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FINAL REPORT
Highway 2A Realignment Functional Planning Update





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April 2, 2015



Accepted by:

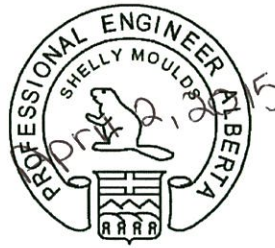

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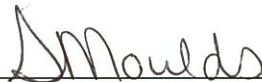

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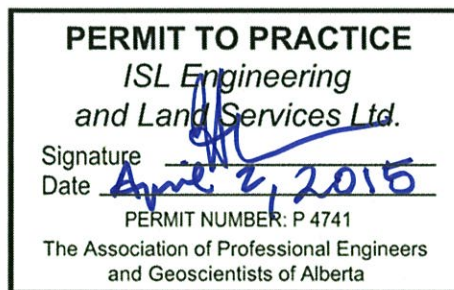
Corporate Authorization

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Shelly Moulds, P.Eng.
Transportation Engineer





Executive Summary

Background

In 2009 Alberta Transportation completed the Highway 2/2A Interchange Functional Planning Study which proposed to realign Highway 2A approximately 2.4km south of its current location. The alignment of Highway 2A was established along the municipal boundary between the City of Leduc and Leduc County, with the majority of the road within the city neighborhood of South Fork. Following the conclusion of the functional planning study the lands within South Fork has changed owners, and the new owner has expressed concerns to the City that the recommended alignment results in the loss of developable land within the South Fork development.

In 2010 ISL was retained by the City to develop conceptual alignment alternatives for the realignment of Highway 2A that respected the previously proposed interchange location, limited intrusions into the South Fork development, respected the active well site within the County, and provided connections to the City's boundary roads, while maintaining the design and functionality requirements outlined by Alberta Transportation. ISL prepared three alternatives, and the City, County, and Alberta Transportation have agreed in principle to an option that freed up more land within South Fork. The City has now retained ISL to finalize the alignment based on the general principle of Option 3, and complete an update to the 2009 functional planning study.

Recommended Plans

The recommended plans identify three key stages of construction:

1. Shifting the existing Highway 2A alignment away from the CP Rail line to meet Transport Canada offset requirements between an intersection and a railway crossing. This allows for a new access from the South Fork development, and the future connection to the East Boundary Road across the tracks. Detailed design is under way for the north, south, and west legs of this intersection and construction is anticipated in the fall of 2015. Negotiations with CP are also under way for a crossing agreement, ensuring that this time consuming task is complete before construction of the east leg begins in 2016.
2. This stage twins both Highway 2A and the East Boundary Road; however, these tasks can be completed independently of each other. There is also the potential that Highway 2A may not be twinned along the existing alignment if it is determined that the realignment is anticipated in the near future.
3. At the ultimate stage, Highway 2A will be realigned to a new interchange along Highway 2. Based on the latest Bridge Inspection and Maintenance Report for Highway 2/Highway 2A, the interchange structure will need to be replaced by 2029. It is anticipated that a new interchange on Highway 2 will be reconstructed, and Highway 2A will be realigned shortly before the existing structure is decommissioned.

Costs for the various construction stages have been summarized below:

Table E.1: Summary of Probable Costs by Stage

Stage	Opinion of Probable Costs
1A	\$7.1M
1B	\$1.3M
2	\$2.9M
Ultimate – Trumpet B with VIS	\$172.5M
Ultimate – Parclo AB without VIS	\$124.4M
Ultimate – Parclo AB with VIS	\$119.8M

Conclusions

This functional planning study has refined the necessary right-of-way needed for the realignment of Highway 2A, based on input from stakeholders, landowners, and interested residents. While this study has identified the alignment and related right-of-way required for Highway 2A near Leduc, there are many unknowns that will ultimately affect this project. Alberta Transportation needs to assess their regional network to determine how and where regional highways such as the 170 Street extension will connect to Highway 2. If it is determined that the 170 Street extension is to serve as the west leg for the Highway 2A interchange at Highway 2, then Alberta Transportation should also initiate a new functional planning study to develop a systems level interchange at this location.

Until such time as these network issues are resolved, isolated studies such as this one will have limited significance since they are all based on unsubstantiated assumptions about traffic patterns, design standards, and permissible access opportunities.

Recommendations

In the short-term Alberta Transportation needs to identify the long-term network requirements for the region. Once the network issues have been resolved, the following will also need to be relooked at:

- Determine the long-term function of Highway 2A and develop the appropriate type of connection to Highway 2 (system versus service interchange);
- Quantify the long-term traffic volumes on Highway 2A thru the study area;
- Review the design standards for roads, particularly those not under provincial jurisdiction; and
- Complete traffic analysis to determine the most appropriate intersection treatment for the long-term Highway 2A/50 Street intersection (roundabout versus signals).
- Review the land use plans near the Highway 2A realignment to determine if remnant parcels should be purchased.
- Complete a Historical Resources Impact Assessment as per the HRO recommendations.
- Prepare a diversion plan for Deer Creek and seek approval from DFO, AENV, and APL.
- Look for opportunities to provide vegetation pockets within the corridor to replace vegetation lost during construction.
- Confirm Noise Attenuation requirements along the new alignment of Highway 2A.



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1.0 Introduction

1.1 Background and Content

In 2009 Alberta Transportation completed the *Highway 2/2A Interchange Functional Planning Study* which proposed to realign Highway 2A approximately 2.4km south of its current location, shown on Exhibit 1.1. The alignment of Highway 2A was established along the municipal boundary between the City of Leduc and Leduc County, with the majority of the road within the city neighborhood of Southfork. Following the conclusion of the functional planning study the lands within Southfork has changed owners, and the new owner has expressed concerns to the City that the recommended alignment results in the loss of developable land within the Southfork development.

In 2010 ISL was retained by the City to develop conceptual alignment alternatives for the realignment of Highway 2A that respected the previously proposed interchange location, limited intrusions into the Southfork development, respected the active well site within the County, and provided connections to the City's boundary roads, while maintaining the design and functionality requirements outlined by Alberta Transportation. ISL prepared three alternatives, and the City, County, and Alberta Transportation have agreed in principle to Option 3 (shown on Exhibit 1.2); freeing up more land within Southfork. The City has now retained ISL to finalize the alignment based on the general principle of Option 3, and complete an update to the 2009 functional planning study.

1.2 Study Area

The study area is from Grant MacEwan Boulevard in the west, to the CP Railway in the east, and from Highway 2A in the north to Deer Creek in the south.

1.3 Key Objectives

The following objectives have been established for this study:

- Update the long-term and staging plans;
- Identify right-of-way requirements and surplus;
- Define order-of-magnitude cost of realignment of Highway 2A;
- Consider highway performance and operation, long-term serviceability and construction impacts;
- Carry out a comprehensive communications plan complete with stakeholder meetings and a public open house; and
- Identify risks and uncertainties.

September, 2014 - J:\138000\13893_Hwy 2A Realignment FPS Update\02_CADD\20_Drafting\202_CADD\13893_leduc_2D-20140109.dgn - Study Area

