	24.5	24.5	24.5	48.5	48.5	48.5
Actuated g/C Ratio	0.42	0.42	0.42	0.52	0.52	0.52	0.20	0.20	0.20	0.40	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	64	2425	808	317	3002	1001	248	784	392	826	1553	776
v/s Ratio Prot		0.17		0.02	c0.43			0.13		c0.12	0.05	
v/s Ratio Perm	0.07		0.00	0.18		0.18	0.07		0.03	c0.18		0.15
v/c Ratio	0.16	0.40	0.01	0.39	0.83	0.35	0.33	0.65	0.12	0.73	0.13	0.37
Uniform Delay, d1	21.5	24.2	20.2	16.0	24.3	16.8	40.8	43.8	39.0	26.8	22.5	25.1
Progression Factor	1.00	1.00	1.00	0.53	0.82	1.27	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.1	0.5	0.0	2.7	2.1	0.7	3.6	4.2	0.6	5.6	0.2	1.4
Delay (s)	26.7	24.7	20.2	11.1	21.9	22.1	44.4	48.0	39.6	32.4	22.6	26.5
Level of Service	C	C	C	B	C	C	D	D	D	C	C	C
Approach Delay (s)		24.7			21.5			45.8			29.1	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM Average Control Delay	26.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	97.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

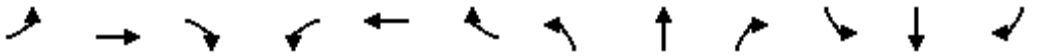


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	410	750	760	210	2390	70	620	70	10	160	410	1440
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	*1.00	*1.00	*1.00	1.00	*1.00	1.00	*1.00	*1.00	1.00	1.00	*1.00	*1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	3842	7684	3842	1921	7684	1921	3842	3842	1921	1921	3842	3842
Flt Permitted	0.11	1.00	1.00	0.27	1.00	1.00	0.40	1.00	1.00	0.71	1.00	1.00
Satd. Flow (perm)	421	7684	3842	524	7684	1921	1552	3842	1921	1363	3842	3842
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	426	810	790	218	2581	73	645	73	10	166	426	1498
RTOR Reduction (vph)	0	0	425	0	0	31	0	0	6	0	0	291
Lane Group Flow (vph)	426	810	365	218	2581	42	645	73	4	166	426	1207
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	48.0	37.0	37.0	57.0	42.0	42.0	50.0	50.0	50.0	42.0	42.0	42.0
Effective Green, g (s)	47.0	36.5	36.5	56.5	41.5	41.5	49.5	49.5	49.5	41.5	41.5	41.5
Actuated g/C Ratio	0.41	0.32	0.32	0.49	0.36	0.36	0.43	0.43	0.43	0.36	0.36	0.36
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	484	2439	1219	446	2773	693	738	1654	827	492	1386	1386
v/s Ratio Prot	c0.08	0.11		0.07	c0.34		c0.03	0.02			0.11	
v/s Ratio Perm	0.28		0.10	0.17		0.02	c0.35		0.00	0.12		0.31
v/c Ratio	0.88	0.33	0.30	0.49	0.93	0.06	0.87	0.04	0.01	0.34	0.31	0.87
Uniform Delay, d1	27.9	29.9	29.6	17.4	35.4	24.0	32.0	19.0	18.7	26.7	26.4	34.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	19.9	0.4	0.6	3.8	7.1	0.2	13.6	0.1	0.0	1.9	0.6	7.7
Delay (s)	47.9	30.3	30.2	21.2	42.5	24.2	45.7	19.1	18.7	28.6	27.0	42.0
Level of Service	D	C	C	C	D	C	D	B	B	C	C	D
Approach Delay (s)		34.0			40.4			42.6			37.9	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM Average Control Delay	38.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	119.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

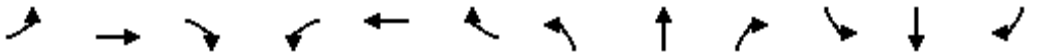
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	510	1900	1510	730	2830	660	250	1230	170	60	340	310
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	*1.00	*1.00	*1.00	*1.00	*1.00	1.00	*1.00	*1.00	1.00	*1.00	*1.00	*1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	3458	6916	3458	3458	6916	1729	3458	5187	1729	3458	5187	3458
Flt Permitted	0.15	1.00	1.00	0.15	1.00	1.00	0.48	1.00	1.00	0.17	1.00	1.00
Satd. Flow (perm)	532	6916	3458	532	6916	1729	1650	5187	1729	589	5187	3458
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	108%	108%	108%	108%	108%	108%	108%	108%	108%	108%	108%	108%
Adj. Flow (vph)	551	2052	1631	788	3056	713	270	1328	184	65	367	335
RTOR Reduction (vph)	0	0	250	0	0	81	0	0	137	0	0	256
Lane Group Flow (vph)	551	2052	1381	788	3056	632	270	1328	47	65	367	79
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	37.0	37.0	37.0	42.0	42.0	42.0	33.0	26.0	26.0	29.0	24.0	24.0
Effective Green, g (s)	36.5	36.5	36.5	41.5	41.5	41.5	32.0	25.5	25.5	28.0	23.5	23.5
Actuated g/C Ratio	0.36	0.36	0.36	0.42	0.42	0.42	0.32	0.26	0.26	0.28	0.24	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	501	2524	1262	674	2870	718	646	1323	441	294	1219	813
v/s Ratio Prot	0.12	0.30		0.18	c0.44		c0.03	c0.26		0.01	0.07	
v/s Ratio Perm	0.29		c0.40	c0.30		0.37	0.11		0.03	0.05		0.02
v/c Ratio	1.10	0.81	1.09	1.17	1.06	0.88	0.42	1.00	0.11	0.22	0.30	0.10
Uniform Delay, d1	40.0	28.7	31.8	28.2	29.2	27.0	25.1	37.2	28.5	28.0	31.5	29.9
Progression Factor	1.12	1.18	1.21	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	62.7	1.9	51.0	91.5	37.2	14.5	2.0	25.7	0.5	1.7	0.6	0.2
Delay (s)	107.6	35.7	89.4	119.7	66.5	41.5	27.1	62.9	29.0	29.8	32.1	30.2
Level of Service	F	D	F	F	E	D	C	E	C	C	C	C
Approach Delay (s)		65.7			71.8			54.0			31.1	
Approach LOS		E			E			D			C	

Intersection Summary			
HCM Average Control Delay	64.0	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	113.5%	ICU Level of Service	H
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)	10	3310	10	10	2280	150	10	10	710	630	10	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	*1.00	1.00	1.00	*1.00	1.00	1.00	1.00	*1.00	*1.00	1.00	1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1921	7684	1921	1921	7684	1921	1921	1921	3842	3842	1921	1921
Flt Permitted	0.07	1.00	1.00	0.07	1.00	1.00	0.75	1.00	1.00	0.75	1.00	1.00
Satd. Flow (perm)	136	7684	1921	136	7684	1921	1443	1921	3842	2886	1921	1921
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	10	3575	10	10	2462	156	10	10	738	655	10	239
RTOR Reduction (vph)	0	0	3	0	0	68	0	0	0	0	0	1
Lane Group Flow (vph)	10	3575	7	10	2462	88	10	10	738	655	10	238
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	57.0	57.0	57.0	57.0	57.0	57.0	35.0	35.0	35.0	35.0	35.0	35.0
Effective Green, g (s)	56.5	56.5	56.5	56.5	56.5	56.5	34.5	34.5	34.5	34.5	34.5	34.5
Actuated g/C Ratio	0.56	0.56	0.56	0.56	0.56	0.56	0.34	0.34	0.34	0.34	0.34	0.34
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	77	4341	1085	77	4341	1085	498	663	1325	996	663	663
v/s Ratio Prot		c0.47			0.32			0.01			0.01	
v/s Ratio Perm	0.07		0.00	0.07		0.05	0.01		0.19	c0.23		0.12
v/c Ratio	0.13	0.82	0.01	0.13	0.57	0.08	0.02	0.02	0.56	0.66	0.02	0.36
Uniform Delay, d1	10.2	17.7	9.5	10.2	13.9	9.9	21.6	21.6	26.6	27.7	21.6	24.5
Progression Factor	1.00	1.00	1.00	0.60	0.50	0.38	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.5	1.9	0.0	1.1	0.2	0.0	0.1	0.0	1.7	3.4	0.0	1.5
Delay (s)	13.7	19.6	9.5	7.3	7.2	3.8	21.7	21.6	28.2	31.1	21.6	26.0
Level of Service	B	B	A	A	A	A	C	C	C	C	C	C
Approach Delay (s)		19.5			7.0			28.1			29.7	
Approach LOS		B			A			C			C	

Intersection Summary			
HCM Average Control Delay	17.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	107.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

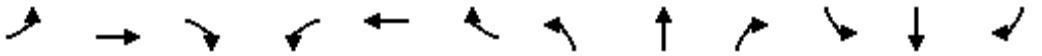


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	730	2150	250	1040	1290	180	120	440	640	530	170	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	*1.00	*1.00	1.00	*1.00	*1.00	1.00	*1.00	*1.00	*1.00	*1.00	*1.00	*1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	3842	7684	1921	3842	7684	1921	3842	3842	3842	3842	3842	1921
Flt Permitted	0.36	1.00	1.00	0.36	1.00	1.00	0.65	1.00	1.00	0.19	1.00	1.00
Satd. Flow (perm)	1397	7684	1921	1397	7684	1921	2480	3842	3842	732	3842	1921
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	759	2322	260	1082	1393	187	125	458	666	551	177	198
RTOR Reduction (vph)	0	0	120	0	0	121	0	0	574	0	0	151
Lane Group Flow (vph)	759	2322	140	1082	1393	66	125	458	92	551	177	47
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	39.0	39.0	39.0	43.0	43.0	43.0	21.0	17.0	17.0	37.0	29.0	29.0
Effective Green, g (s)	38.5	38.5	38.5	42.5	42.5	42.5	20.0	16.5	16.5	36.5	28.5	28.5
Actuated g/C Ratio	0.32	0.32	0.32	0.35	0.35	0.35	0.17	0.14	0.14	0.30	0.24	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	1009	2465	616	1137	2721	680	453	528	528	624	912	456
v/s Ratio Prot	0.17	c0.30		c0.25	0.18		0.01	0.12		c0.11	0.05	
v/s Ratio Perm	0.07		0.07	c0.09		0.03	0.04		0.02	c0.15		0.02
v/c Ratio	0.75	0.94	0.23	0.95	0.51	0.10	0.28	0.87	0.17	0.88	0.19	0.10
Uniform Delay, d1	36.8	39.7	29.9	35.1	30.6	25.9	43.1	50.7	45.7	35.1	36.6	35.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.2	8.9	0.9	17.3	0.7	0.3	1.5	17.3	0.7	16.6	0.5	0.5
Delay (s)	42.0	48.5	30.7	52.5	31.3	26.2	44.6	68.0	46.4	51.7	37.0	36.2
Level of Service	D	D	C	D	C	C	D	E	D	D	D	D
Approach Delay (s)		45.6			39.5			54.1			45.6	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	44.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	107.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

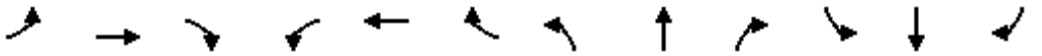
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	410	1540	330	150	750	50	310	460	390	200	270	370
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	*1.00	*1.00	1.00	1.00	*1.00	1.00	*1.00	*1.00	1.00	1.00	*1.00	1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	3842	5763	1921	1921	5763	1921	3842	3842	1921	1921	3842	1921
Flt Permitted	0.30	1.00	1.00	0.11	1.00	1.00	0.59	1.00	1.00	0.27	1.00	1.00
Satd. Flow (perm)	1136	5763	1921	205	5763	1921	2256	3842	1921	528	3842	1921
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	426	1663	343	156	810	52	322	478	406	208	281	385
RTOR Reduction (vph)	0	0	198	0	0	33	0	0	187	0	0	184
Lane Group Flow (vph)	426	1663	145	156	810	20	322	478	219	208	281	201
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	47.0	37.0	37.0	49.0	38.0	38.0	29.0	23.0	23.0	40.0	30.0	30.0
Effective Green, g (s)	46.0	36.5	36.5	48.0	37.5	37.5	28.0	22.5	22.5	39.5	29.5	29.5
Actuated g/C Ratio	0.46	0.36	0.36	0.48	0.38	0.38	0.28	0.22	0.22	0.40	0.29	0.29
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	780	2103	701	279	2161	720	719	864	432	383	1133	567
v/s Ratio Prot	0.05	c0.29		c0.06	0.14		0.02	0.12		c0.07	0.07	
v/s Ratio Perm	0.20		0.08	0.21		0.01	0.10		0.11	c0.15		0.10
v/c Ratio	0.55	0.79	0.21	0.56	0.37	0.03	0.45	0.55	0.51	0.54	0.25	0.35
Uniform Delay, d1	26.5	28.3	21.8	34.7	22.7	19.7	28.3	34.3	33.9	21.4	26.8	27.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.7	3.1	0.7	7.9	0.5	0.1	2.0	2.5	4.2	5.4	0.5	1.7
Delay (s)	29.2	31.5	22.5	42.6	23.2	19.8	30.4	36.8	38.1	26.9	27.3	29.5
Level of Service	C	C	C	D	C	B	C	D	D	C	C	C
Approach Delay (s)		29.8			26.0			35.5			28.2	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM Average Control Delay	30.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
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)	60	1475	240	100	1445	65	420	25	255	100	25	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	*1.00	1.00	1.00	*1.00	1.00	*1.00	*1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1921	5763	1921	1921	5763	1921	1921	1921	1921	1921	1921	1921
Flt Permitted	0.11	1.00	1.00	0.10	1.00	1.00	0.74	0.73	1.00	0.54	1.00	1.00
Satd. Flow (perm)	216	5763	1921	200	5763	1921	1422	1405	1921	1037	1921	1921
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	62	1593	250	104	1561	68	437	26	265	104	26	161
RTOR Reduction (vph)	0	0	151	0	0	39	0	0	102	0	0	103
Lane Group Flow (vph)	62	1593	99	104	1561	29	232	231	163	104	26	58
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	42.0	36.0	36.0	48.0	39.0	39.0	33.0	33.0	33.0	33.0	33.0	33.0
Effective Green, g (s)	41.0	35.5	35.5	47.0	38.5	38.5	32.5	32.5	32.5	32.5	32.5	32.5
Actuated g/C Ratio	0.46	0.39	0.39	0.52	0.43	0.43	0.36	0.36	0.36	0.36	0.36	0.36
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	203	2273	758	267	2465	822	514	507	694	374	694	694
v/s Ratio Prot	0.02	c0.28		c0.04	0.27						0.01	
v/s Ratio Perm	0.12		0.05	0.17		0.02	0.16	c0.16	0.09	0.10		0.03
v/c Ratio	0.31	0.70	0.13	0.39	0.63	0.04	0.45	0.46	0.24	0.28	0.04	0.08
Uniform Delay, d1	15.0	22.8	17.4	14.1	20.2	15.0	21.9	22.0	20.1	20.4	18.6	18.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.9	1.8	0.4	4.2	1.3	0.1	2.8	2.9	0.8	1.8	0.1	0.2
Delay (s)	18.9	24.6	17.7	18.4	21.5	15.0	24.8	24.9	20.9	22.3	18.7	19.2
Level of Service	B	C	B	B	C	B	C	C	C	C	B	B
Approach Delay (s)		23.5			21.0			23.4			20.2	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	22.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	67.2%	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)	60	1420	240	100	1855	65	420	25	255	100	25	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	*1.00	1.00	1.00	*1.00	1.00	*1.00	*1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.85	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1921	5763	1921	1921	5763	1921	1921	1921	1633	1921	1921	1921
Flt Permitted	0.11	1.00	1.00	0.11	1.00	1.00	0.74	0.73	1.00	0.51	1.00	1.00
Satd. Flow (perm)	211	5763	1921	220	5763	1921	1422	1405	1633	989	1921	1921
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	62	1534	250	104	2003	68	437	26	265	104	26	161
RTOR Reduction (vph)	0	0	136	0	0	36	0	0	114	0	0	109
Lane Group Flow (vph)	62	1534	114	104	2003	32	232	231	151	104	26	52
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	43.0	37.0	37.0	45.0	38.0	38.0	24.0	24.0	24.0	24.0	24.0	24.0
Effective Green, g (s)	42.0	36.5	36.5	44.0	37.5	37.5	23.5	23.5	23.5	23.5	23.5	23.5
Actuated g/C Ratio	0.52	0.46	0.46	0.55	0.47	0.47	0.29	0.29	0.29	0.29	0.29	0.29
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	228	2629	876	259	2701	900	418	413	480	291	564	564
v/s Ratio Prot	0.02	0.27		c0.03	c0.35						0.01	
v/s Ratio Perm	0.12		0.06	0.19		0.02	0.16	c0.16	0.09	0.11		0.03
v/c Ratio	0.27	0.58	0.13	0.40	0.74	0.04	0.56	0.56	0.32	0.36	0.05	0.09
Uniform Delay, d1	12.1	16.1	12.6	10.3	17.3	11.5	23.8	23.9	22.0	22.3	20.2	20.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.9	1.0	0.3	4.6	1.9	0.1	5.2	5.4	1.7	3.4	0.2	0.3
Delay (s)	15.0	17.1	12.9	14.8	19.2	11.6	29.1	29.3	23.7	25.7	20.4	20.8
Level of Service	B	B	B	B	B	B	C	C	C	C	C	C
Approach Delay (s)		16.4			18.7			27.2			22.5	
Approach LOS		B			B			C			C	

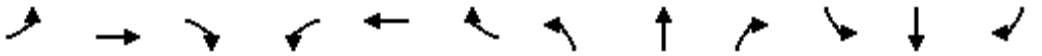
Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	72.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	1870	500	450	1160	300	180	1060	200	310	960	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	*1.00	*1.00	*1.00	*1.00	*1.00	1.00	*1.00	*1.00	1.00	*1.00	*1.00	1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	3842	5763	3842	3842	5763	1921	3842	5763	1921	3842	5763	1921
Flt Permitted	0.19	1.00	1.00	0.08	1.00	1.00	0.17	1.00	1.00	0.14	1.00	1.00
Satd. Flow (perm)	731	5763	3842	314	5763	1921	664	5763	1921	521	5763	1921
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	260	2020	520	468	1253	312	187	1102	208	322	998	177
RTOR Reduction (vph)	0	0	190	0	0	97	0	0	125	0	0	126
Lane Group Flow (vph)	260	2020	330	468	1253	215	187	1102	84	322	998	51
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	53.0	45.0	45.0	62.0	50.0	50.0	34.0	28.0	28.0	38.0	30.0	30.0
Effective Green, g (s)	52.0	44.5	44.5	61.5	49.5	49.5	33.0	27.5	27.5	37.0	29.5	29.5
Actuated g/C Ratio	0.47	0.40	0.40	0.56	0.45	0.45	0.30	0.25	0.25	0.34	0.27	0.27
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	558	2331	1554	576	2593	864	358	1441	480	402	1546	515
v/s Ratio Prot	0.03	c0.35		c0.09	0.22		0.03	0.19		c0.05	0.17	
v/s Ratio Perm	0.19		0.09	0.36		0.11	0.13		0.04	c0.21		0.03
v/c Ratio	0.47	0.87	0.21	0.81	0.48	0.25	0.52	0.76	0.17	0.80	0.65	0.10
Uniform Delay, d1	16.9	30.0	21.3	29.9	21.3	18.7	29.1	38.3	32.3	28.5	35.6	30.3
Progression Factor	0.67	0.95	1.29	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	2.3	0.2	11.9	0.6	0.7	5.4	3.9	0.8	15.4	2.1	0.4
Delay (s)	12.6	30.8	27.6	41.8	21.9	19.4	34.4	42.2	33.1	43.9	37.7	30.6
Level of Service	B	C	C	D	C	B	C	D	C	D	D	C
Approach Delay (s)		28.5			26.1			39.9			38.2	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	31.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	97.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

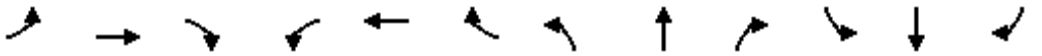
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	1880	0	170	870	450	180	410	260	800	210	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	*1.00		1.00	*1.00	1.00	1.00	*1.00	1.00	*1.00	*1.00	1.00
Frt	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1921	5763		1921	5763	1921	1921	3842	1921	3842	3842	1921
Flt Permitted	0.25	1.00		0.09	1.00	1.00	0.62	1.00	1.00	0.25	1.00	1.00
Satd. Flow (perm)	478	5763		177	5763	1921	1195	3842	1921	975	3842	1921
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	146	2030	0	177	940	468	187	426	270	832	218	10
RTOR Reduction (vph)	0	0	0	0	0	283	0	0	105	0	0	7
Lane Group Flow (vph)	146	2030	0	177	940	185	187	426	165	832	218	3
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	52.0	44.0		52.0	44.0	44.0	31.0	20.0	20.0	46.0	31.0	31.0
Effective Green, g (s)	51.0	43.5		51.0	43.5	43.5	30.0	19.5	19.5	45.5	30.5	30.5
Actuated g/C Ratio	0.46	0.40		0.46	0.40	0.40	0.27	0.18	0.18	0.41	0.28	0.28
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	320	2279		201	2279	760	395	681	341	964	1065	533
v/s Ratio Prot	0.03	c0.35		c0.06	0.16		0.05	0.11		c0.17	0.06	
v/s Ratio Perm	0.18			0.35		0.10	0.08		0.09	c0.19		0.00
v/c Ratio	0.46	0.89		0.88	0.41	0.24	0.47	0.63	0.48	0.86	0.20	0.01
Uniform Delay, d1	17.7	31.0		24.5	24.0	22.2	32.2	41.9	40.7	25.3	30.5	28.8
Progression Factor	1.00	1.00		0.68	0.63	3.43	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.6	5.8		35.7	0.5	0.7	4.0	4.3	4.8	10.1	0.4	0.0
Delay (s)	22.3	36.8		52.5	15.6	76.9	36.3	46.2	45.5	35.4	30.9	28.8
Level of Service	C	D		D	B	E	D	D	D	D	C	C
Approach Delay (s)		35.8			37.8			43.9			34.4	
Approach LOS		D			D			D			C	

Intersection Summary			
HCM Average Control Delay	37.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	99.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



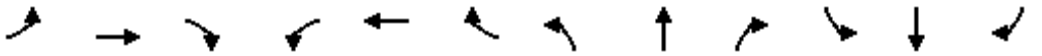
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1160	1840	700	30	850	180	660	250	70	110	140	590
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	*1.00	*1.00	*1.00	1.00	*1.00	1.00	*1.00	*1.00	1.00	1.00	*1.00	*1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	3842	7684	3842	1921	7684	1921	3842	3842	1921	1921	3842	3842
Flt Permitted	0.18	1.00	1.00	0.19	1.00	1.00	0.54	1.00	1.00	0.60	1.00	1.00
Satd. Flow (perm)	699	7684	3842	357	7684	1921	2073	3842	1921	1150	3842	3842
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	1206	1987	728	31	918	187	686	260	73	114	146	614
RTOR Reduction (vph)	0	0	317	0	0	147	0	0	6	0	0	494
Lane Group Flow (vph)	1206	1987	411	31	918	40	686	260	67	114	146	120
Turn Type	pm+pt		Perm	Perm		Perm	pm+pt		Perm	Perm		Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	57.0	57.0	57.0	22.0	22.0	22.0	35.0	35.0	35.0	20.0	20.0	20.0
Effective Green, g (s)	56.5	56.5	56.5	21.5	21.5	21.5	34.5	34.5	34.5	19.5	19.5	19.5
Actuated g/C Ratio	0.56	0.56	0.56	0.22	0.22	0.22	0.34	0.34	0.34	0.20	0.20	0.20
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	1354	4341	2171	77	1652	413	901	1325	663	224	749	749
v/s Ratio Prot	c0.27	0.26			0.12		c0.08	0.07			0.04	
v/s Ratio Perm	c0.23		0.11	0.09		0.02	c0.18		0.03	0.10		0.03
v/c Ratio	0.89	0.46	0.19	0.40	0.56	0.10	0.76	0.20	0.10	0.51	0.19	0.16
Uniform Delay, d1	23.3	12.8	10.6	33.7	35.0	31.5	27.5	23.0	22.2	36.0	33.7	33.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.1	0.3	0.2	14.9	1.4	0.5	6.0	0.3	0.3	8.0	0.6	0.5
Delay (s)	32.4	13.1	10.8	48.7	36.3	31.9	33.6	23.3	22.5	44.0	34.3	33.9
Level of Service	C	B	B	D	D	C	C	C	C	D	C	C
Approach Delay (s)		18.6			36.0			30.2			35.3	
Approach LOS		B			D			C			D	

Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	86.3%	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)	340	2380	340	220	1940	110	940	580	620	540	1280	550
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	*1.00	*1.00	*1.00	*1.00	*1.00	1.00	*1.00	*1.00	1.00	*1.00	*1.00	*1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	3458	6916	3458	3458	6916	1729	3458	5187	1729	3458	5187	3458
Flt Permitted	0.11	1.00	1.00	0.12	1.00	1.00	0.12	1.00	1.00	0.43	1.00	1.00
Satd. Flow (perm)	379	6916	3458	413	6916	1729	432	5187	1729	1478	5187	3458
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	108%	108%	108%	108%	108%	108%	108%	108%	108%	108%	108%	108%
Adj. Flow (vph)	367	2570	367	238	2095	119	1015	626	670	583	1382	594
RTOR Reduction (vph)	0	0	203	0	0	81	0	0	71	0	0	141
Lane Group Flow (vph)	367	2570	164	238	2095	38	1015	626	599	583	1382	453
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	45.0	37.0	37.0	39.0	34.0	34.0	56.0	43.0	43.0	37.0	28.0	28.0
Effective Green, g (s)	44.0	36.5	36.5	38.0	33.5	33.5	55.5	42.5	42.5	36.0	27.5	27.5
Actuated g/C Ratio	0.40	0.33	0.33	0.35	0.30	0.30	0.50	0.39	0.39	0.33	0.25	0.25
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	362	2295	1147	267	2106	527	864	2004	668	637	1297	865
v/s Ratio Prot	c0.07	c0.37		0.04	0.30		c0.25	0.12		0.07	0.27	
v/s Ratio Perm	0.34		0.05	0.27		0.02	c0.34		0.35	0.23		0.13
v/c Ratio	1.01	1.12	0.14	0.89	0.99	0.07	1.17	0.31	0.90	0.92	1.07	0.52
Uniform Delay, d1	27.6	36.8	25.8	32.8	38.2	27.2	33.3	23.6	31.7	32.0	41.2	35.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	50.8	60.5	0.3	33.0	18.4	0.3	90.8	0.4	17.1	20.0	44.5	2.3
Delay (s)	78.5	97.2	26.0	65.8	56.6	27.5	124.1	24.0	48.8	52.0	85.7	37.9
Level of Service	E	F	C	E	E	C	F	C	D	D	F	D
Approach Delay (s)		87.2			56.1			75.1			66.9	
Approach LOS		F			E			E			E	

Intersection Summary			
HCM Average Control Delay	72.5	HCM Level of Service	E
HCM Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	125.8%	ICU Level of Service	H
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)	200	2760	10	110	3230	560	10	10	10	290	50	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	*1.00	1.00	1.00	*1.00	1.00	1.00	1.00	*1.00	*1.00	1.00	1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1921	7684	1921	1921	7684	1921	1921	1921	3842	3842	1921	1921
Flt Permitted	0.08	1.00	1.00	0.08	1.00	1.00	0.72	1.00	1.00	0.75	1.00	1.00
Satd. Flow (perm)	160	7684	1921	160	7684	1921	1389	1921	3842	2886	1921	1921
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	208	2981	10	114	3488	582	10	10	10	302	52	52
RTOR Reduction (vph)	0	0	4	0	0	214	0	0	8	0	0	43
Lane Group Flow (vph)	208	2981	6	114	3488	368	10	10	2	302	52	9
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	62.0	62.0	62.0	56.0	56.0	56.0	18.0	18.0	18.0	18.0	18.0	18.0
Effective Green, g (s)	61.5	61.5	61.5	55.5	55.5	55.5	17.5	17.5	17.5	17.5	17.5	17.5
Actuated g/C Ratio	0.62	0.62	0.62	0.56	0.56	0.56	0.18	0.18	0.18	0.18	0.18	0.18
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	336	4726	1181	221	4265	1066	243	336	672	505	336	336
v/s Ratio Prot	0.08	c0.39		0.04	c0.45			0.01			0.03	
v/s Ratio Perm	0.30		0.00	0.25		0.19	0.01		0.00	c0.10		0.00
v/c Ratio	0.62	0.63	0.01	0.52	0.82	0.35	0.04	0.03	0.00	0.60	0.15	0.03
Uniform Delay, d1	29.2	12.1	7.4	15.9	18.1	12.3	34.3	34.2	34.0	38.0	35.0	34.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.3	0.6	0.0	8.4	1.9	0.9	0.3	0.2	0.0	5.2	1.0	0.1
Delay (s)	37.5	12.8	7.4	24.2	20.0	13.1	34.6	34.4	34.1	43.2	36.0	34.3
Level of Service	D	B	A	C	B	B	C	C	C	D	D	C
Approach Delay (s)		14.3			19.1			34.3			41.1	
Approach LOS		B			B			C			D	

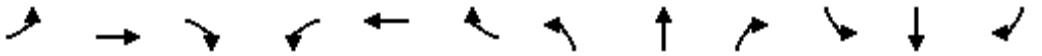
Intersection Summary			
HCM Average Control Delay	18.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	88.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	1360	70	920	1860	510	300	270	1200	420	530	600
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	*1.00	*1.00	1.00	*1.00	*1.00	1.00	*1.00	*1.00	*1.00	*1.00	*1.00	*1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	3842	7684	1921	3842	7684	1921	3842	3842	3842	3842	3842	1921
Flt Permitted	0.24	1.00	1.00	0.24	1.00	1.00	0.37	1.00	1.00	0.50	1.00	1.00
Satd. Flow (perm)	904	7684	1921	904	7684	1921	1437	3842	3842	1934	3842	1921
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	260	1469	73	957	2009	530	312	281	1248	437	551	624
RTOR Reduction (vph)	0	0	57	0	0	210	0	0	809	0	0	114
Lane Group Flow (vph)	260	1469	16	957	2009	320	312	281	439	437	551	510
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	25.0	25.0	25.0	45.0	45.0	45.0	38.0	33.0	33.0	44.0	36.0	36.0
Effective Green, g (s)	24.5	24.5	24.5	44.5	44.5	44.5	37.0	32.5	32.5	43.0	35.5	35.5
Actuated g/C Ratio	0.22	0.22	0.22	0.40	0.40	0.40	0.34	0.30	0.30	0.39	0.32	0.32
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	402	1711	428	1100	3109	777	582	1135	1135	886	1240	620
v/s Ratio Prot	0.04	c0.19		c0.22	0.26		0.02	0.07		c0.03	0.14	
v/s Ratio Perm	0.10		0.01	c0.13		0.17	0.16		0.11	0.16		c0.27
v/c Ratio	0.65	0.86	0.04	0.87	0.65	0.41	0.54	0.25	0.39	0.49	0.44	0.82
Uniform Delay, d1	40.5	41.1	33.5	27.7	26.4	23.4	28.3	29.5	30.8	23.7	29.5	34.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.8	5.8	0.2	9.4	1.1	1.6	3.5	0.5	1.0	2.0	1.2	11.7
Delay (s)	48.3	46.9	33.7	37.2	27.5	25.0	31.8	30.0	31.8	25.7	30.6	46.0
Level of Service	D	D	C	D	C	C	C	C	C	C	C	D
Approach Delay (s)		46.6			29.7			31.5			35.2	
Approach LOS		D			C			C			D	

Intersection Summary			
HCM Average Control Delay	34.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	88.7%	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)	320	720	210	290	1560	210	430	460	160	80	600	490
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	*1.00	*1.00	1.00	1.00	*1.00	1.00	*1.00	*1.00	1.00	1.00	*1.00	1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	3842	5763	1921	1921	5763	1921	3842	3842	1921	1921	3842	1921
Flt Permitted	0.25	1.00	1.00	0.37	1.00	1.00	0.27	1.00	1.00	0.45	1.00	1.00
Satd. Flow (perm)	961	5763	1921	713	5763	1921	1032	3842	1921	866	3842	1921
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	333	778	218	302	1685	218	447	478	166	83	624	510
RTOR Reduction (vph)	0	0	163	0	0	124	0	0	109	0	0	152
Lane Group Flow (vph)	333	778	55	302	1685	94	447	478	57	83	624	358
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	25.0	25.0	25.0	35.0	35.0	35.0	43.0	35.0	35.0	37.0	32.0	32.0
Effective Green, g (s)	24.5	24.5	24.5	34.5	34.5	34.5	42.0	34.5	34.5	36.0	31.5	31.5
Actuated g/C Ratio	0.24	0.24	0.24	0.34	0.34	0.34	0.42	0.34	0.34	0.36	0.32	0.32
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	480	1412	471	469	1988	663	644	1325	663	359	1210	605
v/s Ratio Prot	c0.06	0.13		0.12	c0.29		c0.05	0.12		0.01	0.16	
v/s Ratio Perm	0.11		0.03	0.10		0.05	c0.24		0.03	0.07		0.19
v/c Ratio	0.69	0.55	0.12	0.64	0.85	0.14	0.69	0.36	0.09	0.23	0.52	0.59
Uniform Delay, d1	32.0	32.9	29.3	28.6	30.3	22.5	20.4	24.5	22.1	21.4	28.0	28.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.0	1.6	0.5	6.7	4.7	0.4	6.1	0.8	0.3	1.5	1.6	4.2
Delay (s)	40.0	34.5	29.8	35.2	35.0	23.0	26.4	25.3	22.4	22.9	29.6	33.0
Level of Service	D	C	C	D	D	C	C	C	C	C	C	C
Approach Delay (s)		35.1			33.9			25.3			30.6	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM Average Control Delay	31.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	88.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

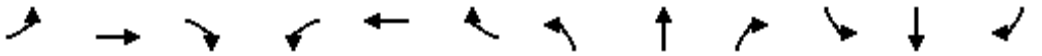


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	785	385	140	1860	180	245	20	100	55	80	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	*1.00	1.00	1.00	*1.00	1.00	*1.00	*1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1921	5763	1633	1921	5763	1921	1921	1921	1921	1921	1921	1921
Flt Permitted	0.10	1.00	1.00	0.35	1.00	1.00	0.70	0.70	1.00	0.65	1.00	1.00
Satd. Flow (perm)	185	5763	1633	667	5763	1921	1351	1347	1921	1250	1921	1921
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	146	848	400	146	2009	187	255	21	104	57	83	109
RTOR Reduction (vph)	0	0	193	0	0	97	0	0	79	0	0	82
Lane Group Flow (vph)	146	848	208	146	2009	90	138	138	25	57	83	27
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	51.0	42.0	42.0	45.0	39.0	39.0	20.0	20.0	20.0	20.0	20.0	20.0
Effective Green, g (s)	50.0	41.5	41.5	44.0	38.5	38.5	19.5	19.5	19.5	19.5	19.5	19.5
Actuated g/C Ratio	0.62	0.52	0.52	0.55	0.48	0.48	0.24	0.24	0.24	0.24	0.24	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	300	2990	847	453	2773	924	329	328	468	305	468	468
v/s Ratio Prot	c0.05	0.15		0.02	c0.35						0.04	
v/s Ratio Perm	0.25		0.13	0.15		0.05	0.10	c0.10	0.01	0.05		0.01
v/c Ratio	0.49	0.28	0.24	0.32	0.72	0.10	0.42	0.42	0.05	0.19	0.18	0.06
Uniform Delay, d1	11.2	10.9	10.6	8.8	16.5	11.3	25.5	25.5	23.2	24.0	23.9	23.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.6	0.2	0.7	1.9	1.7	0.2	3.9	3.9	0.2	1.4	0.8	0.2
Delay (s)	16.8	11.1	11.3	10.6	18.2	11.5	29.4	29.4	23.4	25.3	24.7	23.4
Level of Service	B	B	B	B	B	B	C	C	C	C	C	C
Approach Delay (s)		11.8			17.2			27.8			24.3	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	72.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

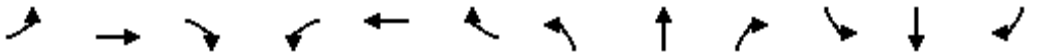
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	1155	385	140	1890	180	245	20	100	55	80	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	*1.00	1.00	1.00	*1.00	1.00	*1.00	*1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1921	5763	1921	1921	5763	1921	1921	1921	1921	1921	1921	1921
Flt Permitted	0.12	1.00	1.00	0.19	1.00	1.00	0.70	0.70	1.00	0.67	1.00	1.00
Satd. Flow (perm)	236	5763	1921	374	5763	1921	1351	1347	1921	1285	1921	1921
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	104%	108%	104%	104%	108%	104%	104%	104%	104%	104%	104%	104%
Adj. Flow (vph)	146	1247	400	146	2041	187	255	21	104	57	83	109
RTOR Reduction (vph)	0	0	214	0	0	103	0	0	78	0	0	82
Lane Group Flow (vph)	146	1247	186	146	2041	84	138	138	26	57	83	27
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	41.0	33.0	33.0	39.0	32.0	32.0	18.0	18.0	18.0	18.0	18.0	18.0
Effective Green, g (s)	40.0	32.5	32.5	38.0	31.5	31.5	17.5	17.5	17.5	17.5	17.5	17.5
Actuated g/C Ratio	0.57	0.46	0.46	0.54	0.45	0.45	0.25	0.25	0.25	0.25	0.25	0.25
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	315	2676	892	347	2593	864	338	337	480	321	480	480
v/s Ratio Prot	c0.05	0.22		0.04	c0.35						0.04	
v/s Ratio Perm	0.21		0.10	0.19		0.04	0.10	c0.10	0.01	0.04		0.01
v/c Ratio	0.46	0.47	0.21	0.42	0.79	0.10	0.41	0.41	0.05	0.18	0.17	0.06
Uniform Delay, d1	10.7	12.8	11.1	8.3	16.4	11.1	21.9	21.9	20.0	20.6	20.6	20.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.8	0.6	0.5	3.7	2.5	0.2	3.6	3.7	0.2	1.2	0.8	0.2
Delay (s)	15.5	13.4	11.6	12.0	18.9	11.3	25.6	25.6	20.2	21.8	21.4	20.2
Level of Service	B	B	B	B	B	B	C	C	C	C	C	C
Approach Delay (s)		13.2			17.9			24.1			21.0	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	73.0%	ICU Level of Service	D
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)	209	406	545	123	1178	69	106	191	33	8	182	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	*1.00	*1.00	*1.00	*1.00	*1.00	1.00	*1.00	*1.00	1.00	*1.00	*1.00	*1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1729	6916	1729	1729	6916	1729	3458	5187	1729	1729	5187	1729
Flt Permitted	0.36	1.00	1.00	0.36	1.00	1.00	0.63	1.00	1.00	0.63	1.00	1.00
Satd. Flow (perm)	629	6916	1729	629	6916	1729	2192	5187	1729	1087	5187	1729
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	108%	108%	108%	108%	108%	108%	108%	108%	108%	108%	108%	108%
Adj. Flow (vph)	226	438	589	133	1272	75	114	206	36	9	197	205
RTOR Reduction (vph)	0	0	322	0	0	55	0	0	27	0	0	154
Lane Group Flow (vph)	226	438	267	133	1272	20	114	206	9	9	197	51
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	24.0	24.0	24.0	19.0	19.0	19.0	22.0	18.0	18.0	22.0	18.0	18.0
Effective Green, g (s)	23.5	23.5	23.5	18.5	18.5	18.5	21.0	17.5	17.5	21.0	17.5	17.5
Actuated g/C Ratio	0.34	0.34	0.34	0.26	0.26	0.26	0.30	0.25	0.25	0.30	0.25	0.25
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	408	2322	580	284	1828	457	721	1297	432	358	1297	432
v/s Ratio Prot	c0.10	0.06		0.05	c0.18		c0.01	c0.04		0.00	0.04	
v/s Ratio Perm	0.09		0.15	0.07		0.01	0.04		0.01	0.01		0.03
v/c Ratio	0.55	0.19	0.46	0.47	0.70	0.04	0.16	0.16	0.02	0.03	0.15	0.12
Uniform Delay, d1	20.0	16.5	18.3	20.7	23.2	19.2	17.7	20.5	19.8	17.2	20.5	20.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.3	0.2	2.6	5.5	2.2	0.2	0.5	0.3	0.1	0.1	0.2	0.6
Delay (s)	25.3	16.7	20.9	26.1	25.4	19.3	18.2	20.8	19.9	17.4	20.7	20.8
Level of Service	C	B	C	C	C	B	B	C	B	B	C	C
Approach Delay (s)		20.2			25.2			19.9			20.7	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM Average Control Delay	22.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	64.1%	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)	201	817	322	132	495	33	462	82	136	71	77	442
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	*1.00	*1.00	*1.00	*1.00	*1.00	1.00	*1.00	*1.00	1.00	*1.00	*1.00	*1.00
Frt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Satd. Flow (prot)	1729	6916	1729	1729	6916	1729	3458	5187	1729	1729	5187	1729
Flt Permitted	0.46	1.00	1.00	0.28	1.00	1.00	0.70	1.00	1.00	0.70	1.00	1.00
Satd. Flow (perm)	804	6916	1729	477	6916	1729	2431	5187	1729	1209	5187	1729
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	108%	108%	108%	108%	108%	108%	108%	108%	108%	108%	108%	108%
Adj. Flow (vph)	217	882	348	143	535	36	499	89	147	77	83	477
RTOR Reduction (vph)	0	0	266	0	0	28	0	0	98	0	0	227
Lane Group Flow (vph)	217	882	82	143	535	8	499	89	49	77	83	250
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	25.0	17.0	17.0	25.0	17.0	17.0	29.0	24.0	24.0	29.0	24.0	24.0
Effective Green, g (s)	24.0	16.5	16.5	24.0	16.5	16.5	28.0	23.5	23.5	28.0	23.5	23.5
Actuated g/C Ratio	0.34	0.24	0.24	0.34	0.24	0.24	0.40	0.34	0.34	0.40	0.34	0.34
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	375	1630	408	298	1630	408	1038	1741	580	517	1741	580
v/s Ratio Prot	c0.06	0.13		0.05	0.08		c0.03	0.02		0.01	0.02	
v/s Ratio Perm	c0.14		0.05	0.11		0.00	c0.16		0.03	0.05		0.14
v/c Ratio	0.58	0.54	0.20	0.48	0.33	0.02	0.48	0.05	0.09	0.15	0.05	0.43
Uniform Delay, d1	17.3	23.4	21.5	16.6	22.2	20.5	14.9	15.7	15.9	13.2	15.7	18.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.4	1.3	1.1	5.4	0.5	0.1	1.6	0.1	0.3	0.6	0.1	2.3
Delay (s)	23.7	24.7	22.6	22.0	22.7	20.6	16.5	15.8	16.2	13.8	15.7	20.4
Level of Service	C	C	C	C	C	C	B	B	B	B	B	C
Approach Delay (s)		24.0			22.5			16.3			19.0	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	21.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	68.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

D Appendix D - Area Pipeline Map

PENN WEST-
88mm-OIL

PENN WEST-
114mm-SALT WATER

PENN WEST-
114mm-GAS

PERTOFUND-
88mm-WATER

323mm

ATCO PL-42mm-GAS
(ABANDONED)

ATCO PL-323mm-GAS

ATCO PL-60mm-GAS (ABANDONED)

ATCO PL-323mm-GAS
TRANSF ATCO PL-219mm-GAS
(TUC)

ATCO PL-60mm-GAS ABANDONED

PEMBINA-406mm-OIL
ATCO PL-323mm-GAS
ATCO PL-406mm-GAS
STRATHCONA-73mm-GAS (ABANDONED)
BP-273mm-HVP
BP-219mm-LVP
ATCO PL-610mm-GAS

ATCO PL-219mm-GAS
ATCO PL-323mm-GAS

EDMONTON
ETHANE
EXTRACTION
PLANT

STRATHCONA
73mm-GAS
(ABANDONED)

ALTA PL-323mm-GAS
NOVA CHEM-168mm-HVP
KEYERA-168mm-HVP

TRANSPORTATION UTILITY CORRIDOR

ATCO PL-508mm-GAS
(TUC)

NOVA CHEM-273mm-HVP

ALTA GAS-323mm-GAS
PLAINS-323mm-OIL
PEMBINA-219mm-OIL
KEYERA-219mm-OIL
KEYERA-219mm-OIL
KEYERA-219mm-OIL
PEMBIA-406mm-BATCH

KEYERA (RIMBEY)-219mm-HVP
IMPERIAL-273mm-LVP

NOVA CHEM-273mm-HVP
BP-219mm-HVP
BP-273mm-HVP
KEYERA-60mm-HVP
KEYERA-60mm-OIL
KEYERA-88mm-OIL
KEYERA-114mm-HVP
ATCO PL-323mm-GAS
ATCO PL-219mm-GAS
ATCO PL-610mm-GAS

PEMBINA-406mm-OIL
ATCO PL-406mm-GAS-ODORLESS

KEYERA-219mm-HVP
KEYERA-219mm-OIL
KEYERA-219mm-OIL
PLAINS-323mm-OIL
PEMBINA-219mm-OIL
PEMBINA-406mm-BATCH
ATCO PL-323mm-GAS

ATCO PL-323mm-GAS
PEMBINA-406mm-BATCH

NOVA CHEM - 273mm - HVP
BP - 219mm - HVP
BP - 273mm - HVP

COUNTY
OF
LEDUC

CITY BOUNDARY

CITY BOUNDARY

(Leduc)

41 AVE SW

41 AVE SW

ANTHONY HENDAY DRIVE

ELLERSLIE ROAD (9 AVE SW)

ELLERSLIE ROAD (9 AVE SW)

WHITEMUD CREEK

BLACKMUD CREEK

IRVINE CREEK

CALGARY TRAIL

GATEWAY BOULEVARD

PARSONS RD

91ST SW

101 ST SW

814

41 Avenue
Study Corridor

DETAIL 'A' (N.T.S.)