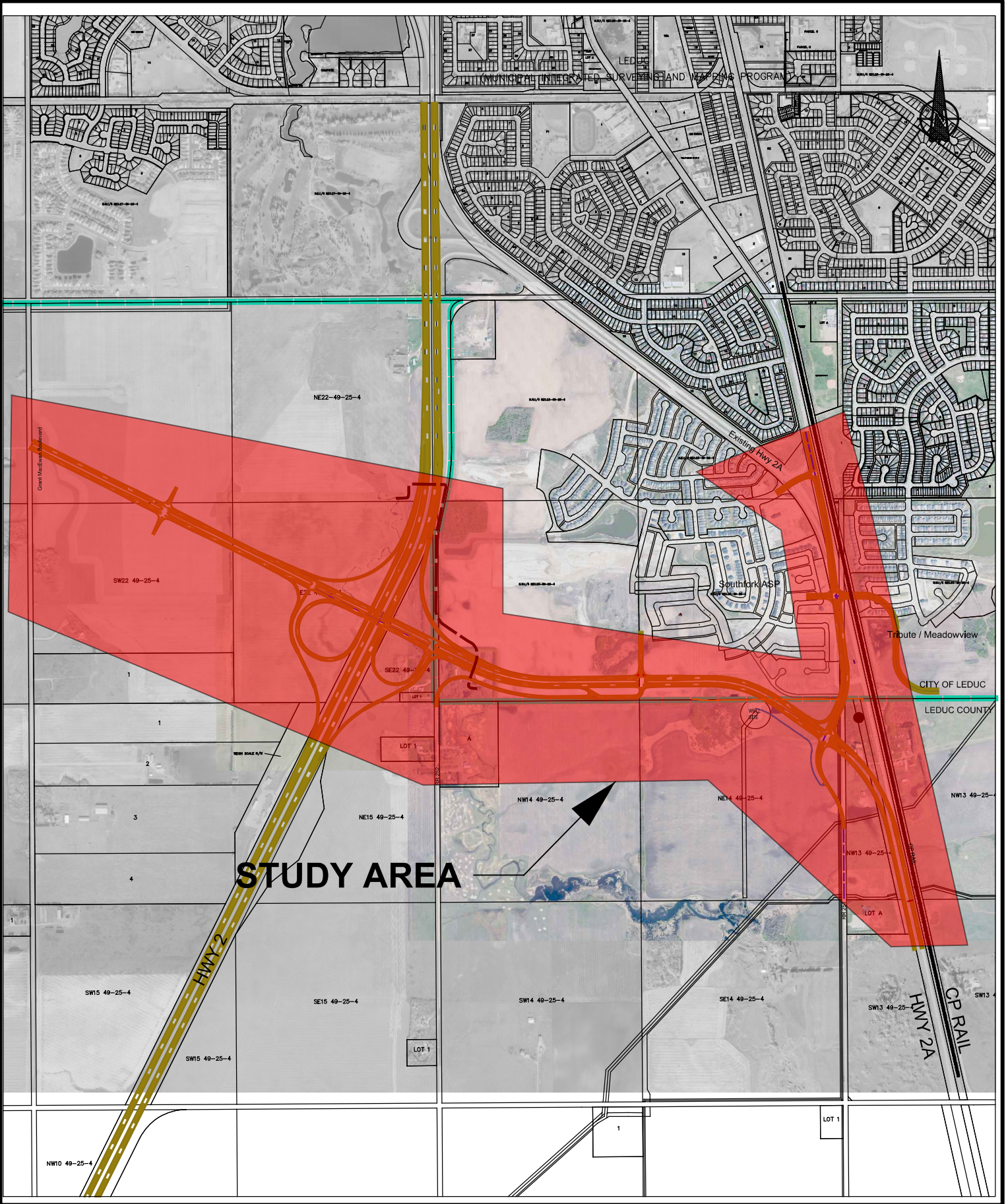


EXHIBIT 1.1

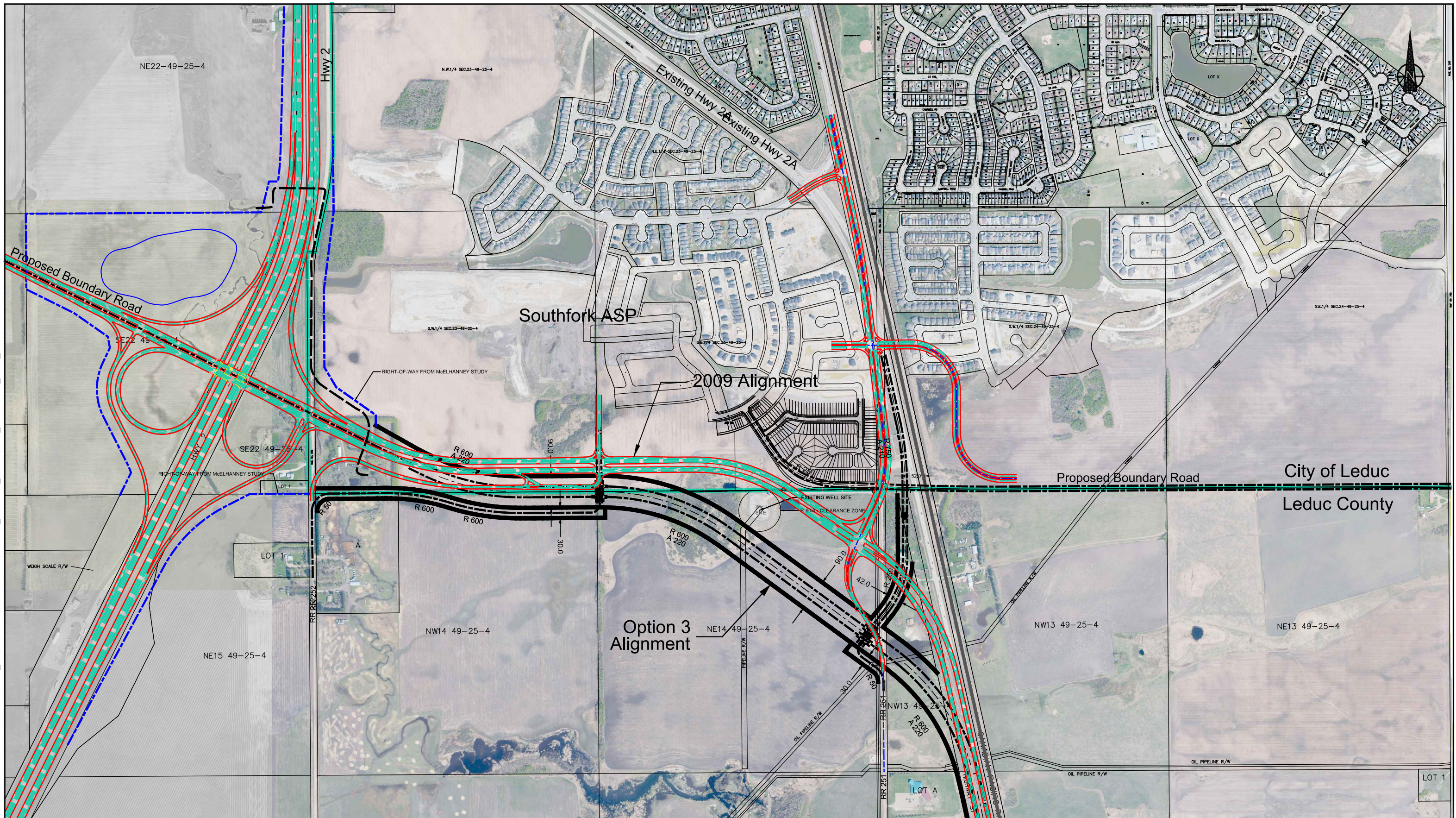


STUDY AREA and 2009 PLAN

HIGHWAY 2A FUNCTIONAL PLAN UPDATE

OCTOBER, 2014
SCALE N.T.S.

Model: org option 3
September, 2014
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City of Leduc
Leduc County

HIGHWAY 2A REALIGNMENT - OPTION 3

HIGHWAY 2A FUNCTIONAL PLAN UPDATE

EXHIBIT 1.2



October, 2014
SCALE: 10 000



2.0 Background Information

2.1 Surrounding Roadway Network

2.1.1 Highway 2A

Highway 2A is a 2-lane Collector Class Highway (Level 3) with a Multi-Lane Roadside Management classification. The highway connects to the Queen Elizabeth II highway (Highway 2) at a three-legged interchange, and provides access to the southern part of the City of Leduc and other rural communities within Leduc County. The existing bridge at the Highway 2/2A interchange is anticipated to need replacement in 2029, at which time Highway 2A will be realigned to the south with a new service level interchange (designed to accommodate local regional traffic).

In the original 2009 study, the recommended interchange included a fourth leg to provide local access to the west; however, there was some discussion about the leg taking on more of a provincial network role. The report recommended that if the west leg was upgraded to a new provincial highway, it should connect to Anthony Henday Drive at 170 Street/ Terwilligar Drive.

Following the McElhanney study, Focus prepared interchange plans along Highway 2 that presumed the Highway 2/2A interchange would include this west highway connection. The proposed connect to Highway 2 was from a systems level interchange (designed to accommodate provincial traffic). This report was never approved by Alberta Transportation, and the systems interchange design is to be ignored. Yet, at the time of this report, discussions about the long-term function of the Highway 2/2A interchange within the study area continue. At the time of this report, the project team was told Alberta Transportation was unofficially completing high level reviews of their network around the Capital Region; however, it was not expected that recommendations would be completed in time to be used for this project. For that reason this study has proceeded on the basis that the approved service interchange is still valid.

However, the project team recognized the need to confirm what the impacts would be if a systems interchange was later approved. As the main scope of this project was to confirm the right-of-way requirements within the City's Southfork development, the project team superimposed the system's level interchange developed by Focus onto the McElhanney plans to see if there is sufficient right-of-way protected within Southfork. The drawing in Appendix C includes both the service and systems interchanges previously developed at Highway 2. The blue line shows one possible centerline connection for the systems interchange to the proposed tie-in points for this project. It is reasonable to assume that with refinements to the geometry, the S-curve across Highway 2 could be avoided with a minor shift to the north. No additional right-of-way will be required within Southfork for either option.

If the new highway and systems interchange option is selected, there will be no direct access onto the local roads off of Highway 2A. This will affect not only City access, but County access as well. Further consultation will be required in the future if this option is to be carried forward by Alberta Transportation.

2.1.2 Queen Elizabeth II Highway

The Queen Elizabeth II Highway (QEII or Highway 2) is part of Alberta's North/South Trade Corridor and has National Highway status. The highway provides the most direct connection between Edmonton and Leduc and consists of six-lane rural divided freeway cross section. It is ultimately planned to be a fourteen-lane freeway with 8 Core lanes and 6 Collector/Distributor (C/D) lanes from Leduc to Anthony Henday Drive in Edmonton. No changes to Highway 2 are expected for this project.

2.1.3 50 Street

50 Street is the main north-south arterial through the City of Leduc, and serves as the south access to the City. It currently intersects Highway 2A at a signalized intersection that also serves as the only access into the Southfork development at this time. The McElhanney study proposed to modify the Highway 2A/50 Street intersection into a T-intersection, with 50 Street continuing south to Highway 2A, and the Southfork access tying in at a right angle. However, changes to the Southfork development plan includes a new access onto Highway 2A north of 50 Street. No changes are anticipated to the existing Highway 2A/50 Street intersection as part of this study.

2.1.4 Future East Boundary Road

The future East Boundary Road is intended to serve as an outer ring road around the City of Leduc, tying into existing Highway 2A (50 Street). The McElhanney study showed this connection, across from a Southfork development access approximately 500m south of the existing 50 Street intersection and approximately 600m north of the future Highway 2A/50 Street intersection; however, no right-of-way was protected, and the intersection location has been developed into residential lots. As part of this study, a new intersection location will be established closer to the municipal boundary, and it will be compatible with the current Southfork development plans.

2.1.5 Grant MacEwan Boulevard/ Range Road 253

Grant MacEwan Boulevard is an existing arterial north-south roadway within the City limits that connects to Range Road 253 in the County. A connection to the new roadway is anticipated as part of this project.

2.1.6 Range Road 251

Range Road 251 is a gravel grid road that currently connects to Highway 2A at the City boundary where the future East Boundary Road/Southfork Access intersection is anticipated to be located. New connections in the short- and long-term will be developed as part of this study.

2.1.7 Range Road 252

Range Road 252 is a gravel grid road that currently connects to Highway 2A immediately east of the Highway 2 interchange. When Highway 2 is realigned, Range Road 252 will be bisected. It is anticipated that the roadway within the City limits will be decommissioned, and the portion within the County will be reconnected to Highway 2A at the Southfork access intersection. Only minor changes to this roadway are anticipated as part of this study.

2.2 City of Leduc

The City of Leduc, is located within Leduc County, approximately 15km south of the City of Edmonton and 30km from the downtown core. Stats Canada reported a population of 24,293 in 2011, and 16,967 in 2006, representing an annual increase of 8.6%, significantly higher than the provincial average. The municipal census for 2014 reported a population of 28,583, which also represents a 8.6% annual increase since 2006.

The City is centered east/west on Highway 2, and currently has access via the Highway 2A interchange, and the Highway 39/50 Avenue interchange, and the 50 Street interchange. A fourth interchange at 65 Avenue has been planned, but it is not currently on Alberta Transportation's 3-year construction program. The new Highway 2A interchange is anticipated to serve both local and regional traffic.