DETAIL 'B' (N.T.S.)

DETAIL 'C' (N.T.S.)

NOTES:

1) HVP (HIGH VAPOUR PRESSURE): PIPELINES CARRY LIQUIDS THAT WILL RAPIDLY CHANGE TO GAS WHEN RELEASED
2) Address comments or concerns to :
EAPUOC
Box 57134
2020 Sherwood Dr.
Sherwood Park, Alberta
T8A 5L7
Or through the 'Contacts' area of the web site:
www.eapuoc.com
3) The City of Edmonton is not responsible for the accuracy or completeness of the data .

LEGEND

- DETAIL boundary
- PIPELINE CORRIDOR - Pipeline corridors for 2 to 5 pipelines
- PIPELINE CORRIDOR - Pipeline corridors for 6 or more pipelines
- BATCH/EDMONTON POWER/OTHER - Pipeline substance (Batch) or miscellaneous
- GAS - Natural Gas
- HVP - Propane, Ethane, Butane, Etc...
- OIL - Crude Oil, Synthetic Crude Oil, Etc....
- LVP - Condensate, Diesel Fuel, Gasoline, Etc....
- MISC. GAS - - Hydrogen, Nitrogen, Carbon Dioxide, Etc...
- ABANDONED LINES

MAIN PIPELINES EDMONTON AREA

Update March 2009

SCALE 1 :40 000

BE ADVISED

The information provided on this map is to be used only as a guideline.

Pipe location and alignment may not be accurate.

Please contact the appropriate authorities for accurate information.

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E Appendix E - Environmental Report

ENVIRO MAK Inc. Environmental Management Consultants

February 5, 2008 *File Reference #07-51*

Associated Engineering Alberta Ltd.
1000 Pacific Plaza, 10909 Jasper AVE
Edmonton AB T5J 3L9

Attention: Mr. Bryan Petzold

RE: PRELIMINARY ENVIRONMENTAL SCREENING ASSOCIATED WITH THE PROPOSED DEVELOPMENT OF 41ST AVENUE SW IN EDMONTON, ALBERTA IN 51-024 AND 025-W4M

From the City of Edmonton Terms of Reference requesting concept plans for the development of the 41 Avenue SW Arterial Roadway, please see the following information as it relates to the natural resources associated with 41 Avenue SW. At this preliminary stage of the environmental screening and the biophysical assessment, some information is provided prior to the completion of the biophysical assessment which would be conducted in the spring and summer of 2008. A site-specific assessment was conducted on January 16, 2007 when much of the roadway and adjacent area was snow-covered. This information provides the preliminary screening; thus, a spring field assessment and the development of a mitigation and environmental protection plan are yet required.

1.0 INTRODUCTION

The City of Edmonton is interested in developing a conceptual roadway plan for 41 Avenue SW, 51-024 and 025-W4M, in Edmonton that includes 41 Avenue from 50 Street to 184 Street. The proposed roadway development considers the 41 Avenue SW and arterial roadways and would include construction activities, which may influence the aquatic and terrestrial ecosystems. Since 41 Avenue SW may be affected by the development, an environmental assessment was initiated to determine how these activities might affect various components of the aquatic and terrestrial ecosystems. Therefore, the environmental assessment of the potential effects of this land development on 41 Avenue SW is being prepared by EnviroMak Inc. Environmental Management Consultants for Associated Engineering Alberta Ltd.

EnviroMak Inc. is focusing its expertise on gathering sufficient baseline information on the aquatic and terrestrial ecosystems, assessing the potential effects, establishing an environmental protection plan, and developing a monitoring plan outline. This report focuses on the preliminary environmental screening and awaits further instruction and the engineering design to address field assessments, environmental effects, mitigation and monitoring.

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As part of this assessment, liaison with provincial and federal government agencies has occurred. Communication with various government representatives established the specific government expectations as they relate to this project and several pieces of legislation (provincial and federal) were addressed including the *Alberta Water Act* and the various Codes of Practice which were effective as of May 1, 2000. In addition to the provincial requirements, the Canadian Government Department of Fisheries and Oceans (DFO) would make a determination on the possibility of the project affecting the fish habitat (HADD determination). The legislated requirements for terrestrial ecosystem assessment are particularly relevant to rare and endangered wildlife species (Section 6 of the *Alberta Wildlife Act* and Section 7 of the Wildlife Regulation). There are no provisions for the specific protection of endangered species habitats at this time under the *Alberta Wildlife Act*. There are protections for nests and dens of endangered animals under Section 38 of the Wildlife Act and Section 96 of the Wildlife Regulation. However, matters associated with critical or significant wildlife habitats, with wildlife and cumulative effects were also examined.

The City of Edmonton has developed a listing and mapping of the Natural Areas or Environmentally Sensitive Areas within the City and this was also examined to determine if such areas incorporate or are in close proximity to the 41 Avenue SW route (Conservation of Natural Sites in Edmonton's Table Lands Policy Bylaw 9076 and North Saskatchewan River Valley Area Redevelopment Plan Bylaw 7188.).

Numerous guidelines have been developed to ensure that road developments have a minimal impact on the environment. These guidelines have been assessed to determine those that may be required for the site-specific parameters/conditions that exist at this location on the 41 Avenue SW route.

2.0 OBJECTIVES

The overall objectives of this assessment were to describe and document the current status of aquatic and terrestrial resources in the vicinity of the proposed land development at a preliminary screening level. The specific objectives of this preliminary study were:

- To design a baseline aquatic inventory that would effectively assess the status of the aquatic ecosystems prior to the development;
- To examine the need for a terrestrial ecosystem assessment; and
- To provide a preliminary environmental screening of the site.

This report focuses on the preliminary environmental screening and awaits further instruction, field assessment and the engineering design to address environmental effects, mitigation, monitoring and regulatory approvals.

3.0 LOCATION, ECOLOGICAL FEATURES, WATERSHED CHARACTERISTICS

The assessment area incorporated 41 Avenue SW from 50 Street to 184 Street (Figure 1).

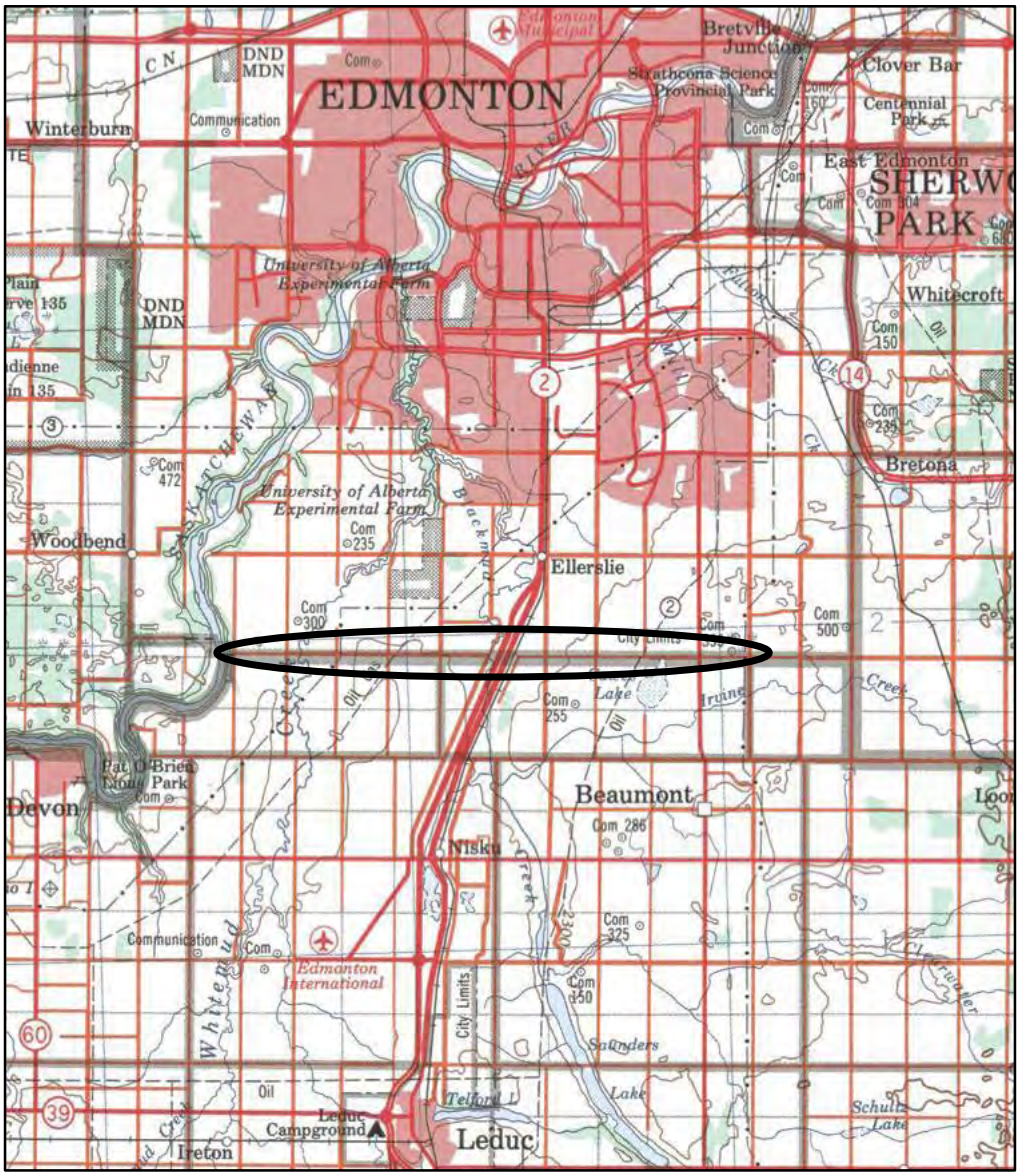

Figure 1. Study area for 41 Avenue SW from 50 Street to 184 Street in the City of Edmonton (Etopo 1:250,000 scale NTS map, 1994).

The roadway properties (N½ 7, 8, 9, 10 and 11-51-24-W4M; S½ 14, 15, 16, 17 and 18-51-24-W4M; N½ 9, 10, 11 and 12-51-25-W4M; S½ 13, 14, 15 and 16-51-25-W4M) were located in the Aspen Parkland Ecoregion (Strong and Leggat, 1992) (Table 3.1).

The sites were located within the Dark Gray - Gray Soil Zone of central Alberta (Soil Correlation Area 11, Pedocan Land Evaluation Ltd. 1993). The area was characterized by Dark Gray Chernozemics and Luvisols with some Orthic Gray Luvisols. Gleysolic and occasionally Organic soils occurred in depressional areas (Pedocan 1993). The landscape was generally undulating to hummocky moraine.

Table 3.1. General location descriptors of N½ 7, 8, 9, 10 and 11-51-24-W4M; S½ 14, 15, 16, 17 and 18-51-24-W4M; N½ 9, 10, 11 and 12-51-25-W4M; S½ 13, 14, 15 and 16-51-25-W4M including Whitemud Creek (NW10-051-25-W4M), Blackmud Creek (NW08-051-24-W4M), Cawes Lake (NW11-051-24-W4M), Unnamed Wetland 1 (NW10-051-24-W4M) and Unnamed Wetland 2 (NW09-051-24-W4M) where crossing 41st Avenue SW in the City of Edmonton.

Descriptor	Specific Location
Legal Land Description	51-024 AND 025-W4M
[1]Soil Correlation Area	SC 10
[2]Ecoregion	Aspen Parkland
Municipality	The City of Edmonton
[3]Environmentally Significant Area	None
[4]Natural Areas or Environmentally Sensitive Areas (City of Edmonton)	None

[1] Pedocan Land Evaluation 1993 [2] Strong & Leggat 1992 [3] ANHIC Map 2002
[4] Conservation of Natural Sites in Edmonton's Table Lands Policy Bylaw 9076 and North Saskatchewan River Valley Area Redevelopment Plan Bylaw 7188

Climate data was gathered from Environment Canada (2007) which maintains a weather station at Edmonton City Centre. Edmonton City Centre temperature averages 3.9 °C annually; the July mean is 17.5 °C, and; the January mean is -11.7 °C. Mean annual precipitation is 476.9 mm with approximately 26% occurring as snow. Rainfall averages 365.7 mm.

The growing season lasts approximately 180-185 days (Alberta Agriculture, Food and Rural Development 1971-2000). Agroclimate is 2H to 3H (slight to moderate heat limitations). Growing season is P-PE= -150 to -200mm (Pedocan 1993).

According to the capability classification (1:1,000,000 scale Canada Land Inventory Soil Capability for Agriculture – Alberta Map) the area surrounding Whitemud Creek and Cawes Lake is classified as 6_T and surrounding Blackmud Creek is classified as 6_T and 4_D. The area surrounding the rest of the 41st Avenue right-of-way (ROW) is classified as 1. Class 1 indicates soils have no significant limitations to use for crops; Class 4 indicates soils have severe limitations that restrict the range of crops; and Class 6 soils are capable of producing perennial crops only (Alberta Soil Survey with the support of ARDA, Canada Department of Forestry and Rural Development 1967; and Canada Land Inventory, Lands Directorate, Environmental Management Service, Environment Canada 1976, from the agriculture capability inventory provided by the Alberta Soil Survey).

4.0 SUMMARY OF THE SIGNIFICANT LANDSCAPE FEATURES

A summary of the key landscape features indicates that the majority of the lands adjacent to the roadway consisted of cleared and cultivated agricultural land. The majority of the roadside ditches were cleared of vegetation and have been backsloped.

There were two watercourses and 12 wetlands along the route. As well, there were 11 areas containing trees or shrubs providing upland wildlife habitats (Table 4.1; Figures A to I in Appendix 1). All of these landscapes were minor in comparison to the agricultural developments along the roadside.

Table 4.1. Screening of watercourses, wetlands and upland habitats associated with 41st Avenue SW in south Edmonton from 50th Street (East) to 184th Street (West) (as determined from 2005 Alberta Environment aerial photography).

Distance from 50th Street (km)	Landscape Type	Legal Land Description	Approx. Length Along 41st Avenue SW (m)	*Preliminary Valuation	Information Comments
0.1	Upland	NE11-51-24-W4	100		
0.2	Wetland	NE11-51-24-W4	100	Class II	Spring assessment
0.9	Wetland	NW11-51-24-W4	100	Class IV	Public Land status to be checked Spring assessment
1.0	Wetland	NW11-51-24-W4	100	Class II	
1.0	Wetland (Cawes Lake)	NW11-51-24-W4	200	Class V	Public Land status to be checked Northern Leopard Frog Spring assessment
1.6	Upland	NE10 & NW11-51-24-W4	150		Spring assessment
2.0	Wetland	NE10-51-24-W4	75	Class II	Spring assessment
2.2	Wetland	NE10-51-24-W4	100	Class II	Spring assessment
2.2	Upland	NE10-51-24-W4	100		Great Horned Owl
2.5	Wetland	SW15-51-24-W4	400	Class III	Public Land status to be checked Spring assessment
2.5	Wetland	NW10-51-24-W4	400	Class V	Public Land status to be checked Spring assessment
3.4	Upland	NE09-51-24-W4	200		
3.5	Wetland	NE09-51-24-W4	100	Class IV	Public Land status to be checked Spring assessment
4.3	Upland	NW09-51-24-W4	100		
4.7	Wetland	NW09-51-24-W4	200	Class I	Spring assessment
5.5	Wetland	SE17-51-24-W4	100	Class I	Spring assessment
5.7	Wetland	SW17-51-24-W4	75	Class I	Spring assessment
6.4	Watercourse (Blackmud Creek)	NE07-51-24-W4	20	Fish Bearing Bed and banks are public lands	Aquatic biophysical features to be checked BRST, LKCH, WHSC, FTMN, LNDC, LNSC
8.1	Upland	NE12-51-25-W4	500		
9.0	Upland	NW12-51-25-W4	500		Great Horned Owl
11.5	Upland	SE15-51-25-W4	200		Not native
12.1	Upland	NW10-51-25-W4	400		
12.3	Watercourse (Whitemud Creek)	NW10-51-25-W4	20	Fish Bearing Bed and banks are public lands	Aquatic biophysical features to be checked BRST
13.4	Upland	NE09-51-25-W4	50		Bald Eagle nest
13.9	Upland	SW09-51-25-W4	500	Significant Natural Area	

*Stewart and Kantrud 1971 (Appendix 2)

BRST - Brook stickleback *(Culaea inconstans)*
FTMN – Fathead minnow (*Pimephales promelas)*
WHSC – White sucker (*Catostomus commersoni*)
LKCH - Lake chub (*Couesius plumbeus)*
LNDC – Longnose dace (*Rhinichthys cataractae)*
LNSC – Longnose sucker (*Catostomus catostomus)*

5.0 Environmentally Significant Areas

The property does not contain any ecological reserves, special wildlife projects or recorded environmentally sensitive areas. However, the Alberta Natural Heritage Information Centre (ANHIC) Environmentally Significant Areas Provincial map does identify Whitemud Creek as bordering a provincial environmentally significant area - the North Saskatchewan River (2002).

No lands on the route appeared to be mentioned in the Conservation of Natural Sites in Edmonton's Table Lands Policy Bylaw 9076.

The North Saskatchewan River (west of 184th Street), Whitemud Creek and Blackmud Creek are mentioned in the North Saskatchewan River Valley Area Redevelopment Plan Bylaw 7188. Special considerations should be given to these watercourses and their riparian vegetation.

6.0 Public Land Ownership Determination

The bed and banks of both Blackmud Creek and Whitemud Creek are owned by the Alberta Government and are considered Public Lands. The wetlands identified in Table 4.1 and mapped in Figures A to I (Appendix 1) are currently being assessed with regard to their ownership status.

7.0 Water Resources

An examination of the wetlands identified in Table 4.1 indicates that 5 of them are Class III, IV and V (Stewart and Kantrud 1971; Appendix 2) which may suggest that some compensation may be required should they be altered (*Alberta Water Act*). These wetlands should be further addressed in the spring and summer of 2008.

8.0 Fish Resources

No site specific information of fish distribution or fish habitat was available for the two 41st Avenue SW crossings of Whitemud Creek or Blackmud Creek. However, an examination of Alberta Environment files and communication with provincial government personnel (H. Norris, D. Watters, A. Gibson and P. Mitchell, per. comm.) revealed that considerable information does exist on various aquatic ecosystem components of the Whitemud Creek as well as some for the Blackmud Creek in downstream locations.

8.1 Whitemud Creek

Existing information contained on the Alberta Sustainable Resource Development (ASRD) Fish Management Information System (FWMIS) did not provide site specific references to fish resources at Whitemud Creek crossing at 41st Avenue SW (D. Watters, per. comm.). ASRD indicated that the presence of Northern pike (*Esox lucius*), Walleye (*Stizostedion vitreum vitreum*), Burbot (*Lota lota*), Longnose sucker (*Catostomus catostomus*), White sucker (*Catostomus commersoni*), Lake chub (*Couesius plumbeus*), Brook stickleback (*Culaea inconstans*) and Fathead minnow (*Pimephales*

promelas) might be possible as they have been recorded in the North Saskatchewan River (D. Watters, per. comm.; R. Makowecki, per. know.).

Three fish species, including Longnose sucker, Brook stickleback and White sucker, were recorded in the vicinity of the proposed Smith Crossing Stormwater Outfall in May 2002 (Makowecki and Makowecki 2002). As well, a 2003 fish salvage at the Anthony Henday crossing resulted in large numbers of 5 fish species including: Brook stickleback, White sucker, Lake chub, Fathead minnow and Northern pike (Makowecki and Makowecki 2003).

One field observation at the 41 Avenue SW crossing indicated on both upstream and downstream sides of the crossing high exposed banks suggesting some instability. This may suggest some need to investigate the alignment, should the design encroach on these areas.

A further assessment of fish distribution should be conducted in the spring as the current channel did appear to have suitable morphometric features indicating a fish habitat.

8.2 Blackmud Creek

Existing information contained on the ASRD Fish Management Information System (FWMIS) did not provide site specific references to fish resources at Blackmud Creek crossing at 41 Avenue SW (D. Watters per. comm.). ASRD indicated that the presence of Northern pike (*Esox lucius*), Walleye (*Stizostedion vitreum vitreum*), Burbot (*Lota lota*), Longnose sucker (*Catostomus catostomus*), White sucker (*Catostomus commersoni*), Lake chub (*Couesius plumbeus*), Brook stickleback (*Culaea inconstans*) and Fathead minnow (*Pimephales promelas*) might be possible as they have been recorded in the North Saskatchewan River (D. Watters, per. comm.; R. Makowecki, per. know.).

Downstream site-specific sampling in Blackmud Creek (Makowecki and Makowecki 2000) indicated abundant numbers of Lake chub, Fathead minnow and Brook stickleback. Further at a location south of Ellerslie Road, abundant fish numbers of Fathead minnow and Brook stickleback were salvaged in conjunction with a stormwater outfall project (Makowecki and Walker-Makowecki 2007).

One field observation at the 41 Avenue SW crossing indicated on the upstream side of the crossing that the watercourse had been channelized. This may have some influence on the site-specific conditions at the crossing location.

A further assessment of fish distribution should be conducted in the spring as the current channel did appear to have suitable morphometric features indicating a fish habitat.

9.0 FISH HABITAT

No current (post 1991) fish habitat information was found in government files and no information was gathered in the field. Further assessment is to be conducted in the spring of 2008.

10.0 PRESENCE OF THREATENED, RARE OR ENDANGERED TERRESTRIAL RESOURCES

According to the Natural Heritage Information Coordinator (Alberta Community Development), a data search of two townships around the project study area in the Alberta Natural Heritage Information Centre (ANHIC) system did not identify any recorded occurrences of elements on tracking lists (J. Rintoul, per. comm.).

The local ASRD Wildlife Biologist (J. Folinsbee, per. comm.) indicated that the Biodiversity Species Observation Directory (BSOD) (more recently referenced as the Fish and Wildlife Management Information System - FWMIS) had an old record (from 1960) for Northern Leopard Frog (*Rana pipiens*) at Cawes Lake (NW11-051-24-W4M). It is suspected that the population is now extirpated but there is a remote possibility that it still exists. No other information for the location was indicated and the Alberta Government files did not provide any information suggesting the presence of any other threatened, rare or endangered species of plants or animals at this location.

No site-specific studies have been conducted to determine if any threatened or endangered wildlife species occur. No records of such species occur in the provincial government files on this property other than the identification of a Northern Leopard Frog population described above.

No other rare or endangered amphibians or reptiles have been recorded in this vicinity (J. Rintoul, per. comm.; J. Folinsbee, per. comm.). Also, no unusual or unique wildlife habitats have been recorded (J. Folinsbee, per. comm.).

An assessment of the presence or absence of amphibians in the Class III, IV and V wetlands is planned for the spring of 2008.

11.0 CONCLUSIONS AND RECOMMENDATIONS

The preliminary information from this initial screening would suggest the following:

- There is information that would suggest that fish and fish habitat are present at the watercourse locations, and, as a result, a fish and fish habitat assessment should be completed with appropriate field examination. This would be part of the biophysical assessment to be completed in the spring of 2008. As well, the biophysical assessment will need to include the requirements of the City of Edmonton Bylaw 7188 that applies to both crossings.
- No rare, endangered or threatened plant or animal species were noted on the said lands from the file review; however, some were noted in the vicinity. Some field examination in conjunction with the fish and fish habitat assessment is normally undertaken.
- The wetland classification for the 12 wetlands should be verified in the spring of 2008.
- The Class III, IV and V wetlands should be further assessed for rare amphibians.
- The Class III, IV and V wetlands are being assessed to determine bed ownership status.

- An environmental protection, mitigation and compensation plan that addresses the water and environmental values should be prepared as part of the further assessment as this project advances.
- Noxious weeds assessments should be conducted.
- The bed and banks of 41 Avenue SW of Whitemud and Blackmud Creeks are owned by the Alberta Government. The engineering plan and the environmental assessment report will provide the basis for further discussions with ASRD.
- Depending upon the details of the engineering plans, provincial and federal regulatory approvals should be obtained from ASRD, Alberta Environment (AENV), the Department of Fisheries and Oceans (DFO), The City of Edmonton Planning and Development Department and The City of Edmonton Recreation and Parks Department.

If you need any further information or clarification, please contact Kyla Walker-Makowecki or Ray Makowecki by telephone at (780) 425-2461 or (780) 918-5527 (cellular).

Sincerely,

Ray Makowecki, M.Sc., B.Ed., P.Biol., R.P. Bio.
Principal, EnviroMak Inc.

Attachment: *Bibliography and Appendices*

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13.0 APPENDICES

13.1 Figures

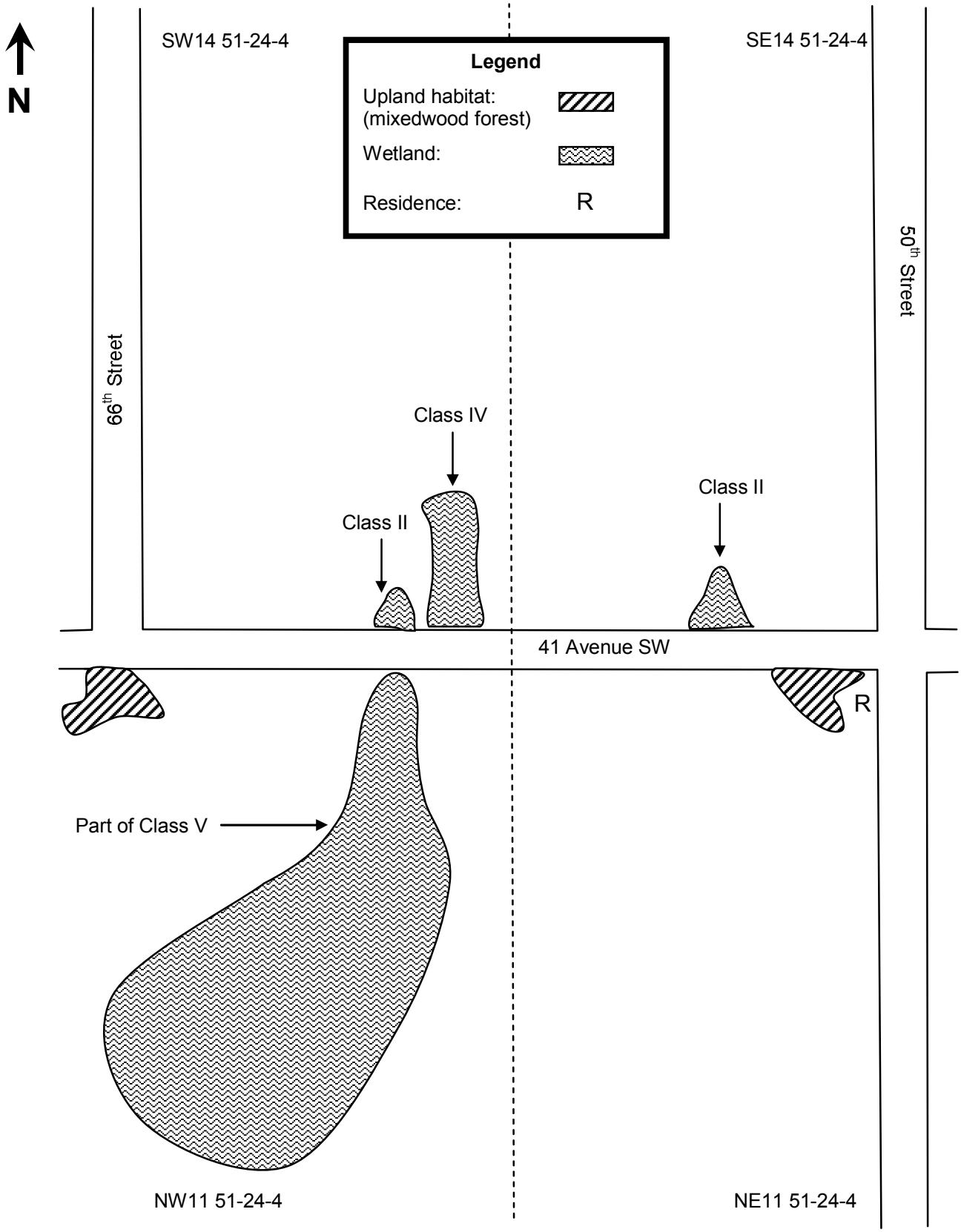


Figure A. Watercourses, wetlands and upland habitats located along 41st Avenue SW in S14 and N11 (diagrammatic - not to scale).

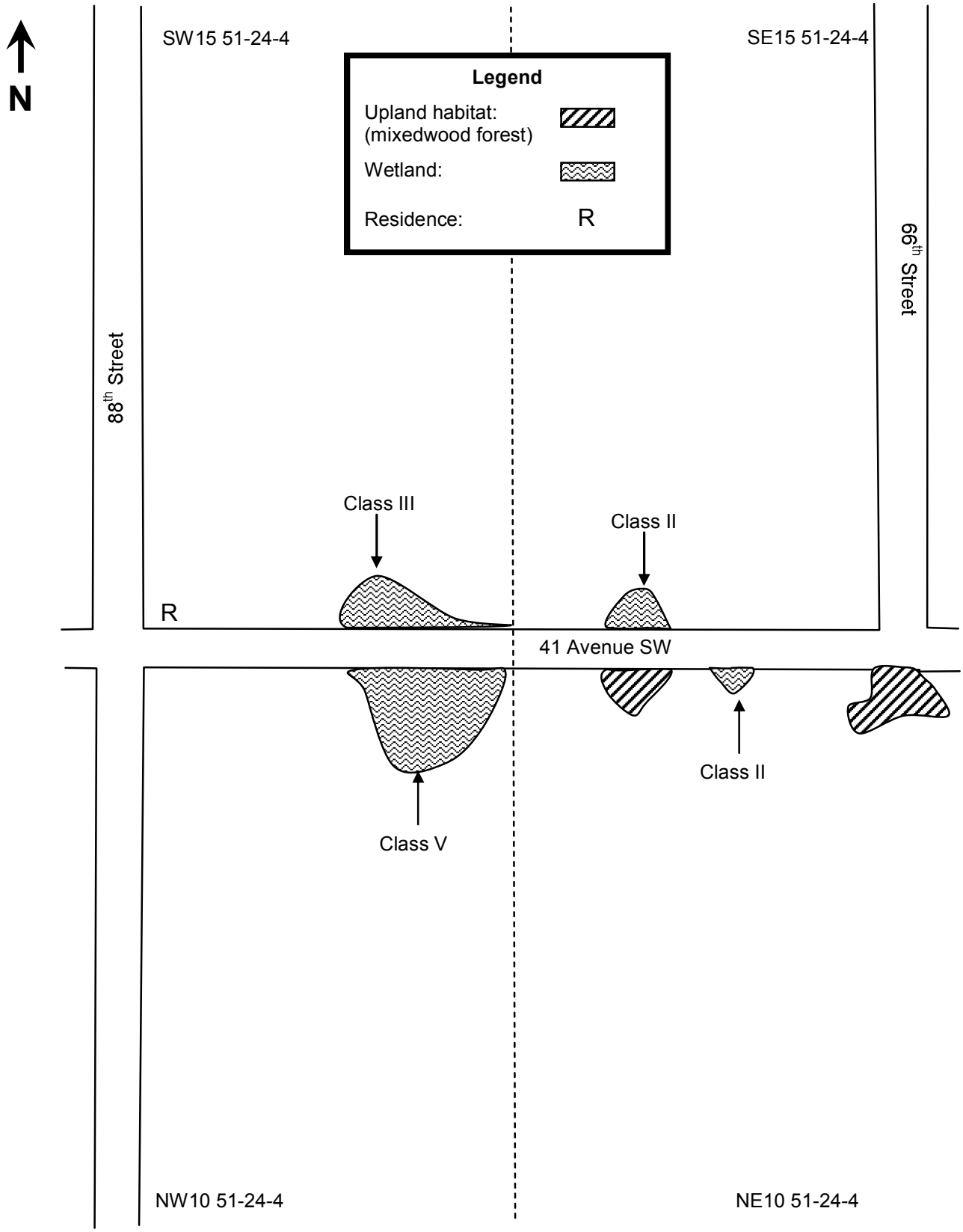


Figure B. Watercourses, wetlands and upland habitats located along 41st Avenue SW in S15 and N10 (diagrammatic - not to scale).

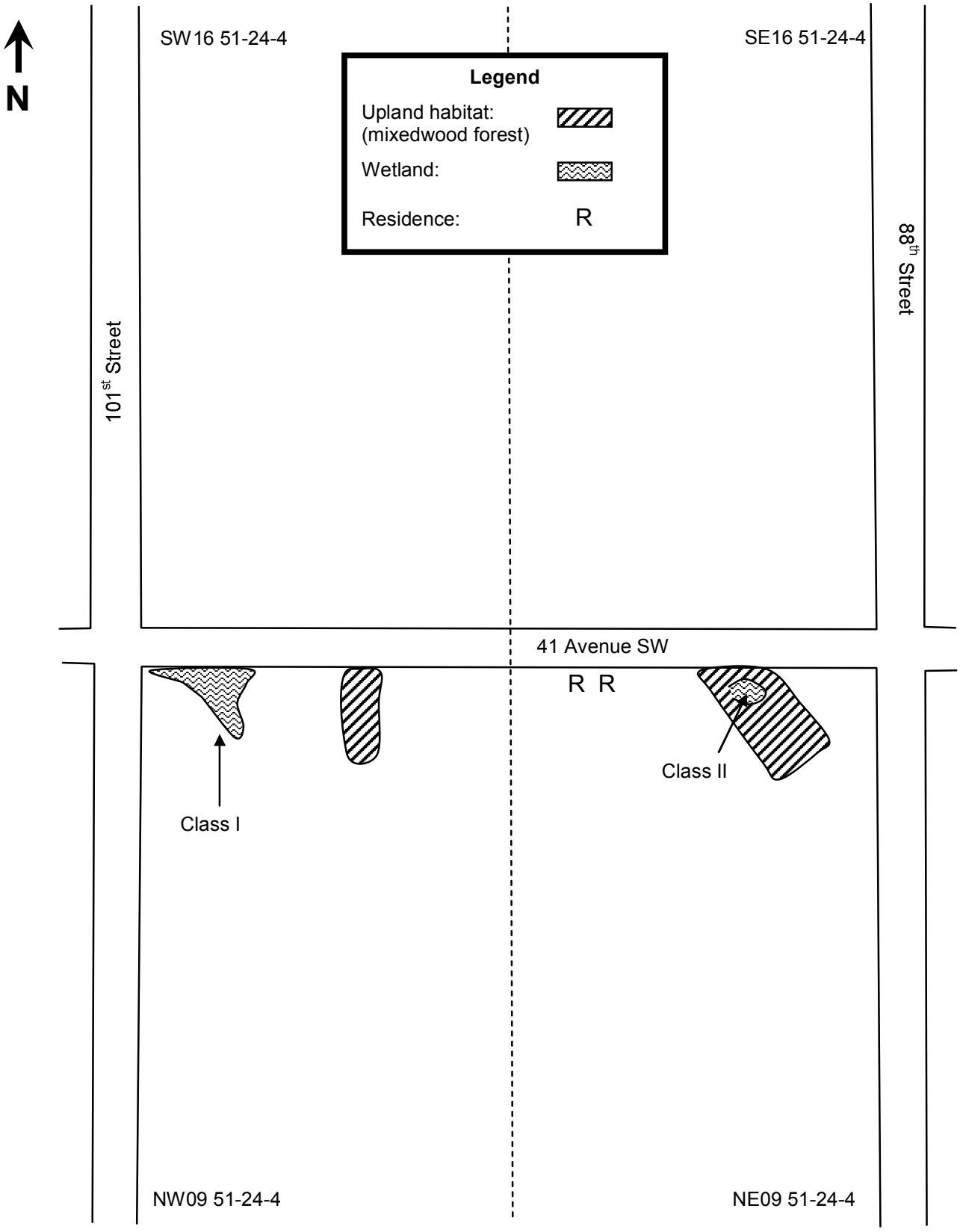


Figure C. Watercourses, wetlands and upland habitats located along 41st Avenue SW in S16 and N9 (diagrammatic - not to scale).

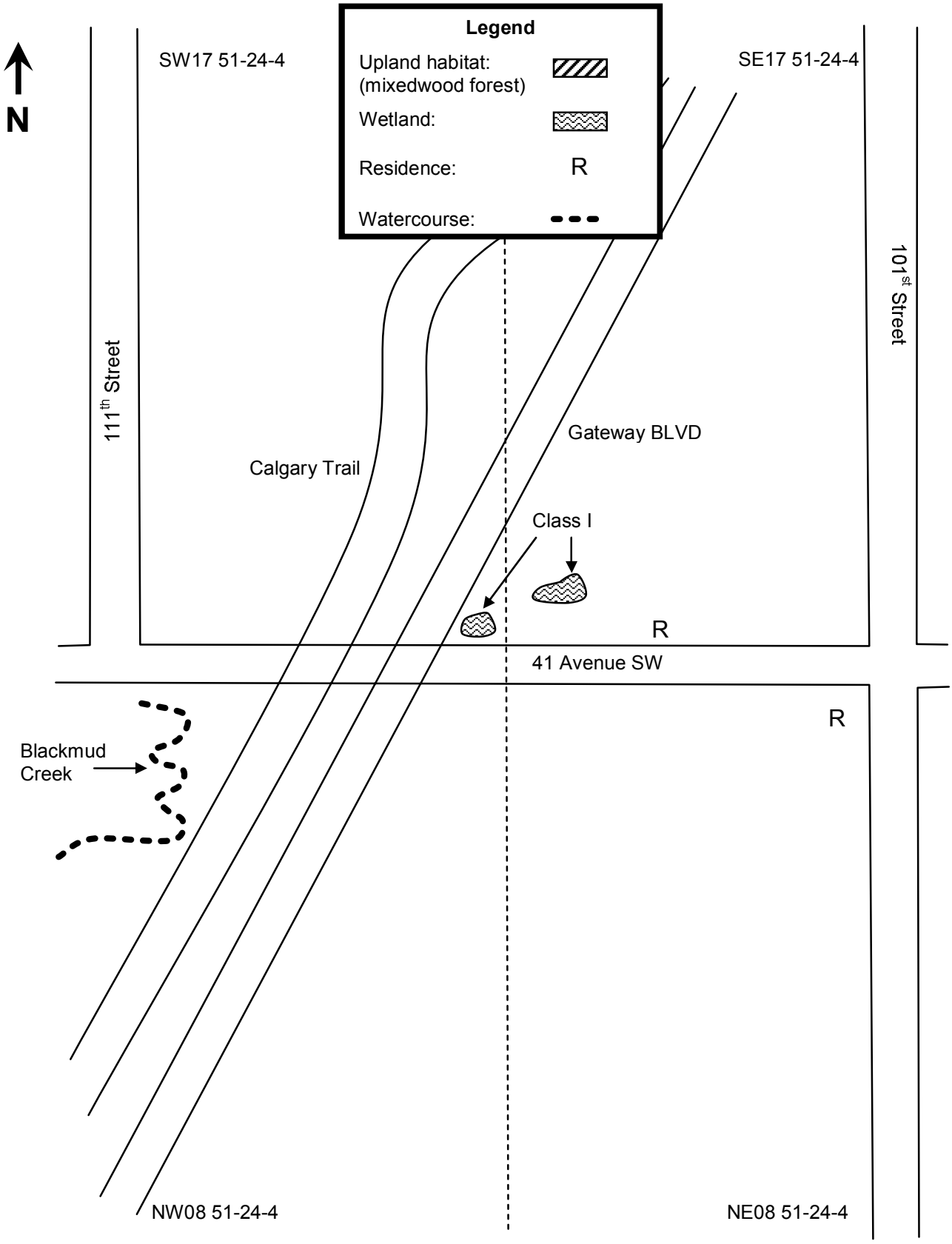


Figure D. Watercourses, wetlands and upland habitats located along 41st Avenue SW in S17 and N8 (diagrammatic - not to scale).