2.2.1 Transportation Master Plan

In 2013, City Council approved the Transportation Master Plan, a document that defines the City's transportation needs up to a population horizon of 44,000 people. Based on current growth rates, that horizon is anticipated for 2020, approximately nine years before the Highway 2/2A interchange structure will need to be decommissioned.

As much of the development in the southern portions of Leduc is expected to be completed prior to 2028, the traffic volumes from the TMP for the Southfork access of the future Highway 2A, 50 Street, and the future East Boundary Road will be used to develop the long-term traffic volumes for this project.

2.2.2 Southfork Subdivision

Southfork is a developing residential neighborhood located on a triangular piece of land between Highway 2, existing Highway 2A, and the future realigned Highway 2A being developed by Tamani Communities.

Ultimately the community will have four accesses:

1. The existing access onto Highway 2A that serves as the fourth leg of the 50 Street intersection;
2. A new access onto Highway 2A that serves as the fourth leg of the future East Boundary Road intersection;
3. A new south access onto the realigned Highway 2A, on the quarterline between NW & NE14 49-25-4; and
4. A new north access onto the existing Highway 2A.

The second and third access will be reviewed as part of this study.

2.2.3 Tribute Subdivision

Tribute is a residential neighborhood east of the Highway 2A and the CP Railway being developed by Qualico Home Builders. Since the McElhanney study was completed, residential lots have been constructed over the proposed East Boundary Road connection. This study will identify a future East Boundary Road near the southern limits of this development.

2.3 Leduc County

Leduc County is located immediately south of the City of Edmonton, and is bordered by Parkland County and Brazeau County in the west, Wetaskiwin County in the south and Camrose County, Beaver County and Strathcona County in the east. Stats Canada reported a population of 13,541 in 2011 and 13,135 in 2006, representing an annual increase of 0.6%.

Several municipalities, including the City of Leduc, are all currently at various stages of annexing land from the County. The City has annexed lands north west of the proposed Highway 2/2A interchange location.

2.3.1 Temple Baptist Church of Leduc

The church is located on Range Road 251 approximately 800m south of the City/County municipal boundary. Changes to Range Road 251 will have minor impacts on access to the site.

2.3.2 Private Residence on NE13 49-25-4

There is a private residence located on a triangular parcel of land between the Highway 2A road right-of-way and Range Road 251, immediately south of the municipal boundary. The parcel currently has direct access off of Highway 2A and Range Road 251. This parcel will ultimately be purchased as part of the long-term highway realignment.

2.3.3 Private Residence on NW13 49-25-4

There is a private residence located east of Highway 2A with a private crossing of the CP Railway. Impacts and access to this site will be reviewed as part of this study.

2.4 Deer Creek

Deer Creek crosses Highway 2 approximately 1.6km south of the Highway 2/2A interchange. The creek is ephemeral and flows north parallel to the west side of the Highway 2A, through the Leduc Golf and Country Club and Leduc Estates, and ultimately drains into Whitemud Creek. The City of Leduc and Leduc County complete a joint drainage study of the Deer Creek Basin in the fall of 2002 (GPEC Consultants).

The Highway 2/2A Functional Planning Study proposed to divert Deer Creek near Range Road 252 where it would travel through culverts under Highway 2A, flow along a new creek bed created between Southfork and Highway 2 (old RR252 road allowance), then cross under Highway 2 before reconnecting to the existing channel. Only minor modifications to the realignment plan are anticipated as part of this study.

2.5 Canadian Pacific Railway

The CPR Edmonton to Calgary main line runs parallel to the east side of Highway 2A. The 2009 train frequency on the main line was 12 to 15 trains per day, operating 7 days a week, 24 hours/day. The original 2009 study identified a new East Boundary Road crossing of the railway, approximately 500m south of the 50 Street intersection. Land in this area has since developed as the Tribute subdivision, and the City is proposing a new at-grade crossing of the railway at the Township Road 493 quarter line as part of their new East Boundary Road construction.

Transport Canada requires a minimum of 30m from the nearest rail to the shoulder of the highway, so the new crossing will trigger a Highway 2A realignment in the immediate area. The highway realignment, requirements for the crossing, and next steps are discussed in later stages of this report. Previous correspondence between ISL, the CPR, and Transport Canada regarding this crossing are included in Appendix G.

There is also an existing private railway crossing to a farmstead approximately 1.2km south of the 50 Street intersection which will need to be addressed in this project.

2.6 Vehicle Inspection Station

There is a permanent southbound VIS 2.4km south of the existing Highway 2/2A interchange. The facility includes a weigh-in-motion scale, installed in the southbound highway lanes approaching the exit to the VIS. Land is also protected on the east side of the highway for a potential northbound VIS; however, to meet the visibility, signing and auxiliary lane requirements, the stations are desirably located 3km from adjacent interchanges.



At the time of the McElhanney study, there were preliminary discussions about relocating the VIS to a more rural location. Since no decision was ever reached, the McElhanney plans located the new interchange immediately north of the VIS site, and included options for the interchange with and without the VIS in place. Both provisions will remain in place for this study.

2.7 Well Site

There is an existing oil well located at the north limits of NE14 49-25-4 that is owned by Revive Energy. Discussions with a company representative have determined that the well has reached the end of its economic life span, and is anticipated to be capped in the fall of 2014. A recent Phase 1 Assessment was completed a few years ago and no issues were identified. Estimated costs for abandoning the well and capping it would be approximately \$60,000, and reclamation would be fairly inexpensive.

Based on the above information it is feasible that Highway 2A could be realigned through the well site; however, there was no apparent benefit to doing so. To avoid the risks associated with acquisition of a well site and additional expense of remediation, all realignment options included the minimum 105m offset from the center of the highway median to the wellhead.

2.8 Pipelines

There are five existing pipelines within the project limits:

- 4.50" Natural Gas pipeline that runs north-south from the well site within NE14 49-25-4 is currently operated by Revive Energy;
- 6.63" High Vapour Pressure pipeline that runs east-west across Highway 2A approximately 400m south of the RR251 intersection is currently operated by Keyera Energy Ltd.;
- 12.75" Natural Gas pipeline that runs east-west across Highway 2A near the southern boundary of NW13 49-25-4 is currently operated by ATCO Gas and Pipelines Ltd (South);
- 16" Crude Oil pipeline that runs east-west across Highway 2A near the southern boundary of NW13 49-25-4 is currently operated by Plains Midstream Canada; and a
- 6.63" Natural Gas discontinued pipeline along the southern boundary of the NE14 49-25-4 is owned by Quattro Exploration and Production Ltd.

If the proposed highway crosses over the pipeline the oil companies could place conditions on the depth that the pipe has to be below the highway in relation to concerns with frost penetration, etc. Cut and fill becomes a design issue and the oil company would need to be involved in the development of the crossing plans. Costs for protection/remediation for the affected lines is discussed in Section 5.3.5.

2.9 Additional Utilities

In addition to the oil and gas utilities discussed above, there are also the following municipal services within the study area.

ALTA Gas

- A local gas line runs parallel to the west side of SE22, splitting to the west towards Grant MacEwan Boulevard, and to the southeast across Highway 2 near the interchange location then travelling south parallel to Range Road 252 as two lines. The lines branch out to provide service to the local residences.
- The lines mentioned above travel along the southern boundary of NW14 and NE14, where it splits again to travel north along the western side of Range Road 251, into the local farmstead, and across Highway 2A where it continues along the quarterline to the east and to the north and south, parallel to Highway 2A.

Power

- An overhead powerline serves the Vehicle Inspection Station from the south, parallel to Highway 2.
- An overhead powerline serves the local residences along Range Road 252 from the south.
- An overhead powerline serves the local residences along Highway 2A from the south, with two crossings of the Highway 2A to service the residence and church along Range Road 251.
- An overhead powerline parallels the east side of the CP Railway from the north, then turns east to run along the municipal boundary.

Communications

- There is a Telus line that runs parallel to Highway 2 from the north to the Vehicle Inspection Station.
- There is a Telus line that runs parallel to Range Road 252 from the south, servicing the local residences.
- There are two Telus lines that run parallel to Range Road 251 from the south, to the municipal boundary where it crosses Highway 2A and connects to a Telus line that runs between the highway and the CP Railway.

Refer to Appendix G for maps of the existing utilities.



3.0 Traffic Forecasting

3.1 Regional Model

As part of this study ISL requested traffic data from AT’s regional model. Data was provided for 3.6M population horizon which represents a population of 67,300 within the City of Leduc. Refer to Appendix C for model data provided by Alberta Transportation. The forecasted volume on Highway 2A (at Highway 2) is 39,000 vpd, which is considerably higher than the previous studies. This model also uses a systems interchange configuration (with 3 loop ramps and a directional ramp) that does not match the approved service interchange configuration approved in the 2009 study. When the model volumes were added to the approved interchange configuration, it failed operationally.

It was decided that the regional model volumes represented a different road network than was being used for this project, and should not be used exclusively. Model volumes in isolated locations (Highway 2 interchange and Highway 2A west of Highway 2A) were used, but factored down to balance with the adjacent network developed using the historical and development growth procedures discussed below.

3.2 Background Traffic

In 2013 the Average Annual Daily Traffic on Highway 2A, immediately east of Highway 2, was 11,350 vpd; representing a population of approximately 27,000 people within the City of Leduc. The historical growth rates shown below were calculated from the historical data on Alberta Transportation’s website.

Table 3.1: Historical Growth Rates on Highway 2A

Location on Hwy 2A at	AADT			Annual Linear Growth Rate	
	2004	2009	2013	9 year	5 year
East of Hwy 2	7,780	9,930	11,350	5.1%	2.9%
N of TWP RD 492	6,900	7,740	8,650	2.8%	2.4%

Background traffic on Highway 2A was forecasted forward using a linear growth rate of 2.5% per year to 2029 (opening day of Highway 2 interchange).

3.3 City of Leduc TMP Model

The City of Leduc’s current Transportation Master Plan (TMP) included a travel demand model for the 44,000 population. Based on current growth rates of 8.6%, this population horizon is anticipated to occur around 2020. Long-term turning movements on Highway 2A to/from the Southfork south and southeast accesses were taken directly from the TMP’s demand model (included in Appendix C), since the subdivisions are at full build out within the model.

Model volumes for Hwy 2A/50 Street and 50 Street/East Boundary Road were taken from the model and factored up to 2029 using a linear growth factor of 5.0% per year (midpoint between the growth rate on Highway 2A and the growth within the City).