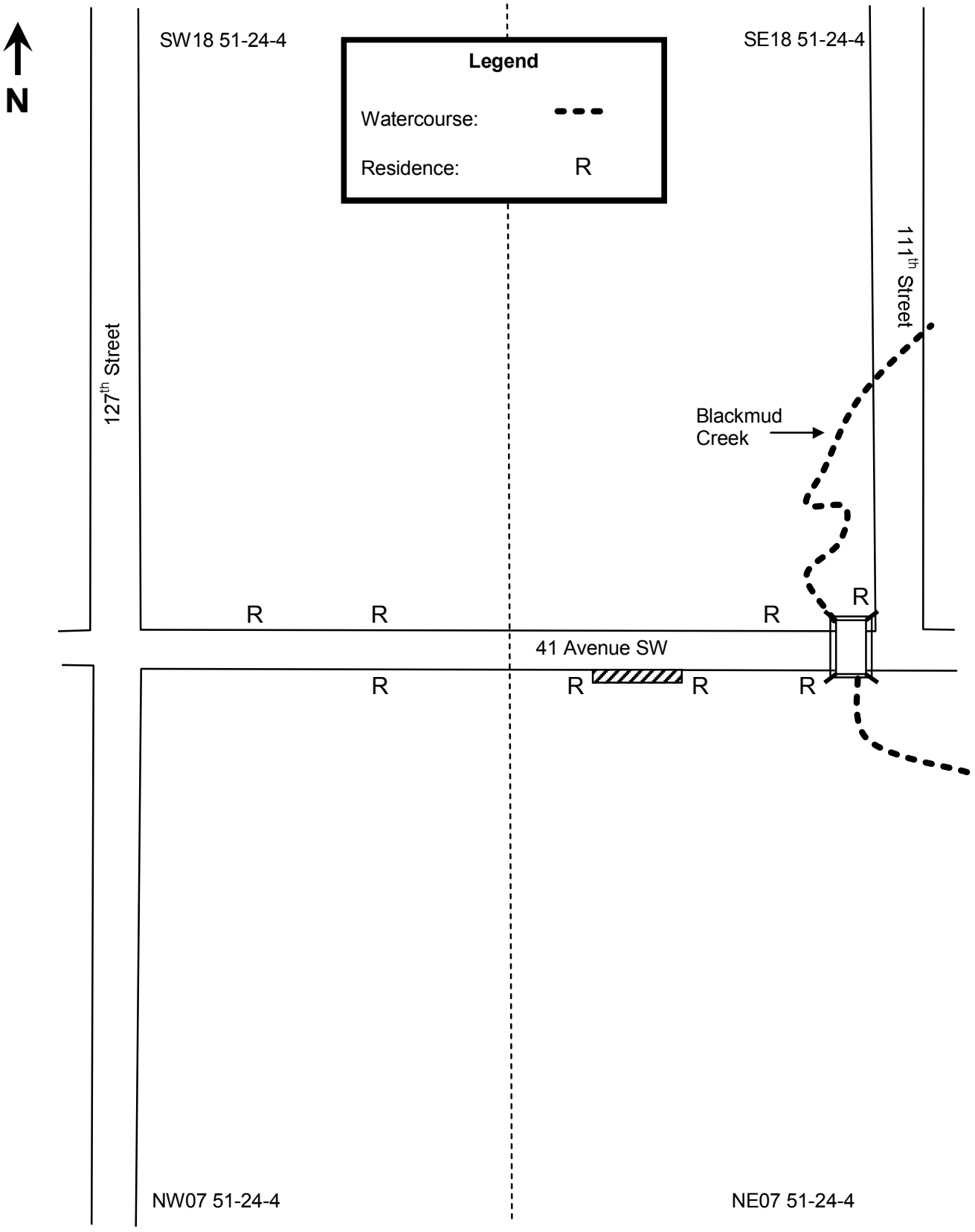


Figure E. Watercourses, wetlands and upland habitats located along 41st Avenue SW in S18 and N7 (diagrammatic - not to scale).

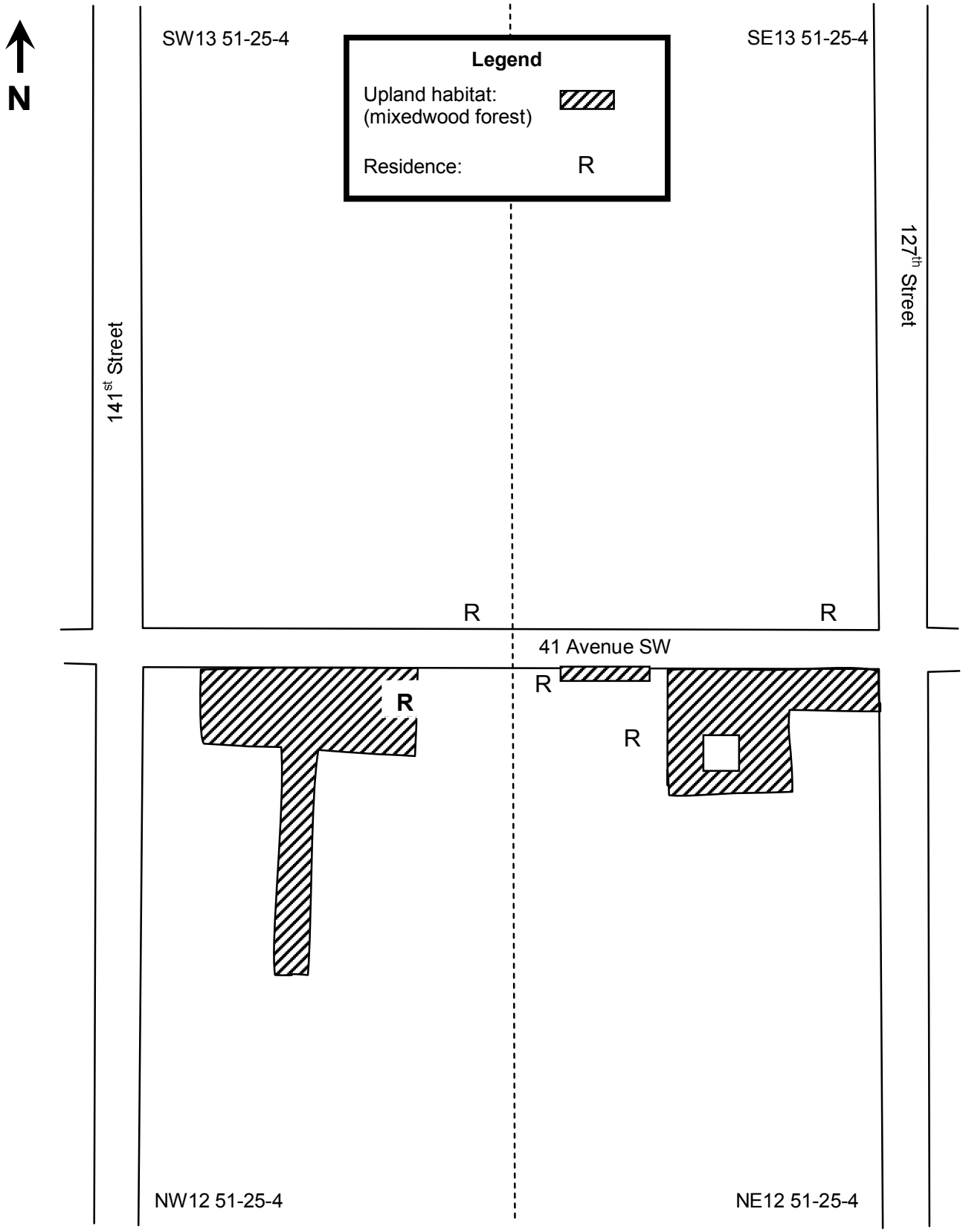


Figure F. Watercourses, wetlands and upland habitats located along 41st Avenue SW in S13 and N12 (diagrammatic - not to scale).

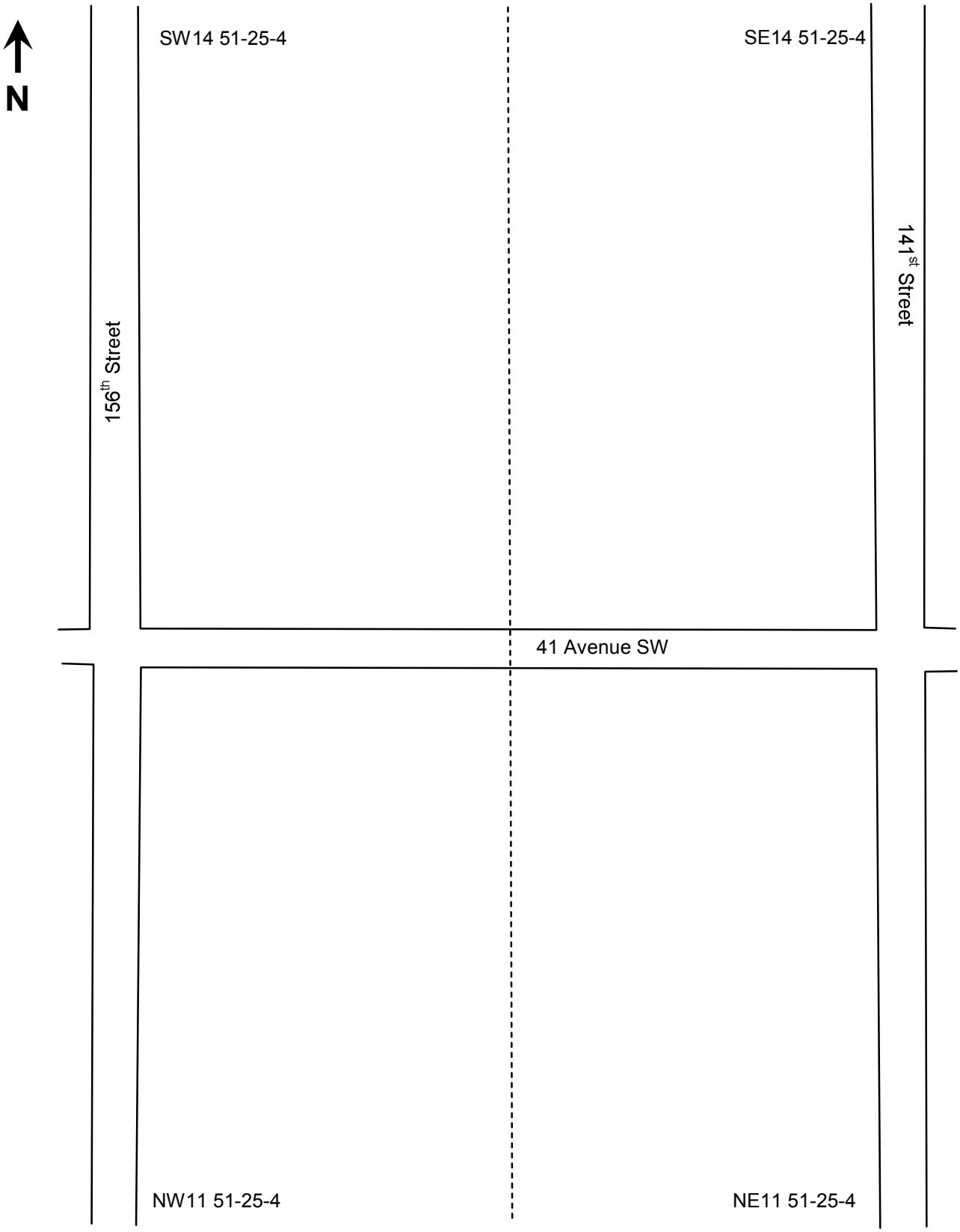


Figure G. Watercourses, wetlands and upland habitats located along 41st Avenue SW in S14 and N11 (diagrammatic - not to scale).

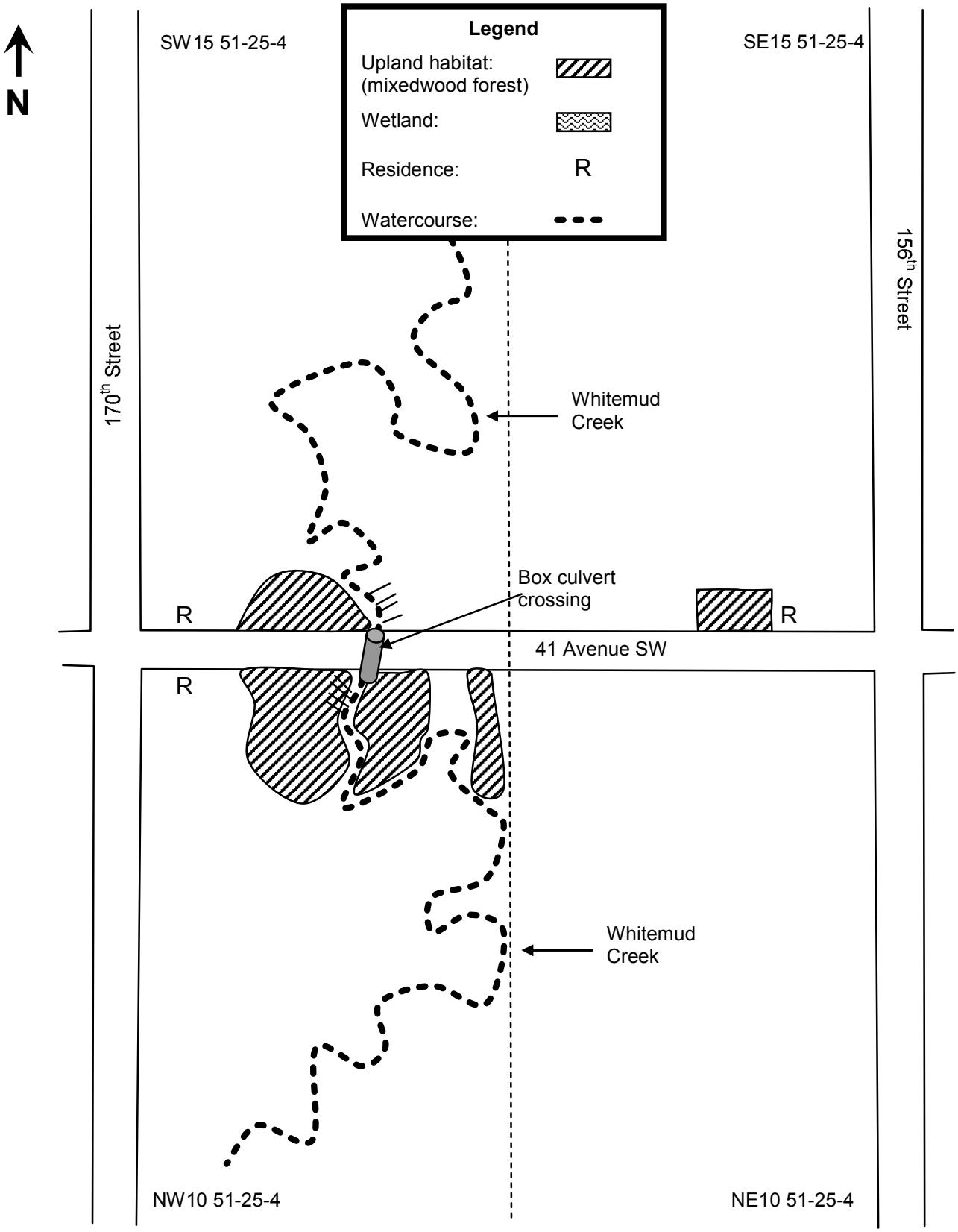


Figure H. Watercourses, wetlands and upland habitats located along 41st Avenue SW in S15 and N10 (diagrammatic - not to scale).

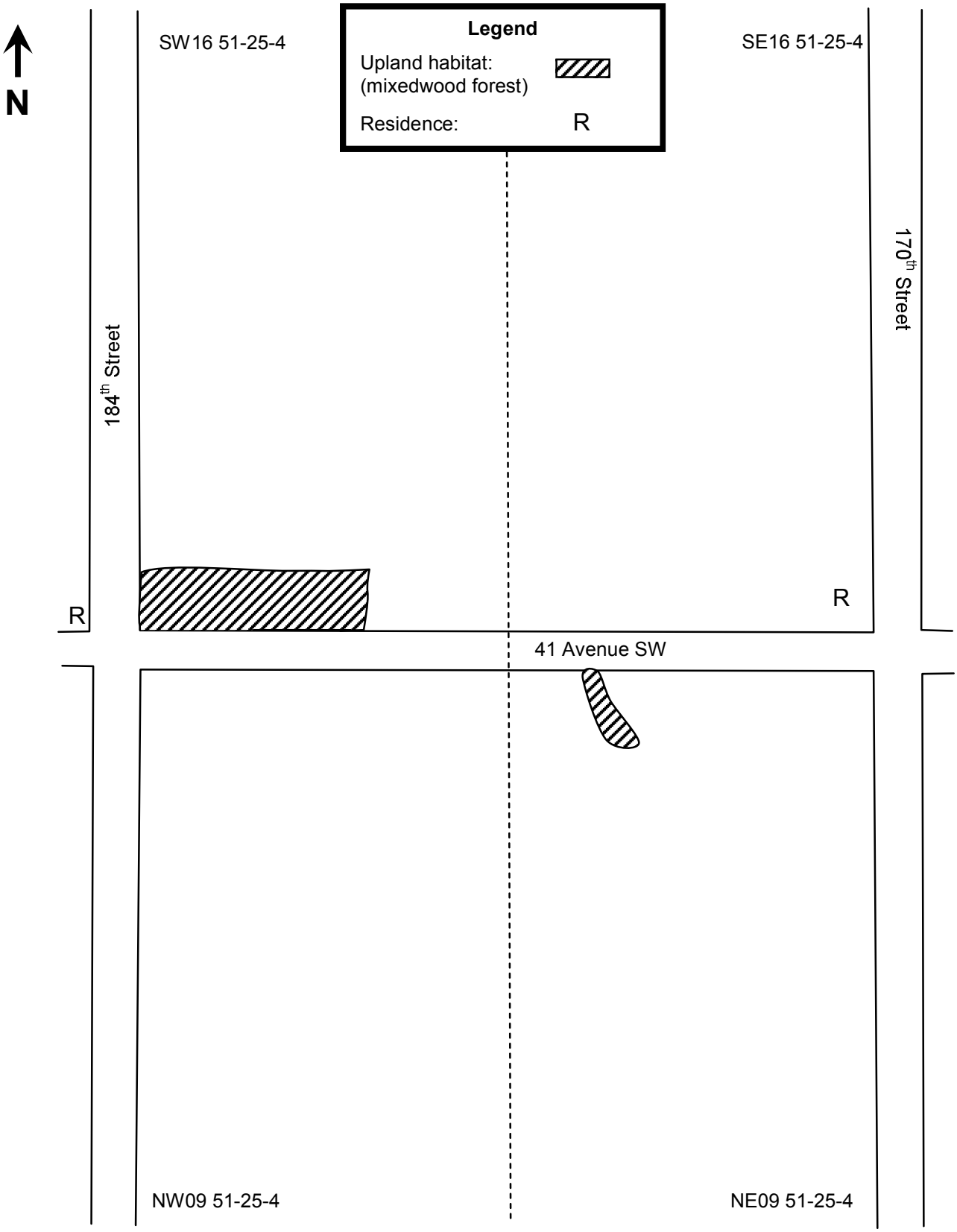


Figure I. Watercourses, wetlands and upland habitats located along 41st Avenue SW in S16 and N9 (diagrammatic - not to scale).

13.2 Steward and Kantrud (1971) Wetland Classification System

The Stewart and Kantrud (1971) system classifies wetland type based on seven vegetation zones that can be identified by characteristic species, evidence of salinity and the presence and depth of water:

Wetland low prairie: periodically flooded in spring but predominately a transition zone between upland and saturated zones, dominated by sedges and upland grasses, with snowberry and rose shrubs.

Wet meadow: rapidly drained, with periodic spring flooding; dominated by grasses, sedge and rushes.

Shallow marsh: retains water for much of the spring and early summer, dry by fall; depending on water depth, will have normal emergent vegetation, an open-water phase at high flood, natural drawdown emergent phase, and after prolonged dry periods, a drawdown bare-soil period.

Deep marsh: maintains surface water through spring and summer, frequently retaining water through fall and winter; in drought years, a drawdown phase and a natural drawdown emergent phase are present, otherwise both a normal emergent and an open-water phase with submerged aquatic plants are evident.

Permanent open water: found in ponds and lakes with stable water levels; submerged aquatic plants only.

Intermittent alkali zone: highly saline shallow water and salt flats; no emergent plants, and few submerged aquatic species.

Fen (alkaline bog) zone: surface water may be lacking, or may be present as seeps; mats of emergent vegetation (sedges, rushes).

Table A. Summary of wetland classification (Stewart and Kantrud 1971).

Class	Class Name	Deepest Vegetation Zone
Class I	Ephemeral Pond	Wetland-low prairie zone
Class II	Temporary Pond	Wet meadow zone
Class III	Seasonal Pond or Lake	Shallow-marsh zone
Class IV	Semi-permanent Pond or Lake	Deep-marsh zone
Class V	Permanent pond or Lake	Permanent open water zone
Class VI	Alkali Pond or Lake	Intermittent alkali zone
Class VII	Fen (Alkaline bog) Pond	Fen zone

F Appendix F - Geotechnical Report

THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

March 7, 2008 File: 17-123-499

Associated Engineering Alberta Ltd.
Suite 1000 Associated Engineering Plaza
10909 Jasper Avenue
Edmonton, Alberta
T5J 5B9

Attention: Mr. Bryan Petzold, P.Eng., Project Manager

41 AVENUE SW - 50 STREET TO 184 STREET
FUNCTIONAL PLANNING STUDY
PRELIMINARY GEOTECHNICAL ASSESSMENT

Dear Sir:

This letter presents the findings of a geotechnical desktop study carried out by Thurber Engineering Ltd. (Thurber) for the proposed alignment of 41 Avenue SW from 50 Street to 184 Street in Edmonton, Alberta. The work was completed as input to the functional planning study that is currently being carried out by Associated Engineering Alberta Ltd.

This report is subject to the Statement of General Conditions which is included at the end of the text of this report. The reader's attention is specifically drawn to these conditions as it is considered essential that they be followed for the proper use and interpretation of this report.

1. PROJECT DESCRIPTION

A concept planning study is required for 41 Avenue SW to assist in planning for the future development in the city south limits where the existing development surrounding the project area is still mainly agricultural or undeveloped.

The total project length is about 14.5 km extending from 50 Street in the east to 184 Street near the North Saskatchewan River, as shown on Figure 1 in Appendix A. The future roadway comprising 6 to 8 lanes will require crossings of Queen Elizabeth II Highway, Blackmud Creek and Whitemud Creek. East of Queen Elizabeth II Highway the alignment will cross some potential muskeg areas, such as Cawes Lake. The alignment also involves intersections such as 50, 91 and 101 Streets on the east side and 170 and 184 Streets on the west side of the project area.

It is understood that the crossings of Queen Elizabeth II Highway and Blackmud Creek will be undertaken by others and have been excluded from this scope of work.

2. METHOD OF INVESTIGATION

The following available information was reviewed as part of our desktop study work:

- 1:20,000 scale 2003 aerial photography;
- 1:5,000 scale 1984 aerial photography;
- City of Edmonton available report files about nearby urban developments;
- Associated Engineering Alberta Ltd. photomosaic plan for 41 Avenue SW;
- Associated Engineering Alberta Ltd. contour lines of the area;
- Available geological maps and references; and
- Thurber's in-house files.

Available stereo aerial photographs of the site were examined, and existing geotechnical information pertaining to the area was reviewed to provide preliminary information on the site topography, geology and drainage characteristics. Preliminary geological and geotechnical information was obtained from Kathol and McPherson (1975).

Existing geotechnical reports relevant to the study were obtained from the City of Edmonton's Material Testing Branch library and from Thurber's in-house files. These reports provided nine test holes mainly concentrated along 41 Avenue SW from 156 Street to QE II highway. About three of the test holes were located further north of 41 Avenue SW. Almost no borehole data was found along the alignment east of QE II highway.

The depth of the selected boreholes ranged from 5.8 m to 19.0 m and all of them reached bedrock. References are provided at the end of the text. Figure 1 presents the approximate test hole locations and is attached in Appendix A. A copy of the logs is included in Appendix B for ease of reference.

In addition, Mr. Don Proudfoot, P.Eng. and Mr. Evandro Gimenes, P.Eng. of Thurber carried out a site reconnaissance on January 17 and 22, 2008. A set of 10 selected photographs covering the site visit along the 41 Avenue SW alignment is attached in Appendix C.

3. SITE CONDITIONS

3.1 Geology and Air Photo Interpretation

Kathol and McPherson described the geology of the area in some detail in 1975. As shown on Figure 2, Appendix A, the surficial geology described by Bayrock (1972) along the western 1.6 km of the road alignment consists of glacio-lacustrine sand and silty sand. Thin creek valley alluvium (7.5 m thick) is present through the Whitemud Creek valley section. Further east of Whitemud Creek the surficial geology consists of glacio-lacustrine deposits of silt, sand and clay. Extensive glaciofluvial eroded lacustrine plain deposits extend from west of Blackmud Creek to 50 Street intersection, with thin and fine to medium grained sand and gravelly lenses overlying lacustrine deposits, till and bedrock. Local gravelly lenses may occur. Kathol and McPherson indicate that the surficial sediments in this area can be up to 22 m thick.

Aerial photographs from 1984 and 2003 were examined specifically near the intersection of 41 Avenue SW and Whitemud Creek to the north and to the south of the intersection. An air photo interpretation is provided on Figure 3, Appendix A. Whitemud Creek is a meandering creek and is located in a shallow valley with relatively gentle slopes. A couple of oxbow features were identified in the air photo mosaic about 100 m south of 41 Avenue SW, indicating probable abandoned river channels.

Immediately to the west of the crossing with QE II highway is Blackmud Creek whose valley is very shallow and also contains thin and fine alluvium. Continuing east there is evidence of some organic material to the west of and at Cawes Lake.

3.2 Surface Conditions

Figure 1 attached shows the location of the photographs taken along the extent of the 41 Avenue SW east-west alignment. Highway QE II and a CN rail line are located in the central portion of the study area and constitute a notable geographic divide.

The land along the 41 Avenue SW corridor is mainly used for farming and ranches. An industrial area is located south of 41 Avenue SW at the intersection with QE II highway.

East of QE II highway and the CN rail line, the topography is relatively flat and there are no major creek valleys. However, there are some low-lying swampy areas located in depressions between 91 and 50 Streets (Photos 2, 3). The most important area is Cawes Lake located about 1 km west of 50 Street, which

appears to be a shallow lake. The air photos suggest the possible presence of sodium-sulphate in the soils and in surface water near the northern end of Cawes Lake (near the road alignment). There were also some minor low-lying areas between 91 and 101 Streets.

West of QE II highway and the CN rail line, the ground surface is relatively flat lying, incised by two creek valleys along the way toward the North Saskatchewan River. Both Whitemud Creek and Blackmud Creek follow a meandering course northward through the area.

The Blackmud Creek valley is located approximately 500 m west of the QE II highway and it is relatively shallow. The depth of this creek is about 3 meters in the vicinity of 41 Avenue SW.

The Whitemud Creek Ravine, located approximately 7 km west of the QE II highway, is about 200 m to 300 m wide and about 15 m to 18 m deep (Photos 7, 8). An aerial photomosaic of the Whitemud Creek Ravine is shown on Figure 3. Ravine slopes, covered with mature forest, vary from 18 to 20 degrees to the horizontal in relatively stable old meander banks. Steeper eroded and bare subvertical slopes are present along the outside active meander bends of the Whitemud creek banks, upstream and downstream of the current creek crossing.

The present alignment of 41 Avenue SW crosses Whitemud Creek on a 7 m high fill over a concrete arch culvert.

From Whitemud Creek further to the west the ground surface is relatively gently rolling and starts dipping to the river at about 500 m east of 184 Street intersection (Photo 10).

Two ravines are present immediately west of 184 Street. These twin ravines are approximately 100 meters apart and about 3.0 m to 7.0 m below the level of 184 Street. These ravines feed directly into the east slope of the North Saskatchewan River valley.

3.3 Soil Conditions

A review of available test hole information from projects previously undertaken in the general project area indicates a general subsurface stratigraphy of topsoil and/or fill overlying lacustrine clay over glacial till. In all selected boreholes bedrock was encountered below the till. Detailed soil and groundwater information from previous field investigation is provided on the individual test hole logs (Appendix B) and summarized in Table 1.

Most of the selected test holes are located relatively close to 41 Avenue SW alignment. However, some additional boreholes (CTA-1, TH08-1, TH08-2) are located 1.0 km to 1.5 km north of 41 Avenue SW and were also included to get a bigger picture of the stratigraphy. Following is a description of the individual strata encountered.

3.3.1 Topsoil and/or Fill

Typically a topsoil layer of about 0.25 m to 0.3 m was encountered in the test holes. In some of the test holes such as EBA-1 there was no topsoil and in other holes, e.g. (TH08-1, TH08-3) clay fill was encountered from ground surface to a depth of 0.8 m, probably due to construction of roadway or other nearby activities.

3.3.2 Lacustrine Clay

The clay layer extended to depths of about 1.0 m to 12.0 m below ground surface. Lacustrine clay thicknesses of 2.1 m to about 11.2 m were encountered in the test holes. At test hole locations near Blackmud Creek (TH-5 and TH-6) the clay layer was absent.

The clay was typically firm to stiff, silty, grey to brown and of medium to high plasiticity. Some silt and sand layers were observed in the clay. Moisture contents in the clay ranged from about 25% to 40%. Standard Penetration Test (SPT) blow counts in the clay ranged from 5 to 16 blows for 300 mm penetration.

3.3.3 Glacial Till

The glacial till layer typical thickness ranged from 1.4 m to 7.0 m. At test locations CTA-1 and TH08-3 the till was absent.

The glacial till typically consisted of clay till, generally stiff to hard, silty, sandy, grey and medium plastic. The clay till contained occasional sand layers and bedrock and coal fragments. Moisture contents in the clay till ranged from about 20% to 28%. Standard Penetration Test (SPT) blow counts in the clay till generally ranged from about 16 to 48 blows for 300 mm penetration, corresponding to a consistency of very stiff to hard. Till deposits often contain occasional cobbles and boulders, which are likely present within the till at this site.

3.3.4 Bedrock

Bedrock was encountered at depths ranging from 3.0 m (TH08-6) to 12.0 m (TH08-4) below ground surface in the test holes located along the alignment.

Apparently bedrock was closer to surface around Blackmud creek. At Whitemud creek, sandstone and clay shale sequences with 4 to 5 m thick covering overburden were exposed along outside bends of the river (Photo 8).

The bedrock generally consisted of clay shale and sandstone interbedded sequences. The clay shale was typically hard to very hard, light to dark brown, and bentonitic. The sandstone was typically dense to very dense, blue grey, medium to fine grained and sometimes clayey or bentonitic. The moisture content in the bedrock ranged from 17% to 23%. Standard Penetration Test (SPT) blow counts in the bedrock ranged from 42 to an equivalent of 93 blows for 300 mm penetration indicating a hard to very hard consistency.

3.4 Groundwater Conditions

The available geotechnical information indicated that typically the depth to groundwater ranged between 1.0 m to 2.0 m below surface with exception of CTA-1 (depth of 11.5 m from surface), which was probably located close to Whitemud Creek and was controlled by the creek level. A relatively shallow water table is also evidenced in the area by numerous irregularly shaped small bodies of surface water including ponds in the air photos.

TABLE 1
SUMMARY OF AVAILABLE GEOTECHNICAL INFORMATION

Borehole	Location	Stratigraphy Thickness [m]			Depth [m] to	
		Top Soil/Fill	Clay	Glacial Till	Ground Water	Bedrock
CTA-1	1 km N. 41 Ave SW	0.8	11.1	0.0	11.5	11.9
HE-1	500 m N. 41 Ave SW	0.9	2.8	2.0	4.5	5.8
TH 08-1	1.5 km N. 41 Ave SW	0.7	11.2	1.4	2.0	13.3
TH 08-2	1.5 km N. 41 Ave SW	0.5	4.8	5.2	5.9	10.5
TH 08-3	along 41 Ave	0.8	8.2	0.0	1.2	9.0
TH 08-4	along 41 Ave	0.7	4.3	7.0	1.3	12.0
TH 08-5	along 41 Ave	0.8	0.0	3.3	1.3	4.1
TH 08-6	along 41 Ave	0.6	0.0	2.4	1.1	3.0
EBA-1	along 41 Ave	0.0	2.1	3.5	1.0	5.6
	min	0.0	0.0	0.0	1.0	3.0
	max	0.8	8.2	7.0	1.3	12.0
	average	0.6	2.9	3.2	1.2	6.7

4. POTENTIAL GEOTECHNICAL CONSTRAINTS

The study area generally appears favourable for the proposed roadway alignment from a geotechnical point of view. Most of the topography along the alignment is relatively flat or gently dipping, hence no major cuts or fills are anticipated except at the Whitemud Creek crossing.

The Whitemud creek crossing is expected to impose some constraints since the valley is relatively deep and extensive. The existing crossing consists of a 4 m wide arch concrete culvert. The widening could use a similar culvert or a bridge could be considered. The bridge can be supported on steel piles driven to bedrock (abutments) or drilled piles socketed in bedrock (piers). The bedrock is likely shallow at the site, based on the bedrock exposure observed in riverbanks during the site reconnaissance.

Widening to the north will require an extensive cut on the east side of the riverbank and fill on the west side as well as armouring of the east bank of the river to protect the east headslope, if a bridge is adopted. Widening to the south might provide a better cut/fill balance with approach fills on both sides of the river.

Other main features to be considered are some low-lying wet and/or marshy areas near Cawes Lake. These areas are expected to have some muskeg soils and possibly organics, which will tend to settle over long periods of time under load. Test holes should be drilled to assess the thicknesses of the soft materials. If the soft soil layers are relatively thin they can be removed and replaced with imported common fill. If these soil layers are thick they may have to be padded over with geogrid with staged embankment fill construction. If soft/organic layers are present, they are probably thinner on the north side of 41 Avenue SW, which would be the preferable side to widen to.

Two ravines situated immediately west of 184 Street were noted as potential geotechnical concerns. These ravines feed directly into the east slope of the North Saskatchewan River valley, which generally has steep slopes. Improvements to 184 Street SW could require extensions or upgrades to the culvert crossings in the ravines. The current ditches along 184 Street at these locations are overly steep and have experienced some erosion. 184 Street is far enough away from the North Saskatchewan River valley that there should not be any significant concerns regarding valley stability. However, care should be taken to avoid concentrating extra drainage into the ravines, which could lead to erosion of the river valley slopes.

Based on the available boreholes, surficial soils along the alignment appear to consist of mainly medium to high plastic clay and clay till, which are generally

suitable for grading. Due to a relatively high groundwater table, deep cuts should be avoided but since the ground is gently sloping it does not appear that they will be required, except near the crest of the Whitemud Creek valley, where the water table is likely lower.

5. CLOSURE

We trust that the above preliminary geotechnical input is sufficient for your present needs. Additional input can be provided, if required, once more details of the selected arterial route are known. In the meantime if you have any questions, please contact us at your convenience.

Yours very truly,
Thurber Engineering Ltd.
D. W. Proudfoot, P.Eng.
Review Principal

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
Signature
Date March 7, 2008
PERMIT NUMBER: P 5186
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

Evandro D. Gimenes, P.Eng.
Senior Geotechnical Engineer
/dw

Enclosures

REFERENCES

1. Kathol, C.P. and R.A. McPherson (1975): “Urban Geology of Edmonton”, Alberta Research Council Bulletin 32.

2. Thurber Consultants Ltd. (1999): “East Heritage Valley Area Master Plan”, submitted to Cochrane Engineering Ltd.

3. Thurber Consultants Ltd. (1999): “Ellerslie Area Master Plan”, submitted to Stantec Consulting Ltd.

4. Thurber Consultants Ltd. (1998): “Proposed Ellerslie Freshwater Lake 91 Street and Ellerslie Road”, submitted to Stantec Consulting Ltd.

5. Hoggan Engineering & Testing Ltd. (2006): “Preliminary Geotechnical Investigation - Proposed Heritage Valley Neighborhood 8 – 30 Avenue & 111 Street”, submitted to Heritage Valley Developments Ltd.

6. CT & Associates Engineering Inc. (2007): “Slope Stability Evaluation & Set-back Distance Determination”, submitted to Delcon Development Group.

Maps

1. Hydrogeological Map, Edmonton Area (Southwest Segment) Alberta, NTS 83H-S.W. (part), dated 1973.

2. Bayrock, L.A. “Surficial Geology of Edmonton”, NTS Alberta Research Council Map, 1972.

3. Atlas: Coal Mine Workings of the Edmonton Area, Taylor, R.S., 1971.

THURBER ENGINEERING LTD.

STATEMENT OF GENERAL CONDITIONS

1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document, subject to the limitations provided herein, are only valid to the extent that this Report expressly addresses proposed development, design objectives and purposes, and then only to the extent there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation or to consider such representations, information and instructions.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS WE MAY EXPRESSLY APPROVE. The contents of the Report remain our copyright property. The Client may not give, lend or, sell the Report, or otherwise make the Report, or any portion thereof, available to any person without our prior written permission. Any use which a third party makes of the Report, are the sole responsibility of such third parties. Unless expressly permitted by us, no person other than the Client is entitled to rely on this Report. We accept no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without our express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and this report is delivered on the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by us. We are entitled to rely on such representations, information and instructions and are not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

(see over . . . .)

INTERPRETATION OF THE REPORT *(continued . . . .)*

c) Design Services: The Report may form part of the design and construction documents for information purposes even though it may have been issued prior to the final design being completed. We should be retained to review the final design, project plans and documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the report recommendations and the final design detailed in the contract documents should be reported to us immediately so that we can address potential conflicts.

d) Construction Services: During construction we must be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RISK LIMITATION

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause an accidental release of those substances. In consideration of the provision of the services by us, which are for the Client's benefit, the Client agrees to hold harmless and to indemnify and defend us and our directors, officers, servants, agents, employees, workmen and contractors (hereinafter referred to as the "Company") from and against any and all claims, losses, damages, demands, disputes, liability and legal investigative costs of defence, whether for personal injury including death, or any other loss whatsoever, regardless of any action or omission on the part of the Company, that result from an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project. This indemnification shall extend to all Claims brought or threatened against the Company under any federal or provincial statute as a result of conducting work on this Project. In addition to the above indemnification, the Client further agrees not to bring any claims against the Company in connection with any of the aforementioned causes.

7. SERVICES OF SUBCONSULTANTS AND CONTRACTORS

The conduct of engineering and environmental studies frequently requires hiring the services of individuals and companies with special expertise and/or services which we do not provide. We may arrange the hiring of these services as a convenience to our Clients. As these services are for the Client's benefit, the Client agrees to hold the Company harmless and to indemnify and defend us from and against all claims arising through such hirings to the extent that the Client would incur had he hired those services directly. This includes responsibility for payment for services rendered and pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. In particular, these conditions apply to the use of drilling, excavation and laboratory testing services.

8. CONTROL OF WORK AND JOBSITE SAFETY

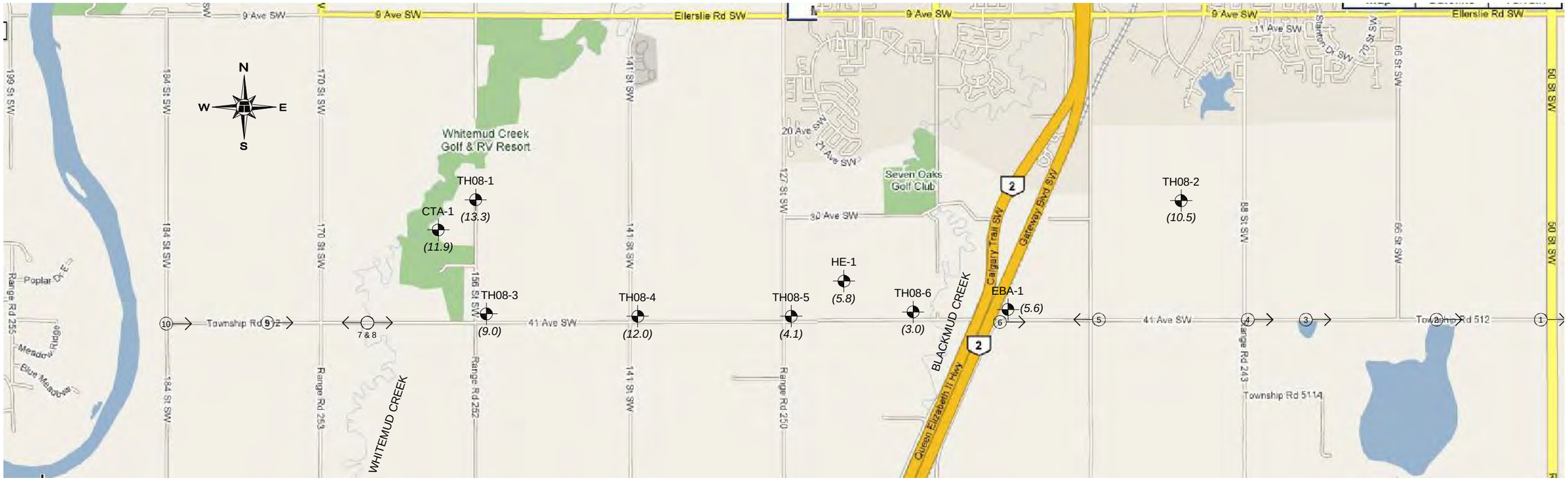
We are responsible only for the activities of our employees on the jobsite. The presence of our personnel on the site shall not be construed in any way to relieve the Client or any contractors on site from their responsibilities for site safety. The Client acknowledges that he, his representatives, contractors or others retain control of the site and that we never occupy a position of control of the site. The Client undertakes to inform us of all hazardous conditions, or other relevant conditions of which the Client is aware. The Client also recognizes that our activities may uncover previously unknown hazardous conditions or materials and that such a discovery may result in the necessity to undertake emergency procedures to protect our employees as well as the public at large and the environment in general. These procedures may well involve additional costs outside of any budgets previously agreed to. The Client agrees to pay us for any expenses incurred as the result of such discoveries and to compensate us through payment of additional fees and expenses for time spent by us to deal with the consequences of such discoveries. The Client also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the Client agrees that notification to such bodies by us will not be a cause of action or dispute.

9. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on our interpretation of conditions revealed through limited investigation conducted within a defined scope of services. We cannot accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

APPENDIX A

Figures



LEGEND

TH08-3
APPROXIMATE TEST HOLE LOCATIONS

(9.0)
DEPTH TO BEDROCK IN METERS

NUMBER AND DIRECTION OF PHOTO

THURBER PROJECT #17-123-499

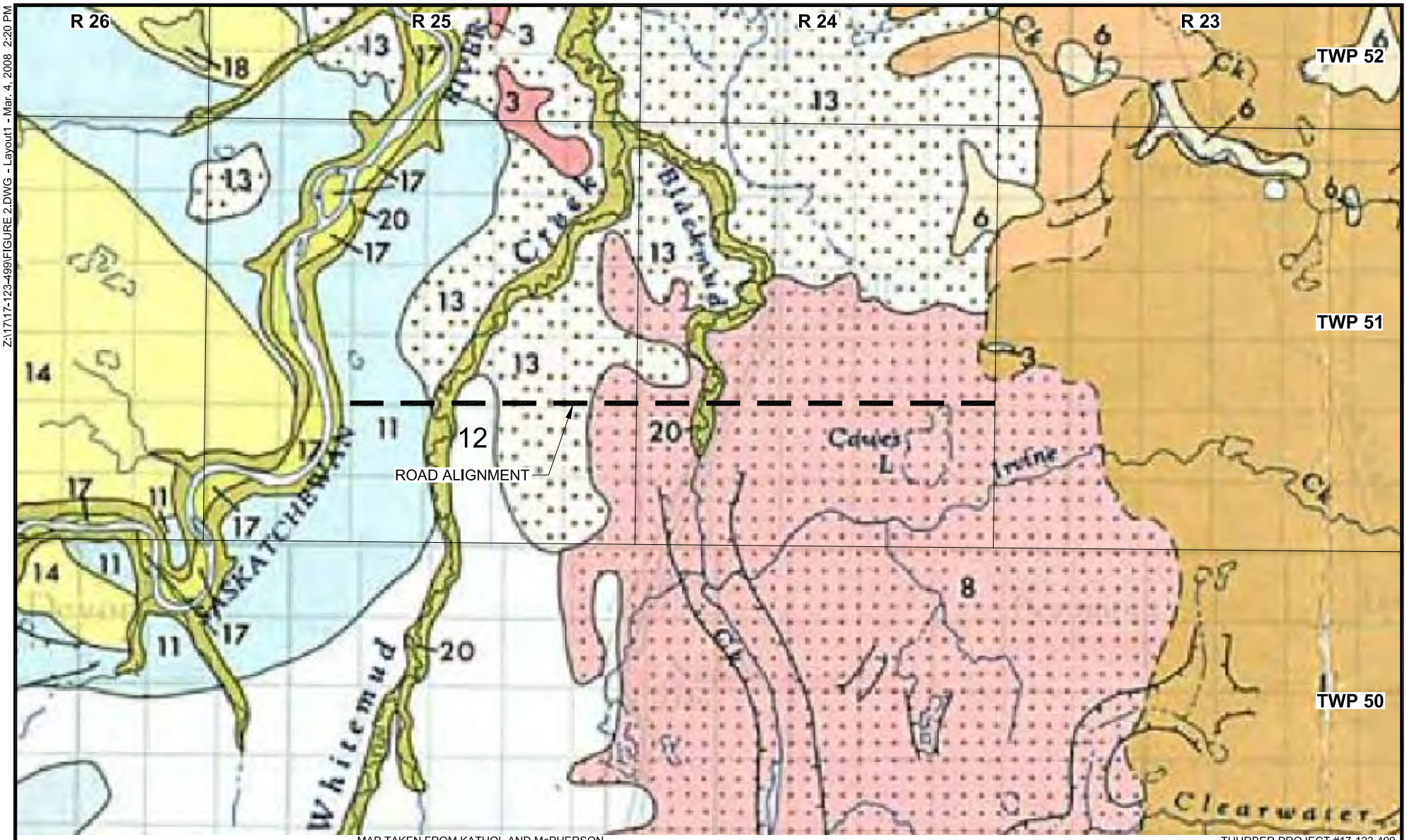
ASSOCIATED ENGINEERING ALBERTA LTD.

SITE PLAN SHOWING
APPROXIMATE TEST HOLE LOCATIONS

41 AVENUE SW - 50 STREET TO 184 STREET
FUNCTIONAL PLANNING STUDY
EDMONTON, AB

THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

ENGINEER :	DRAWN :	APPROVED :
EDG	HH	DWP
DATE :	SCALE :	DRAWING No.
FEBRUARY 2008	NOT TO SCALE	**FIGURE 1**



MAP TAKEN FROM KATHOL AND McPHERSON

THURBER PROJECT #17-123-499

LEGEND

EROSIONAL FEATURE
20 - CREEK VALLEY, THIN ALLUVIUM

GLACIOLACUSTRINE DEPOSITS
11 - SAND, SILTY SAND
12 - SILT, SAND AND CLAY
13 - SILT AND CLAY WITH MINOR SAND

GLACIOFLUVIAL DEPOSITS
8 - SAND, GRAVELLY LENSES OVERLYING LACUSTRINE DEPOSITS, TILL AND BEDROCK

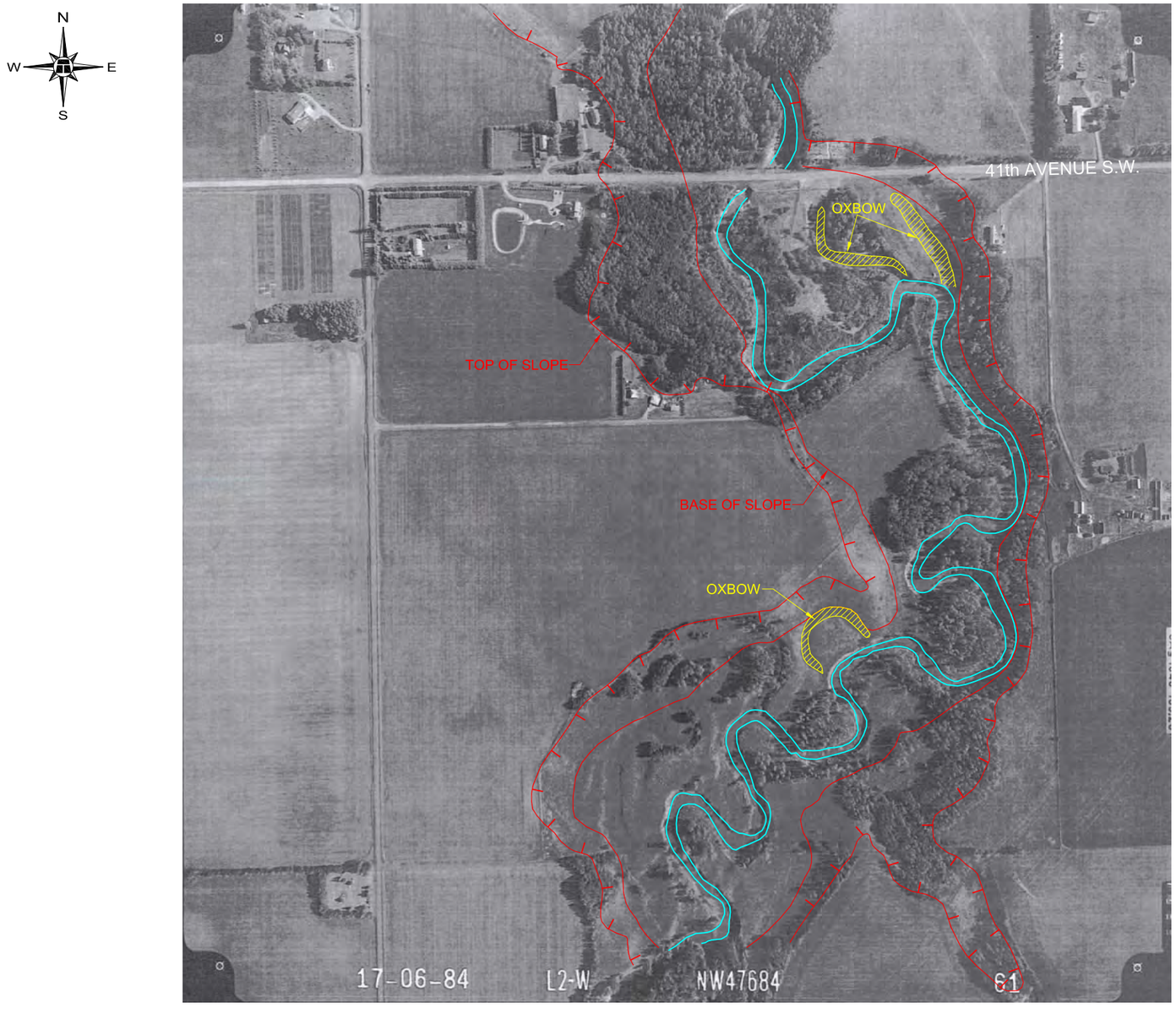
ASSOCIATED ENGINEERING ALBERTA LTD.

SURFACE GEOLOGY OF THE PROJECT AREA (AFTER BAYROCK, L.A. 1972)

41 AVENUE SW - 50 STREET TO 184 STREET
FUNCTIONAL PLANNING STUDY
EDMONTON, AB

THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

ENGINEER :	DRAWN :	APPROVED :
EDG	HH	DWP
DATE :	SCALE :	DRAWING No.
FEBRUARY 2008	NOT TO SCALE	**FIGURE 2**



0 50 100 150 200 300 m

SCALE 1 : 6 000

THURBER PROJECT #17-123-499

ASSOCIATED ENGINEERING ALBERTA LTD.

AIR PHOTO INTERPRETATION OF
WHITEMUD CREEK AREA

41 AVENUE SW - 50 STREET TO 184 STREET
FUNCTIONAL PLANNING STUDY

EDMONTON, AB

THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

ENGINEER :	DRAWN :	APPROVED :
EDG	HH	DWP
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MARCH 2008	1:6,000	**FIGURE 3**

APPENDIX B

Available Borehole Logs

SYMBOLS AND TERMS USED ON TEST HOLE LOGS

1. VISUAL TEXTURAL CLASSIFICATION OF MINERAL SOILS

CLASSIFICATION	APPARENT PARTICLE SIZE
Boulders	Greater than 200 mm
Cobbles	75 mm to 200 mm
Gravel	5 mm to 75 mm
Sand	Not visible to 5 mm
Silt	Non-Plastic particles, not visible to the naked eye
Clay	Plastic particles, not visible to the naked eye

2. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	APPROXIMATE UNDRAINED SHEAR STRENGTH	
Very Soft	Less than 10 kPa	
Soft	10 - 25 kPa	
Firm	25 - 50 kPa	
Stiff	50 - 100 kPa	
Very Stiff	100 - 200 kPa	} Modified from
Hard	200 - 300 kPa	} National Building
Very Hard	Greater than 300 kPa	} Code

3. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	STANDARD PENETRATION TEST (SPT) (Number of Blows per 300 mm)	
Very Loose	0 - 4	
Loose	4 - 10	
Compact	10 - 30	Modified from
Dense	30 - 50	} National Building
Very Dense	Over 50	} Code

4. LEGEND FOR TEST HOLE LOGS

SYMBOL FOR SAMPLE TYPE


Shelby Tube


SPT


No Recovery


A-Casing


Grab


Core

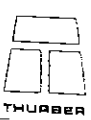

MC - Moisture Content (% by weight) as determined by sample.


Water Level

CPen - Shear Strength determined by pocket penetrometer

CVane - Shear Strength determined by pocket vane.

Cu - Undrained Shear Strength determined by unconfined compression test.

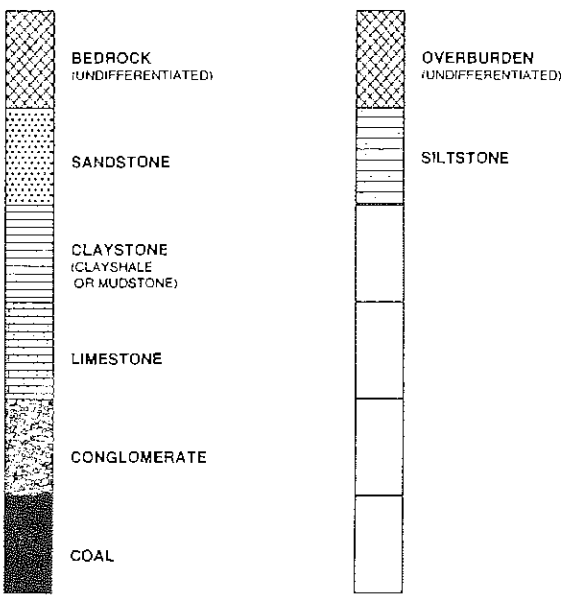


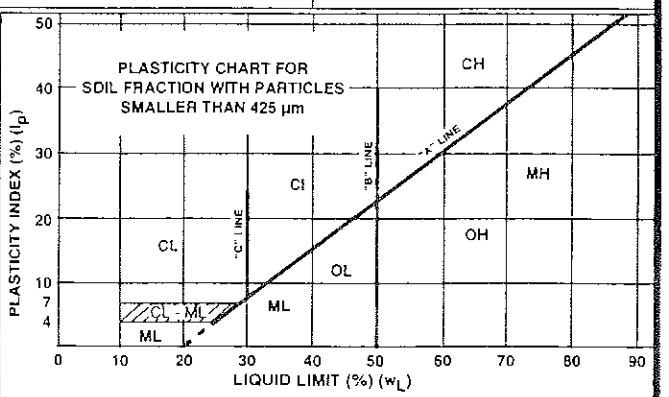
MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

(MODIFIED BY PFRA, 1985)

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

SPECIAL SYMBOLS





THURBER

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

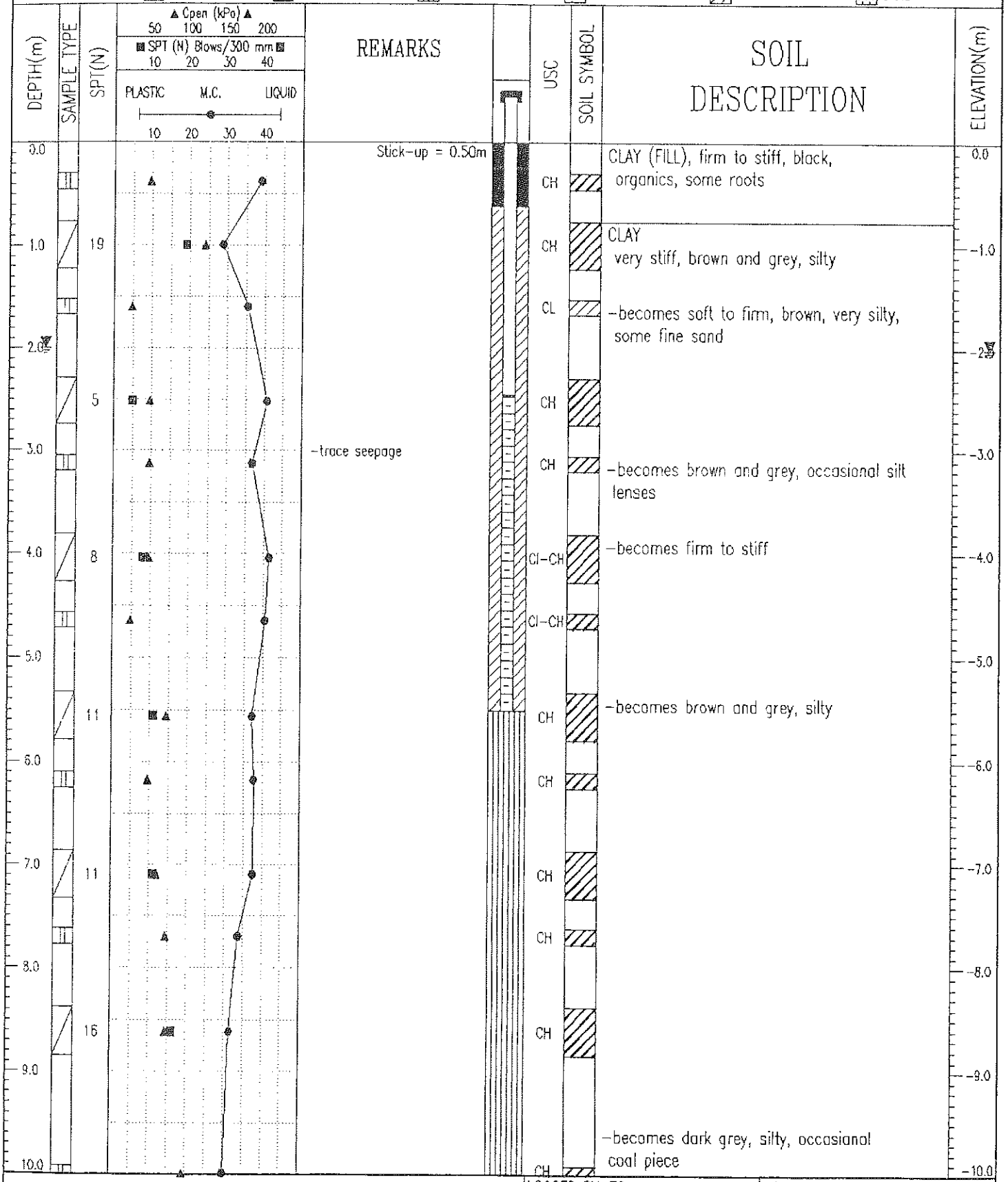
(MODIFIED BY PFRA, 1985)

TH98-1

CLIENT: COCHRANE ENGINEERING LTD.	PROJECT: EAST HERITAGE VALLEY	HOLE NO: TH98-1
DRILLING CO.: CDN GEOLOGICAL DRILLING	DATE DRILLED: APRIL 28, 1998	PROJECT NO: 19-2290-2
DRILL/METHOD: B61 / SOLID STEM AUGER	LOCATION: SEE DRAWING #19-2290-2-1	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | SPT | NO RECOVERY | A-CASING | GRAB SAMPLE | CORE SAMPLE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



Thurber Engineering Ltd.
Edmonton, Alberta.

LOGGED BY: TC	COMPLETION DEPTH: 14.6 m
REVIEWED BY: DJL	COMPLETE: 98/04/28
Fig. No:	Page 1 of 2

98/06/26 04:18PM (THURPIEZ)

TH08-1 (CONT'D)

CLIENT: COCHRANE ENGINEERING LTD.	PROJECT: EAST HERITAGE VALLEY	HOLE NO: TH98-1
DRILLING CO.: CDN GEOLOGICAL DRILLING	DATE DRILLED: APRIL 28, 1998	PROJECT NO: 19-2290-2
DRILL/METHOD: B61 / SOLID STEM AUGER	LOCATION: SEE DRAWING #19-2290-2-1	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | SPT | NO RECOVERY | A-CASING | GRAB SAMPLE | CORE SAMPLE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

DEPTH(m)	SAMPLE TYPE	SPT(N)	▲ Cpen (kPa) ▲ 50 100 150 200 / ■ SPT (N) Blows/300 mm ■ 10 20 30 40 / PLASTIC M.C. LIQUID 10 20 30 40	REMARKS	SLOTTED PIEZOMETER	USC	SOIL SYMBOL	SOIL DESCRIPTION	ELEVATION(m)
10.0						CH		CLAY – continued	10.0
11.0									11.0
		16				CH			
12.0								CLAY (TILL) dark grey, silty, sandy, occasional coal piece	12.0
13.0				–trace seepage		CI			13.0
								CLAY SHALE (BEDROCK) very hard, light greenish-grey, weathered	
14.0						CS			14.0
		120		■ Equivalent N = 120		CS			
15.0								END OF TEST HOLE AT 14.6m ON COMPLETION: WATER AT 5.0m SLOUGH AT 5.3m STANDPIPE PIEZOMETER INSTALLED Water Level From Ground Surface: April 29/98 at 2.0m May 1/98 at 1.9m May 20/98 at 2.0m	15.0
16.0									16.0
17.0									17.0
18.0									18.0
19.0									19.0
20.0									20.0

Thurber Engineering Ltd.
Edmonton, Alberta.

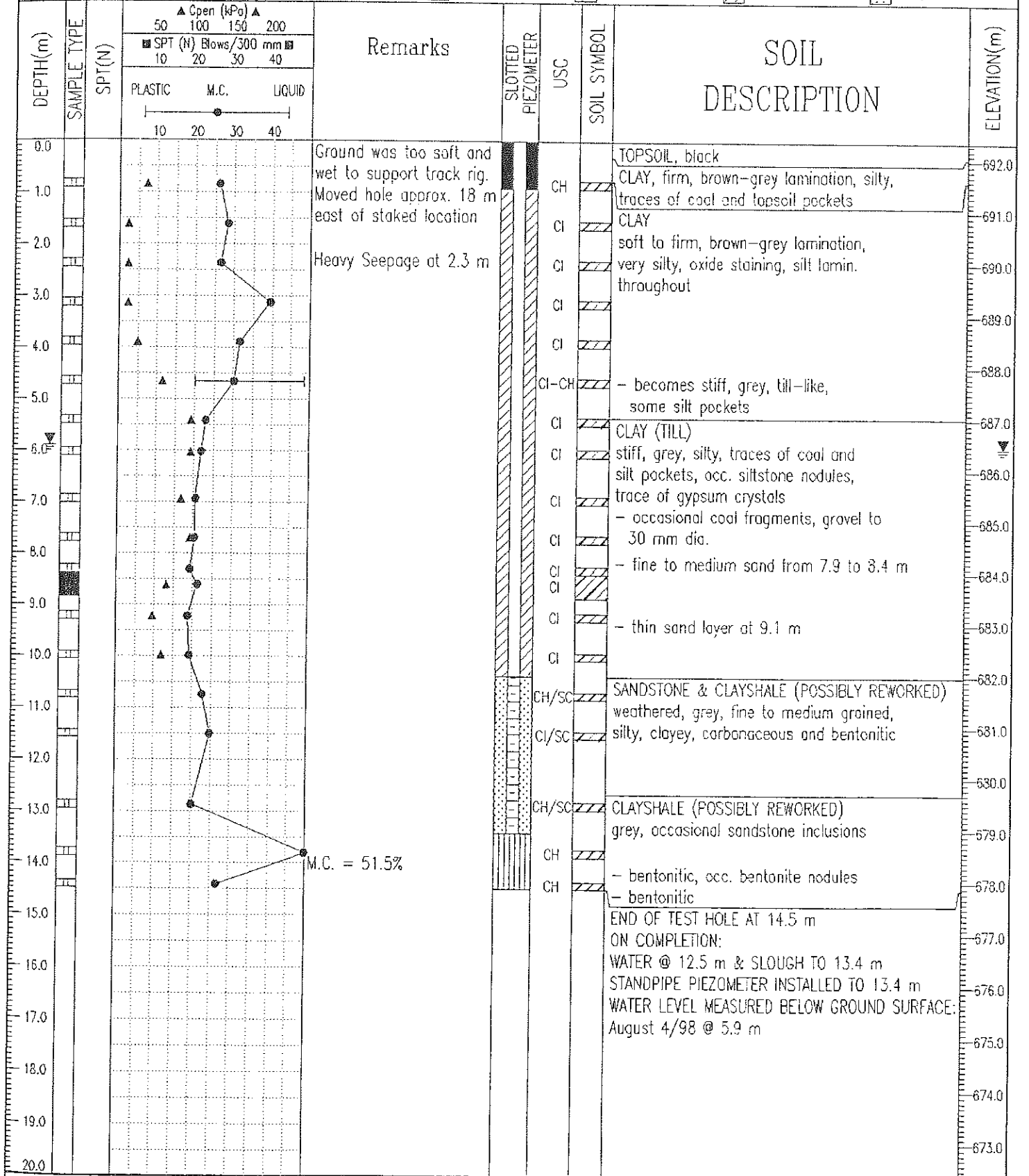
LOGGED BY: TC	COMPLETION DEPTH: 14.6 m
REVIEWED BY: DJL	COMPLETE: 98/04/28
Fig. No:	Page 2 of 2

98/06/28 04:20PM (THURPIEZ)

CLIENT: STANLEY CONSULTING GROUP LTD.	PROJECT: ELLERSLIE FRESHWATER LAKE	TH08-2
DRILLING CO: MOBILE AUGERS & RESEARCH	DATE DRILLED: JULY 25, 1998	PROJECT NO: 17-308-240
RIG/METHOD: TRACK/SOLID STEM AUGERS	LOCATION: 5921692.836N, 35033.632E	ELEVATION: 692.342 (m)

SAMPLE TYPE: Shelby Tube; SPT; No Recovery; A-CASING; Grab Sample; Core Sample

BACKFILL TYPE: BENTONITE; PEA GRAVEL; SLOUGH; GROUT; DRILL CUTTINGS; SAND



Thurber Engineering Ltd. Edmonton, Alberta.	LOGGED BY: LWB
	REVIEWED BY: LWB
	Fig. No:
COMPLETION DEPTH: 14.5 m	
COMPLETE: 25/07/98	
Page 1 of 1	

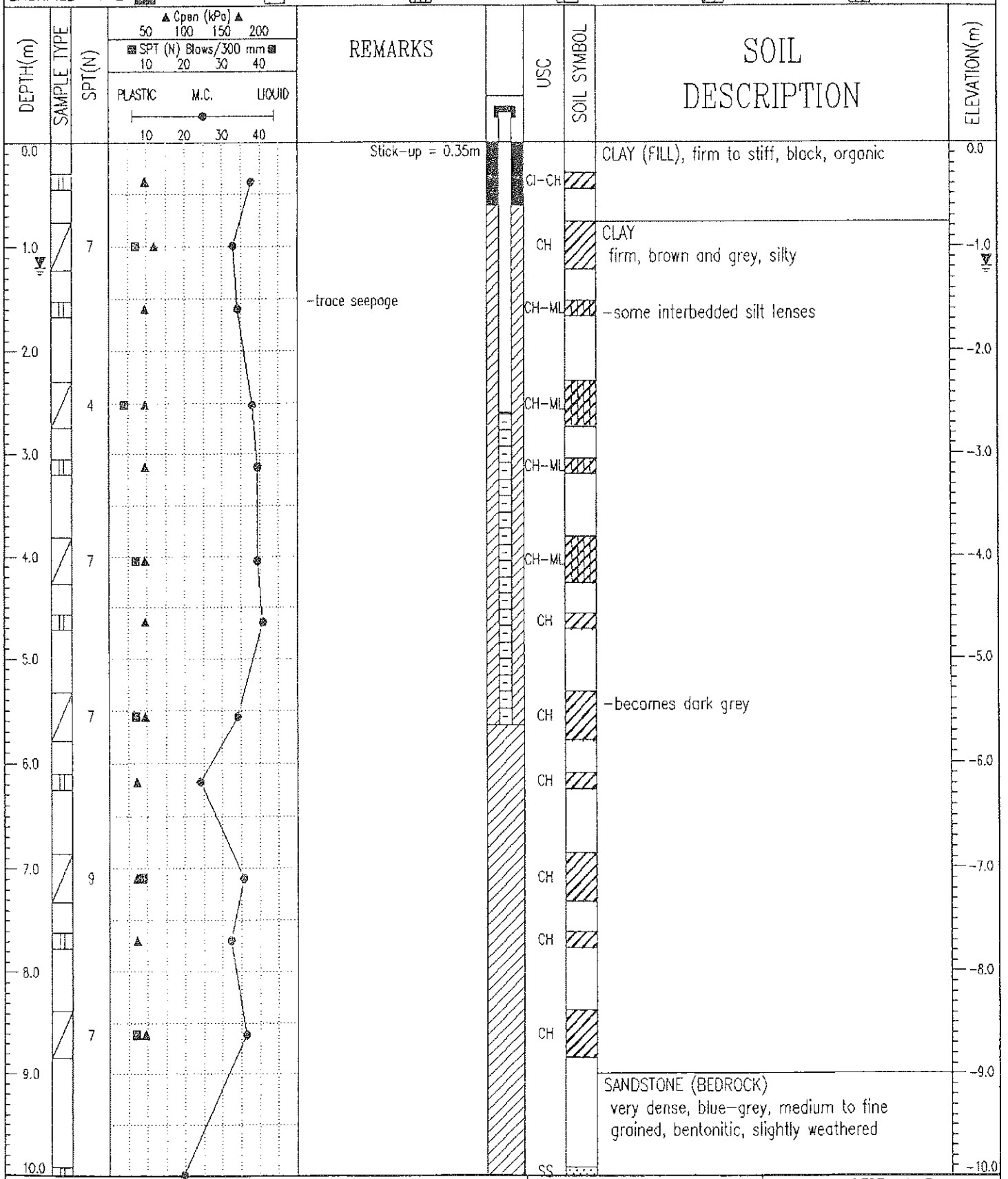
98/08/31 05:26PM (THURBERP)

TH 08-3

CLIENT: COCHRANE ENGINEERING LTD.	PROJECT: EAST HERITAGE VALLEY	HOLE NO: TH98-2
DRILLING CO.: CDN GEOLOGICAL DRILLING	DATE DRILLED: APRIL 28, 1998	PROJECT NO: 19-2290-2
DRILL/METHOD: B61 / SOLID STEM AUGER	LOCATION: SEE DRAWING #19-2290-2-1	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | SPT | NO RECOVERY | A-CASING | GRAB SAMPLE | CORE SAMPLE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



Thurber Engineering Ltd.
Edmonton, Alberta.

LOGGED BY: TC	COMPLETION DEPTH: 11.7 m
REVIEWED BY: DJL	COMPLETE: 98/04/28
Fig. No:	Page 1 of 2

98/04/26 04:35PM (THURPIEZ)

TH98-3 (CONT'D)

CLIENT: COCHRANE ENGINEERING LTD.	PROJECT: EAST HERITAGE VALLEY	HOLE NO: TH98-2
DRILLING CO.: CDN GEOLOGICAL DRILLING	DATE DRILLED: APRIL 28, 1998	PROJECT NO: 19-2290-2
DRILL/METHOD: B61 / SOLID STEM AUGER	LOCATION: SEE DRAWING #19-2290-2-1	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | SPT | NO RECOVERY | A-CASING | GRAB SAMPLE | CORE SAMPLE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

DEPTH(m)	SAMPLE TYPE	SPT(N)	▲ Cpen (kPa) ▲ 50 100 150 200 / ■ SPT (N) Blows/300 mm ■ 10 20 30 40 / PLASTIC M.C. LIQUID 10 20 30 40	REMARKS	SLOTTED PIEZOMETER	USC	SOIL SYMBOL	SOIL DESCRIPTION	ELEVATION(m)
10.0						SS		SANDSTONE – continued	-10.0
11.0									-11.0
		120		Equivalent N = 120		SS			
12.0								END OF TEST HOLE AT 11.7m ON COMPLETION: WATER AT 4.0m SLOUGH AT 10.1m STANDPIPE PIEZOMETER INSTALLED Water Level From Ground Surface: April 29/98 at 0.8m May 1/98 at 0.8m May 20/98 at 1.2m	-12.0
13.0									-13.0
14.0									-14.0
15.0									-15.0
16.0									-16.0
17.0									-17.0
18.0									-18.0
19.0									-19.0
20.0									-20.0

Thurber Engineering Ltd.
Edmonton, Alberta.

LOGGED BY: TC	COMPLETION DEPTH: 11.7 m
REVIEWED BY: DJL	COMPLETE: 98/04/28
Fig. No:	Page 2 of 2

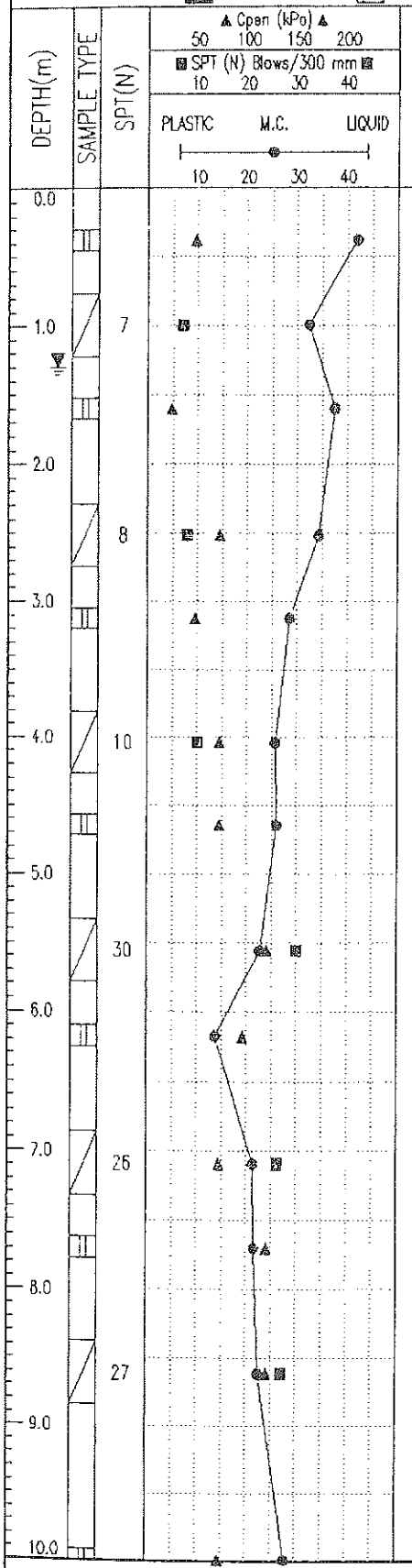
98/06/26 04:37PM (THURPEZ)

TH98-4

CLIENT: COCHRANE ENGINEERING LTD.	PROJECT: EAST HERITAGE VALLEY	HOLE NO: TH98-3
DRILLING CO.: CDN GEOLOGICAL DRILLING	DATE DRILLED: APRIL 28, 1998	PROJECT NO: 19-2290-2
DRILL/METHOD: B61 / SOLID STEM AUGER	LOCATION: SEE DRAWING #19-2290-2-1	ELEVATION:

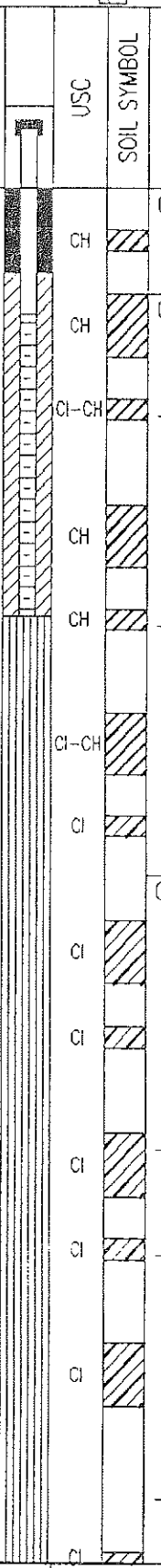
SAMPLE TYPE: SHELBY TUBE | SPT | NO RECOVERY | A-CASING | GRAB SAMPLE | CORE SAMPLE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



REMARKS

Stick-up = 0.50m



SOIL DESCRIPTION

CLAY (FILL), firm to stiff, black, organic

CLAY
firm to stiff, brown and grey, silty

-becomes very silty

-becomes brown, silty, iron oxides, occasional pebble

CLAY (TILL)
very stiff, brown, very silty, sandy, occasional pebble, iron oxides and coal chip

-becomes dark grey, silty

-becomes brown and grey

-becomes dark grey, occasional claystone inclusion

Thurber Engineering Ltd.
Edmonton, Alberta.