3.4 County Growth Nodes

In addition to Southfork, there are seven legal parcels adjacent to Highway 2A that will be granted direct access to the road network. The three parcels on the east side of Highway 2 are:

- NE15 49-25-4;
- NW14 49-25-4; and
- NE14 49-25-4.

The four parcels are on the west side of Highway 2 are:

- NW22 49-25-4, being developed as the Knie Lands subdivision;
- NE22 49-25-4;
- SW22 49-25-4, small triangular parcel between Knie Lands and Highway 2A; and
- SE22 49-25-4, small parcel will be developable next to the storm pond.

It is anticipated that all these lands will be developed as medium density residential. The ITE Trip Generation Manual was used to develop trip generation rates for these areas, then the traffic was assigned to the long-term network. For detailed calculations refer to Appendix C.

3.5 Design Horizon Traffic

Post realignment volumes (long-term traffic) were developed for the 2029 through the summation of the background traffic, the TMP model volumes, and the County growth node volumes. Refer to Appendix C for the long-term 2029 peak hour volumes.

Stage 1/2 volumes (pre-realignment) volumes were developed for 2029 to represent the “day before the realignment”, ensuring that the short-term improvements had sufficient capacity. These volumes were derived by reassigning the long-term 2029 traffic volumes onto the existing network. The Southfork south access traffic was reassigned to the other 3 accesses along existing Highway 2A, with the majority using the existing 50 Street connection.



4.0 Development of a Short-Term Plan (Stage 1 and 2)

In the immediate future the Southfork development will require a second access onto existing Highway 2A. This second access is planned to provide the west leg to the future intersection for the Boundary Road near the existing RR 251 intersection.

4.1 Design Criteria

Table 4.1: Short-Term Design Criteria for Highway 2A passing the City of Leduc

Criteria	Rural Option
Roadway Management Class	Expressway
Service Class	Collector (Level 3)
Design Designation	RED-413.4-110
Design Vehicle	WB-21
Design Speed	110 km/h
Posted Speed	70 km/h
Alignment	
Minimum Curve Radius	600m
Minimum k for Sight Distance (crest/sag)	100/60
Desirable Grade	3%
Cross Section	
Lane Width	4 lanes at 3.7m
Outside Shoulder Width	3.0m
Inside Shoulder Width	3.0m
Center-to-center spacing	16.4m
Outside Ditch Width	4.0m rounded
Sideslope Ratio	6:1
Backslope Ratio	3:1 (minimum)
Clear Zone	9m
Right-of-Way	
Basic Highway Right-of-Way Width	90m-100m

A typical cross-section for Highway 2A is shown on Exhibit 4.1.

At the time of this report the detailed design for Stage 1A was being prepared for tender. The plans and estimated costs have been included in this report for information. It is worth noting that the cross-section in the detailed design varies from the originally proposed version submitted with the design exception request. This modification is a result of changes to the drainage methodology.

Table 4.2: Design Criteria for the Boundary Road

Criteria	City Standard
Roadway Management Class	Arterial
Design Designation	UAD-48.4-70
Design Vehicle	WB-21
Design Speed	70 km/h
Posted Speed	60 km/h
Alignment	
Minimum Curve Radius	160m
Minimum k for Sight Distance (crest/sag)	16 / 10
Minimum / Maximum Grade	0.6% / 6%
Minimum Intersection Spacing	200m
Cross Section	
Lane Width (curb face to curb face)	4 lanes at 4.2m
Center Median	6.3m ¹
Boulevard	3.0m – 5.2m
Sidewalk / Multi-way	1.5m / 3.0m
Berm Sideslope	4.5:1
Right-of-Way	
Basic Highway Right-of-Way Width	52m

¹ The center median was widened from 4.6m to 6.3m from Highway 2A to the first horizontal curve (approximately 400m to the east) to ensure that if the future left turn bay went across the railway crossing, the minimum median width requirements for cantilever crossing arms could still be achieved.

A typical cross-section is shown on Exhibit 4.2.

4.2 Development of Alternatives

Stage 1

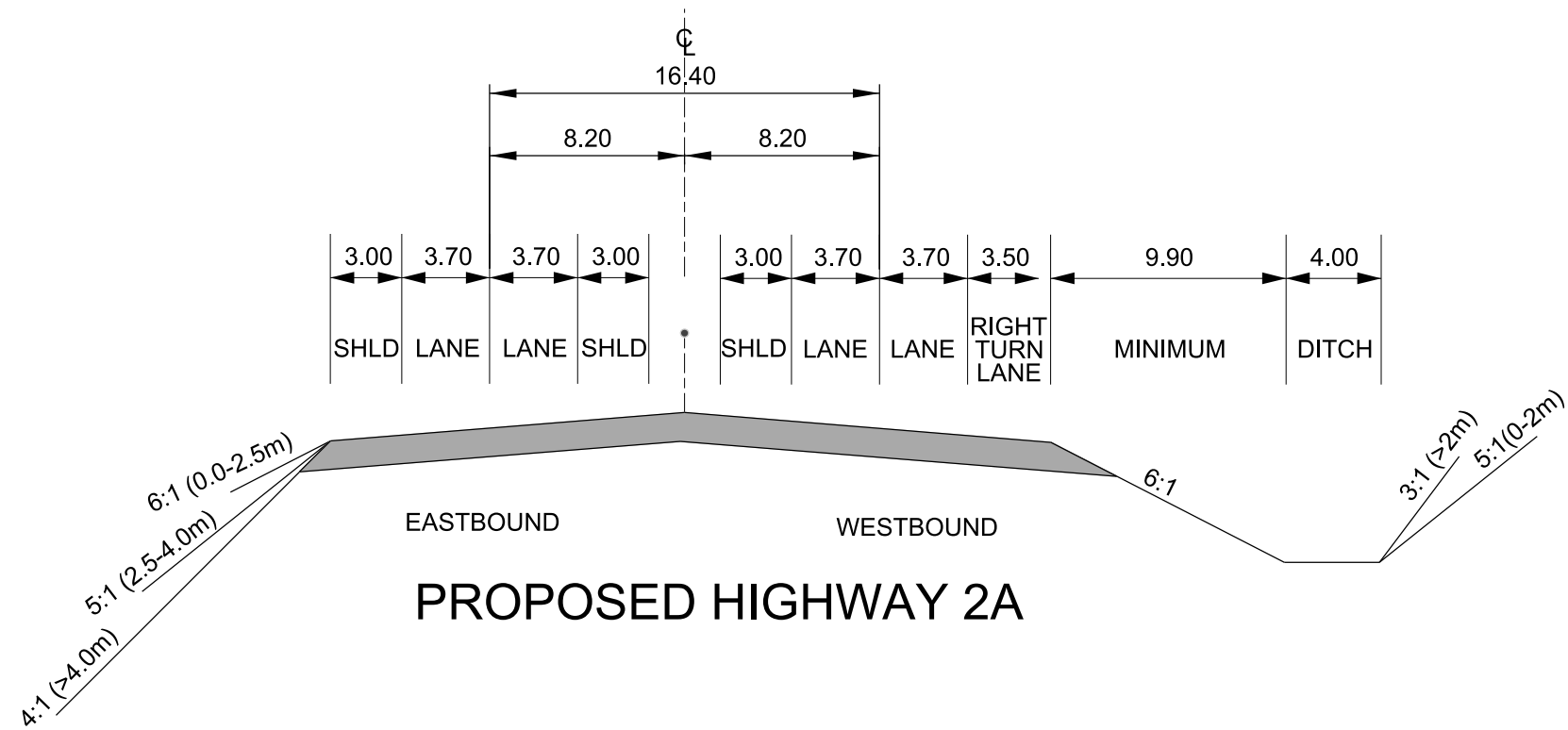
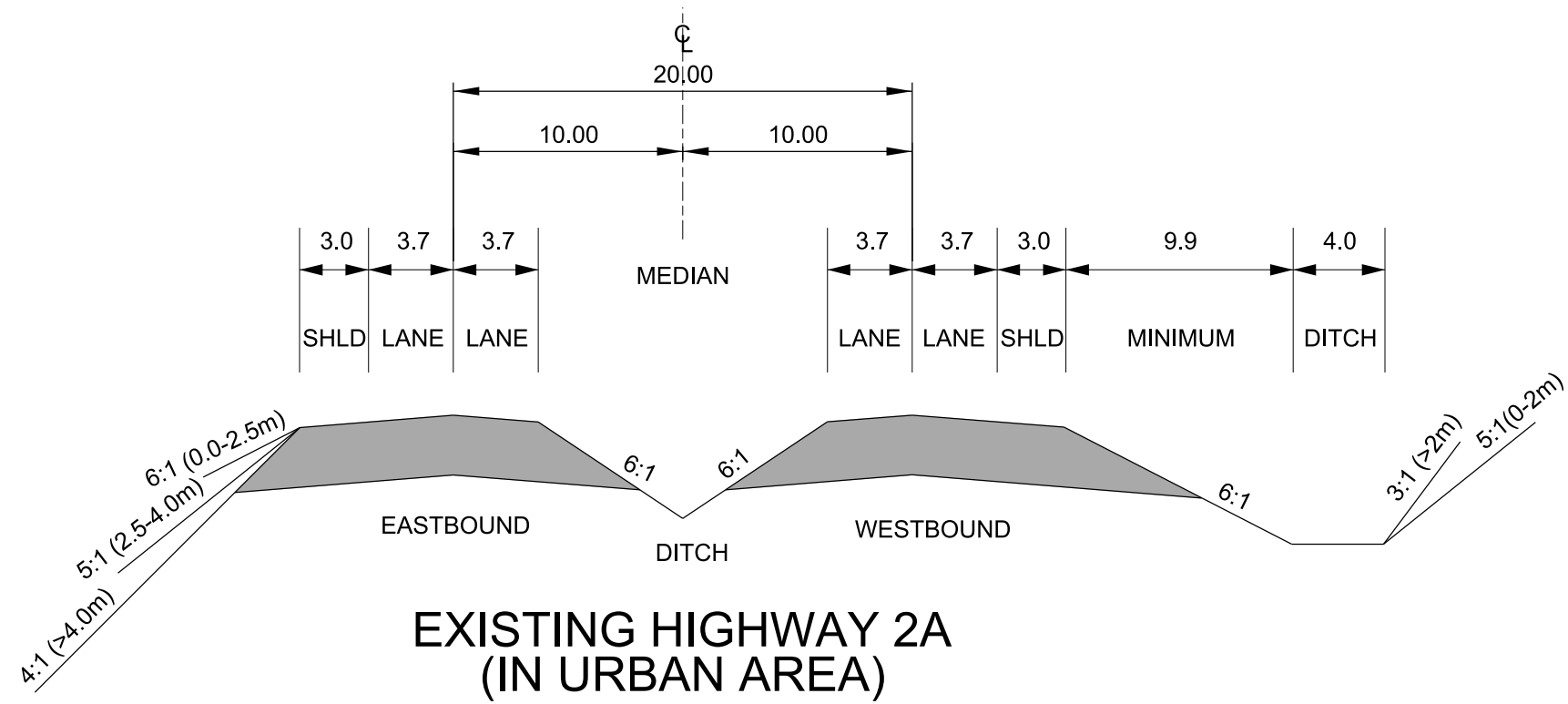
To address the proximity requirements of the CP Rail crossing and the future intersection, a section of existing Highway 2A will need to be realigned. Exhibit 4.3 shows the Stage 1 plan where existing Highway 2A continue as a 4-lane divided highway to the intersection, then transition to a 2-lane undivided highway before tying back into the existing alignment approximately 500m south of the City limits. No right-of-way is required from County parcels at this stage. There is an elongated parcel of land immediately west of the existing highway that appears to be used by the resident on the next parcel; however, this land is currently owned by Alberta Transportation. Stage 1 assumes a 2-lane cross-section on the Boundary Road.