LOGGED BY: TC	COMPLETION DEPTH: 14.6 m
REVIEWED BY: DJL	COMPLETE: 98/04/28
Fig. No:	Page 1 of 2

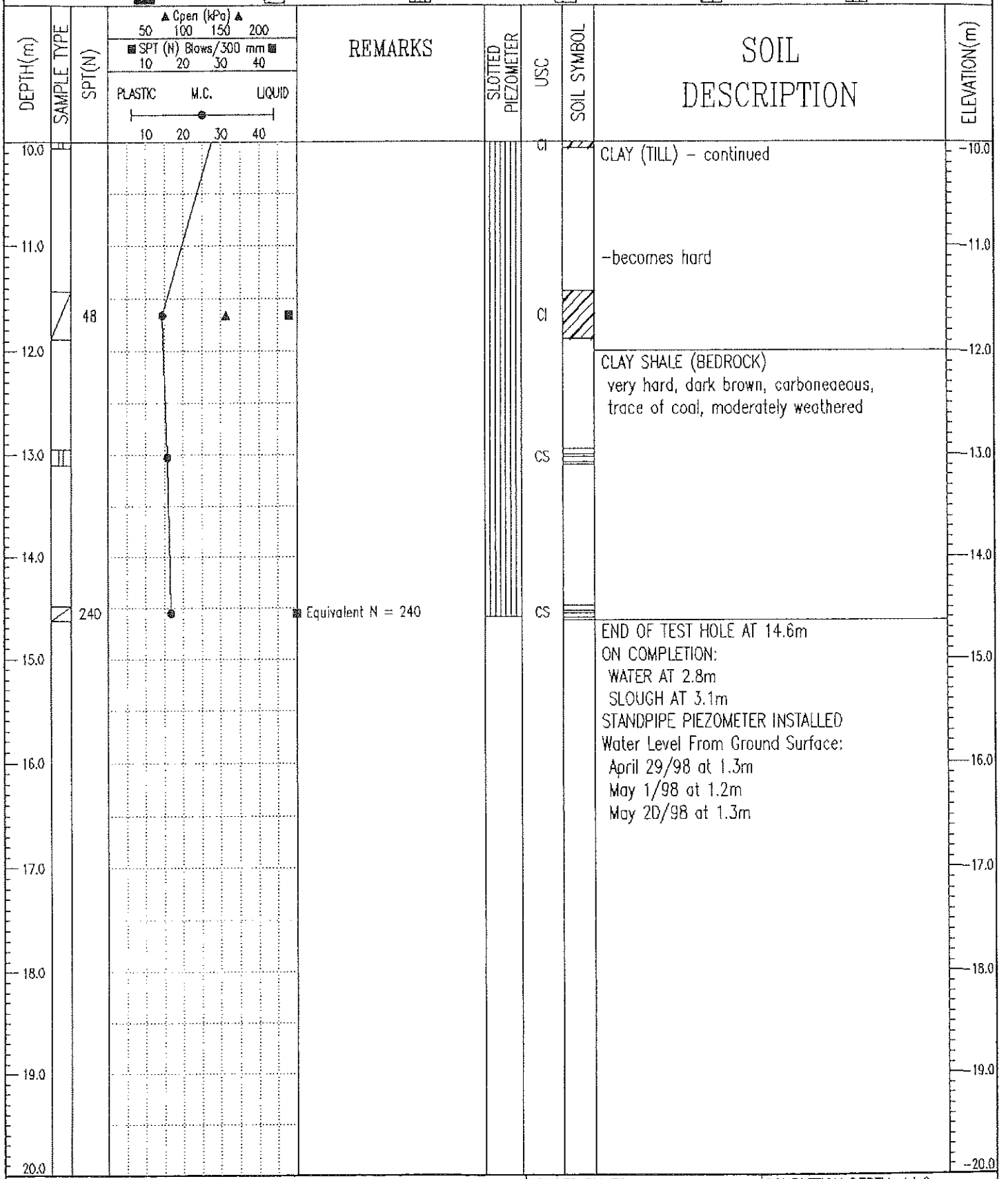
98/08/28 04:33PM (THURPEZ)

TH08-4 (CONT'D)

CLIENT: COCHRANE ENGINEERING LTD.	PROJECT: EAST HERITAGE VALLEY	HOLE NO: TH98-3
DRILLING CO.: CDN GEOLOGICAL DRILLING	DATE DRILLED: APRIL 28, 1998	PROJECT NO: 19-2290-2
DRILL/METHOD: B61 / SOLID STEM AUGER	LOCATION: SEE DRAWING #19-2290-2-1	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | SPT | NO RECOVERY | A-CASING | GRAB SAMPLE | CORE SAMPLE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



Thurber Engineering Ltd. Edmonton, Alberta.	LOGGED BY: TC	COMPLETION DEPTH: 14.6 m
	REVIEWED BY: DJL	COMPLETE: 98/04/28
	Fig. No:	Page 2 of 2

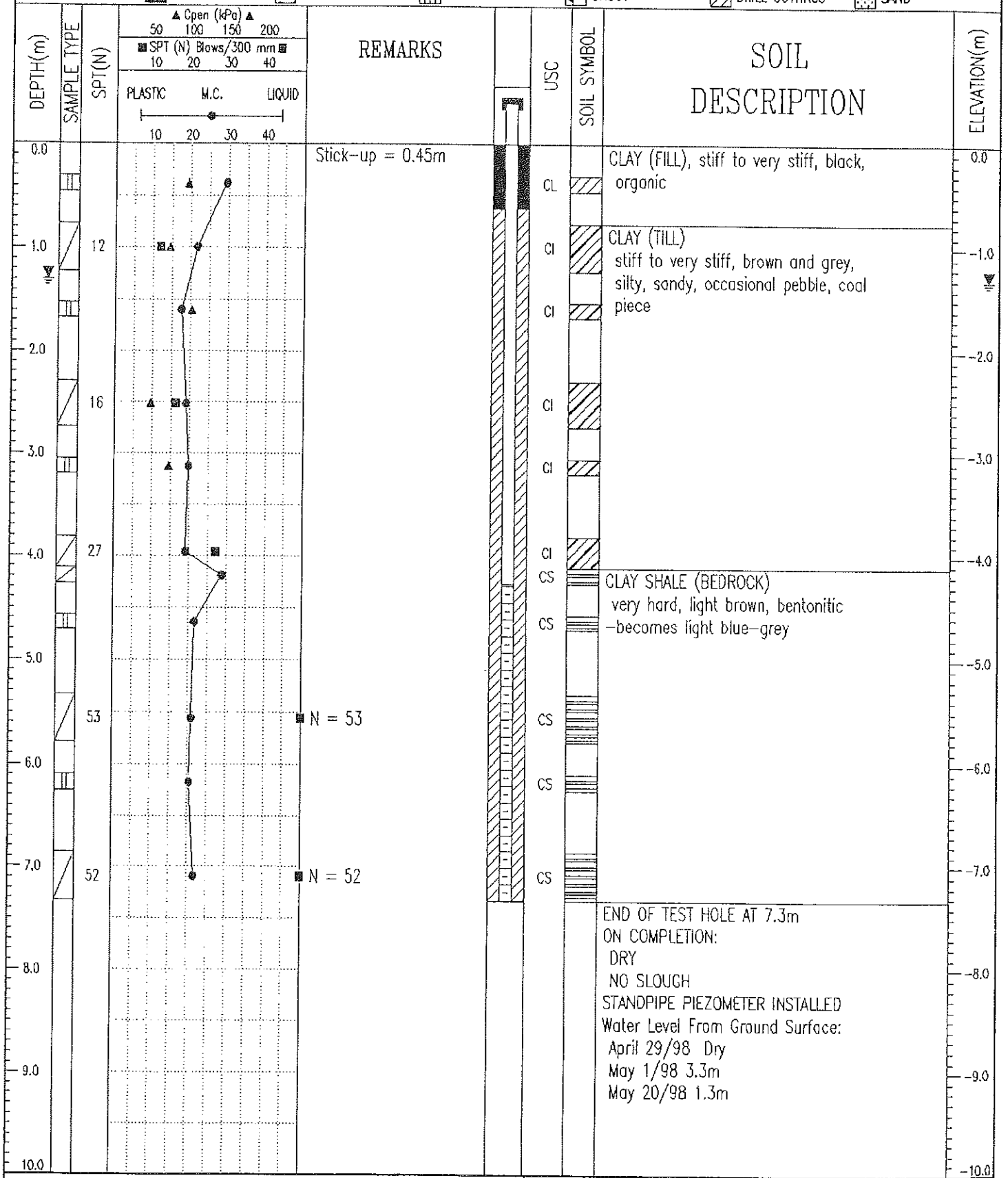
98/08/28 04:40PM (THURPREZ)

TH08 - 5

CLIENT: COCHRANE ENGINEERING LTD.	PROJECT: EAST HERITAGE VALLEY	HOLE NO: TH98-8
DRILLING CO.: CDN GEOLOGICAL DRILLING	DATE DRILLED: APRIL 28, 1998	PROJECT NO: 19-2290-2
DRILL/METHOD: 861 / SOLID STEM AUGER	LOCATION: SEE DRAWING #19-2290-2-1	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | SPT | NO RECOVERY | A-CASING | GRAB SAMPLE | CORE SAMPLE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



Thurber Engineering Ltd. Edmonton, Alberta.	LOGGED BY: TC	COMPLETION DEPTH: 7.3 m
	REVIEWED BY: DJL	COMPLETE: 98/04/28
	Fig. No:	Page 1 of 1

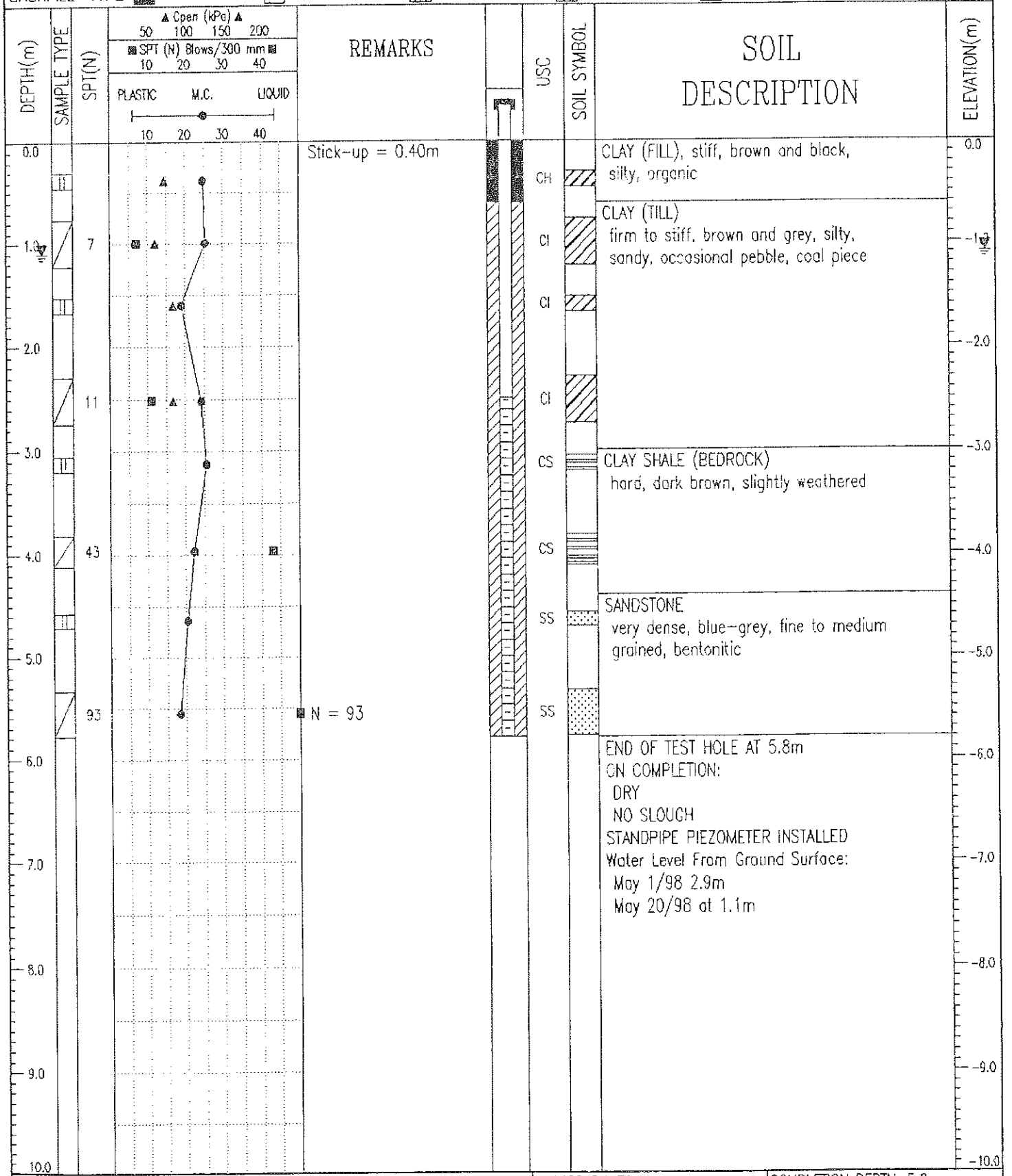
98/07/03 02:05PM (THURPIEZ)

TH98 - 6

CLIENT: COCHRANE ENGINEERING LTD.	PROJECT: EAST HERITAGE VALLEY	HOLE NO: TH98-9
DRILLING CO.: CDN GEOLOGICAL DRILLING	DATE DRILLED: APRIL 30, 1998	PROJECT NO: 19-2290-2
DRILL/METHOD: B61 / SOLID STEM AUGER	LOCATION: SEE DRAWING #19-2290-2-1	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | SPT | NO RECOVERY | A-CASING | GRAB SAMPLE | CORE SAMPLE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



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Edmonton, Alberta.

LOGGED BY: TC	COMPLETION DEPTH: 5.8 m
REVIEWED BY: DJL	COMPLETE: 98/04/30
Fig. No:	Page 1 of 1

98/08/26 05:37PM (THURPLEZ)

EBA-1

PROJECT: SERTS - STAGE 5 (SOUTH)	HOLE NO.: 10 PROJECT NO.: 102-3854
LOCATION: SW¼ Sec. 17 - Twp. 51 - Rge. 24 - W4M (adjacent to AGT repeater station on north side of road)	SURFACE ELEVATION: 695.31 metres (Geodetic)
	DRILL: Mobile B61 Solid Flight Auger

SAMPLE TYPE: THIN WALLED TUBE; SPLIT SPOON; DISTURBED; NO RECOVERY; CORE; OTHER

DEPTH (m.)	SOIL DESCRIPTION	STANDPIPE PIEZOMETER	SAMPLE	DEPTH (ft.)
0	CLAY - black, organic, moist, stiff			2
1	- olive brown, no organics, trace of grey, mottled, moist, stiff, high plasticity, trace of oxides and carbonates			4
	- trace of moist sand partings			6
2	SILT (TILL) - brown, clayey, very sandy, fine grained, compact, trace of oxides, coal and fine gravel			8
3	- clayey			10
				12
4	CLAY (TILL) - olive brown, silty, sandy, moist, stiff, medium to high plasticity, trace of coal and fine gravel particles			14
5	- dark brownish grey, some sand, silty			16
				18
	SANDSTONE - bluish grey, silty, clayey, bentonitic, fine grained, dense			
6	CLAY(SHALE) - dark grey, very stiff			20
	SANDSTONE - light bluish grey, silty, some clay, bentonitic, fine grained, very dense			22
7				24
8				26
				28
	- SPT not possible (4.5 m slough)			
9				30
				32
10	END OF BOREHOLE (9.9 m)			
11				36
				38
12				40

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) — LIQUID LIMIT (W_L)
20 40 60 80

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

33/08/05

UU

opp 5.0

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

DEPTH TO WATER: Dry at slough level upon completion
DEPTH TO SLOUGH: 4.9 m upon completion

COMPLETION DEPTH: 9.9 metres	DATE DRILLED: 1983 07 20
LOGGED BY: MAL	DRAWING NO.: 3854-A-12

This log is a compilation of subsurface conditions and soil or rock classification obtained from the field as well as from laboratory testing of samples from the borehole. Soil zones have been interpreted according to commonly accepted practice. The change from one zone to another, as indicated on the log, may be transitional and approximate in nature. Groundwater conditions refer only to those observed at the times and places indicated and they may vary with time, geologic conditions, and construction activity.

HE-1

PROJECT: Heritage Valley Neighborhood 8	PROJECT NO: 6004-13	BOREHOLE NO: 05-13
CLIENT: Stantec Consulting Ltd.	DRILL METHOD: Solid Stem Auger	ELEVATION: 696.057 m
OWNER: MLC and United	LOCATION: As per site plan	

SAMPLE TYPE: SHELBY TUBE | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE | NO RECOVERY

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	USC	SOIL DESCRIPTION	SPT (N)	OTHER DATA	Elevation (m)
0	OR	**TOPSOIL**: 250 mm thick			696
	SC	0.3 m **SAND**: clayey, damp, medium grained			
	CI	0.6 m **CLAY**: sandy, silty, medium plastic, very stiff, slightly moist, brown			
1		1.0 m **CLAY**: silty, sandy, medium plastic, moist, very stiff, brown, till-like	10		695
2				P.L. = 14.1 L.L. = 39.4 M.C. = 16.4	694
	CI	Below 2.4 m: very moist, stiff	13		
3					693
		3.8 m **CLAY TILL**: sandy, silty, medium plastic, moist, stiff to very stiff, grey			
4			15		692
	CI				
5		Below 5.0 m: bedrock mixed in			691
		5.8 m **SANDSTONE**: clayey, moist, hard, light grey	24		
6					690
7		Below 6.8 m: more clayey, high plastic			689
	SS		25-47 in 150	P.L. = 13.3 L.L. = 50.7 M.C. = 15.0	
8					688
			40 in 50		
9		**END OF TESTHOLE @ 8.5 m.** No water and no slough on completion of drilling.		WT Jan. 13/06 = 4.48 m BGS	687
10					

▲ POCKETPEN. (kPa) ▲ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

SLOTTED PIEZOMETER

JRP 6004-13.GPJ JRPV2_1.GDT 6/2/06

HOGGAN ENGINEERING & TESTING (1980) LTD.
An Affiliate of J.R. Paine & Associates Ltd.
17505 - 106 Avenue
Edmonton, AB T5S 1E7
Phone: (780) 489-0700
Fax: (780) 489-0800

LOGGED BY: R.Evans | COMPLETION DEPTH: 8.50 m

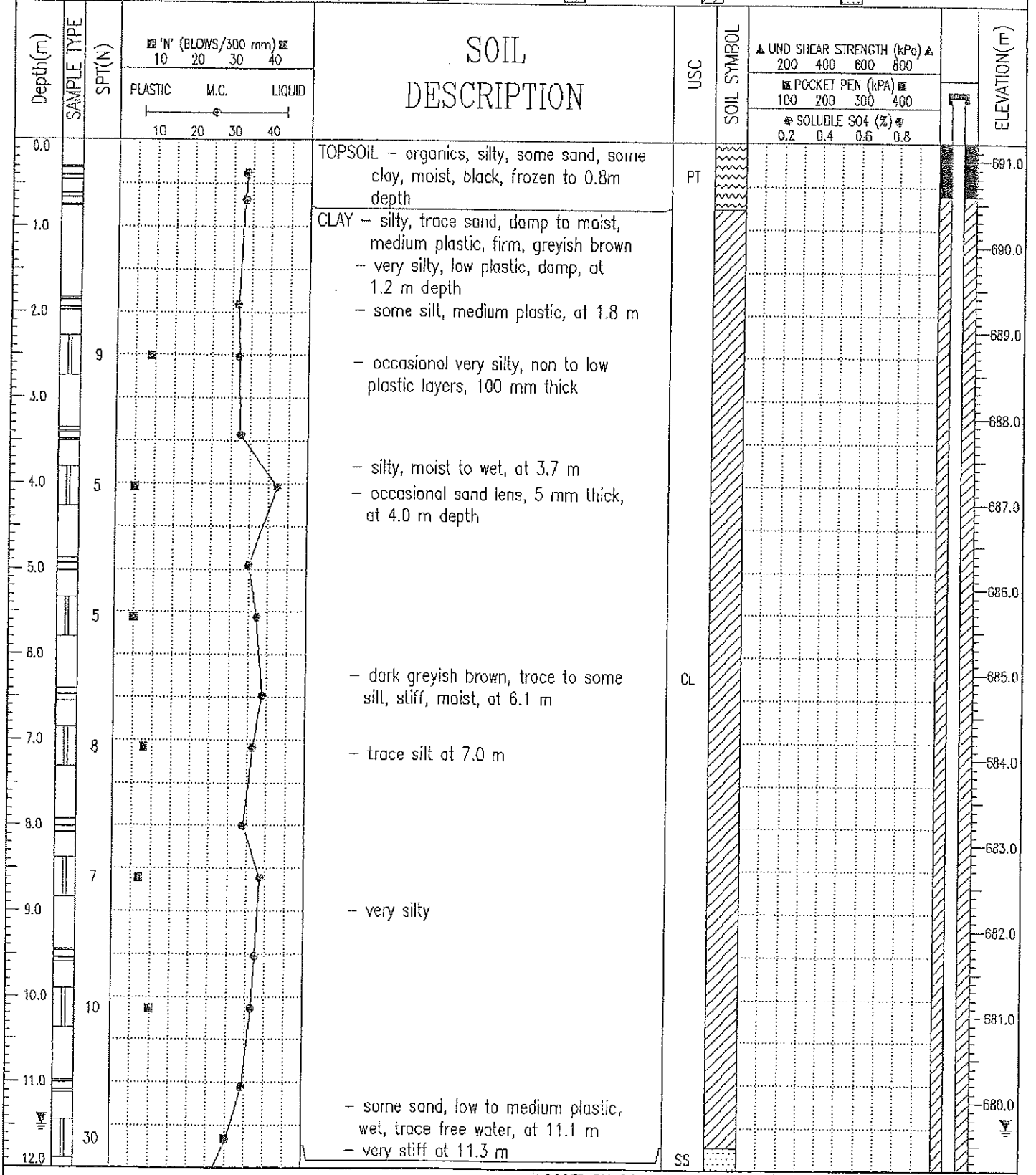
REVIEWED BY: | COMPLETION DATE: 24/11/06

CTA-1

GEOTECHNICAL EVALUATION	SHERRICK MANAGEMENT LIMITED	TEST HOLE NO: BH3-15
41 AVE SW AND 156 STR LANDS - SITE 3	B-61 TRACK-MOUNTED DRILL RIG	PROJECT NO: 02-596.02
EDMONTON, ALBERTA	SOLID STEM AUGER	ELEVATION: 691.2 m

SAMPLE TYPE: CORE | A CASING | NO RECOVERY | DISTURBED | SPT | SHELBY TUBE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



C.T. & Associates Engineering Inc.	LOGGED BY: DSN	COMPLETION DEPTH: 19 m
	REVIEWED BY: MJW	COMPLETE: 02/07/07
	Fig. No: B-15	Page 1 of 2

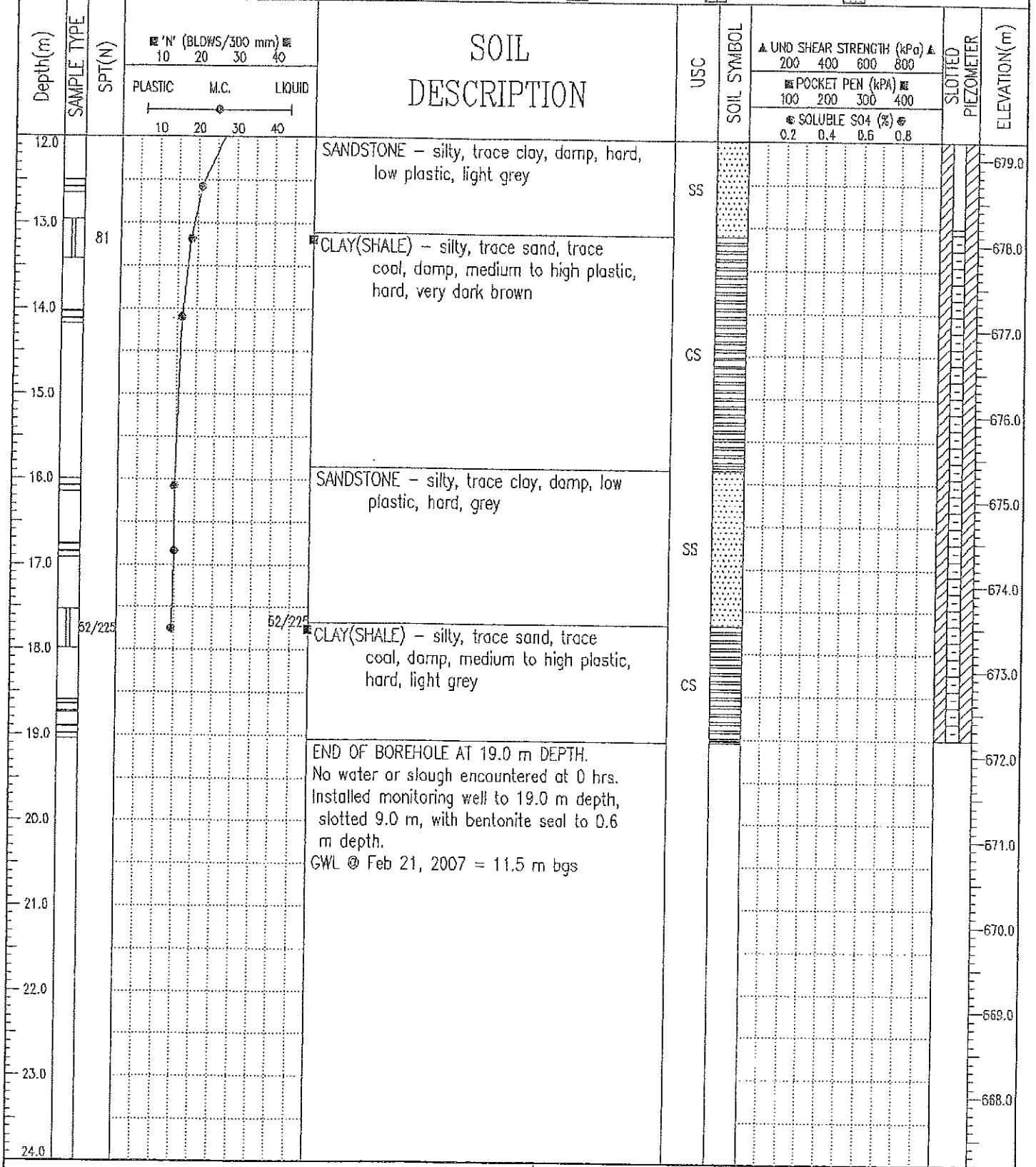
07/03/12 12:39PM (GEO1)

CTA-1 (CONT'D)

GEOTECHNICAL EVALUATION	SHERRICK MANAGEMENT LIMITED	TEST HOLE NO: BH3-15
41 AVE SW AND 156 STR LANDS - SITE 3	B-61 TRACK-MOUNTED DRILL RIG	PROJECT NO: 02-596.02
EDMONTON, ALBERTA	SOLID STEM AUGER	ELEVATION: 691.2 m

SAMPLE TYPE: CORE | A CASING | NO RECOVERY | DISTURBED | SPT | SHELBY TUBE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



SANDSTONE - silty, trace clay, damp, hard, low plastic, light grey

CLAY(SHALE) - silty, trace sand, trace coal, damp, medium to high plastic, hard, very dark brown

SANDSTONE - silty, trace clay, damp, low plastic, hard, grey

CLAY(SHALE) - silty, trace sand, trace coal, damp, medium to high plastic, hard, light grey

END OF BOREHOLE AT 19.0 m DEPTH.
No water or slough encountered at 0 hrs.
Installed monitoring well to 19.0 m depth, slotted 9.0 m, with bentonite seal to 0.6 m depth.
GWL @ Feb 21, 2007 = 11.5 m bgs

C.T. & Associates Engineering Inc.	LOGGED BY: DSN	COMPLETION DEPTH: 19 m
	REVIEWED BY: MJW	COMPLETE: 02/07/07
	Fig. No: B-15	Page 2 of 2

07/03/12 12:33PM (GEO1)

APPENDIX C

Site Photographs

Photo 1 – 41 Avenue SW and 50 Street Intersection looking Northeast.

Photo 2 – 41 Avenue SW crossing Cawes Lake area looking East.

Photo 3 – 41Avenue SW crossing smaller pond area west of Cawes Lake (looking Southeast).

Photo 4 – 41 Avenue SW and 91 Street Intersection looking East.

Photo 5 – 41 Avenue SW and 101 Street Intersection looking West.

Photo 6 – 41 Avenue SW and Railroad Intersection looking Northeast.

Photo 7 – 41 Avenue SW at Whitemud Creek Crossing looking West.

Photo 8 – Sandstone exposed in Whitemud Creek east bank about 40 m downstream of culvert.

Photo 9 – 41 Avenue SW west of 170 Street gently rolling farmland looking East.

Photo 10 – 41 Avenue SW and 184 Street Intersection looking East.

G Appendix G - Whitemud Creek Report

Report

City of Edmonton

BF 00137, Whitemud Creek Culvert

October 2010

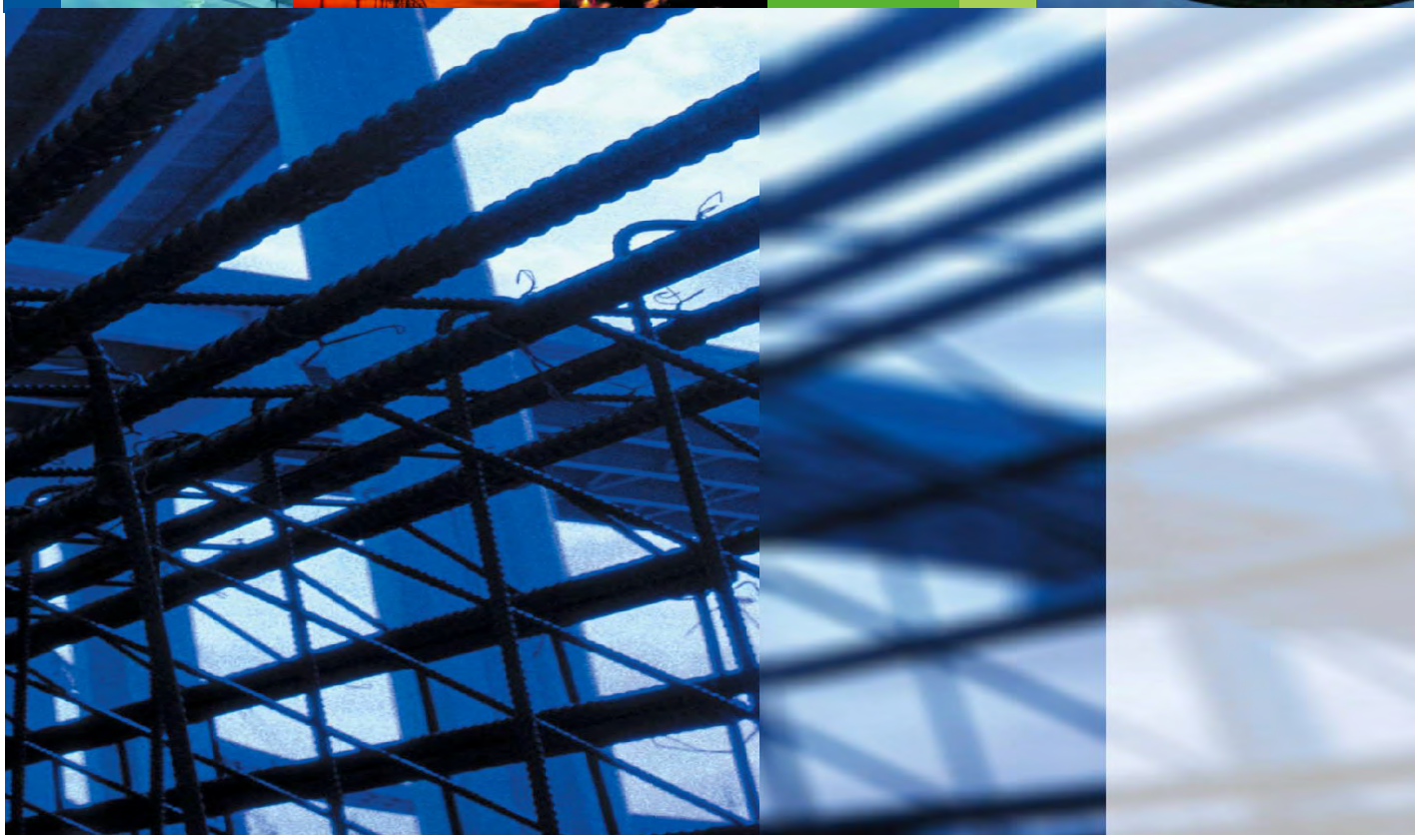


Table of Contents

1 Introduction

The City of Edmonton retained Associated Engineering in 2007 to develop a “Conceptual Plan” for 41 Avenue SW entitled “41 Avenue SW Concept Planning Study”. One component of the Conceptual Plan is to recommend improvements required to meet immediate and long-term traffic demands. This includes existing structures along the roadway alignment.

This Assessment Report concerns Bridge File (BF) 00137, which carries 41 Ave SW over Whitemud Creek. As this site is in the study area of the Conceptual Plan, a strategy for the bridge site is required. The purpose of this assessment is to evaluate repair/rehabilitation options versus replacement while satisfying the demands of the change in usage. The Conceptual Plan indicates that the roadway will be upgraded from a 2 lane rural roadway to a 4 lane arterial roadway in about 10 years.

This report includes a description of the culvert and its history, a review of BIM inspections, a discussion of the controlling factors, the assessment options, life cycle cost analysis and recommendations.

This report should only be read in conjunction with the 41 Avenue SW Concept Planning Study.

2 Culvert Description

BF 00137 is a concrete arch culvert which carries 41 Ave SW over Whitemud Creek. The crossing is located between 156th Street and 170th Street (refer to the aerial photo in Appendix B). The culvert is located on a 45° Left Hand Forward (LHF) skew. The roadway width was measured to be 7.5 m with an ACP riding surface.

The existing culvert comprises a 5.3 m diameter by 36.6 m long cast-in-place concrete arch structure. It was constructed in 1960 to replace a 70’ pony truss. The existing crossing was adequate for traffic, but had experienced significant scour, and was on a poor alignment. The construction work involved realigning the road and diverting the creek.

The structure consists of a concrete arch founded on a concrete footing bearing on soil. Alberta Transportation BIM Inspection and Maintenance System Reference Manual notes that this particular concrete arch design has not been widely used, as corrugated metal culverts are typically more cost-effective. However the few concrete arches of the same design located around Alberta have proven to be very durable and do not have many maintenance problems. A common defect is the culvert floor which tends to be thin and not well reinforced. As such it heaves and cracks. In this particular structure, the upstream and downstream concrete aprons were broken and used as rip rap. The design data drawing and three construction drawings are located in **Appendix D**.

3 Culvert History

A review of the history from Alberta Transportation's Bridge Files was completed and is summarized as follows:

1902 - Flood, May 2, 1 year old timber bridge washed out
1908 - Flood, July 3, approaches washed out, superstructure moved off line
1960 - Existing parabolic concrete arch constructed – Replaced 70' x 18' pony truss
1965 - Flood, April 15, HWM estimated 770 mm below inlet crown
1979 - Bridge Authorization – Break up concrete apron and leave as rip-rap
1992 - Level 1 BIM Inspection
1998 - Level 1 BIM Inspection
2001 - Flood, July 31, significant flow, but culvert handling it well
2004 - Level 1 BIM Inspection
2008 - Level 1 BIM Inspection

4 Site Inspection

The most recent Level 1 (visual) BIM Inspection was conducted November 6th 2008. A copy of the BIM Inspection Report is attached in **Appendix A**. A site visit was performed by Associated Engineering on May 9, 2008 (refer to **Appendix B** for photos). From BIM inspection reports, the ratings from previous inspections are compared, and summarized as follows:

BIM Level 1 Inspection Results	Aug. 10 1992	May 15 1998	Nov. 22 2004	Nov. 6 2008	Remarks
Approach Road	7	7	7	6	– Poor sight distance at west approach
Upstream End	7	6	6	7	– Some cracks and staining on headwall – Minor erosion at bottom of wingwall – Could use additional riprap – Beaver dam across entry
Barrel	7	7	7	4	– Wide longitudinal crack on East wall full length. – Some spalling, large delamination at N/E corner
Downstream End	7	6	6	6	– Some cracking of wingwall – Could use additional riprap – Small dam
Channel	7	5	5	4	– Both upstream & downstream are curved – Bank sloughing at upstream, southwest corner
Structural Condition	77.0 %	77.0 %	77.0%	44.4 %	
Sufficiency Rating	70.4 %	67.3 %	67.3%	56.4. %	

The most recent BIM Inspection report estimated replacement will be required in 2020.

5 Controlling Factors

This section discusses the controlling factors that are usually considered in assessments and in determining a feasible repair strategy. These include the following factors:

- structural condition
- hydrotechnical issues
- geotechnical issues
- environmental issues
- roadway geometrics
- traffic usage
- future development
- other bridges or culverts
- traffic accommodation.

Details of these factors are discussed below.

5.1 Structural Condition

From the November 2008 BIM Inspection and the 2008 site inspection, the existing culvert was found to be in poor condition, but a low priority for repair. Items to note include:

- Wide longitudinal crack on east wall, full length of the culvert
- Large delamination at the northeast corner
- Some spalling
- Some cracking of wingwalls and staining

The upstream end was rated 7 and the downstream end was rated 6. The barrel was giving a rating of 4.

Based on the above findings, **Structural Condition is may be** a controlling factor. This will largely depend when the structure requires repairs, and when the road is to be upgraded. This is discussed further under “Assessment Options”.

5.2 Hydrotechnical Issues

The Whitemud Creek is a tributary to the North Saskatchewan River. From its crossing at BF 00137, it heads northeast, through the city of Edmonton to its confluence with the North Saskatchewan River. At the crossing location the creek is bounded by steep-banks.

Water Survey of Canada has a monitoring station (05DF006) located approximately 3km downstream from BF 00137. Archived Hydrometric data is available for this station from 1969.

The Hydrotechnical Information System on the Alberta Transportation web-site reports 4 recorded floods on the Whitemud Creek at BF 00137. Significant floods have occurred, damaging previous bridge structures at the site. However, floods occurring since the construction of the concrete arch culvert have caused no damage. This would indicate the culvert may be hydraulically adequately.

Based on the above, **Hydrotechnical Issues are not** controlling factors in this assessment. If the structure were to be replaced a more detailed review of the hydrotechnical issues would be required as part of the preliminary design.

5.3 Geotechnical Issues

A detailed Geotechnical Investigation was not carried out as part of the assessment. At the time of the inspection, the culvert had been in service for 48 years, and showed no significant signs of movement or deflections.

Base on the above findings, **Geotechnical Issues are not** a controlling factor in this assessment.

5.4 Environmental Issues

The Whitemud Creek area is described as naturally vegetated surrounded by agriculture lands and naturally forested areas. There is vegetation growth along the banks of the creek and significant wildlife habitat in the area. During the site visit several Canada geese and mallards were observed in the area, as well as ducks nests on the banks. A fox was also observed nearby.

The large wildlife presence in this area is known, and was considered in the design of the recently constructed Whitemud Arch (BF 80517, located downstream), which was built in 2006 to carry Anthony Henday Drive over Whitemud Creek. At that site, provisions were made for ungulate and pedestrian passage. It is understood that the City of Edmonton is keen to allow for a similar situation at this site. From a conceptual point of view, and based on the data available, a 20 m provision for passage along the banks should be sufficient. This allows for a 9 m allowance for the creek with 5 m to 6 m on either side for pedestrians and wildlife passage. This would be refined at the preliminary design stage.

Fish habitat was not assessed, but at this location Whitemud Creek is a Class ‘D’ watercourse as defined by Alberta Environment’s “Code of Practice for Watercourse Crossings” with no Restricted Activity Period (RAP). However, the advice of a qualified aquatic specialist will be required before any in-stream work proceeds.

With respect to Navigable Waters, a review of recent Navigable Waters Protection Act (NWPA) decisions indicates that BF 01355 on Whitemud Creek is Navigable. This structure is located approximately 3 km upstream. Therefore, it is likely the BF 00137 is navigable.

Based on the above findings, **Environmental Issues are not** a controlling factor in this assessment. However, navigable clearance, provisions for wildlife passage, and mitigation requirements will need to be a consideration in any replacement structure.

5.5 Geometrics

The Whitemud creek culvert is located at the crossing of 41 Ave SW and Whitemud Creek. The crossing is located between 170th Street and 156th Street. It is a straight section of roadway with a sag curve at the crossing.

Whitemud Creek runs from southwest to northeast, under the intersection, with the culvert oriented at 45º LHF with respect to 41 Ave SW.

The side slopes are at approximately 2:1, there is 2.0 m of cover to the culvert, and the clear roadway width is 7.5 m between barriers.

Consideration of the geometrics with respect to the conceptual planning of 41 Ave SW is important, as the conceptual study was the impetus for the culvert assessment. The recommendations from the report are to upgrade to a four lane arterial urban roadway section in approximately the next 10 years. The roadway cross-section comprises two east bound lanes, two west bound lanes, a 12.0 m median and a multi-use trail. The conceptual design centreline of roadway is expected to move slightly in plan from its current location and be raised by approximately 4 m although this is only conceptual at this stage.

Based on the above findings, **Geometrics is a controlling factor** in this assessment.

5.6 Traffic Usage & Future Development

There is no documented AADT at the site. Based on a traffic count during the site visit, the existing AADT is estimated to be 85, comprising residential, farmers, and commuters.

As outlined in the Conceptual Plan, it is anticipated that the road will be upgraded to an urban section and the usage requirements will substantially change. Initially, it is anticipated the roadway will be upgraded to a 4 lane urban section in approximately 10 years when adjacent land is developed. Farm equipment usage is expected to decrease.

Based on the above observations, **Traffic Usage and Future Developments are controlling factors**.

5.7 Other Bridges or Culverts & Traffic Accommodation

In the event the culvert site needs to be temporarily closed for repairs or replacement, there are detour routes available.

One possible detour route would extend south of 41 Ave SW, on Range Roads 252, Township Road 510 and Range Road 253. At the Whitemud Creek crossing on Township Road 510 is BF 01355, a 3 span concrete girder bridge. This bridge also has no load restriction. The roads are all two-lane rural sections. TWP RD 510 and Rng Rd 253 are both gravel.

As such, other bridge crossings and **Traffic Accommodation** are a consideration, but **not** a controlling factor.

6 Assessment Options

The major factors that control a future repair/rehabilitation or replacement at this site are summarized as follows:

- **Geometrics, Traffic Usage and Future Developments** – 41 Ave SW, which is carried over Whitemud creek by BF 00137 is currently undergoing a Conceptual Study. The current roadway section (2 Lane Rural) is planned to be replaced by a 4 Lane Urban Section with a Multi-Use Trail on a new raised alignment. There is also a large skew (45º LHF) with respect to the creek.

The main requirement affecting the assessment options is the change of usage of the road - supporting a four lane urban roadway with a raised grade with an AADT of 25000 to 30000.

6.1 Option 1: Do-Nothing

Typically when assessing a replacement structure, it is necessary to evaluate for comparative purposes a "Do-Nothing" solution. This option involves only those activities required to maintain the culvert's current level of service. This structure currently has an estimated remaining service life of 10 years. As such a replacement structure would be required in 2020.

As the options for this site are driven by the requirements of the Functional Plan, this option is not considered viable, and is therefore not considered further.

6.2 Option 2: Rehabilitation

The second option to consider a rehabilitation to upgrade the structure for the change of usage. This would involve all major repairs and rehabilitation necessary to achieve the functional requirements for the site.

To accommodate the future urban roadway, it is estimate that the existing culvert as aligned would need to be extended by a minimum of 50 m. This is based on the increased roadway elevation by 4 m, widening the roadway and using 4:1 sideslopes.

The existing culvert has a remaining life of 10 years, which corresponds with the timeline for the road upgrade. As such, a rehabilitation/repair strategy could be implemented at about the same time as the road upgrade.

This option is not desirable for a number of reasons. First, at about 90 m long, the culvert would likely be undesirable from a fish passage point of view, and the advice of qualified biologist would be required to determine whether it is fish bearing, and its adequacy from a fish passage point of view.

Second, the City has expressed interest in accommodating pedestrian traffic under the roadway. From a wildlife safety perspective, it is also desirable to accommodate wildlife passage. As described in Environmental Issues, it is estimated 20 m would be required to accommodate pedestrian traffic, wildlife passage and the creek under the structure. This is not possible with the current structure.

Any viable solution would require increasing the depth of cover to achieve the new road alignment, and consequently increasing the culvert length. Considering the required extension in culvert length, the repairs that would be required for the existing portion of the culvert and the reduced lifespan of the structure make this an undesirable option. For these reasons, this option is not considered further.

6.3 Option 3: Replacement

The third option for consideration at this site is replacement.

The bridge structure replacement would provide a 9.0 m allowance for the channel, with 5 to 6 m allowance for pedestrians and wildlife on either side, with 3:1 headslopes. It is understood from the 41 Avenue Conceptual Plan that the top of roadway would be raised by approximately 4 m. An out-to-out of fills of approximately 100 m would be required. It is anticipated the structure would be situated on skew to follow the creek alignment.

Also, based on the wide median, it is anticipated that separate bridge structures would be used for east bound and west bound traffic. Preliminary estimates give the structure deck widths of 12.5 m for two lanes and shoulders, and 16 m for two lanes, shoulders and a multi-use trail.

It is expected that the road will be upgraded in 10 years, while the current structure has 10 years of serviceable life remaining. However, it is possible that repairs may be required in less than 10 years to keep the culvert serviceable. As such, if inspections indicate that repairs are required, an assessment of repair options should be required at that time to determine the most cost-effective approach.

For costing purposes it is assumed that culvert repairs will be required to keep the structure serviceable until 2020, when the roadway is upgraded. A nominal value of $150,000 is used for budgetary purposes, and a year of repairs of 2015 is used.

The cost of new bridge structures are:

100 m x 12.5 m (at $3,500/$m^2$) = $4,375,000
100 m x 16.0 m (at $3500/$m^2$) = $5,600,000
For a total bridge cost of $9,975,000 (+/- 50%)

7 Life Cycle Costs

In this section, a life cycle economic assessment is made to compare these options and shows the initial capital investment and related operating costs. In the end result, there is a "Net Present Value" cost that shows the estimated total "Life Cycle Cost" of each option.

In calculating the Net Present Value (in 2010 dollars), this assessment used an escalation rate of 4% and has considered an evaluation period of 50 Years.

From the above options, the estimated Life Cycle Costs are presented in **Appendix C** and summarized as follows:

Life Cycle Costs	Option 3a Replace with Bridge in 2015	Option 3b Repair and Replace with Bridge in 2020
Total Expenditure to 2060 (in 2010 dollars)	$9,975,000	$10,125,000
Net Present Value (in 2010 dollars)	$8,198,723	$6,862,042

Based on the above evaluation, the most economical option is Option 3b, repair the culvert in 2015 and replace in 2020.

8 Recommendation

The Whitemud Creek Culvert has an age of 50 years and an estimate remaining service life of 10 years. The road is anticipated to be upgraded from a two lane rural road to a 4 lane urban road in 10 years, which will entail a raised grade of 4 m.

The Life Cycle Cost Analysis shows the most economic solution is **Option 3b**, to do the repairs required to keep the culvert in service until the road is upgraded, at which point the culvert is replaced with new bridge structures.

It is recommended that the structure be repaired, as required to keep it serviceable until the road is upgraded. At that point the existing culvert should be replaced with new bridge structures that are capable of accommodating the proposed roadway.

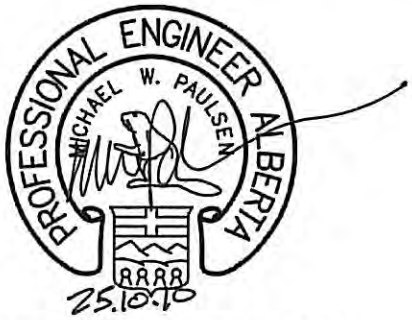
This is based on an assumed cost of repairs to keep the culvert serviceable of $150,000. If repairs are required, it is recommended that the City complete an assessment of the culvert at that time to determine the most cost-effective solution.

The total budget cost for new bridges is $9,975,000 (+/- 50%).

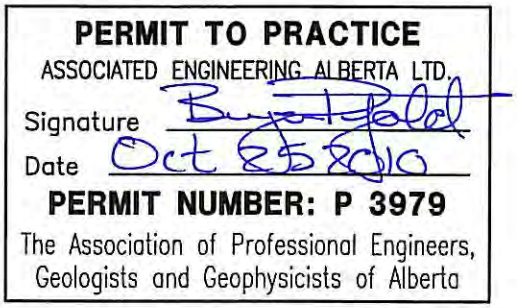
9 Closure

The services provided by Associated Engineering Alberta Ltd. in preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,
ASSOCIATED ENGINEERING ALBERTA LTD.



Michael Paulsen, M.Sc., P.Eng.
Bridge Engineer



APPENDIX A - BIM INSPECTION REPORTS

Bridge Culvert Inspection

Bridge File Number	00137 -1 Bridge Culvert	Form Type	CUL1
Year Built	1960	Lot No.	
Bridge or Town Name	EDMONTON	Inspector Name	Tom Hubbard
Located Over	WHITEMUD CREEK, 6.95, WATERCRS-ST	Inspector Class	BR CLS A
Located On	LOCAL ROAD	Assistant Name	Andre Gosselin
Water Body Cl./Year		Assistant Class	BR CLS B
Navigabil. Cl./Year		Inspection Date	06-Nov-2008
Legal Land Location	SW SEC 15 TWP 51 RGE 25 W4M	Data Entry By	Andre Gosselin
Longitude, Latitude	-113:36:30, 53:23:45	Data Entry Date	20-Jan-2009
Road Authority	EDMONTON	Reviewer Name	
Contract Main. Area	UNDEFINED CMA	Review Date	
Clear Roadway/Skew	7.3 / -45 deg. (LHF)	Dept. Reviewer Name	Shiraz Kanji
AADT/Year		Dept. Review Date	20-Jan-2009
Road Classification		Follow-Up By	
Detour Length (km)			

Bridge Culvert Information

Number of Culverts		1						
Pipe #	Barrel	Span	Rise (or Dia.)	Type	Length	Corr. Profile	Pl./Slab Thickness	Shape
1	MAIN	5300	5300	AP	36.6			ARCH
Special Features								
Special Features Comment								

Utilities (Located at)

Utility Attachments			
Telephone		Gas	
Power		Municipal	
Others		Problem (Y/N)	
Remarks			

Approach Road / Embankment

		Last	Now	Explanation of Condition
Horizontal Alignment		7	7	
Vertical Alignment		7	6	Poor sight distance at west approach.
Roadway Width (m)	6.500			Roadway with between guardrails 8m.
Embankment		7	7	
Sideslope (__:1)	2.0			
(Height of Cover (m) :)				
Guardrail (Y/N)	Yes			Hazard markers at all four corners.
Approach Road / Embankment General Rating		**7**	**6**	

Upstream End

Culvert Component		Last	Now	Explanation of Condition
Direction				
End Treatment (Concrete, Steel, Others, None)	CONCRETE			
Headwall		6	7	Some cracks and staining.
Collar		X	X	
Wingwalls		7	7	Minor erosion at bottom (S/W corner concrete slope protection.
(Shape :)				
Cutoff Wall		N	N	

Upstream End				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
Bevel End		X	X	
Heaving (mm)				
Invert Above/Below Stream Bed	BELOW			
Above/Below (mm)	100			
Scour Protection		5	5	
(Type :)				
(Avg. Rock Size (mm) :)				
Scour/Erosion		5	5	Some erosion at concrete footing.
Beavers (Y/N)	Yes			Beaver dam accross entry.
Upstream End General Rating		**6**	**7**	

Bridge Culvert Barrel				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
(Pipe # : **1, Primary Span, Location Code: MAIN, Span (mm): 5300, Rise (mm): 5300, Type: AP**)				
Barrel Last Accessible Date	06-Nov-2008			
Special Features				
Special Feature				
(Type :)				
Special Feature				
(Type :)				
Roof		7	7	
Measured Rise (mm)				
Measured At Ring No.				
Sag (mm)	0			
Percent Sag				
Sidewall		4	4	Wide longitudinal crack on East wall, full lenght of pipe. Large delamination at N/E corner.
Measured Span (mm)				
Measured At Ring No.				
Deflection (mm)	0			
Percent Deflection				
Floor		7	6	Scalling along footing, base of arch and edges of floor. Spall at S/W corner.
Bulge (mm)	0			
Measured At Ring No.				
Abrasion (Y/N)				
Circumferential Seams		7	6	Staining (rust/efflorescence) N/E wall.
Separation (mm)	0			
Longitudinal Seams		6	X	
Total No. of Cracked Rings				
Total No. of Rings with Two Cracked Seams				
Min. Remaining Steel Between Cracks (mm)				
Proper Lap (Y/N)				
Longitudinal Stagger (Y/N)				
Coating		X	X	
Corrosion By Soil (Y/N)				
Corrosion By Water (Y/N)				
Camber POS/ZERO/NEG	NEG			
Ponding (Y/N)	No			

Bridge Culvert Barrel				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
(Pipe # : **1, Primary Span, Location Code: MAIN, Span (mm): 5300, Rise (mm): 5300, Type: AP**)				
Fish Passage Adequacy		X	4	Beaver dam at inlet.
Baffle			X	
(Type :)				
Waterway Adequacy		8	8	
Icing (Y/N)	No			
Silting (Y/N)	No			
Drift (Y/N)	No			
Barrel General Rating		**7**	**4**	Due to cracks in sidewall.

Downstream End				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
Direction				
End Treatment (Concrete, Steel, Others, None)	CONCRETE			
Headwall		7	7	
Collar		X	X	
Wingwalls		5	6	
(Shape :)				
Cutoff Wall		N	N	
Bevel End		X	X	
Heaving (mm)				
Invert Above/Below Stream Bed	ABOVE			
Above/Below (mm)	100			
Scour Protection		6	6	
(Type :)				
(Avg. Rock Size (mm) :)				
Scour/Erosion		6	6	
Beavers (Y/N)	No			
Downstream End General Rating		**6**	**6**	

Structure Usage				
		Last	**Now**	**Explanation of Condition**
Channel (U/S and D/S)				
Alignment		5	5	Both U/S & D/S are curved.
Bank Stability		4	4	Bank sloughing at U/S (SW corner).
HWM (m below Top of Culvert)				
Drift (Y/N)	No			
Channel Bottom Degrading/Aggrading				Beaver dam upstream of inlet.
Beavers (Y/N)	Yes			
(Fish Compensation Measure 1 : **NONE**)				
(Fish Compensation Measure 2 : **NONE**)				
Channel General Rating		**5**	**4**	

Maintenance Recommendations						
Inspector Recommendations	Year	Inspector Comments	Department Comments	Target Year	Est. Cost	Cat #
SHOTCRETE REPAIRS						
PLACE ADDITIONAL RIP RAP						
REMOVE DRIFT ACCUMULATION						
INSTALL CONCRETE/STEEL LINING						
INSTALL STRUTS						
INSTALL CONCRETE COLLAR/CUTOFF						
REPAIR SEAMS						
OTHER ACTION	2009	Remove beaver dam U/S of Inlet.				
OTHER ACTION	2009	Repair spall at N/E corner and minor concrete patches inside barrel (3).				
OTHER ACTION	2009	Replace rail at inlet headwall.				
OTHER ACTION						
OTHER ACTION						
OTHER ACTION						
OTHER ACTION						
OTHER ACTION						
OTHER ACTION						

Structural Condition Rating (Last/Now) (%)	**77.0/44.4**	**Sufficiency Rating (Last/Now) (%)**	**67.3/56.4**	Est. Repl. Yr	2020	Maint. Reqd. (Y/N)	Yes

Special Comments for Next Inspection		Department Comments	

Maintenance Reviewed By		Date		Estimated Total	0
Proposed Long-Term Strategy					
On 3-Year Program (Y/N)					
Proposed Action					
Previous Inspector's Name	Name Unknown	Previous Assistant's Name			
Next Inspection Date	06-Aug-2013	Previous Inspection Date	22-Nov-2004		
Inspection Cycle (Default) (months)	57				
Comment					

TRANSPORTATION DEPARTMENT
THE CITY OF Edmonton
BRIDGE MAINTENANCE

File No.: B076 **Bridge Name:** Culvert – Concrete 5.3 x 7.3 m
Location: Whitemud Creek - 41 Ave. SW
Inspector: T. Hubbard / A. Gosselin **Date:** November 6, 2008 **Temp:** 1°C


Inlet looking North


Upstream looking South from intlet


Downstream looking North from outlet


Typical barrel


Approach road looking West


Large delamination area at NE end of barrel

TRANSPORTATION DEPARTMENT
THE CITY OF Edmonton
BRIDGE MAINTENANCE

File No.: B076 **Bridge Name:** Culvert – Concrete 5.3 x 7.3 m
Location: Whitemud Creek - 41 Ave. SW
Inspector: T. Hubbard / A. Gosselin **Date:** November 6, 2008 **Temp:** 1°C

Broken rail at top of inlet

Bridge Culvert Inspection

Bridge File Number	00137 -1 Bridge Culvert	Form Type	CUL1
Year Built	1960	Lot No.	
Bridge or Town Name	EDMONTON	Inspector Name	Name Unknown
Located Over	WHITEMUD CREEK, 6.76, WATERCRS-ST	Inspector Class	
Located On	LOCAL ROAD	Assistant Name	
Water Body Cl./Year		Assistant Class	
Navigabil. Cl./Year		Inspection Date	22-Nov-2004
Legal Land Location	SW SEC 15 TWP 51 RGE 25 W4M	Data Entry By	Name Unknown
Longitude, Latitude	-113:36:30,53:23:45	Data Entry Date	30-Mar-2005
Road Authority	City of Edmonton	Reviewer Name	Dilip Dasmohapatra
Contract Main. Area	UNDEFINED CMA	Review Date	25-Feb-2005
Clear Roadway/Skew	7.3 / -45 deg. (LHF)	Department Reviewer Name	Dilip Dasmohapatra
AADT/Year		Department Review Date	25-Feb-2005
Road Classification		Follow-Up By	
Detour Length (km)			

Bridge Culvert Information

Number of Culverts	1

Pipe #	Barrel	Span	Rise (or Dia.)	Type	Length	Corr. Profile	Pl. Thickness	Shape
1	MAIN	5300	5300	AP	36.6			ARCH

Special Features	
Special Features Comment	CIP arch with flared wingwalls

Utilities (Located at)

Telephone	Buried along south side	Gas	North
Power	Overhead @ north side	Municipal	
Others	Irrigation pipe at southwest	Problem (Y/N)	No
Remarks			

Approach Road / Embankment

		Last	Now	Explanation of Condition
Horizontal Alignment		7	7	Straight road
Vertical Alignment		7	7	Poor sight distance at west approach
Roadway Width (m)	6.500			Roadway with between guardrails 8m
Embankment		7	7	
Sideslope (__:1)	2.0			Hazard markers at all four corners
(Height of Cover (m) :)				
Guardrail (Y/N)	Yes			
Approach Road / Embankment General Rating		7	7	

Upstream End

Culvert Component		Last	Now	Explanation of Condition
Direction				
End Treatment (Concrete, Steel, Others, None)	CONCRETE			
Headwall		6	6	Some cracks and staining
Collar/Concrete Slope Protection		5	X	
Wingwalls		7	7	Minor erosion at bottom (Sw corner)
(Shape :)				concrete slope protection.
Cutoff Wall		N	N	

Upstream End				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
Bevel End		X	X	
Heaving (mm)				
Invert Above/Below Stream Bed	BELOW			
Above/Below (mm)	100			
Scour Protection		5	5	Could use additional riprap
(Type :)				
(Avg. Rock Size (mm) :)				
Scour/Erosion		5	5	Some erosion at concrete footing
Beavers (Y/N)	Yes			Beaver dam accross entry
Upstream End General Rating		**6**	**6**	

Bridge Culvert Barrel				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
(Pipe # : 1, Primary Span, Location Code: MAIN, Span (mm): 5300, Rise (mm): 5300, Type: AP)				
Barrel Last Accessible Date	22-Nov-2004			
Special Features				
Special Feature				
(Type :)				
Special Feature				
(Type :)				
Roof		7	7	Large spall at NE end, hammer sounding
Measured Rise (mm)				
Measured At Ring No.				
Sag (mm)	0			
Percent Sag				
Sidewall		4	4	revealed delams along constructuion seam 8 feet from bottom
Measured Span (mm)				
Measured At Ring No.				
Deflection (mm)	0			
Percent Deflection				
Floor		7	7	Scalling along footing, base of arch and edges of floor. spall at SW corner
Bulge (mm)	0			
Measured At Ring No.				
Abrasion (Y/N)				
Circumferential Seams		7	7	Staining (rust/efflorescence) NE wall
Separation (mm)	0			
Longitudinal Seams		6	6	Delams along construction seam @NE
Total No. of Cracked Rings				
Total No. of Rings with Two Cracked Seams				
Min. Remaining Steel Between Cracks (mm)				
Proper Lap (Y/N)				
Longitudinal Stagger (Y/N)				
Coating		X	X	
Corrosion By Soil (Y/N)				
Corrosion By Water (Y/N)				

Bridge Culvert Barrel				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
(Pipe # : **1, Primary Span, Location Code: MAIN, Span (mm): 5300, Rise (mm): 5300, Type: AP**)				
Camber POS/ZERO/NEG	NEG			
Ponding (Y/N)	No			
Fish Passage Adequacy		X	X	
Baffle				
(Type :)				
Waterway Adequacy		8	8	
Icing (Y/N)	Yes			
Silting (Y/N)	No			
Drift (Y/N)	No			
Barrel General Rating		**7**	**7**	

Downstream End				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
Direction				
End Treatment (Concrete, Steel, Others, None)	CONCRETE			
Headwall		7	7	
Collar/Concrete Slope Protection		X	X	
Wingwalls		5	5	Some cracking (large spall @ NE is part of barrel section) see photo
(Shape :)				
Cutoff Wall		N	N	
Bevel End		X	X	
Heaving (mm)				
Invert Above/Below Stream Bed				
Above/Below (mm)	100			
Scour Protection		6	6	Could use more riprap
(Type :)				
(Avg. Rock Size (mm) :)				
Scour/Erosion		6	6	Concrete foundation visible
Beavers (Y/N)	Yes			Small dam D/S
Downstream End General Rating		**6**	**6**	

Structure Usage				
		Last	**Now**	**Explanation of Condition**
Channel (U/S and D/S)				
Alignment		5	5	Both U/S & D/S are curved Bank sloughing @ U/S (SW corner)
Bank Stability		4	4	
HWM (m below Top of Culvert)				
Drift (Y/N)				
Channel Bottom Degrading/Aggrading				
Beavers (Y/N)	Yes			
(Fish Compensation Measure 1 : **NONE**)				
(Fish Compensation Measure 2 : **NONE**)				

Structure Usage			
	Last	Now	Explanation of Condition
Channel General Rating	5	5	

Maintenance Recommendations					
Inspector Recommendations	Year	Inspector Comments	Department Comments	Target Year	Est. Cost	Cat #
OTHER ACTION	2005	Remove beaver dams U/S & D/S(Inlet/outlet				
OTHER ACTION	2005	Repair spall @ NE corner, minor concrete				
OTHER ACTION	2004	parches inside barrel (3).				
OTHER ACTION	2005	Place addi. riprap at both inlet&outlet				
OTHER ACTION			See #28	2004		
OTHER ACTION						
OTHER ACTION						
OTHER ACTION						
OTHER ACTION						
OTHER ACTION						

Structural Condition Rating (Last/Now) (%)	**77.0/77.0**	**Sufficiency Rating (Last/Now) (%)**	**67.3/67.3**	Est. Repl. Yr	2024	Maint. Reqd. (Y/N)	

Special Comments for Next Inspection	Repair SW headwall rail - Replace timber anchors (Paint orange)	Department Comments	

Maintenance Reviewed By	Name Unknown	Date	25-Feb-2005	Estimated Total	0
Proposed Long-Term Strategy					
On 3-Year Program (Y/N)					
Proposed Action					

Previous Inspector's Name	Arden Bolton	Previous Assistant's Name	
Next Inspection Date (Overridden)	01-Jan-2008	Previous Inspection Date	15-May-1998
Inspection Cycle (Default) (months)	57		
Comment			

Bridge Culvert Inspection

Bridge File Number	00137 -1 Bridge Culvert	Form Type	CUL1
Year Built	1960	Lot No.	
Bridge or Town Name	EDMONTON	Inspector Name	Arden Bolton
Located Over	WHITEMUD CREEK, 6.76, WATERCRS-ST	Inspector Class	
Located On	LOCAL ROAD	Assistant Name	
Water Body Cl./Year		Assistant Class	
Navigabil. Cl./Year		Inspection Date	15-May-1998
Legal Land Location	SW SEC 15 TWP 51 RGE 25 W4M	Data Entry By	Arden Bolton
Longitude, Latitude	-113:36:30,53:23:45	Data Entry Date	30-Mar-2005
Road Authority	City of Edmonton	Reviewer Name	Dilip Dasmohapatra
Contract Main. Area	UNDEFINED CMA	Review Date	25-Oct-1999
Clear Roadway/Skew	7.3 / -45 deg. (LHF)	Department Reviewer Name	Dilip Dasmohapatra
AADT/Year		Department Review Date	25-Oct-1999
Road Classification			
Detour Length (km)		Follow-Up By	

Bridge Culvert Information

Number of Culverts	1

Pipe #	Barrel	Span	Rise (or Dia.)	Type	Length	Corr. Profile	Pl. Thickness	Shape
1	MAIN	5300	5300	AP	36.6			ARCH

Special Features	
Special Features Comment	

Utilities (Located at)

Telephone	Buried along south side	Gas	North
Power	Overhead @ north side	Municipal	
Others	Irrigation pipe at southwest	Problem (Y/N)	
Remarks			

Approach Road / Embankment

		Last	Now	Explanation of Condition
Horizontal Alignment		7	7	
Vertical Alignment		7	7	
Roadway Width (m)	6.500			
Embankment		7	7	
Sideslope (__:1)	2.0			
(Height of Cover (m) :)				
Guardrail (Y/N)	Yes			
Approach Road / Embankment General Rating		7	7	

Upstream End

Culvert Component		Last	Now	Explanation of Condition
Direction				
End Treatment (Concrete, Steel, Others, None)	CONCRETE			
Headwall		7	6	
Collar/Concrete Slope Protection		7	5	
Wingwalls		7	7	
(Shape :)				
Cutoff Wall		X	N	

Upstream End				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
Bevel End		X	X	
Heaving (mm)				
Invert Above/Below Stream Bed	BELOW			
Above/Below (mm)	100			
Scour Protection		6	5	
(Type :)				
(Avg. Rock Size (mm) :)				
Scour/Erosion		6	5	
Beavers (Y/N)	Yes			
Upstream End General Rating		7	6	

Bridge Culvert Barrel				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
(Pipe # : 1, Primary Span, Location Code: MAIN, Span (mm): 5300, Rise (mm): 5300, Type: AP)				
Barrel Last Accessible Date	15-May-1998			
Special Features				
Special Feature				
(Type :)				
Special Feature				
(Type :)				
Roof		7	7	
Measured Rise (mm)				
Measured At Ring No.				
Sag (mm)	0			
Percent Sag				
Sidewall		4	4	
Measured Span (mm)				
Measured At Ring No.				
Deflection (mm)	0			
Percent Deflection				
Floor		7	7	
Bulge (mm)	0			
Measured At Ring No.				
Abrasion (Y/N)				
Circumferential Seams		7	7	
Separation (mm)	0			
Longitudinal Seams		7	6	
Total No. of Cracked Rings				
Total No. of Rings with Two Cracked Seams				
Min. Remaining Steel Between Cracks (mm)				
Proper Lap (Y/N)				
Longitudinal Stagger (Y/N)				
Coating		X	X	
Corrosion By Soil (Y/N)				
Corrosion By Water (Y/N)				

Bridge Culvert Barrel				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
(Pipe # : **1, Primary Span, Location Code: MAIN, Span (mm): 5300, Rise (mm): 5300, Type: AP**)				
Camber POS/ZERO/NEG	NEG			
Ponding (Y/N)	No			
Fish Passage Adequacy		X	X	
Baffle				
(Type :)				
Waterway Adequacy		8	8	
Icing (Y/N)	No			
Silting (Y/N)	No			
Drift (Y/N)	Yes			
Barrel General Rating		7	7	

Downstream End				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
Direction				
End Treatment (Concrete, Steel, Others, None)	CONCRETE			
Headwall		7	7	
Collar/Concrete Slope Protection		7	X	
Wingwalls		4	5	
(Shape :)				
Cutoff Wall		X	N	
Bevel End		X	X	
Heaving (mm)				
Invert Above/Below Stream Bed				
Above/Below (mm)	100			
Scour Protection		7	6	
(Type :)				
(Avg. Rock Size (mm) :)				
Scour/Erosion		7	6	
Beavers (Y/N)	No			
Downstream End General Rating		7	6	

Structure Usage				
		Last	**Now**	**Explanation of Condition**
Channel (U/S and D/S)				
Alignment		7	5	
Bank Stability		7	4	
HWM (m below Top of Culvert)				
Drift (Y/N)				
Channel Bottom Degrading/Aggrading				
Beavers (Y/N)	Yes			
(Fish Compensation Measure 1 : **NONE**)				
(Fish Compensation Measure 2 : **NONE**)				

Structure Usage			
	Last	Now	Explanation of Condition
Channel General Rating	7	5	

Maintenance Recommendations					
Inspector Recommendations	Year	Inspector Comments	Department Comments	Target Year	Est. Cost	Cat #
OTHER ACTION	1998	Remove beaver dam U/S entry				
OTHER ACTION	1998	Repair spall @ NE corner, minor concrete				
OTHER ACTION	1998	parches inside barrel				
OTHER ACTION	1998	Remove abandoned cable @ SW wingwall				
OTHER ACTION			See #28	1998		
OTHER ACTION						
OTHER ACTION						
OTHER ACTION						
OTHER ACTION						

Structural Condition Rating (Last/Now) (%)	**77.0/77.0**	**Sufficiency Rating (Last/Now) (%)**	**70.4/67.3**	Est. Repl. Yr	2018	Maint. Reqd. (Y/N)	

Special Comments for Next Inspection		Department Comments	

Maintenance Reviewed By	Name Unknown	Date	10-Jun-1999	Estimated Total	0
Proposed Long-Term Strategy					
On 3-Year Program (Y/N)					
Proposed Action					

Previous Inspector's Name	D. Kinsmen	Previous Assistant's Name	
Next Inspection Date	15-Feb-2003	Previous Inspection Date	10-Aug-1992
Inspection Cycle (Default) (months)	57		
Comment			

Bridge Culvert Inspection

Bridge File Number	00137 -1 Bridge Culvert	Form Type	CUL1
Year Built	1960	Lot No.	
Bridge or Town Name	EDMONTON	Inspector Name	D. Kinsmen
Located Over	WHITEMUD CREEK, 6.76, WATERCRS-ST	Inspector Class	
Located On	LOCAL ROAD	Assistant Name	
Water Body Cl./Year		Assistant Class	
Navigabil. Cl./Year		Inspection Date	10-Aug-1992
Legal Land Location	SW SEC 15 TWP 51 RGE 25 W4M	Data Entry By	D. Kinsmen
Longitude, Latitude	-113:36:30,53:23:45	Data Entry Date	30-Mar-2005
Road Authority	City of Edmonton	Reviewer Name	Dilip Dasmohapatra
Contract Main. Area	UNDEFINED CMA	Review Date	05-Jul-1994
Clear Roadway/Skew	7.3 / -45 deg. (LHF)	Department Reviewer Name	Dilip Dasmohapatra
AADT/Year		Department Review Date	05-Jul-1994
Road Classification		Follow-Up By	
Detour Length (km)			

Bridge Culvert Information

Number of Culverts		1						
Pipe #	Barrel	Span	Rise (or Dia.)	Type	Length	Corr. Profile	Pl. Thickness	Shape
1	MAIN	5300	5300	AP	36.6			ARCH
Special Features								
Special Features Comment								

Utilities (Located at)

Telephone	NORTH	Gas	NORTH
Power		Municipal	
Others		Problem (Y/N)	
Remarks			

Approach Road / Embankment

		Last	Now	Explanation of Condition
Horizontal Alignment			7	
Vertical Alignment			7	
Roadway Width (m)	6.500			
Embankment			7	
Sideslope (__:1)	2.0			
(Height of Cover (m) :)				
Guardrail (Y/N)	Yes			
Approach Road / Embankment General Rating			**7**	

Upstream End

Culvert Component		**Last**	**Now**	**Explanation of Condition**
Direction				
End Treatment (Concrete, Steel, Others, None)	CONCRETE			
Headwall			7	
Collar/Concrete Slope Protection			7	
Wingwalls			7	
(Shape :)				
Cutoff Wall			X	

Upstream End				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
Bevel End			X	
Heaving (mm)				
Invert Above/Below Stream Bed	BELOW			
Above/Below (mm)	100			
Scour Protection			6	
(Type :)				
(Avg. Rock Size (mm) :)				
Scour/Erosion			6	
Beavers (Y/N)	Yes			
Upstream End General Rating			7	

Bridge Culvert Barrel				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
(Pipe # : 1, Primary Span, Location Code: MAIN, Span (mm): 5300, Rise (mm): 5300, Type: AP)				
Barrel Last Accessible Date	10-Aug-1992			
Special Features				
Special Feature				
(Type :)				
Special Feature				
(Type :)				
Roof			7	
Measured Rise (mm)				
Measured At Ring No.				
Sag (mm)	0			
Percent Sag				
Sidewall			4	
Measured Span (mm)				
Measured At Ring No.				
Deflection (mm)	0			
Percent Deflection				
Floor			7	
Bulge (mm)	0			
Measured At Ring No.				
Abrasion (Y/N)				
Circumferential Seams			7	
Separation (mm)	0			
Longitudinal Seams			7	
Total No. of Cracked Rings				
Total No. of Rings with Two Cracked Seams				
Min. Remaining Steel Between Cracks (mm)				
Proper Lap (Y/N)				
Longitudinal Stagger (Y/N)				
Coating			X	
Corrosion By Soil (Y/N)				
Corrosion By Water (Y/N)				

Bridge Culvert Barrel				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
(Pipe # : **1, Primary Span, Location Code: MAIN, Span (mm): 5300, Rise (mm): 5300, Type: AP**)				
Camber POS/ZERO/NEG				
Ponding (Y/N)	No			
Fish Passage Adequacy			X	
Baffle				
(Type :)				
Waterway Adequacy			8	
Icing (Y/N)	No			
Silting (Y/N)	No			
Drift (Y/N)	Yes			
Barrel General Rating			7	

Downstream End				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
Direction				
End Treatment (Concrete, Steel, Others, None)	CONCRETE			
Headwall			7	
Collar/Concrete Slope Protection			7	
Wingwalls			4	
(Shape :)				
Cutoff Wall			X	
Bevel End			X	
Heaving (mm)				
Invert Above/Below Stream Bed				
Above/Below (mm)	100			
Scour Protection			7	
(Type :)				
(Avg. Rock Size (mm) :)				
Scour/Erosion			7	
Beavers (Y/N)	No			
Downstream End General Rating			7	

Structure Usage				
		Last	**Now**	**Explanation of Condition**
Channel (U/S and D/S)				
Alignment			7	
Bank Stability			7	
HWM (m below Top of Culvert)				
Drift (Y/N)				
Channel Bottom Degrading/Aggrading				
Beavers (Y/N)	Yes			
(Fish Compensation Measure 1 : **NONE**)				
(Fish Compensation Measure 2 : **NONE**)				

Structure Usage			
	Last	Now	Explanation of Condition
Channel General Rating		7	

Maintenance Recommendations											
Inspector Recommendations	Year	Inspector Comments			Department Comments				Target Year	Est. Cost	Cat #
OTHER ACTION											
OTHER ACTION											
OTHER ACTION											
OTHER ACTION											

Structural Condition Rating (Last/Now) (%)	**/77.0**	**Sufficiency Rating (Last/Now) (%)**	**/70.4**	Est. Repl. Yr	2012	Maint. Reqd. (Y/N)	

Special Comments for Next Inspection		Department Comments	

Maintenance Reviewed By		Date		Estimated Total	0
Proposed Long-Term Strategy					
On 3-Year Program (Y/N)					
Proposed Action					
Previous Inspector's Name		Previous Assistant's Name			
Next Inspection Date	10-May-1997	Previous Inspection Date			
Inspection Cycle (Default) (months)	57				
Comment					

APPENDIX B - SITE PHOTOS AND AERIAL PHOTO

Approach – Road dips at creek crossing

Inlet side (south) – barrier is broken.

Looking south at culvert outlet (North side of 41 Ave SW)
15 – 20 m high vertical bank on east side of Whitemud creek

Looking north at culvert inlet. High banks of creek to west on this side of culvert and on east on far side of culvert

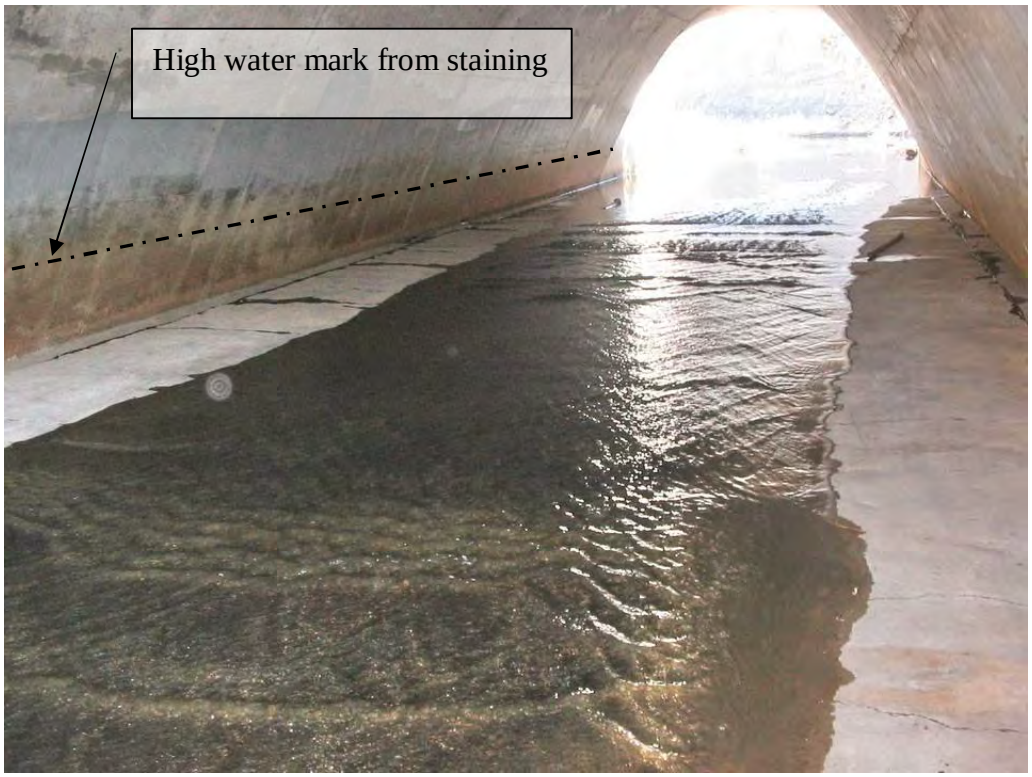
Upstream side of culvert showing broken barrier.

Wingwall with some cracking. Some staining but no evidence of corrosion.

Concrete apron slab broken and used as rip rap

Concrete spall and exposed reinforcing steel – outlet of culvert.

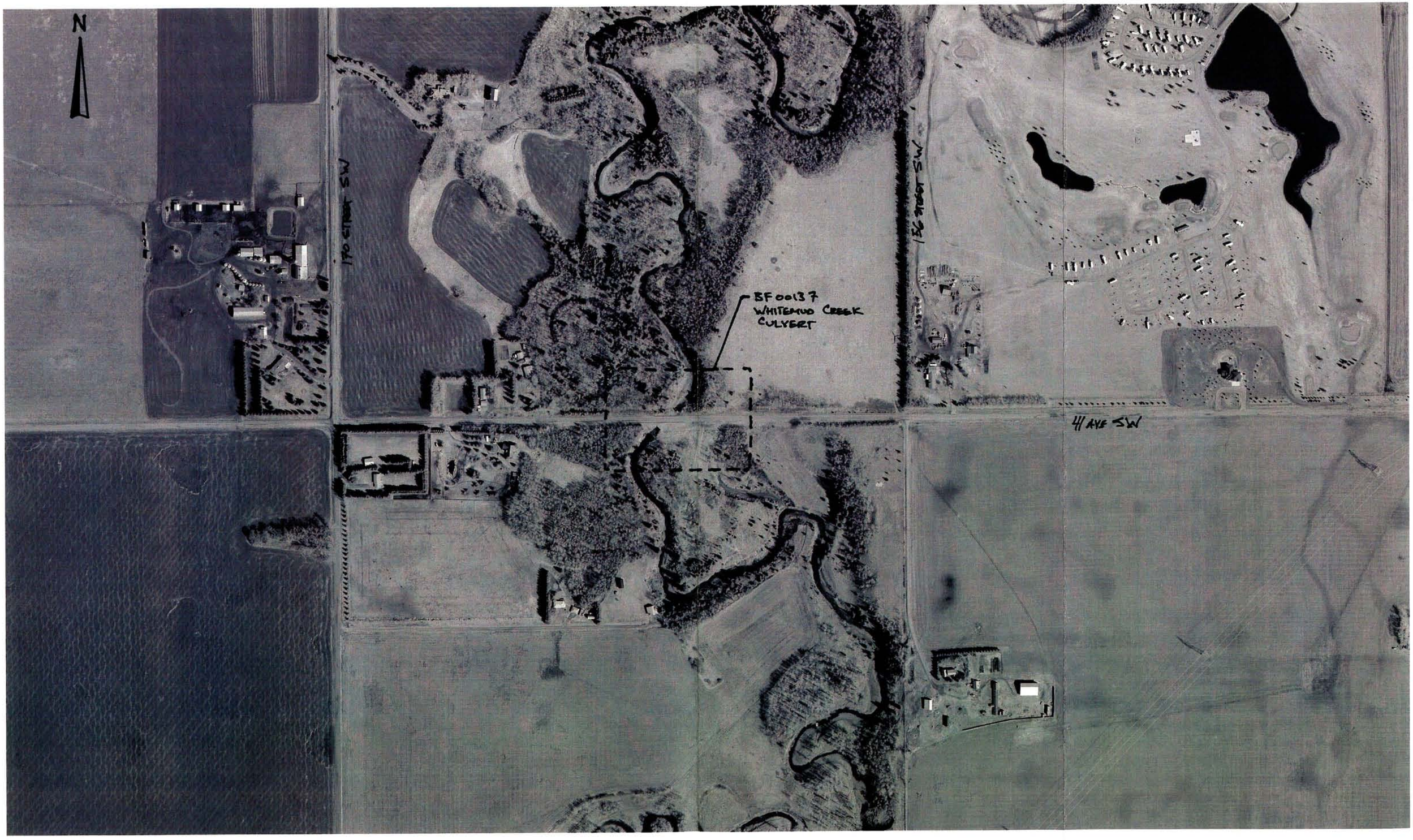
Interior wall of culvert. Minor cracking in base slab.



Culvert flow

Wildlife in area included Canadian geese, and mallards (with nests on the banks)

Fox viewed nearby Whitemud Creek


N
170 STREET SW
BF00137
WHITEMUD CREEK
CULVERT
41 AVE SW

APPENDIX C – LIFE CYCLE COST SUMMARY

City of Edmonton

Assessment Options and Life Cycle Cost Summary

Escalation Rate : 4%

Analysis Period : 50 years

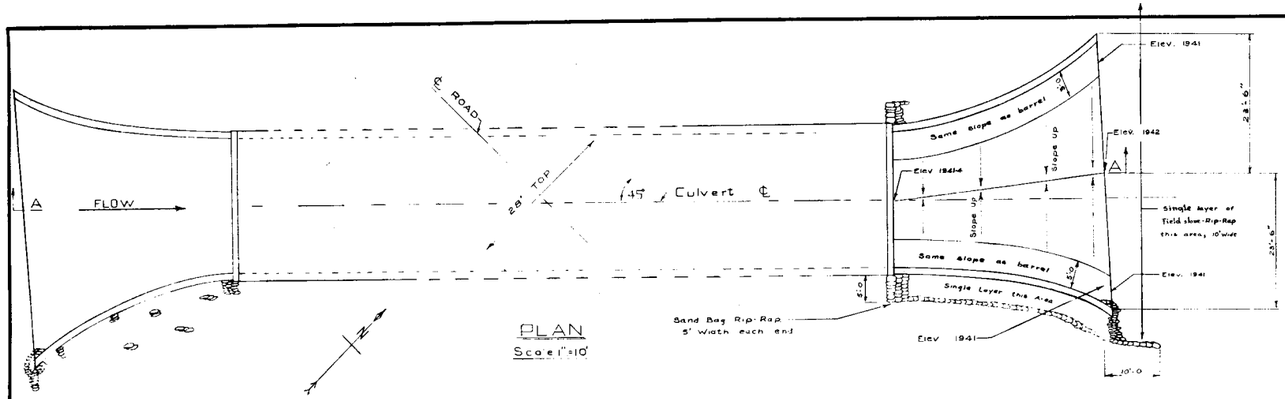
Starting Year : 2010

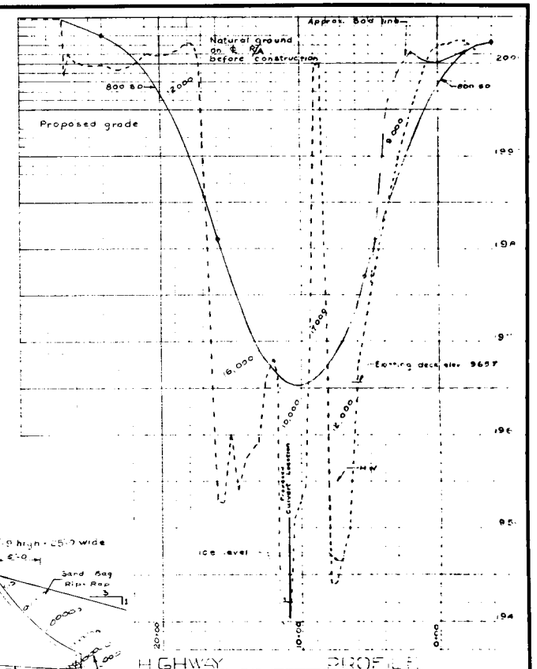
REVISION DATE: October 20, 2010

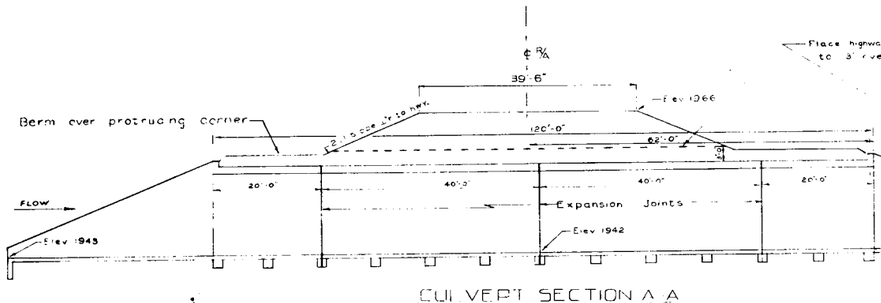
Note: *Bridge Replacement costs based on* ***Span length x Clear width x $3,500/m^2***
Cost estimates are ***Class 'A' accuracy [+/- 50%].***

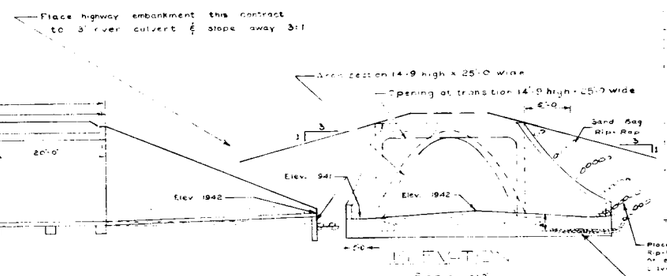
		EXPENDITURE YEAR											
		2010	2015	2020	2024	2030	2035	2040	2045	2050	2055	2060	EXPENDITURE (current dollars)	NET PRESENT VALUE
BF 00137	**Whitemud Creek Culvert**													
	Option 3a - Replace with bridge in 2015													
	Removal and disposal of existing culvert Construction of new bridge 100 m x (12.5 m + 16.0 m) @ $3500/m^2		$9,975,000										$9,975,000.00	$8,198,722.89
													$9,975,000.00	**$8,198,722.89**
	Option 3b - Repair in 2015, Replace in 2020													
	Culvert repairs to keep serviceable until 2020		$150,000										$150,000.00	$123,289.07
	Removal and disposal of existing culvert Construction of new bridge 100 m x (12.5 m + 16.0 m) @ $3500/m^2				$9,975,000								$9,975,000.00	$6,738,752.58
	100 m x (12.5 m + 16.0 m) @ $3500/m^2												**$10,125,000.00**	**$6,862,041.65**

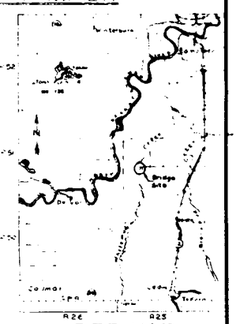
APPENDIX D - DRAWINGS

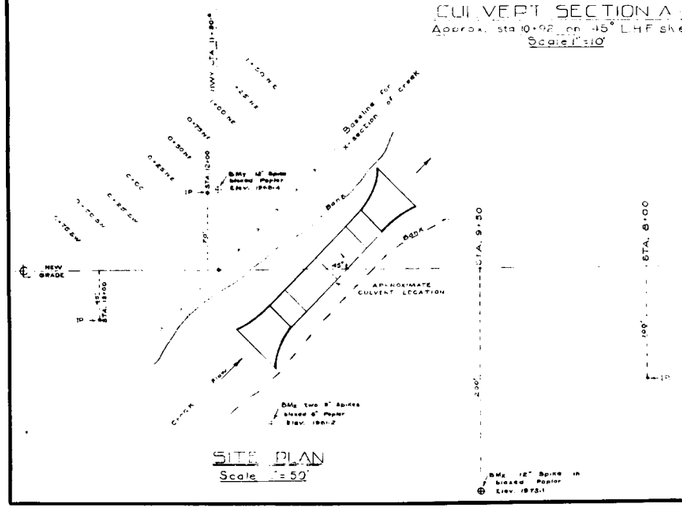












TOTAL QUANTITY ESTIMATE

ITEM	UNIT	SUB STRUCT.	SUPER STRUCT.	TOTAL RETAINING WALLS	TOTAL ALL WORKS
Concrete Class 'A'	Cu Yds	638		636	683
Reinforcing Steel	Lbs	53,671			68,686
Slimbank Rip Rap	Sq Yds	220			244
Backfill - granular	Cu Yd	200			393
Backfill - compacted	Cu Yds	90			97
Highway embankment	Cu Yd	4,300			2,004
Excavation - dry	Cu Yd	400			130
Excavation - wet	Cu Yd	800			410
Excavation - Solid	Cu Yd	50			34

INDEX

Sheet No.	Description	Dwg No.
1	General Layout	2488-P
2	Barrel Details	2489-P
3	Wingwall Details	2490-P

GENERAL NOTES:

- Specs - AASHO
- Excavation for wingwalls and headwalls to be known as Class 2 excavation.
- Highway embankment is that fill required above original ground-line.