As this roadway will eventually become a City arterial once the highway realignment occurs, the City has been granted a Design Exception from Alberta Transportation for a reduced median in this area. Refer to Appendix B for the full document.

Stage 2

As traffic volumes on Highway 2A increase, it is anticipated that twinning will be required before the realignment occurs. Exhibit 4.4 shows how the Stage 2 intersection would be modified to accommodate the additional lanes, tying into the alignment from the adjacent Highway 2A Leduc to Highway 616 (Millet) Functional Planning Study. Stage 2 assumes a 4-lane cross-section on the Boundary Road which will require a small amount of land within the County.

Model: CROSS-SECTION hwy2a
September 5, 2014
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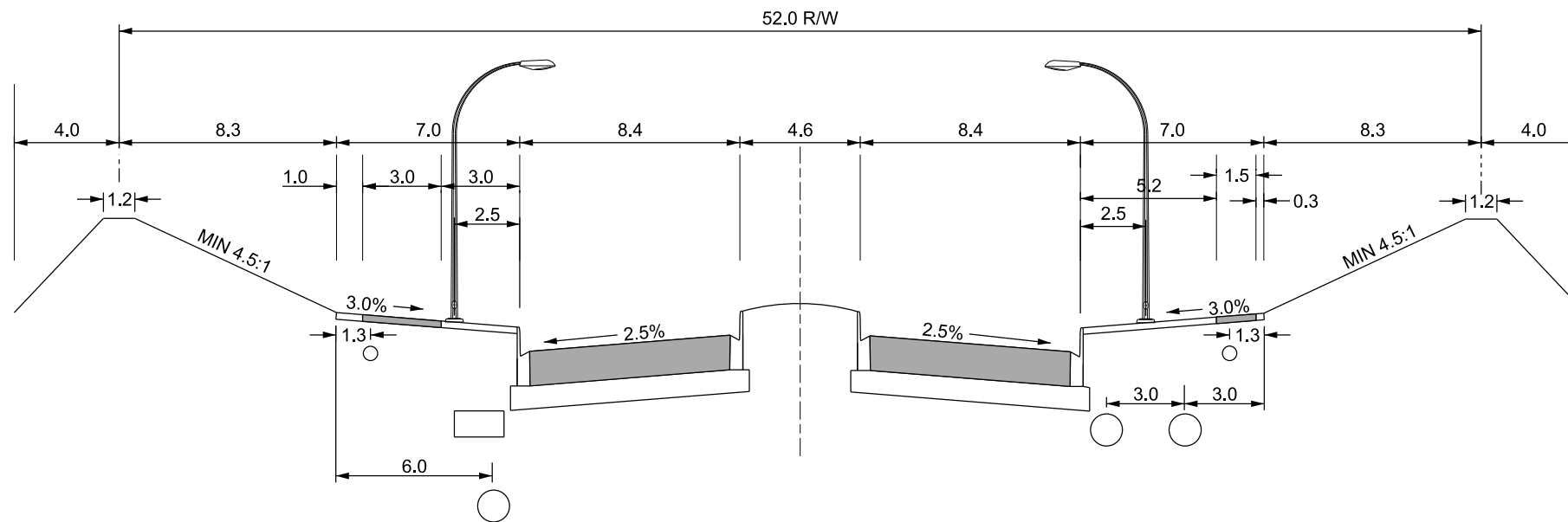
EXISTING CROSS-SECTION (STAGE 1 & 2)

HIGHWAY 2A FUNCTIONAL PLAN UPDATE

EXHIBIT 4.1



SEPTEMBER, 2014
SCALE: N.T.S.

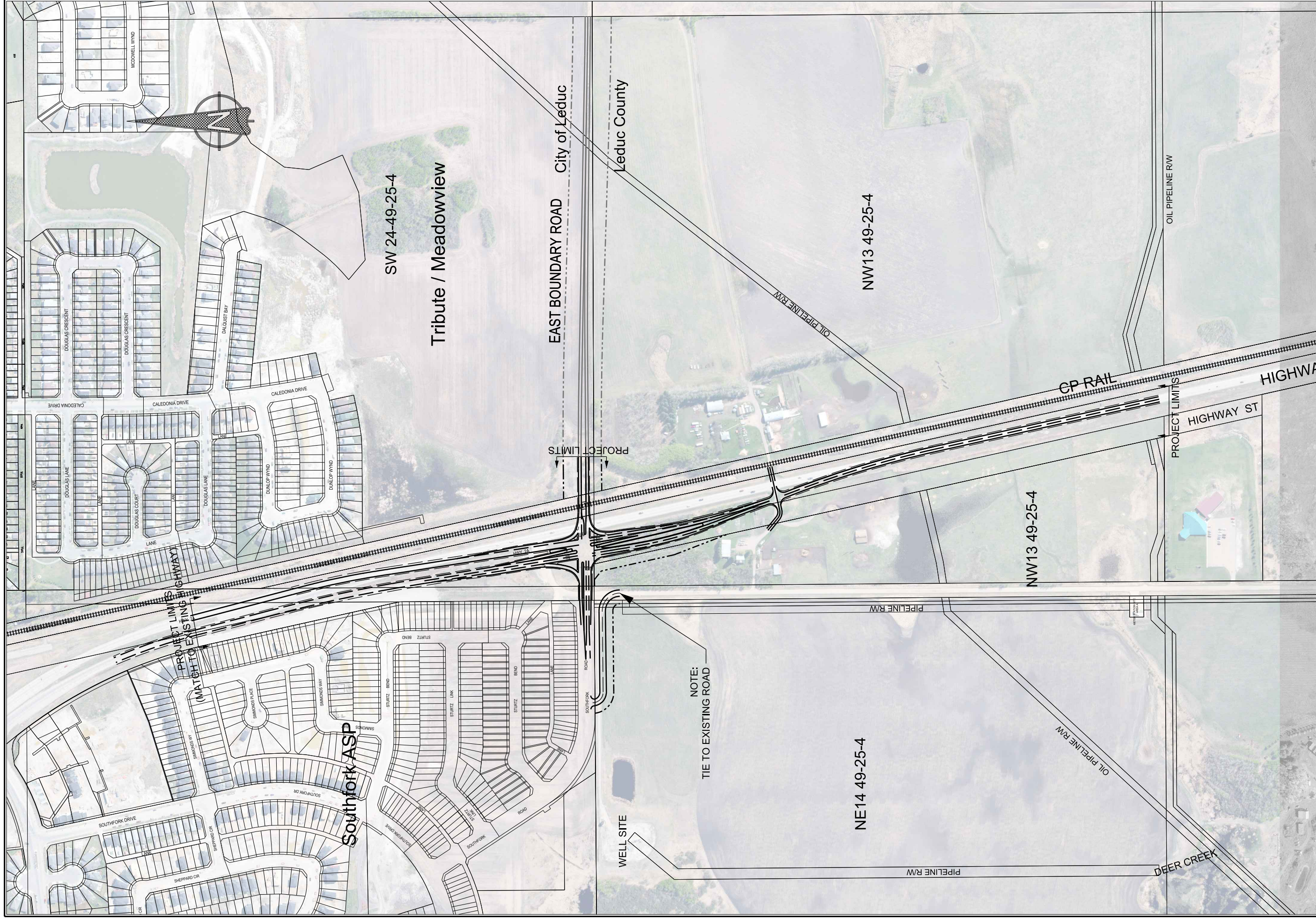


STANDARD 4 LANE DIVIDED RESIDENTIAL
ARTERIAL WITH NOISE BERM

**TYPICAL CROSS-SECTION FOR THE EAST
BOUNDARY ROAD**

HIGHWAY 2A FUNCTIONAL PLAN UPDATE

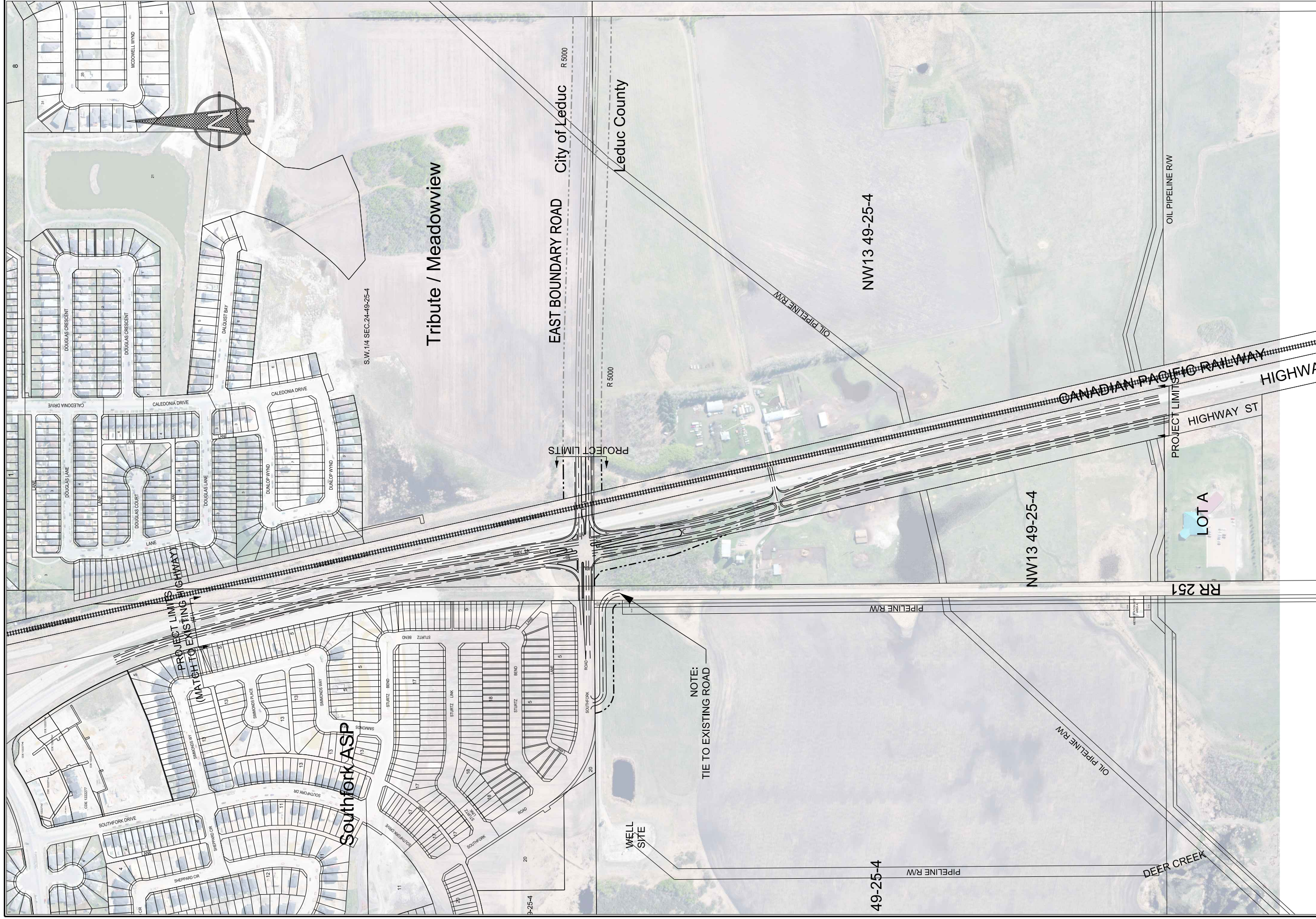
EXHIBIT 4.2



March, 2015 - J:\138001\13893_Hwy 2A Realignment FPS Update\02_CADD\20_Drafting\202_CADD\13893_leduc_2D-20140109.dgn - STAGE 1

STAGE 1 PLAN

HIGHWAY 2A FUNCTIONAL PLAN UPDATE



March, 2015 - J:\13800113893_Hwy 2A Realignment FPS Update\02_CADD\20_Drafting\202_CAD\13893_leduc_2D-20150217.dgn - STAGE 2

STAGE 2 PLAN

HIGHWAY 2A FUNCTIONAL PLAN UPDATE



Range Road 251

The new intersection onto Highway 2A will result in the closure of the RR 251 intersection. The County road provides access to two residences, the Temple Baptist Church of Leduc, a well site, and adjacent agricultural land. Two options were considered for dealing with this closure:

- Terminate RR 251 at the City / County boundary by providing a cul-de-sac and force drivers to use the intersection at Highway 2A and Township Road 492 (1 mile to the south). As this plan requires northbound drivers to backtrack, this option may be poorly received by users.
- Provide a connection to the arterial within Southfork for Stage 1 and 2. This land could be leased or acquired thru the land dedication process. Once Highway 2A is realigned in the long-term, this connection and the unnecessary portion of RR 251 could be removed and the connection into Southfork would provide the long-term access to these remnant parcels of land. The future road network would ensure that no isolated parcels were developed. This option is preferred and is shown on Exhibits 4.3 and 4.4.

4.3 Roundabout at the East Boundary Road

As per AT's Design Bulletin, roundabouts were considered at all intersections where two-way stop control was not sufficient and additional control measures were being considered. Analysis in ASidra shows that the existing Highway 2A (50 Street) / Boundary Road / Southfork Access intersection will ideally operate acceptably with as a roundabout; however, the proximity of the railway is problematic. When the Boundary Road is blocked by a train, vehicles unable to exit at the Boundary Road will remain in the roundabout and restrict all other movements, causing the roundabout to fail operationally. For this reason, a signal is recommended at this location. Although no formal Design Exception was submitted, this issue was discussed with Alberta Transportation's Technical Services Branch staff, and they agreed that this location was not appropriate for a roundabout.

4.4 Crossing of the CP Rail

A new two lane at-grade vehicular crossing of the CP Railway with a 4.6m raised median at CPR Mile 77.0 Leduc Subdivision is proposed as part of the Stage 1 construct, as shown on the preliminary Crossing Plan Drawing No's 13893RR-01 and 13893RR-02 in Appendix H. The proposed warning system in Stage 1 will consist of lights, bell and gates including chicane T-bollards on piles at the sidewalk crossings. Gates will be installed in Stage 1 since the cross product between trains and vehicles is in the order of 150,000 vehicle/trains.

A 3.0m sidewalk is proposed on the north side and a 1.5m sidewalk is proposed on the south side of the crossing with a maximum separation of 3.6m from centre line of the signal to centre line of the sidewalks, as shown on the attached Crossing Plans.

An estimated cost to construct an asphalt crossing surface, flashing light signals (including a bell), gates and the chicane T-bollards on piles is in the order of \$650,000. The City of Leduc submits that all costs associated with the proposed construction of this at-grade crossing will be their responsibility since they are the junior party at the crossing. The annual maintenance cost of the crossing surface and signal system will also be 100% the City of Leduc's responsibility.

At the time of this report a crossing agreement was being prepared for submission to CP Railway.

4.5 Impact on Utilities

Stage 1 construction will impact the following local utilities:

- An overhead powerline serves the local residences along Highway 2A from the south, with two crossings of the Highway 2A to service the residence and church along Range Road 251. The north crossing of the highway will be affected by Stage 1 construction. For Estimating purposes, we have assumed that one wooden pole will need to be relocated, at a cost of \$250 per pole.
- There are two Telus lines that run parallel to Range Road 251 from the south, to the municipal boundary where it crosses Highway 2A and connects to a Telus line that runs between the highway and the CP Railway. The connection between Range Road 251 and the CP Rail will need to be relocated as part of Stage 1 construction. For cost estimating purposes, it has been assumed that 100m of line will need to be removed, and replaced with a new 200m line beyond the intersection. Cost for this work is \$6,000.



5.0 Development of a Long-Term Plan

Based on the 2013 Bridge Inspection and Maintenance Report for Highway 2/Highway 2A, the interchange structure will need to be replaced by 2029. It is anticipated that a new interchange on Highway 2 will be reconstructed, and Highway 2A will be realigned shortly before the existing structure is decommissioned. Existing Highway 2A, west of 50 Street, will remain open to local traffic but will not connect to, or cross Highway 2. For this project, opening day of the new interchange has been assumed to be 2029.

5.1 Design Criteria

In the 2009 study, Highway 2A was given a design classification of RED-412.4-110, which is compatible with the design classification adopted for the adjacent Highway 2A Leduc to Highway 616 (Millet) Functional Planning Study. Within the project limits the original study included four signalized intersections and horizontal curve with an R460 (design speed of 100). No design exceptions were completed during this study since the process came into effect after 2009 study was completed.

As part of this realignment study, ISL is proposing to reduce the Highway 2A design speed in the vicinity of the signalized intersections previously identified at the interchange ramp terminals, 50 Street (existing Highway 2A) and the south access to Southfork.

The section of roadway being considered for the reduced design speed will have four signalized intersections in close proximity to each other operating at a posted speed of 70-80km/h, and residential development on either side. It is ISL's position that a design speed 30-40km/h over the posted speed is an over design that will create unrealistic expectations for the driver. When a roadway is designed as a high-speed rural highway, drivers will not be expecting an urban environment with frequent intersections and pedestrians. ISL is recommending a RED-616.1-90 from the diversion off the existing highway through the interchange at Highway 2, to Grant MacEwan Boulevard.

The design criteria for the project is listed below in Table 5.1.

Table 5.1: Long-Term Design Criteria for Highway 2A passing the City of Leduc

Criteria	Rural Option
Roadway Management Class	Expressway
Service Class	Collector (Level 3)
Design Designation	RED-616.1-90
Design Vehicle	WB-21
Design Speed	90 km/h
Posted Speed	70 km/h
Alignment	
Minimum Curve Radius	340m
Minimum k for Sight Distance (crest/sag)	55 / 40
Desirable Grade	3%
Cross Section	
Lane Width	3 lanes at 3.7m
Outside Shoulder Width	3.0m
Inside Shoulder Width	2.0m

Criteria	Rural Option
Center-to-center spacing	30m (10.2m median)
Outside Ditch Width	4.0m rounded
Sideslope Ratio	6:1
Backslope Ratio and Noise Berm	4:1 (preferred) 3:1 (Maximum)
Clear Zone	10m
Right-of-Way	
Basic Highway Right-of-Way Width	90m

A Design Exception to lower the design speed from 110 km/h to 90 km/h was granted by Alberta Transportation in June, 2014. Refer to Appendix B for the full document.

A typical cross-section is shown on Exhibit 5.1 on the next page.

5.2 Development of Alternatives

The long-term alignment plans for this project were developed with the following assumptions:

- The alignment of Highway 2 will not change (except for possibly a wider center median which will affect the Hwy 2A profile). The systems level interchange at Highway 2 (Focus study) is not currently being pursued.
- The Vehicle Inspection Station is remaining in place.
- The interchange location is fixed and the realignment of Hwy 2A will connect to the previously proposed tangent off the Hwy 2 interchange.
- Highway 2A will be realigned when the existing interchange structure needs major repairs or replacement in 2029.
- Highway 2A will remain under Alberta Transportation jurisdiction.
- The well site is to be preserved for this study.
- The west leg of the Highway 2/2A interchange will be developed using the design criteria shown in Table 5.1.