APPROVED
CHIEF BRIDGE ENGINEER

NO.	DATE	DESCRIPTION	BY
4			
3			
2			
1	Jan. 11, 60	As constructed	B.V.S.

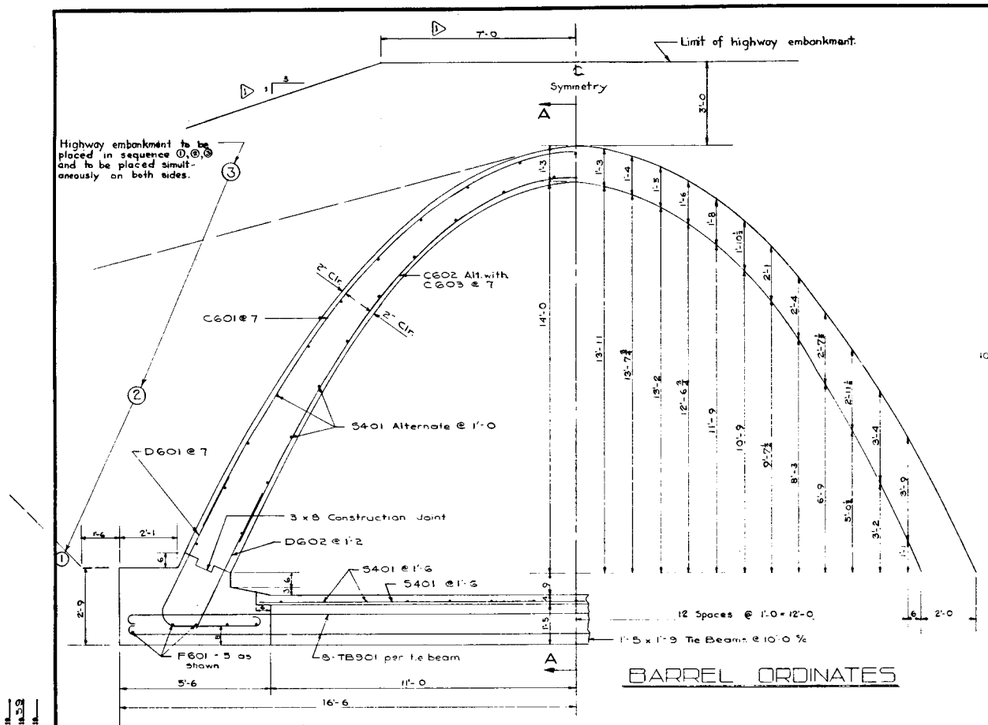
REVISIONS

DESIGNED BY
DETAILED BY A.H.H.
CHECKED BY
DATE
DATE
DATE
DATE

ASPELAND CREEK CULVERT
2 MILES SOUTH, 1 MILES WEST
OF ELLERSLIE
GENERAL LAYOUT

GOVERNMENT OF THE PROVINCE OF ALBERTA
DEPARTMENT OF HIGHWAYS
BRIDGE BRANCH, EDMONTON

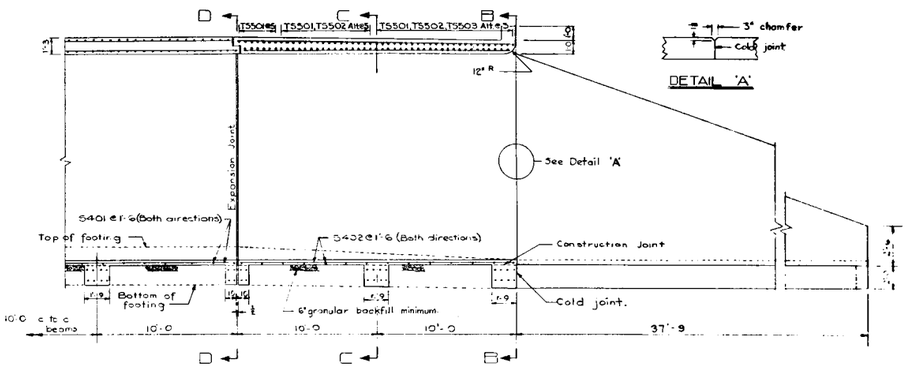
FILE NO. 13-7 HWY. NO. 21-11
LOCATION SSW 18-34-25-4 SCALE As Shown
STREAM Whitemud Cr. SHEET 1 OF 3
DWG. NO. 2488-C



HALF BARREL SECTION

Scale: ½" = 1'-0

BARREL ORDINATES



SECTION 'A-A'

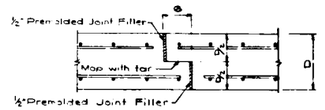
28 day concrete strengths

Barrel footing	4120 P.S.I.
Transition footing	420
Wing footing	4000
Barrel section	4360
Transition section.	5270
Wing.	

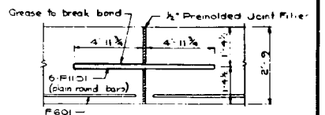
TRANSITION SECTION

Scale: ½" = 1'-0

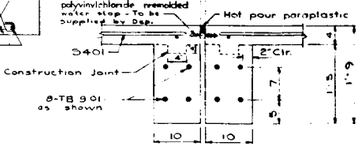
WINGWALL



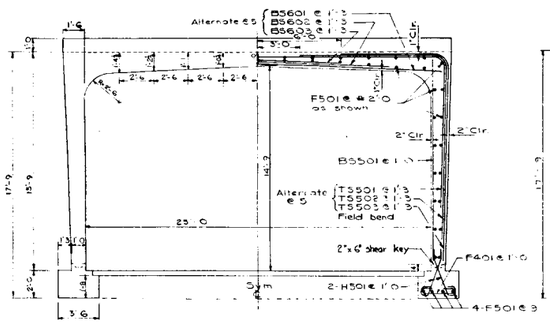
BARREL EXP. JOINT



FOOTING EXP. JOINT

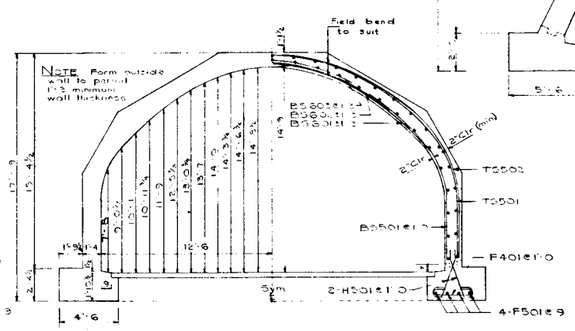


SLAB EXP. JOINT



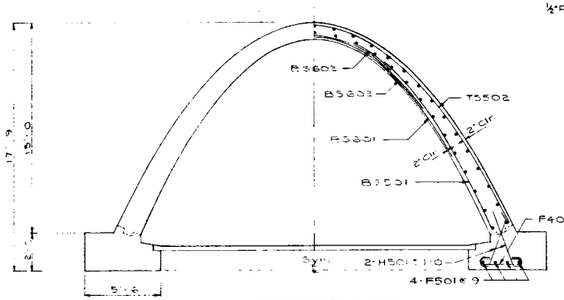
SECTION-BB

Scale ½" = 1'-0



SECTION-CC

Scale ½" = 1'-0



SECTION-DD

Dimensions similar to barrel section.

Scale ½" = 1'-0

GENERAL NOTES

- All concrete to be Class 'A'.
- See drawing 2490-P for steel quantities.
- All reinforcing minimum clearance of 2".

QUANTITY ESTIMATE

Item	As const.	Unit.
Concrete Class 'A'	454	Cu Yds.
Reinforcing Steel (barrel)	54,981	Lbs

NO.	DATE	DESCRIPTION	BY
4			
3			
2			
1	Jan. 11, 1960	As constructed	D.W.S.

REVISIONS

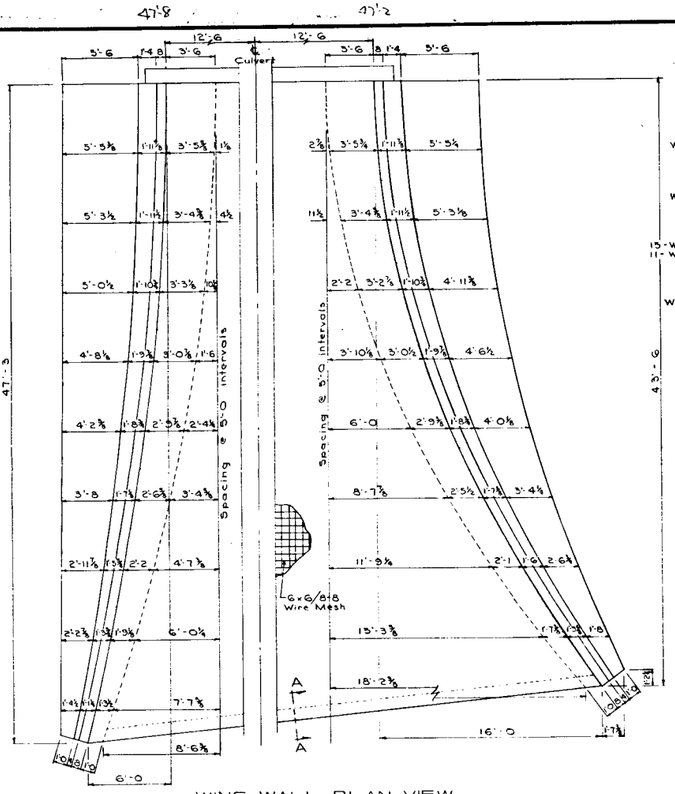
DESIGNED BY: D.G.W. DATE: Jan. 16, 1959
DETAILED BY: DATE:
CHECKED BY: DATE:

WHITEMUD CREEK BRIDGE

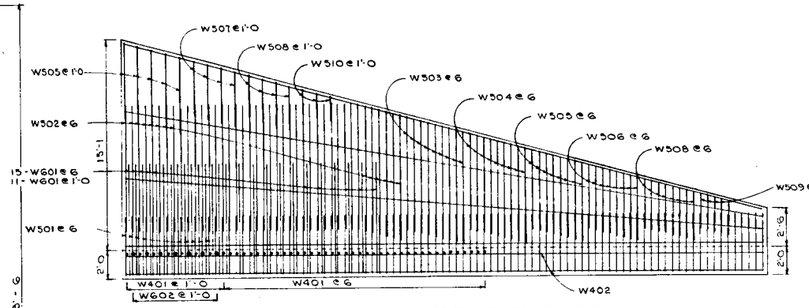
BARREL DETAILS

GOVERNMENT OF THE PROVINCE OF ALBERTA
DEPARTMENT OF HIGHWAYS
BRIDGE BRANCH, EDMONTON

FILE NO. 137 HWY. NO. DISTRICT
LOCATION NEW 18-31-22-4 SCALE Shown DWG. NO. 2489-C
STREAM WHITEMUD CR. SHEET 2 OF 3

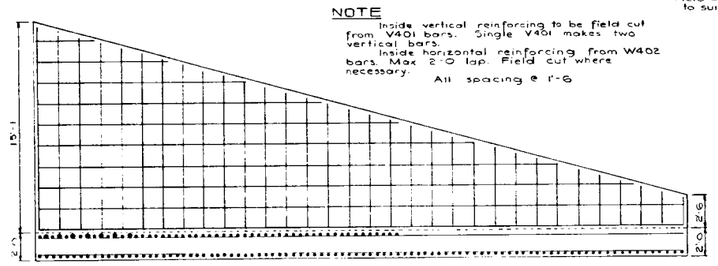


WING WALL PLAN VIEW



WING WALL REINFORCING OUTSIDE FACE

Min 2'-0 lap on all bars



WING WALL REINFORCING INSIDE FACE

NOTE

Inside vertical reinforcing to be field cut from V401 bars. Single V401 makes two vertical bars.
Inside horizontal reinforcing from W402 bars. Max 2'-0 lap. Field cut where necessary.

All spacing @ 1'-6

NOTE
Field bend to suit

BAR LIST

CULVERT BARREL

Mark	Size	Number	Type	"X"	Length	Weight
S401	4	346	Str		21'-0	4,854
CG01	6	138	Str		40'-0	8291
CG02	6	70	Str		38'-0	3986
CG03	6	68	Str		24'-0	2951
DG01	6	276	B		9'-3	4042
DG02	6	140	Str		6'-0	1262
FG01	6	40	Str		21'-0	1262
TB901	9	84	C	32'-6	35'-0	3956
F1101	11	56	Str		10'-0	1910
						38,564

NOTE: To make up bars not properly detailed & for splice bars = 5% road - 780 Sq' 812

TRANSITION SECTION

Mark	Size	Number	Type	"X"	Length	Weight
S402	4	60	Str		13'-6	786
F401	4	80	C	5'-2	4'-2	223
F501	5	128	Str		19'-6	2603
H501	5	168	D		5'-5	949
T5501	5	68	Str		25'-0	1773
T5502	5	64	Str		25'-0	1668
T5503	5	64	Str		22'-0	1468
B5501	5	84	Str		14'-6	1270
B5601	6	34	Str		27'-0	1258
B5602	6	32	Str		19'-0	914
B5603	6	32	Str		12'-0	456
TB902	9	20	C	29'-0	51'-6	2,141
						15,505

WING WALLS

Mark	Size	Number	Type	"X"	Length	Weight
V401	4	64	Str		16'-6	705
W401	4	184	Str		6'-0	735
W402	4	136	Str		24'-6	2226
W501	5	384	A		7'-2	2881
W502	5	164	Str		9'-0	1515
W503	5	36	Str		7'-10	294
W504	5	36	Str		6'-7	247
W505	5	52	Str		5'-6	298
W506	5	36	Str		4'-3	160
W507	5	16	Str		4'-0	67
W508	5	52	Str		3'-2	173
W509	5	24	Str		2'-1	52
W510	5	12	Str		1'-9	22
WG01	6	104	F		12'-4	1927
WG02	6	28	Str		8'-0	252
						11,554

APRON & CUT-OFF WALL

Mark	Size	Number	Type	"X"	Length	Weight
CW401	4	16	Str		33'-9	425
CW402	4	136	E		8'-4	866
6x6/8x8	Wire Mesh @ 30"/100"				3200#	960
						2,251

Total = 68,694

BAR TYPES

All dimensions are out to out of bars

TYPE "A" TYPE "B" TYPE "C" TYPE "D" TYPE "E" TYPE "F"

HALF ELEVATION

INLET SECTION

OUTLET SECTION

There shall be a minimum 1'-0 granular backfill under these apron slabs

WING WALL SECTION
Scale ½" = 1'-0

SECTION A-A
Scale ½" = 1'-0

QUANTITY ESTIMATE

Item	As const.	Unit
Concrete Class "A"	229	Cu Yds
Reinforcing Steel	13,805	Lbs

No.	Date	Description	By
4			
3			
2	Jan. 11-60	As constructed	DWS
1	Aug. 26/59	Revised - Bars added	DGW

REVISIONS

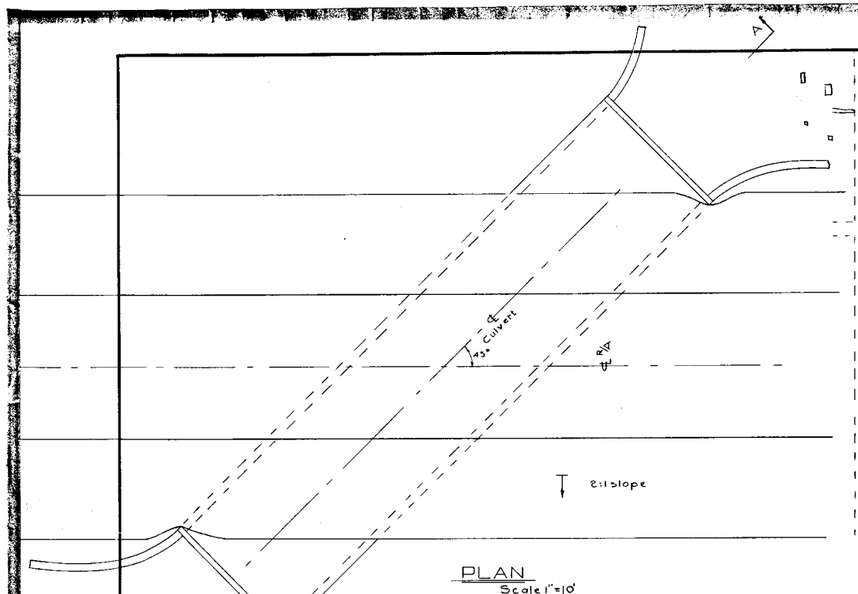
DESIGNED BY
DETAILED BY
CHECKED BY
DATE
DATE Aug. 26
DATE
DATE

WHITEMUD CREEK BRIDGE

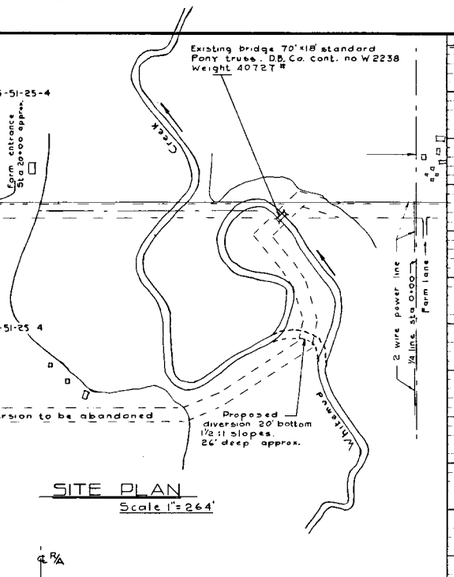
WING WALL DETAILS

GOVERNMENT OF THE PROVINCE OF ALBERTA
DEPARTMENT OF HIGHWAYS
BRIDGE BRANCH, EDMONTON

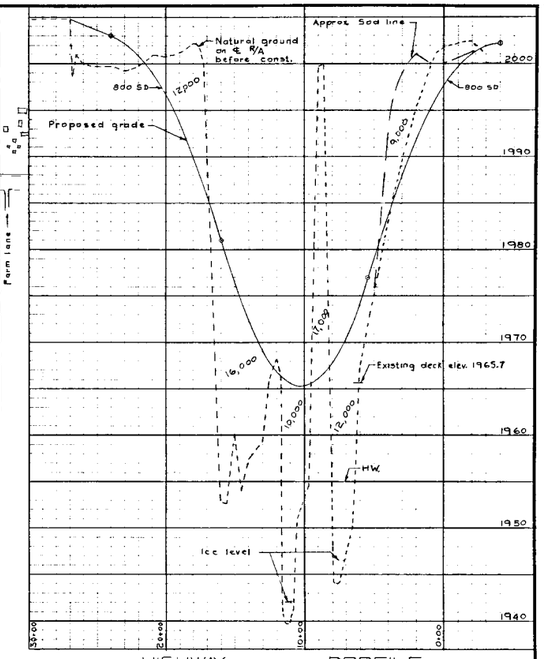
FILE NO. 137 HWY. NO. District
LOCATION S/SW 19-51-25-4 SCALE 1"=1'-0 Except as noted
STREAM Whitemud Creek SHEET 3 OF 3
DWG. NO. 2490-E



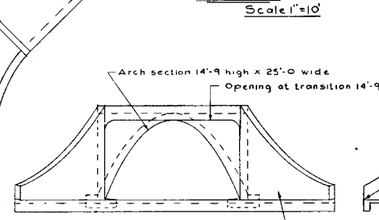
PLAN
Scale 1"=10'



SITE PLAN
Scale 1"=264'

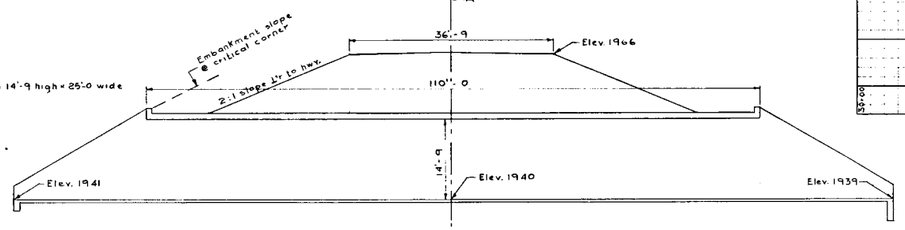


HIGHWAY PROFILE



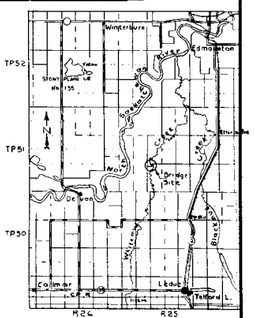
ELEVATION
Scale 1"=10'

NOTE : Wings shown are diagramtic only. To be dimensioned to take embankment and culvert backfill.



CULVERT SECTION A-A
Approx. sta 11+25 on 45° L.H.F skew
Scale 1"=10'

NOTE
- Regime width of natural channel 25'
- Max. est. flow 2000 C.F.S. based on H.W. 10' and rate of flow 9 f.p.s. in flood



SITE MAP
Scale 1"=4 miles

DESIGNED BY EJS DATE
DETAILED BY F.M DATE Nov 27 19 68
CHECKED BY DATE 19

NO.	DATE	DESCRIPTION	BY
4			
3			
2			
1			

REVISIONS

WHITEMUD CREEK BRIDGE
2 MILES SOUTH, 4 MILES WEST OF ELLERSLIE
DESIGN DATA SHEET

GOVERNMENT OF THE PROVINCE OF ALBERTA
DEPARTMENT OF HIGHWAYS
BRIDGE BRANCH, EDMONTON

FILE NO. 137 HWY. NO. District DWG. NO.
LOCATION 2.5 W 15-51-25-4 SCALE Shown 00-232
STREAM Whitemud Ck SHEET 1 OF 1

H Appendix H - Historical Resources Report

HISTORICAL RESOURCES OVERVIEW FORM
Alberta Tourism, Parks, Recreation and Culture

File Opened: _____

Historical Resources Division Project No: _____

Prepared By: Kristin Soucey

Archaeological Permit No: _____

Project Name: 41 Avenue SW Widening

Applicants No: _____

Disposition Type and Number

Applicant's Corporate Name Associated Engineering

Contact Person

Applicant's Address 1000, 10909 Jasper Avenue

Edmonton Alberta T5J 5B9

Telephone (780) 451-7666 **FAX** (780) 453-3871 **E-Mail**

Agent's Corporate Name Altamira Consulting Ltd.

Agent's Contact Person Bruce F. Ball

Agent's Address Suite 211, 10544 - 106 Street

Edmonton Alberta T5H 2X6

Telephone (780) 423-5840 **FAX** (780) 423-5878 **E-Mail** altamira@archaeology.ca

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Nature of Project Widening of 41 Ave. S.W. between 50 St. S.W. and 184 St. S.W.

Project Size Unknown **Nearest Town** Nisku and Beaumont

NTS Mapsheets 83H 5 Leduc
83H 6 Cooking Lake

Legal Location

LSD	1/4	Sec	Twp	Rge	Mer	HRV	HRV Site	Ownership	Ownership Agency
13, 14	NW	9	51	25	W4M	None		Unknown	Unknown
15, 16	NE	9	51	25	W4M	None		Unknown	Unknown
1, 2	SE	16	51	25	W4M	None		Unknown	Unknown
3, 4	SW	16	51	25	W4M	None		Unknown	Unknown
13, 14	NW	10	51	25	W4M	None		Unknown	Unknown
15, 16	NE	10	51	25	W4M	None		Unknown	Unknown
1, 2	SE	15	51	25	W4M	None		Unknown	Unknown
3, 4	SW	15	51	25	W4M	None		Unknown	Unknown
13, 14	NW	11	51	25	W4M	None		Unknown	Unknown

Legals continued on attached page

Existing Surface Disturbance Existing roads, agriculture

Landscape Information Aspen parkland; Coarse grained (glacio) lacustrine, Fine grained (glacio) lacustrine and continuous till blanket; Flat to gently undulating topography

Borden Blocks FiPi, FiPj

HISTORICAL RESOURCES OVERVIEW FORM
Alberta Tourism, Parks, Recreation and Culture

File Opened: _____ Historical Resources Division Project No: _____

Prepared By: Kristin Soucey Archaeological Permit No: _____

Project Name: 41 Avenue SW Widening Applicants No: _____

Disposition Type and Number

Historic Sites in Vicinity	PDA: 48476; Vicinity: 48476, 81825-81830, 81832-81845, 51101, 51111, 51110, 51113-51117, 48472-48481, 81929, 81931, 81932, 90757-90764, 48482, 48483
Archaeological Sites in Vicinity	FiPj-2, FiPj-5, FiPj-10, FiPj-69, FiPj-70, FiPj-71, FiPj-73, FiPj-97, FiPj-98, FiPj-100, FiPj-101, FiPj-102, FiPj-103, FiPj-104, FiPj-105, FiPj-108, FiPj-109, FiPj-110, FiPj-111, FiPj-112, FiPj-118, FiPj-118, FiPj-119, FiPj-120, FiPj-121, FiPj-122, FiPj-129, FiPj-130, FiPj-131, FiPj-132, FiPj-133, FiPj-134, FiPj-135, FiPj-136, FiPj-137, FiPj-138, FiPj-139, FiPj-140, FiPj-145, FiPj-146, FiPj-147, FiPj-148, FiPj-150, FiPj-151, FiPj-152, FiPk-12, FiPk-13, FiPk-14, FiPk-45, FiPk-68, FiPk-71, FiPk-76, FiPi-44, FiPi-45, FiPi-46, FiPi-110
Historic Sites Impacted	48476
Archaeological Sites Impacted	FiPj-148
Previous Permits in Vicinity	77-012, 77-054, 79-175, 80-062, 82-003, 97-025, 98-126, 99-063, 00-192, 01-332, 02-232, 03-071, 04-111, 04-417, 06-495, 06-645, 07-293, 07-302, 07-513
Previous Permits in Impact Zone	77-012, 77-054, 98-126, 04-111, 06-645

Evaluation

The 41 Avenue SW project is located in Edmonton south between 50th Street to 184th Street. The project does not include the interchange at 41 Ave and the QE II nor does it include the Blackmud Creek crossing; both are being considered separately. The proposed ROW encompasses an area of 590 ha, including 263 ha of existing road and 327 ha of new ROW. The project crosses Whitemud Creek as well as Blackmud Creek. The western terminus is approximately 300m east of the North Saskatchewan River. Other waterbodies within the project upgrade area include Cawes Lake and two smaller lakes/sloughs. There is one previously identified archaeological site (FiPj-148) located within the proposed upgrade r-o-w along with and over twenty recorded historic sites including a a coal mine (historic site #48476). There are several local collections from this general area from unknown sites indicating the potential for new site discoveries. The proposed project area includes both sections that have been previously disturbed as well as undisturbed. And, although portions of the project area have been subject to construction and agricultural disturbance factors, there is potential for locating undisturbed historic and archaeological components below these disturbance layers. Areas of potential for locating archaeological sites include the Whitemud Creek crossings, the top of the bluff above the North Saskatchewan River, any area of raised relief in the otherwise flat landscape. Areas of potential for locating historical sites include all farmsteads, past and present. Additionally, there exists reasonable potential for paleontological sites and for same to be adversely impacted. Finally, recent events in the vicinity have resulted in human burial concerns. Such concerns should be addressed. It is concluded that there is reasonable potential for historical resources to be adversely affected by construction associated with the proposed upgrade project.

Recommendation

Given the number of known archaeological and historic sites, the potential indicated by local collections, the potential for paleontological materials and human burial concerns it is recommended that an HRIA be conducted prior to construction or any project land altering preparation activities .

Signature **Date** 13 March, 2008

GOVERNMENT USE ONLY

HSAS _____ **Date** _____

Approved _____ **Date** _____
Regional Planner

Approved _____ **Date** _____
Regional Archaeologist

Approved _____ **Date** _____
Head Archaeological Survey

Appendix I - Cost Estimate

41 Avenue SW Concept Planning Study
Mainline Estimate (per metre)

	8-lane Cross-Section				6-lane Cross-Section			
Item	**Quantity**	**Unit**	**Unit Price**	**Total**	**Quantity**	**Unit**	**Unit Price**	**Total**
Asphalt (250mm)	17.8	t	$ 192.94	$ 3,439.06	14.1	t	$ 192.94	$ 2,719.78
GBC (300mm)	21.4	t	$ 39.69	$ 848.95	16.9	t	$ 39.69	$ 671.39
Cement Stabilized Sugrade (150mm)	46.5	m^2	$ 21.50	$ 999.75	39.6	m2	$ 21.50	$ 851.40
250mm Concrete Curb and Gutter	4.0	m	$ 207.38	$ 829.52	2.0	m	$ 207.38	$ 414.76
Concrete Median	11.9	m2	$ 264.60	$ 3,148.74	11.9	m2	$ 264.60	$ 3,148.74
Pavement Marking-Secondary	6.0	m	$ 16.54	$ 99.24	4.0	m	$ 16.54	$ 66.16
Pavement Marking-Solid	0		$ 33.08	$ -	2.0		$ 33.08	$ 66.16
Top Soil and Sod	10.5	m2	$ 52.50	$ 550.20	17.4	m2	$ 52.50	$ 913.50
Clearing R.O.W.	36.9	m2	$ 3.00	$ 110.58	36.9	m2	$ 3.00	$ 110.58
Asphalt Multi-Use Trail	1.0	lm	$ 501.63	$ 501.63	1.0	lm	$ 501.63	$ 501.63
Excavation	38.0	m3	$ 38.59	$ 1,465.26	24.2	m3	$ 38.59	$ 935.42
Fill	3.2	m3	$ 55.13	$ 176.42	3.8	m3	$ 55.13	$ 210.05
Fill compaction	3.2	m3	$ 14.88	$ 47.62	3.8	m3	$ 14.88	$ 56.69
Streetlightings & Power	1	LS	$ 1.00	$ 600.00	1	LS	$ 1.00	$ 400.00
Tree (3 tress every 10m)	0.3	each	$ 600.00	$ 180.00	0.3	each	$ 600.00	$ 180.00
Remove Driveway/Private Access	0.2	m^2	$ 55.13	$ 13.12	0.2	m^2	$ 55.13	$ 13.12
Remove Pavement	10.0	m^2	$ 55.13	$ 551.30	10.0	m^2	$ 55.13	$ 551.30
Drainage	-		-	-	-		-	-
			Sub Total	**$ 13,600.00**			**Sub Total**	**$ 11,800.00**

Note:
1) All unit prices are based on year 2010 dollars
2) Costs for utility relocations to be determined by others during the preliminary design phase of the project
3) Whitemud Creek Bridge cost included in Summary

41 Avenue SW Concept Planning Study
Typical Intersection Estimate

	8-lane Cross-Section				6-lane Cross-Section			
Item	**Quantity**	**Unit**	**Unit Price**	**Total**	**Quantity**	**Unit**	**Unit Price**	**Total**
Asphalt (250mm)	14602	t	$ 192.94	$ 2,817,219	12966	m^3	$ 192.94	$ 2,501,747
GBC (300mm)	17522	t	$ 39.69	$ 695,442	15560	m^3	$ 39.69	$ 617,566
Cement Stabilized Subgrade (150mm)	30445	m2	$ 21.50	$ 654,558	27969	m2	$ 21.50	$ 601,332
250mm Concrete Curb and Gutter	2792	m	$ 207.38	$ 579,005	2582	m	$ 207.38	$ 535,455
Concrete Median	3296	m2	$ 264.60	$ 872,122	3446	m2	$ 264.60	$ 911,869
Concrete Slab (chanelized islands)	875	m2	$ 264.60	$ 231,525	855	m2	$ 264.60	$ 226,217
Pavement Marking-Secondary	4450	m	$ 16.54	$ 73,603	3364	m	$ 16.54	$ 55,641
Pavement Marking-Solid	1304	m	$ 33.08	$ 43,136	1476	m	$ 33.08	$ 48,826
Top Soil and Sod	8085	m2	$ 52.50	$ 424,463	10646	m2	$ 52.50	$ 558,915
Clearing R.O.W.	19715	m2	$ 3.00	$ 59,145	17031	m2	$ 3.00	$ 51,093
Asphalt Multi-Use Trail	662	lm	$ 501.63	$ 332,079	662	lm	$ 501.63	$ 332,079
Concrete walk	492	m^2	$ 307.85	$ 151,462	492	m	$ 307.85	$ 151,462
Excavation	14659	m3	$ 38.59	$ 565,691	9357	m3	$ 38.59	$ 361,087
Fill	1235	m3	$ 55.13	$ 68,086	1471	m3	$ 55.13	$ 81,096
Fill Compaction	1235	m3	$ 14.88	$ 18,377	1471	m3	$ 14.88	$ 21,888
Streetlighting and Power	1	LS		$ 600,000	1	LS		$ 600,000
Traffic Signals	1	LS		$ 300,000	1	LS		$ 300,000
Drainage	-		-	-	-		-	-
			Sub Total	**$ 8,486,000.00**			**Sub Total**	**$ 7,957,000.00**

Note:
1) All unit prices are based on year 2010 dollars
2) Costs for utility relocations to be determined by others during the preliminary design phase of the project

41 Avenue SW Concept Planning Study
Drainage Estimate

Pipe Diameter (mm)	Pipe Length (m)	Unit Price ($/m)	Total
300	620	$ 151.11	$ 93,689.75
375	2040	$ 193.39	$ 394,517.64
450	3000	$ 252.42	$ 757,267.50
525	2995	$ 331.12	$ 991,693.92
600	2935	$ 414.89	$ 1,217,709.49
675	1510	$ 570.54	$ 861,519.18
750	1620	$ 660.51	$ 1,070,028.63
900	0	$ 932.95	$ -
1050	0	$ 1,204.10	$ -
		Sub Total	**$ 5,387,000.00**

Note:
1) All unit prices are based on year 2010 dollars

41 Avenue SW Concept Planning Study
Cost Estimate Summary

Mainline	Length (m)	$ / m	Total Cost
50 Street to Southeast Access	295	$ 11,800.00	$ 3,481,000
Southeast Access to Existing 66 Street	335	$ 11,800.00	$ 3,953,000
Existing 66 Street to Existing 91 Street	1203	$ 11,800.00	$ 14,195,400
Existing 91 Street to Existing 101 Street	1130	$ 13,600.00	$ 15,368,000
Existing 101 Street to Future QEII Interchange	403	$ 13,600.00	$ 5,480,800
Future QEII Interchange to Allard Access 2	246	$ 13,600.00	$ 3,345,600
Allard Access 1 to Existing 127 Street	47	$ 13,600.00	$ 639,200
Existing 127 Street to Future Desrochers Access	359	$ 11,800.00	$ 4,236,200
Future Desrochers Access to Existing 141 Street	367	$ 11,800.00	$ 4,330,600
Existing 141 Street to 156A Street	582	$ 11,800.00	$ 6,867,600
156A Street to 156B Street	597	$ 11,800.00	$ 7,044,600
156B Street to West Project Limit	870	$ 11,800.00	$ 10,266,000
		Mainline Subtotal	**$ 79,208,000**

Intersections	No. of Intersections	$ / Intersection	Total Cost
8 lane intersection	5	$ 8,486,000.00	$ 42,430,000.00
6 lane intersection	7	$ 7,957,000.00	$ 55,699,000.00
		Intersections Subtotal	**$ 98,129,000.00**

Whitemud Creek Bridge Replacement	Total Cost
Structural Subtotal	**$ 9,975,000.00**

Drainage	Total Cost
Drainage Subtotal	**$ 5,387,000.00**

Mainline Subtotal	$ 79,208,000.00
Intersections Subtotal	$ 98,129,000.00
Structural Subtotal	$ 9,975,000.00
Drainage Subtotal	$ 5,387,000.00
Construction Subtotal	$ 192,699,000.00
Contingency (50%)	$ 96,349,500.00
Engineering and Administration (12.5%)	$ 24,087,375.00
Grand Total	**$ 313,200,000.00**

J Appendix J - Public Consultation Material

41 AVENUE SW CONCEPT PLANNING STUDY
FUNCTIONAL PLANNING STUDY

Summary of Phase I Consultation with Property Owners and Stakeholders

Prepared by:

ARMIN A. PREIKSAITIS
& ASSOCIATES LTD.

March 19, 2008

Summary of Phase I Consultation with Property Owners and Stakeholders

BACKGROUND AND PURPOSE

The City of Edmonton and Leduc County are planning for the future transportation needs along Edmonton's southern municipal boundary. They have partnered to develop a concept planning study for 41 Avenue SW between 50 Street and 184 Street to identify the roadway's long-term requirements. A project engineering team lead by Associated Engineering was retained in November 2007 to undertake the study.

The project engineering team developed a stakeholder engagement strategy which identified two major public engagement activities throughout the concept planning study. The first phase of public consultation involved one-on-one interviews with stakeholders and landowners. This consultation phase was intended to share and gather information from local property owners before beginning the project engineering and technical analysis. The interviews had three main objectives:

- To introduce the planning study and consulting firms to property owners on both sides of 41 Avenue SW
- To share information and answer questions on the study purpose, scope and timelines
- To solicit input from private property owners on future plans for their property and identify issues related to the current road and traffic conditions.

In preparation for the interviews, the City of Edmonton and Leduc County provided the consultants with a database of property owners adjacent to 41 Avenue SW between 50 Street and 184 Street. In early December 2007, Armin A. Preiksaitis & Associates Ltd. completed directory searches to obtain telephone numbers for each private property owner immediately adjacent to the road. Phone numbers were found for approximately 80% of land owners.

METHODOLOGY

A telephone script was prepared before phoning private property owners to arrange for interviews. Mary-Jane Laviolette of Armin A. Preiksaitis & Associates Ltd. made phone calls during December 2007 and January 2008. Phone calls were made to a total of 48 private property owners along 41 Avenue SW. Three attempts were made to contact each landowner; messages were left requesting a call back. Some property owners could not be contacted and others declined to participate.

After explaining the purpose of the call, individuals were invited to participate in a 45 minute interview with the consultants at the location of their choice. To accommodate as many individuals as possible, the consultants met with most residents at their homes or buisinesses. Two project team members - Shawn Benbow of Associated Engineering and Mary-Jane Laviolette of Armin A. Preiksaitis & Associates Ltd. - attended each interview. The project team met with a total of 40 stakeholders which included 23 within Leduc County (including 1 developer) and 17 within the City of Edmonton (including 6 developers).

INTERVIEW QUESTIONS AND RESPONSES

After making introductions, the consultant team provided information on the study purpose and timelines. Property owners were shown a map of the study area and asked to identify the location of their property. To ensure consistency, each interview was guided by an interview outline and respondent comments were recorded. The following is a summary of the responses received to each interview question.

INITIAL AWARENESS AND KNOWLEDGE

1. What have you heard about transportation plans for this area to date?

Developers:

- All were aware of the proposed interchange at QE II and 41 Avenue SW. One developer commented they believed there would be no access to QE II from 41 Avenue SW.
- All had heard of possible plans for a ring road to the south.
- Regarding future plans to widen 41 Avenue SW, developers commented that it would range from four to six lanes wide.
- A variety of isolated comments were made about other transportation-related plans in the area: a high pressure gas line approved for the centre of 41 Avenue, 170 Street becoming a major six lane road to the airport, rebuilding 141 Street and 50 Street becoming six lanes.

Residential / Business Property Owners:

- Many property owners on both the City and County side were aware of the proposed interchange at QE II and 41 Avenue SW.
- There was mixed awareness of future plans for 41 Avenue SW. A number were unaware of any plans and those who had heard something said future road widening might be four to eight lanes.
- Some property owners were aware of plans for a ring road to the south.
- Comments were made by a few that the City was planning to annex land from the County.
- Some County residents commented on the realignment of 111 Street and 127 Street.
- A few Edmonton residents noted plans for an interchange or overpass at 170 Street.
- A variety of isolated comments were made about other transportation-related plans in the area, such as:.
    - Comments from Leduc County land owners included the possible expansion of 91 Street and Highway 19, a new bridge across the North Saskatchewan River near 184 Street, an intersection at 141 Street and the City acquiring 2 miles on south side of 41 Avenue SW for road expansion.
    - Comments from Edmonton property owners included the realignment of Highways 2 and 19, 50 Street expansion and potential interchange, access points from Heritage Valley development, and the Nisku Spine Road east of the QE II highway.