Using Option 3 as a guideline, two new alignment options were developed using the lower design speed approved for the corridor.

Option A: Highway 2A diverges to the west off its existing alignment near the church sites onto a 1300m curve that continues all the way to 600m radius curve where it joins the common alignment just before the Highway 2 interchange. Shown on Exhibit 5.2. Based on the large radius of the curve, intersections are permitted at 50 Street and the Southfork access.

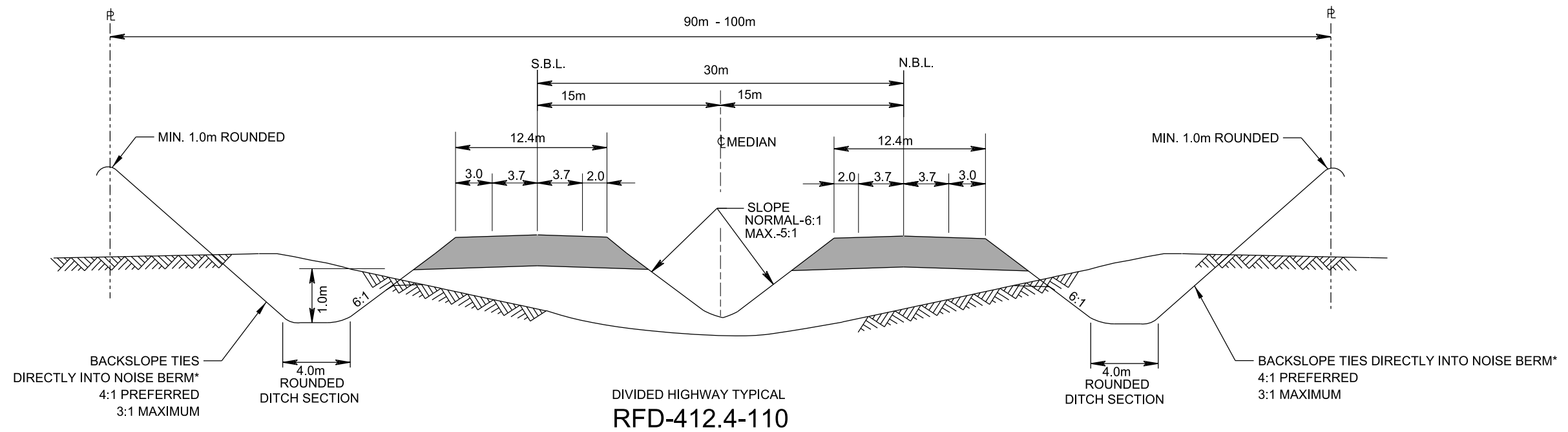
Option B: Highway 2A diverges to the west off its existing alignment approximately 300m north of the church site onto a 340m radius curve, then onto a tangent before the 50 Street intersection. After the intersection, the highway continues on tangent past the well site, then enters another 340m radius curve, then back onto a tangent before the Southfork Access. After that intersection, the highway travels on tangent to the 600m radius curve where it joins the common alignments just before the Highway 2 interchange. Shown on Exhibit 5.3.

For both options Range Road 251 becomes the south leg of the 50 Street intersection, and the temporary connection into Southfork will be removed. Long-term land access to County lands north of Highway 2A will be made via local roads that connect to the Southfork development.

Option B is the recommended alignment as it is considered to have better geometry and has smaller remnant parcels.

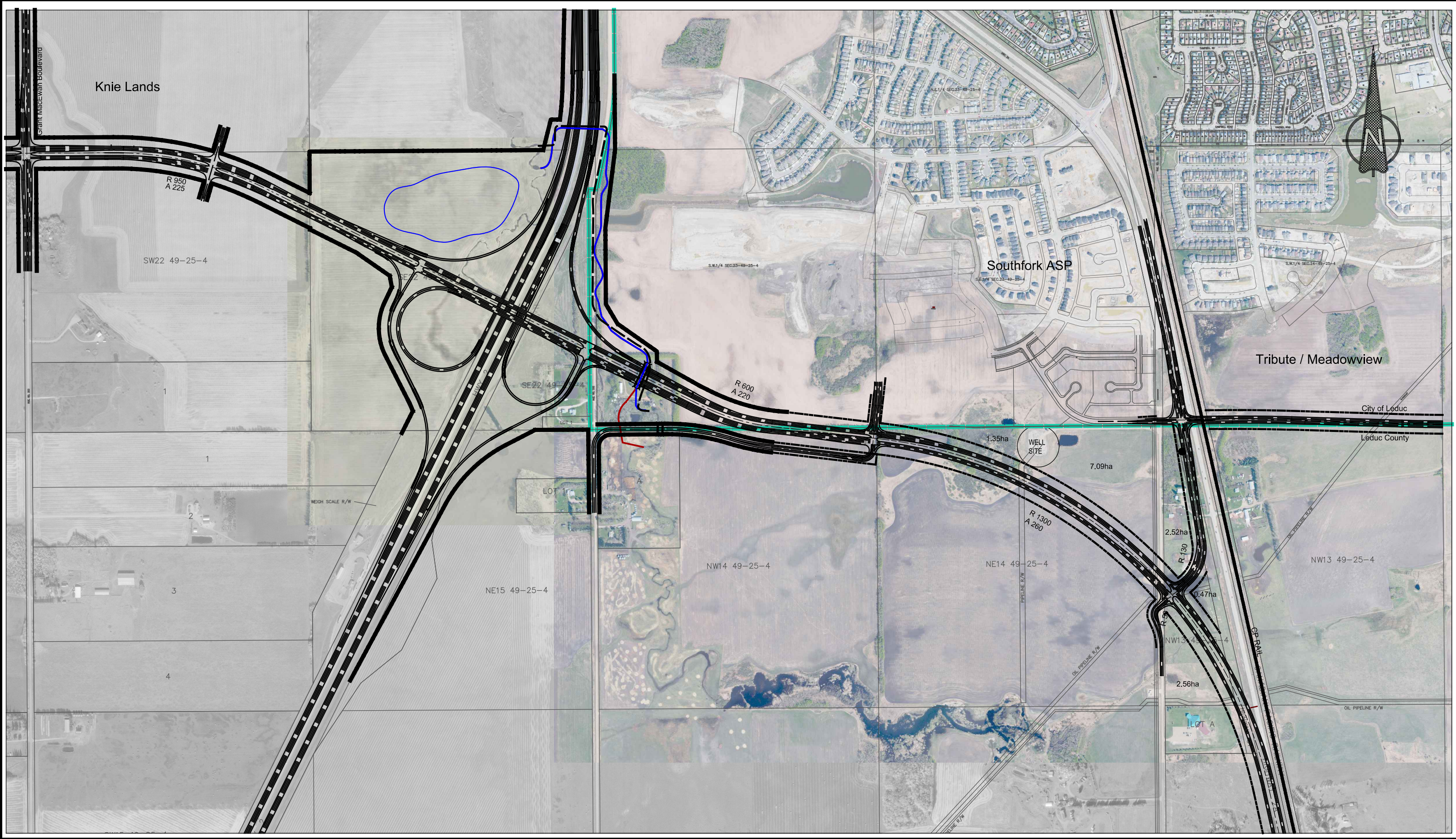
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March 20, 2015



* NOISE BERM REQUIREMENTS TO BE CONFIRMED IN FUTURE STUDIES

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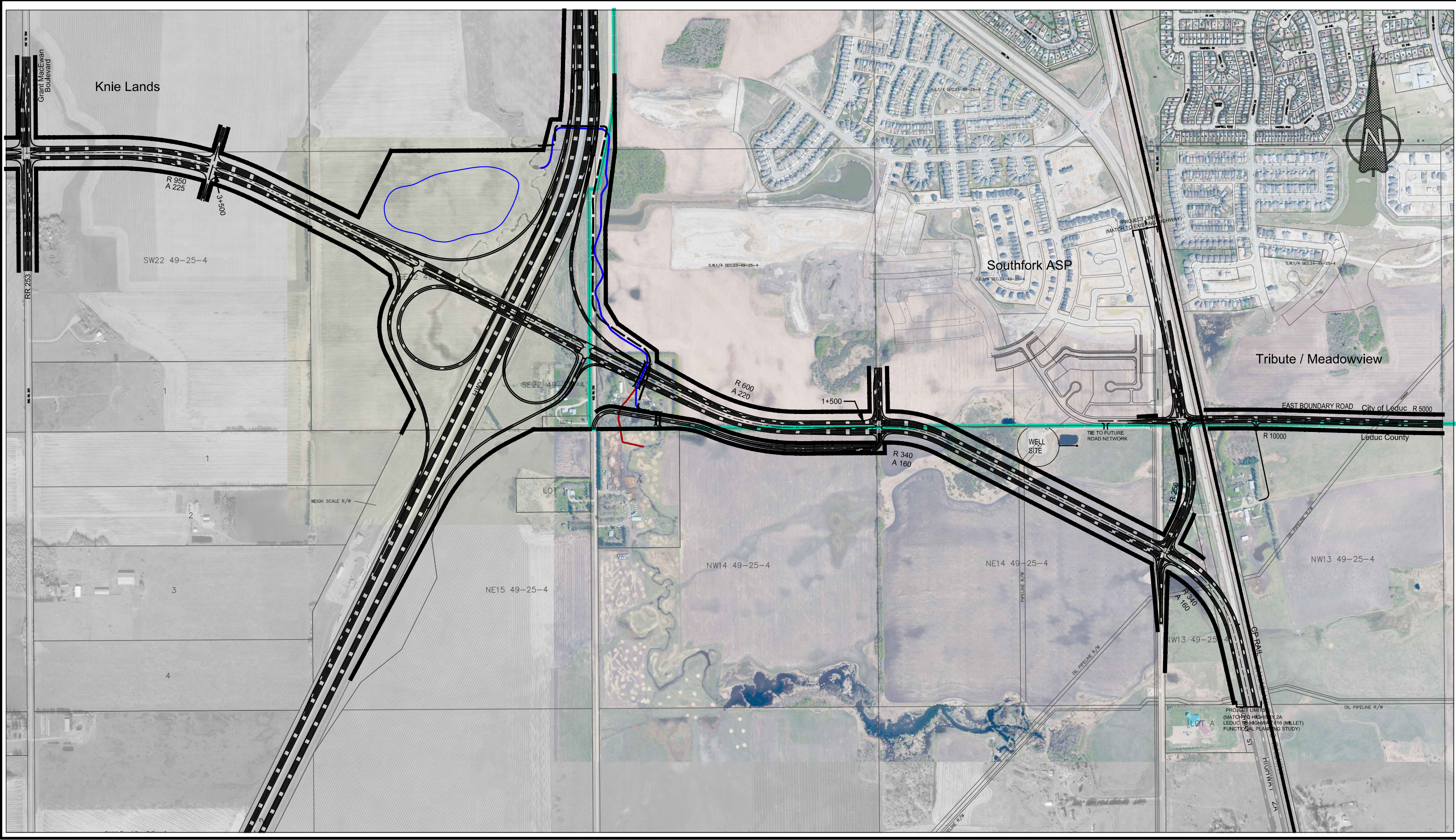