2. What would be the impact or results of these plans on your property or business?

Developers:

- Most commented that the City will require them to pay for all 41 Avenue SW roadway upgrades, including upgrades beyond two lanes.
- The approved plan for Heritage Valley Neighbourhood 8 is based on 41 Avenue SW as four lanes with three access points. Other neighbourhood plans are going to City Council soon.

- One commented that the City should require 41 Avenue SW to be built with Heritage Valley's Neighourhood 10, as Neighbourhood 9 will create pressures on the road.
- Some developers felt that six lanes was not necessary for 41 Avenue SW with the future ring road nearby.
- A few commented that County land should not be developed to a rural standard when land north of the road is at urban densities.

Residential / Business Property Owners:

- Generally residents were aware of the pace of development in southwest Edmonton and know that it is only a matter of time before they see change.
- Concerns were expressed by some residents on both sides of 41 Avenue SW (west of QE II) that road widening would result in their houses and/or garages having to be moved. Some homes are only 100 ft off the road. These people are concerned with a drop in quality of life, reduced property values and loss of farmland. Access was also a concern for those whose property is landlocked with their only access from 41 Avenue SW.
- Some property owners said they will move if 41 Avenue becomes six lanes. They don't want to live near a major roadway.
- A number of Leduc County property owners commented that there are fewer impacts to landowners on the City side as more land is developer-owned and there are fewer residences.
- Property owners closer to the QE II felt that future QE II Highway plans and the proposed interchange will result in the biggest impacts to 41 Avenue SW. It is believed that building this interchange will drive change and development of 41 Avenue SW.
- A few commented that local traffic disruptions would be a problem while the road was being built.
- One property owner felt that land values would increase with an improved 41 Avenue SW.
- A business owner east of the QE II highway is concerned with lost access to 41 Avenue once the QE II interchange is built. This will be a big issue for their trucks and they believe their land value will drop.
- A landowner near 170 Street said road widening will be a challenge for the area near the creek and ravine – care should be taken to preserve it.

LOCAL TRANSPORTATION ISSUES AND PERCEPTION

3. Please describe your general impression of traffic conditions (volumes, speeds, congestion) in the study area.

Developers:

- Comments on traffic conditions were limited. One developer noted that east of the QE II Highway there is little traffic on 41 Avenue SW – it is a typical rural road.

Residential / Business Property Owners:

- Longer-term residents commented that traffic had generally increased over the years with fewer farmers in the area and more development, particularly in the west study area. It was also noted that since the opening of Anthony Henday, traffic had decreased in the area.
- West of the QE II Highway, traffic is busy on 127 and 141 Streets. It was noted that 41 Avenue traffic is higher west of 127 Street with very little between 1278 Street and the highway. There are also some seasonal variations – summer traffic includes vehicles going to the Golf Course/RV Park and Amberlea Meadows Equestrian Centre (via 156 Street), while Rabbit Hill is a winter destination (via 170 Street).

- Development of Heritage Valley has resulted in many construction vehicles. Parts of 41 Avenue SW are in bad shape because it is being used by trucks.
- East of the QE II Highway, peak hour traffic is high on 50 Street (Beaumont commuters) and 101 Street (Nisku commuters). The closing of 91 Street has diverted more traffic to 41 Avenue.

4. What do you forecast traffic conditions to be in your area in the next 10 years?

Developers:

- Traffic will depend on the speed of new development. The QE II interchange may speed development on both sides of the Highway. The west side will develop faster beginning with Heritage Valley.
- The QE II interchange will likely help accomodate new traffic generated from Heritage Valley development and the CP intermodal yard.
- Future traffic levels on 41 Avenue SW will in part be determined by what happens with the Anthony Henday.
- If 41 Avenue SW is developed to an expressway, this will force more traffic into new neighbourhoods and put pressure on the interior neighbourhood collector roads.

Residential / Business Property Owners:

- Most property owners on both sides of 41 Avenue SW commented that traffic will increase significantly in the next 10 years if development continues. 41 Avenue traffic will be similar to that on Ellerslie Road and 23 Avenue. It was felt that 41 Avenue SW will have to be a good road to handle City expansion.
- The QE II Highway interchange will bring more traffic, including trucks. 41 Avenue SW will have to be a minimum of four lanes and will probably be like 50 Street in 10 years. One person noted that with the QE II interchange 41 Avenue will have to be rebuilt – sections of it are currently patched each year (between 50 and 66 Streets).
- Some thought that in 10 years 41 Avenue might have to be 6 to 8 lanes to accommodate all new development.
- Traffic levels at the west end of 41 Avenue SW will increase later once the Windermere area develops.
- Truck traffic will increase considerably on the east side of the QE II Highway with the CP intermodal yard and new industrial development being planned.
- A few commented that 41 Avenue SW should be developed properly from the start – four lanes up front (avoid the Ellerslie Road scenario).
- Most traffic pressures will be in a north-south direction in 10 years.

USAGE AND ACCESS NEEDS

5. What are your plans for your property in the next five to ten years?

Developers:

- Development plans along 41 Avenue SW are specific to each property and developer. Some provided concept plans or drawings of their proposed developments. Most development is planned for the north side of 41 Avenue SW. Development plans west of the highway are primarily low density residential. Heritage Valley neighbourhoods are in various stages of planning, approval and/or construction.

- East of the QE II Highway, industrial development plans are in various stages of planning, approval and/or construction both north and south of 41 Avenue SW. These include CP's intermodal yards, WAM's industrial park and other industrial business park developments.
- North of 41 Avenue SW, low density residential development is underway in The Orchards neighbourhood near 91 Street - full buildout is expected in 10 years. Residential development east of 66 Street could be 10 years away or as the market requires.

Residential / Business Property Owners:

- There are more residents (acreage owners and farmers) on the County side of 41 Avenue SW than the City side. A number are third or fourth generation land owners. Some are younger families who have recently built new homes and garages. Many love the area and want to stay as long as possible; some may stay depending on what develops around them. Some will stay long term if future development is a lower-density acreage type development.
- A number of County residents commented that they will hold their land until the right development opportunity presents itself. Some may consider subdividing a parcel out before selling.
- It was noted by one property owner that County farmland values are not high enough for farmers to sell yet. Currently there is a 3 to 1 price differential between City and County land values, although the differential is smaller on the east side of the study area.
- Business owners interviewed on property near the QE II Highway plan on staying and possibly expanding their operations.

6. What changes to the current roadway would you like to see happen.....

a) For your land?

Developers:

- Some developers showed approved or proposed development plans with access points along 41 Avenue SW. Some also offered information on their traffic estimates.
- Industrial developers have some flexibility with access points, although one noted that industrial uses generally need more access. Two developers indicated that their industrial sites would need two access points. One commented that that right in-right out will be important for future commercial being considered.
- Residential developers generally prefer 41 Avenue SW as an arterial road with collector access from neighbourhoods every 200 m to 300 m. They want to avoid traffic bottlenecks for residents getting out of neighbourhoods – the road has to benefit the daily users and 400 m to 600 m spacing is inadequate. Some commented that it was too late to plan for an expressway as many Heritage Valley communities are designed around 41 Avenue as a four lane arterial. Residential developers also want direct access to businesses in commercial areas along 41 Avenue SW. Both right in-right out and some all-directional access would be ideal.
- Many commented that an expressway is not needed for 41 Avenue given the surrounding network of major roads and a ring road possibly two miles away. The City is over-designing roads and costs are being passed on to home buyers. Some were concerned that the City's traffic analyses are using incorrect base numbers.
- One suggested that two lanes of 41 Avenue be developed now before the QE II Highway interchange is built.

Residential / Business Property Owners:

- There were mixed views on what future changes should be made to 41 Avenue SW. Many residents felt it was important to move traffic efficiently without creating a high traffic road, particularly for areas where residential is the main land use. However, others thought that a higher-speed expressway was preferable.
- Access to their property was important for many residents as was minimizing the amount of land lost to road right of way.
- Some landowners stated no preference for arterial or expressway in relation to their land.
- A few people wanted a road design that would result in the highest property values.
- If commercial development occurs next to the road, one property owner felt all-directional access would be important.
- One property owner who farmed the area suggested that 41 Avenue be wider to accommodate farm equipment.
- To avoid disruptions experienced with past road work in the area, it was suggested that 41 Avenue SW be built to its full width at once rather than staging it.

b) For the area in general?

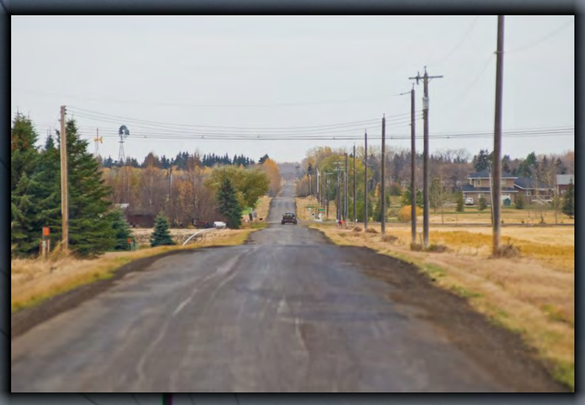
Developers:

- A few developers felt that 41 Avenue SW does not need to be an expressway because of its proximity to Anthony Henday Drive and the QEII Highway. It will serve more local traffic than regional trips. As well, arterial roads have good capacity.
- One developer felt that whatever type of road is planned, 41 Avenue SW should accommodate all commuters (including truckers) not just residents. The road should start at a minimum of four lanes with trigger points identified for expanding it to six lanes.
- Upgrades to 41 Avenue on the west side of the QE II Highway will be needed in the next five years to prepare for the interchange at the QEII.
- One developer wanted to know what was planned in the County's North Major ASP before making suggestions on 41 Avenue SW.
- One comment was to plan three lanes for 41 Avenue with one being convertible during rush hour – the maximum should be four lanes.

Residential / Business Property Owners:

- A number of property owners indicated a preference for an expressway to achieve better traffic flows. However, others preferred an arterial road for 41 Avenue. Some property owners indicated they would rather see intersections than interchanges along 41 Avenue SW – this was felt to be more appropriate for a road that services residential communities.
- Some commented that four lanes should be adequate for 41 Avenue SW given its proximity to nearby roads. Most traffic will travel north and south so 41 Avenue will be only a feeder road.
- A few commented that the speed of building the new road will be more important than type of road – build all lanes at once.
- Access to the QE II Highway will be important.

Welcome to the
41 Avenue SW Concept Planning Study
Open House



June 24, 2008 3:00pm to 7:00pm
at the Ellerslie Rugby Club

Please sign in and take a comment sheet
to fill out before you leave

THE CITY OF Edmonton

LEDUC COUNTY

Associated Engineering

41 Avenue SW Concept Planning Study

Study Purpose

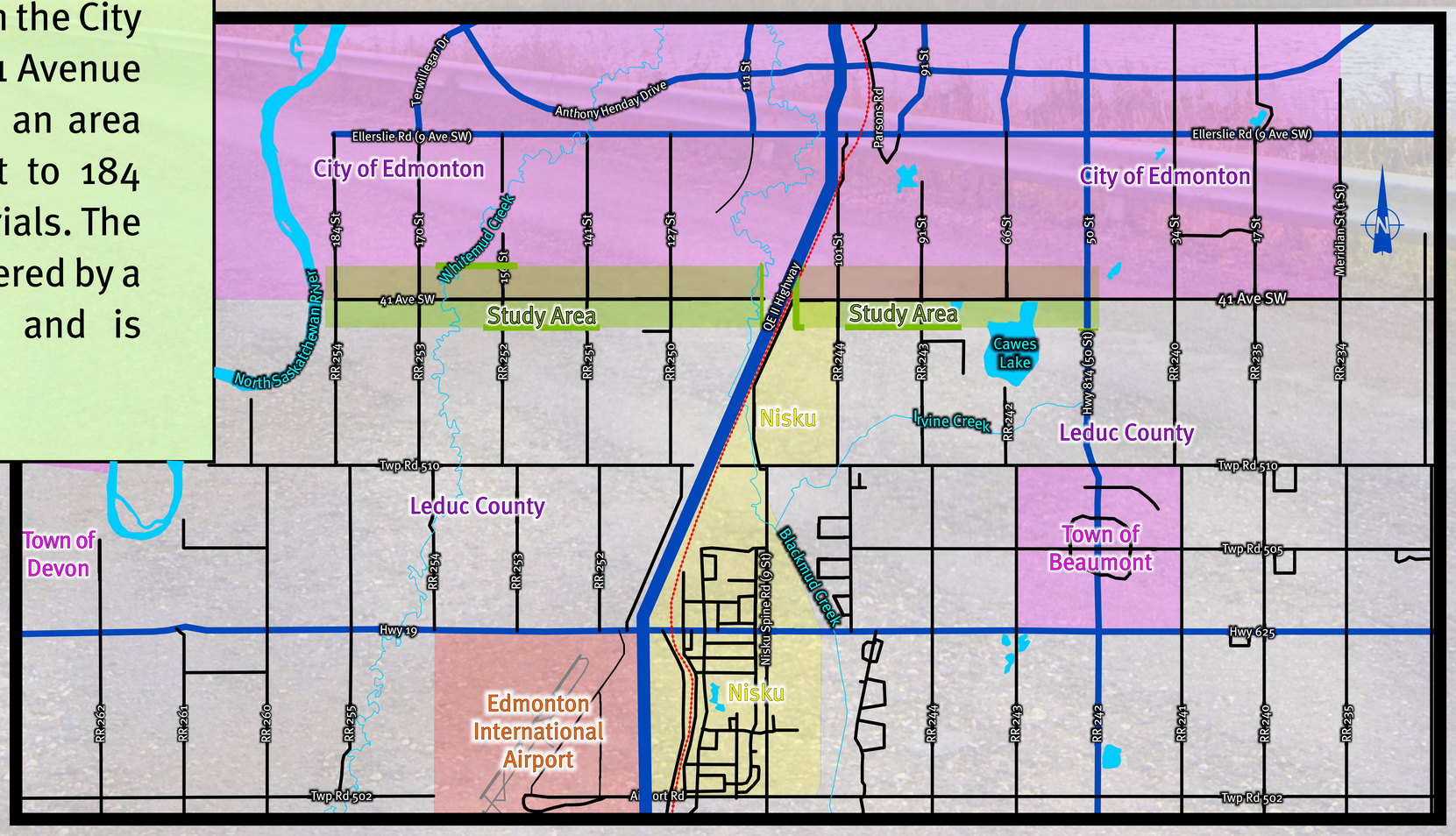
The 41 Avenue SW Concept Planning Study was initiated to clearly outline long-term requirements for the ultimate design of the roadway within the study area. The functional plan will recommend roadway structure, design standards, horizontal and vertical alignment, right-of-way requirements, intersection requirements, and access control.

Residential growth in southern Edmonton and Leduc County, as well as increased industrial development along the Queen Elizabeth II Highway (QEII), has contributed to the need for this study.

The overlying purpose of this study is to provide guidance for long range planning along 41 Avenue SW between 50 Street and 184 Street.

Study Area

41 Avenue SW is the boundary between the City of Edmonton and Leduc County. The 41 Avenue SW Functional Planning Study covers an area along 41 Avenue SW from 50 Street to 184 Street, crossing numerous future arterials. The interchange at the QEII Highway is covered by a separate functional planning study and is therefore not included in this study.



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41 Avenue SW Concept Planning Study

Public Communication Strategy

Key stakeholders in the study area include:

- The City of Edmonton
- Leduc County
- Alberta Transportation
- Adjacent landowners

The public consultation component consists of three stages. Through the first stage, landowners adjacent to the study area were interviewed to obtain their local issues and comments.

This open house is the second stage of public consultation. It is being held to present the study to the public and obtain comments on design concepts for 41 Avenue SW between 50 Street and 184 Street.

A future third open house will present the recommended long-term plans for 41 Avenue SW and obtain public comment.

Comments received at this open house will be reviewed and considered in the selection and design of the recommended concept plan.

Please look at the presented concepts, fill out a comment form, and drop it off before you leave. You may also mail, fax, or e-mail the comment form to Associated Engineering by Friday, July 4, 2008

Relevant Studies and Plans

Development and roadway studies and plans relevant to the 41 Avenue SW Concept Planning Study include:

City of Edmonton

- Chappelle NSP (2008)
- The Orchards at Ellerslie Neighbourhood Structure Plan (2008)
- Allard Neighbourhood Area Structure Plan (2007)
- Ellerslie Area Structure Plan (2007)
- Southeast Area Structure Plan (2007)
- Windermere Neighbourhood Structure Plan (2006)
- Windermere Area Structure Plan (2004)
- Heritage Valley Servicing Concept Design Brief (2003)

Leduc County

- Township Road 510 Functional Plan (Ongoing)
- East Vistas Area Structure Plan (Ongoing)
- WAM Industrial Park Local Area Structure Plan (2008)
- Highway 19 Area Structure Plan (2007)
- QEII Business Park Local Area Structure Plan (2006)
- Nisku Spine Road Functional Plan (2006)
- North Major Area Structure Plan (2004)
- Nisku Area Structure Plan (1981)

Regional

- QEII Functional Planning Study (Ongoing)
- Capital Region Integrated Growth Management Plan (2007)

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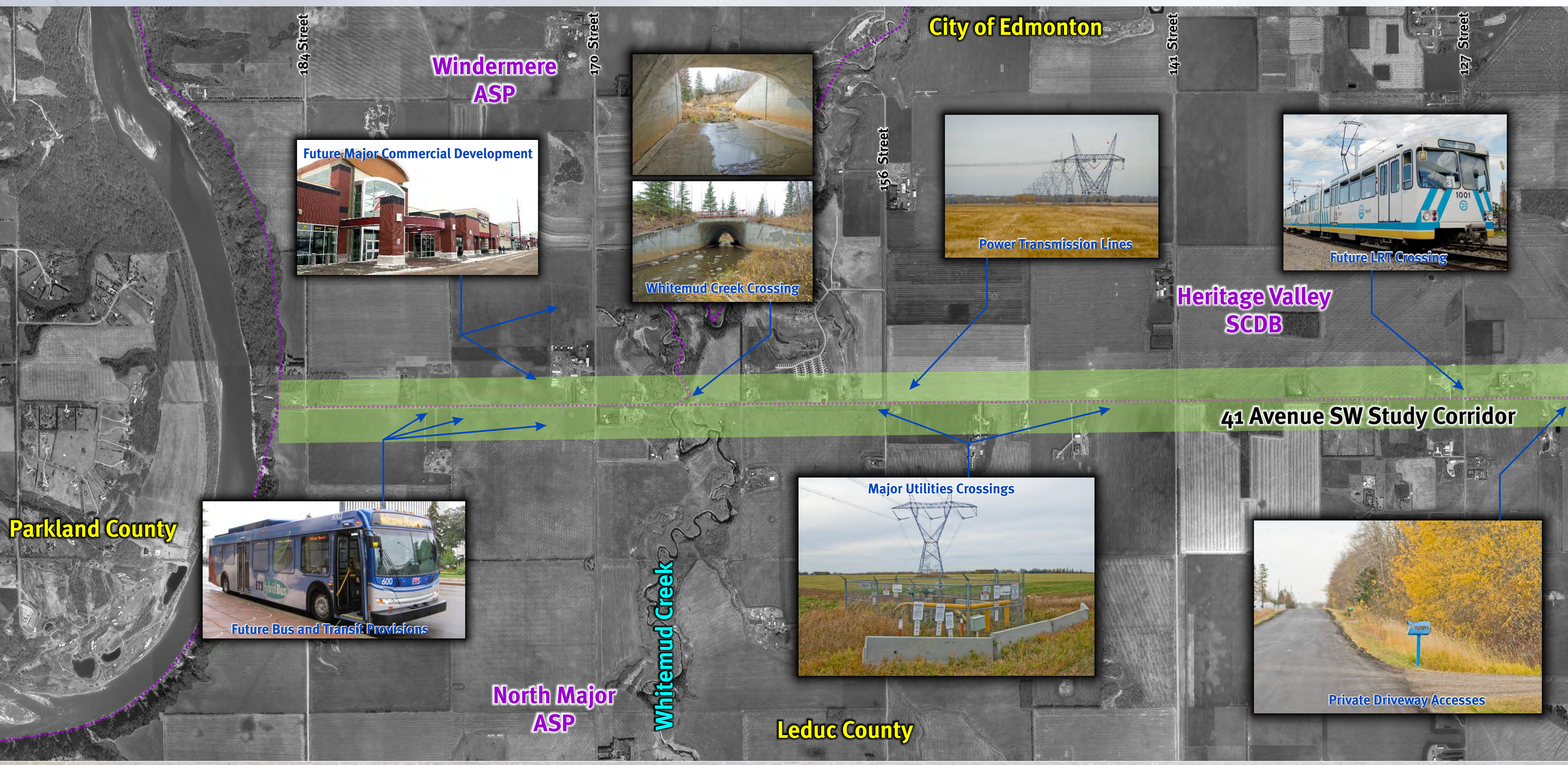
41 Avenue SW Concept Planning Study

Typical Study Issues (west)



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41 Avenue SW Concept Planning Study

Typical Study Issues (east)

111 Street

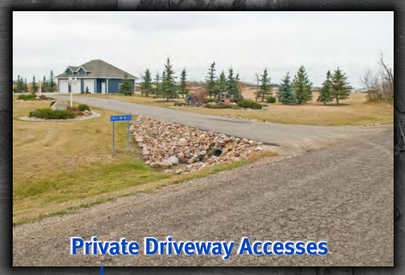
101 Street

91 Street

66 Street

50 Street

City of Edmonton



Ellerslie ASP

Southeast ASP

QEII Interchange
Functional Plan
by Alberta Transportation

Blackmud Creek

Highway 2 (Queen Elizabeth II Highway)

WAM LASP

Nisku Spine Road

Cawes Lake

North Major ASP

Nisku

Leduc County

THE CITY OF Edmonton

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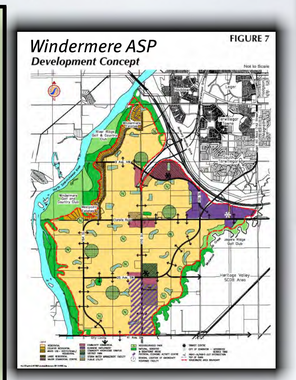
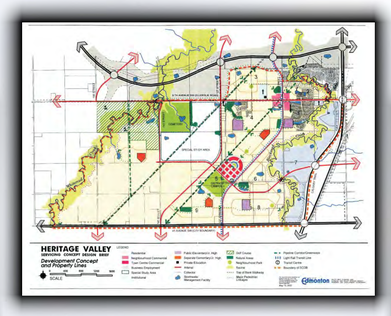
41 Avenue SW Concept Planning Study

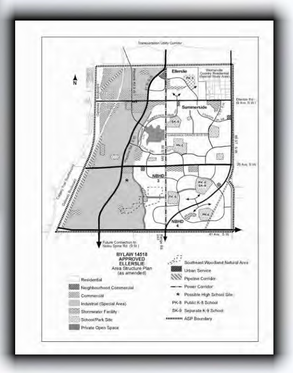
Future Land Use

The City of Edmonton's planning documents identify land use on the north side of 41 Avenue SW as predominantly residential lands. 41 Avenue SW will be bordered by Windermere, Heritage Valley, Ellerslie, and the Southeast planning areas.

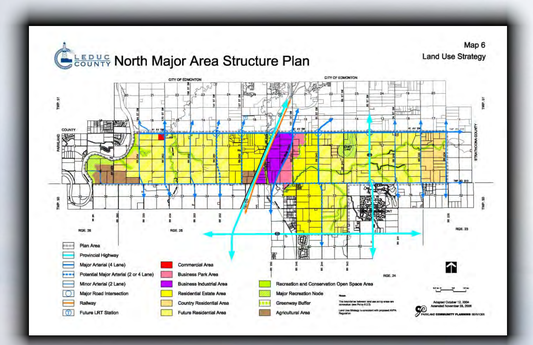
The Leduc County North Major Area Structure Plan identifies future land use on the south side of 41 Avenue SW as generally residential lands. The Nisku business park is located in the centre of the study corridor; these lands will generally be developed into light industrial or business park uses.

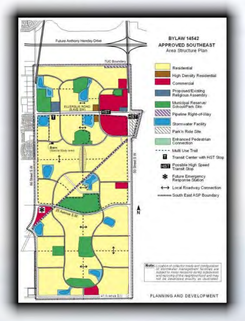


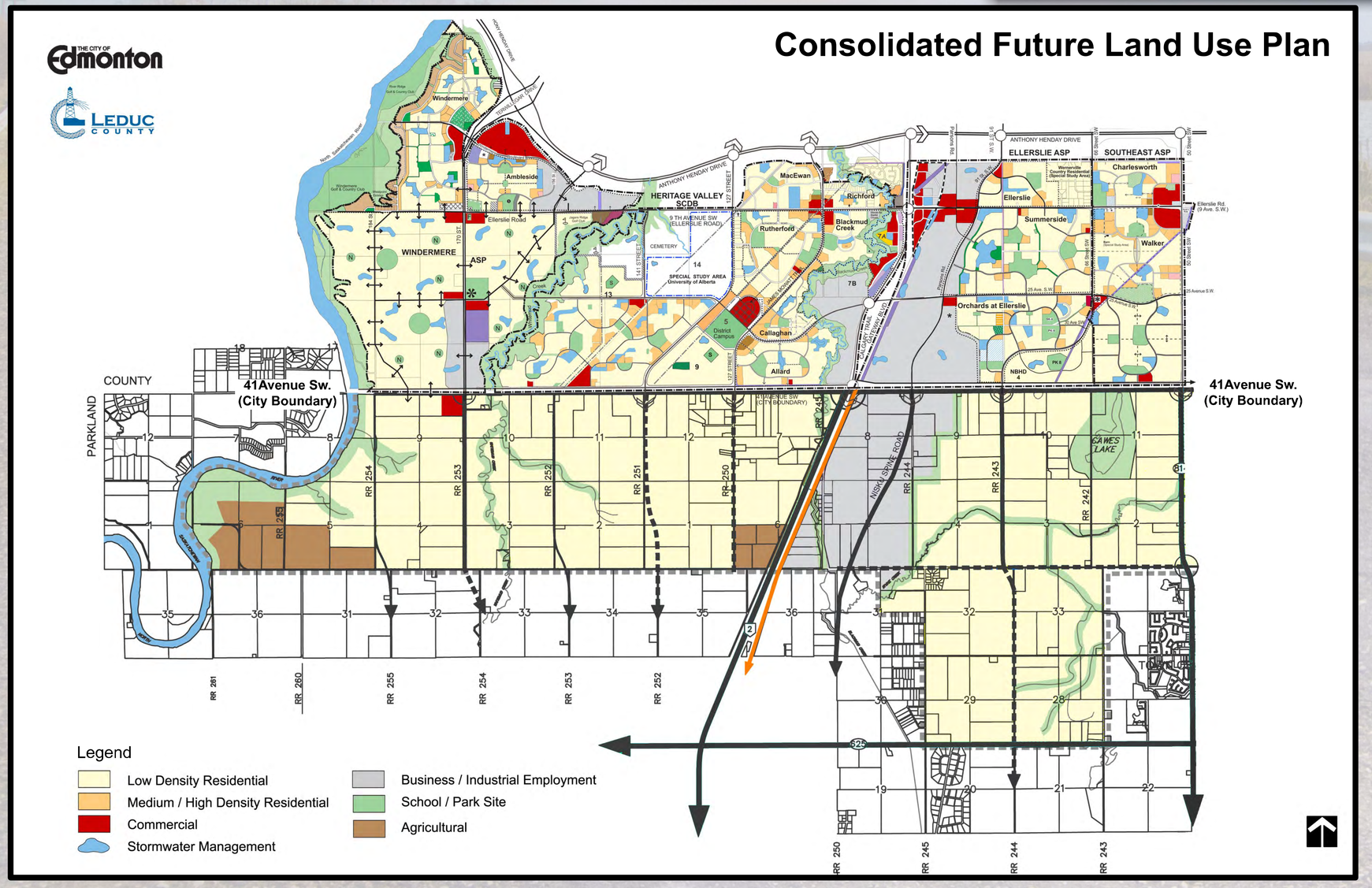




Major Land Use Plans







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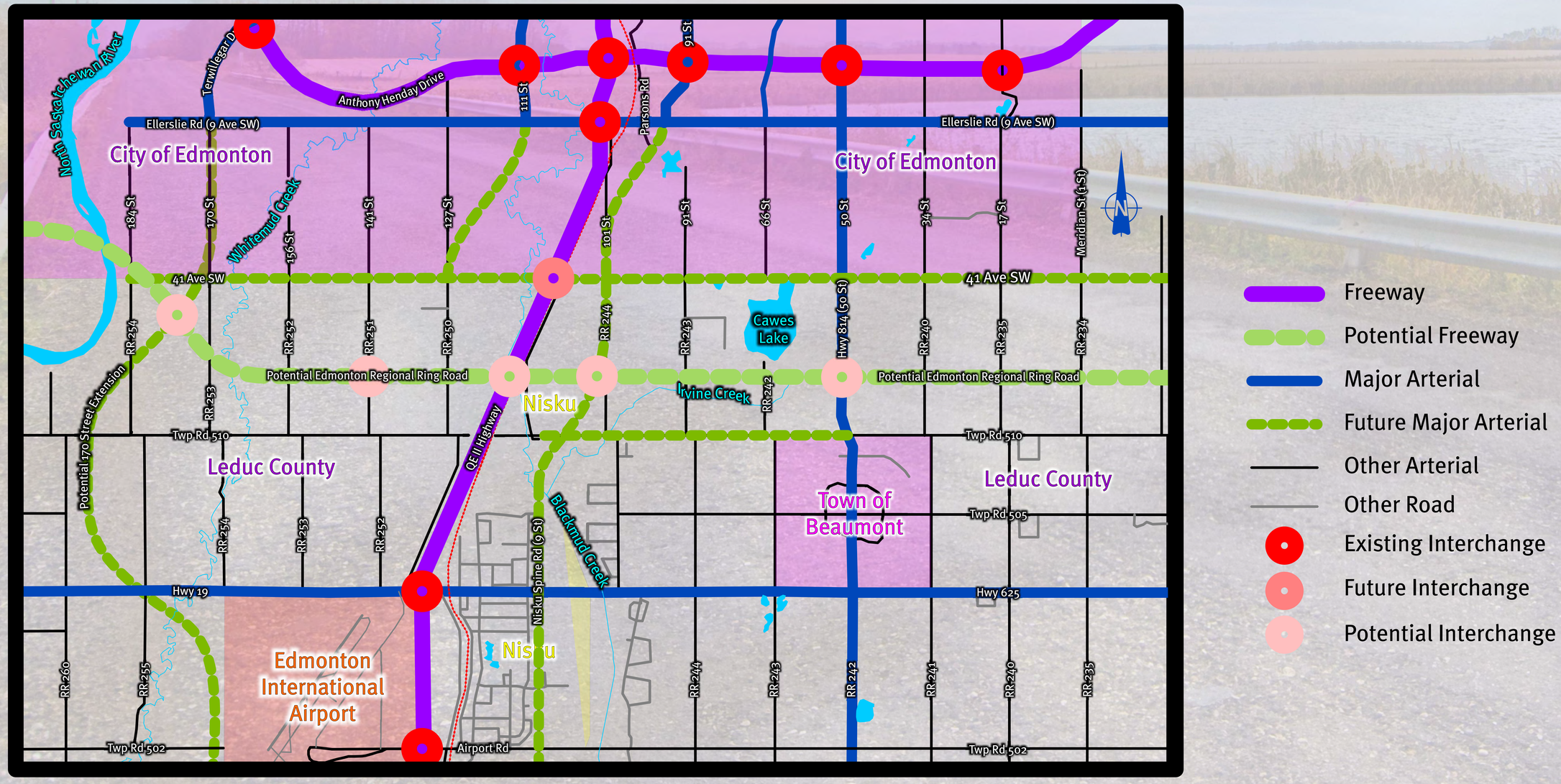
41 Avenue SW Concept Planning Study

Roadway Functionality

41 Avenue SW is planned to operate as a major arterial roadway in the future. Its function will be to collect traffic from the residential developments adjacent to 41 Avenue SW and convey the traffic to major north-south roads including the Queen Elizabeth II Highway, the Nisku Spine Road, and 50 Street (Highway 814).

The Capital Region Integrated Growth Management Plan indicates that a proposed Edmonton Regional Ring Road will be developed south of 41 Avenue SW, and identifies five possible interchanges between 50 Street and 184 Street. The Edmonton Regional Ring Road (ERRR) will be a limited access freeway, similar to Anthony Henday Drive. As a result of the limited access to and from the ERRR, 41 Avenue SW will function to provide major access to the surrounding residential developments.

As a major arterial roadway, access to and from 41 Avenue SW will be through intersections with arterial or collector roads only; no direct access will be allowed from private land. In order to maintain higher speeds (70 – 80 km/h), intersections will be spaced a desirable 800 metres apart wherever possible.



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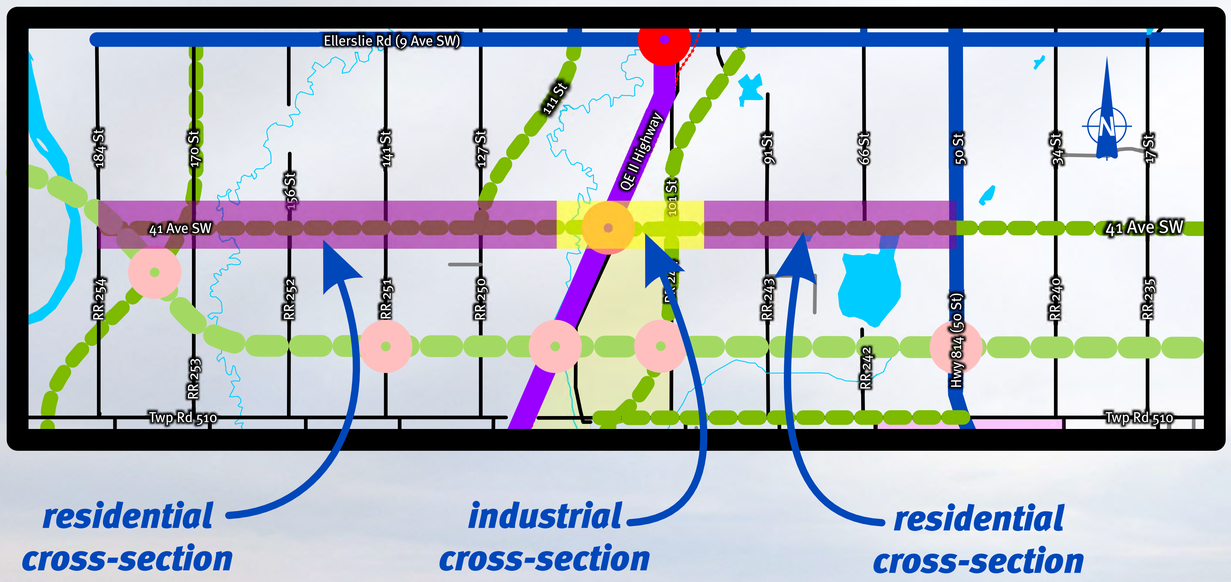
41 Avenue SW Concept Planning Study

Roadway Cross-Sections

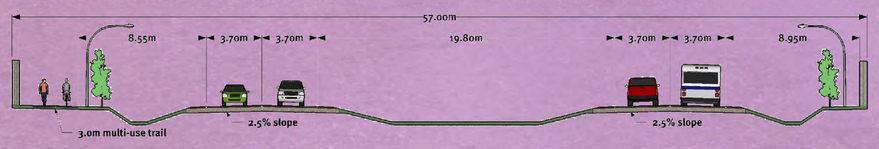
The proposed cross-section for 41 Avenue SW initially provides for four traffic lanes (two in each direction). The design allows for the road to be easily expanded to six and then eight traffic lanes with urban curb and gutter drainage in the future. A raised median provides separation between traffic lanes and allows for left turn lanes at intersections. A multi-use trail for non-motorized users is typically provided on the north side of the roadway.

There are two typical cross-sections provided – for residential and industrial areas – that will provide different levels of visual and noise mitigation. In the residential section, if sound attenuation is required based on noise modeling, noise walls may be provided to help mitigate noise and light pollution into adjacent residential developments. Noise walls will not be provided in the industrial section to allow for visible business frontages.

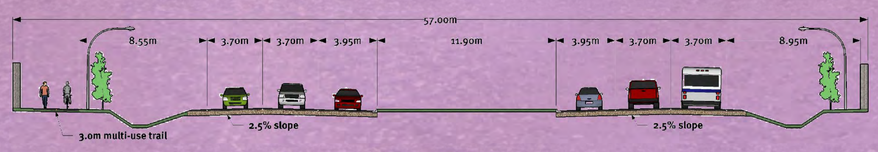


Typical Cross-Sections through residential areas

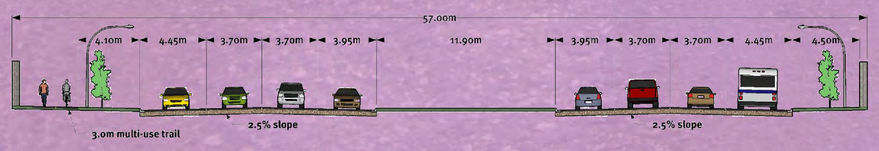
Stage One (four lanes)



Stage Two (six lanes)

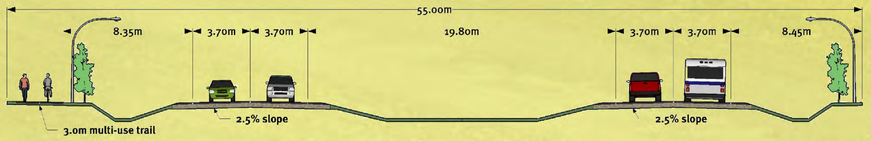


Stage Three (eight lanes)

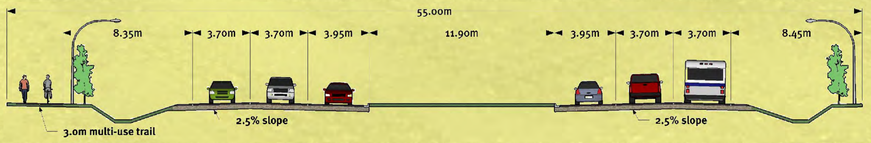


Typical Cross-Sections through industrial areas

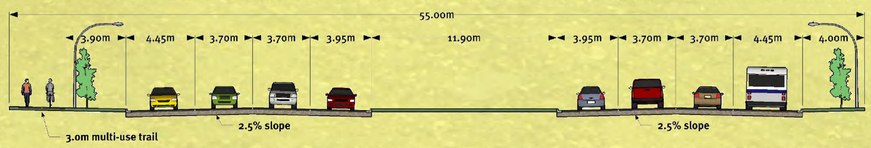
Stage One (four lanes)



Stage Two (six lanes)



Stage Three (eight lanes)



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41 Avenue SW Concept Planning Study

Environmental and Other Considerations

The 41 Avenue SW Concept Planning Study includes environmental, geotechnical, and archeological studies. An assessment of the Whitemud Creek bridge structure will also be completed through the course of this study.

An environmental screening report will look at impacts to riparian and aquatic habitats, water quality, and fish populations at the Whitemud Creek. The screening report will also review potential impacts to flora and fauna through the entire study area, including wetland and migratory bird impacts; impacts to noxious and nuisance weeds will also be assessed.

A noise analysis will be completed to estimate any required noise mitigation measures. If required, noise mitigation may be provided by sound walls at the edge of the road right of way.

Soil conditions, slope stability and groundwater issues will be outlined in a geotechnical review throughout the study area. Sites of archeological and paleontological significance will also be identified and recommendations will be set for recovery or mitigation, if required, whether known in advance or discovered as construction progresses.

Other issues such as public and franchise utility impacts will also be investigated. Strategies for minimizing impact to such facilities will be identified in the study.

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41 Avenue SW Concept Planning Study

Next Steps

Comments gathered from this open house will be compiled, reviewed, and considered in developing the concept plan for the City of Edmonton and Leduc County.

A second open house will be held later this year to present the final recommendations to the public.

The final report will be presented to the City of Edmonton and Leduc County for approval after the second open house.

The timing for construction of 41 Avenue SW is subject to development and funding approval.

Please remember to fill out a comment sheet before you leave

Thank-you for your participation!

THE CITY OF Edmonton

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Open House Participant Survey

Please complete a feedback form and leave it in the box at the door, or send to:

Associated Engineering, Suite 1000, Associated Engineering Plaza
10909 Jasper Avenue, Edmonton, Alberta T5J 5B9

Fax: 780.454.7698
Email: benbows@ae.ca

*Please send the feedback form by **Friday, July 4, 2008***

If you require follow-up to this survey, please call Shawn Benbow at Associated Engineering at 780.451.7666 or email *benbows@ae.ca*

Open House Feedback

1. How did you hear about the open house?

_____

2. Were the displays helpful in explaining the suggested concept for 41 Avenue and intersecting/adjacent roadways?

☑ Yes ☐ No

3. Were the project staff helpful in answering questions?

☑ Yes ☐ No

4. The information provided at the open house was:

☐ Adequate ☑ Too Much ☐ Too Little
☐ Too Technical ☑ Too Conceptual ☐ Just Right

Comments:

_____

_____

5. General comments about the information presented at this open house:

_____

_____

_____

_____

Your comments are being collected for possible summary reports to city and county councils and administration regarding opinions expressed at this open house. The above information is being collected under the authority of Section 33(c) of the *Freedom of Information and Protection of Privacy Act (FOIP)*. It is protected by the privacy provisions of *FOIP*.

Functional Plan Feedback

6. What do you like about the concepts presented?

7. What do you dislike about the concepts presented?

8. What additional issues and ideas would you like the project team to consider as the study continues?

9. Do you have any other general comments about the study?

Thank you for your responses.

The following personal information is optional:
Name:

Address:

Phone Number:

Your comments are being collected for possible summary reports to city and county councils and administration regarding opinions expressed at this open house. The above information is being collected under the authority of Section 33(c) of the *Freedom of Information and Protection of Privacy Act (FOIP)*. It is protected by the privacy provisions of *FOIP*.

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