ALTERNATE ALIGNMENT A

HIGHWAY 2A FUNCTIONAL PLAN UPDATE

EXHIBIT 5.2

September, 2014 - U:\1380013893_Hwy 2A Realignment FPS Update\02_CADD\20_Drafting\202_CAD\13893_leduc_2D-20140109.dgn - ALIGNMENT B



ALTERNATE ALIGNMENT B

HIGHWAY 2A FUNCTIONAL PLAN UPDATE

EXHIBIT 5.3



SEPTEMBER, 2014
SCALE 1:5 000



5.3 Recommended Plan

Option B was refined into the recommended plan and is shown in Appendix A.

5.3.1 Impacts on Environmental

The study area falls mostly within agricultural lands and it is important that the soils are properly salvaged, handled, and managed throughout the construction and reclamation phases of development. Monitoring of soil disturbances is recommended to ensure Alberta Transportation procedures are followed.

Deer Creek will be directly impacted by the interchange construction; however, this plan splits the culverts over Highway 2A and the Range Road 252 connection, allowing for improved water quality and ease of maintenance. Splitting the culverts also preserves more of the original creek bed, and reduces the impacts on fauna and flora. Design of the creek diversion should be completed using current design standards and will require the approval of DFO, AENV, and APL.

Most of the woodlots in the area will be removed by this project, and the lowlands area east of the Southfork access will be bisected. At the time of the McElhanney study, the environmental overview determined that the study area would likely contain migratory passerines and birds of prey, small mammals, amphibians, coyotes / foxes, and ungulates. There was limited amounts of habitat that provided little to no passages with other natural areas, and most were in poor condition. As this area develops into an urban environment, there will be less and less habitat for these animals and they will likely need to relocate to survive.

The environmental overview found poplar woodlots and windrows within the study area. Most of these will be removed as part of highway construction and additional areas will likely be removed as part of urban development, limiting opportunities to replant trees in the area. At the design and construction stage, opportunities to create vegetation pockets should be explored.

Areas of previously identified for their environmental significance are shown on Exhibit 5.4.

5.3.2 Impacts on Structures

The only notable change in the structures from the 2009 plan is the partition of the two 1.9m diameter culverts under Highway 2A and Range Road 252. The culverts were separated into two sets of culverts to improve water quality and allow for the ease of maintenance. There is no change to the capacity requirements.

5.3.3 Impacts on Geotechnical

As per the original Functional Planning Study recommendations, soil testing is required prior to construction to determine topsoil and subsoil depths and recommended soil-handling procedures. Sampling procedures should be done in accordance with Alberta Transportation guidelines.

5.3.4 Impacts on Historical Resources

As per the original Functional Planning Study recommendations, a Historical Resources Impact Assessment (HRIA) is required prior to construction, with emphasis on the recommended interchange location. Initiation of the HRIA should be done in accordance with Alberta Culture guidelines.

5.3.5 Impacts on Drainage

The total drainage catchment area of the updated Highway 2/2A Functional Plan Study Area, which includes both the Highway 2/2A interchange and the proposed upstream portion of Highway 2A, will decrease from 100.9ha down to 98.8ha. The decrease in catchment area reduces any potential risks of stormwater runoff on the proposed Highway 2/2A operation. Impacts on the proposed stormwater management system will be either reduced or equal to what has already been proposed in the previous Functional Planning Report (Dec 2009), and no further recommendation is required at this point.

Due to changes in the alignment, minor realignment and/or elimination of culverts will need to occur:

- 3 culverts at the realigned Highway 2A/ 50 Street intersection will need to be relocated to match the new crossing locations.
- 1 culvert will be removed since the Highway 2A EB jug handle is no longer required.
- 2 culverts (Ø1.9m) crossing Highway 2A and Range Road 252 will be split to create shorter crossings and improve water quality and allow for the ease of maintenance.
- 1 culvert across the Highway 2 SB on-ramp will need to be relocated to match the new crossing location. This culvert will also need to be modestly wider to accommodate the additional travel lane on ramp.

5.3.6 Impacts on Utilities

Impacted utilities are discussed below. Costs for relocation/mitigation are included in the overall cost estimate in Appendix D.

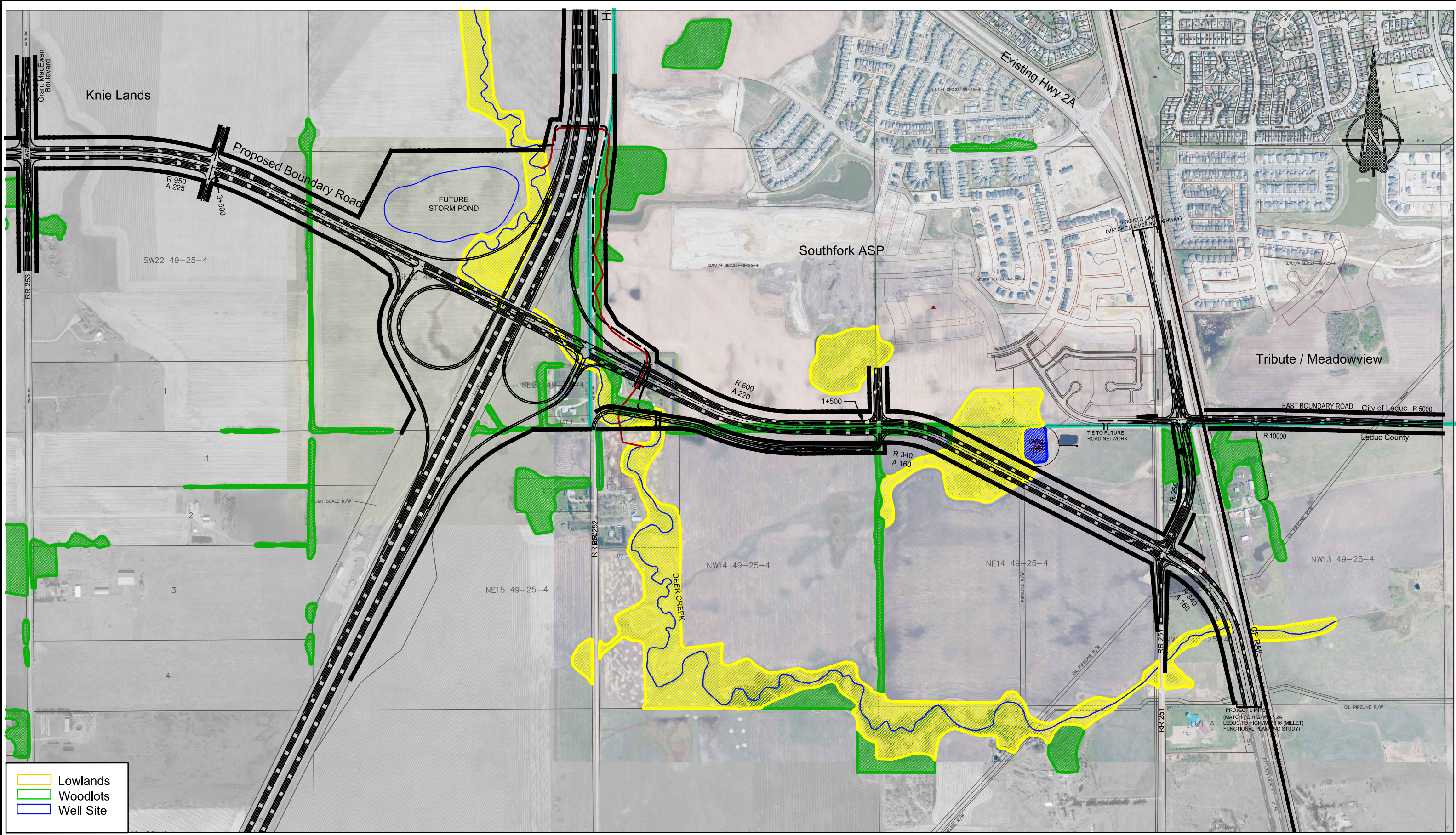
Wellsite

To avoid the risks associated with acquisition of a well site and additional expense of remediation, the recommended realignment meets the minimum 105m offset from the center of the highway median to the wellhead.

Pipelines

- 4.50" Natural Gas pipeline that runs north-south from the well site within NE14 49-25-4 is currently operated by Revive Energy – with the capping of the well site, it is anticipated that this pipeline will be abandoned in the future. The long-term alignment crosses this pipeline and it is recommended that approximately 100m of pipeline be removed during construction. For estimating purposes, a nominal fee of \$5,000 has been included for this work.
- 6.63" High Vapour Pressure pipeline that runs east-west across Highway 2A approximately 400m south of the RR251 intersection is currently operated by Keyera Energy Ltd. – the vertical alignment of Highway 2A will need to maintain appropriate cover over this pipeline in the future, and approximately 100m of the pipeline will need to be realigned to create a perpendicular crossing under the highway. For estimating purposes, a nominal fee of \$50,000 has been included for this work.
- 12.75" Natural Gas pipeline that runs east-west across Highway 2A near the southern boundary of NW13 49-25-4 is currently operated by ATCO Gas and Pipelines Ltd (South) – no impacts are anticipated to this line as it is beyond the tie-in point for construction.
- 16" Crude Oil pipeline that runs east-west across Highway 2A near the southern boundary of NW13 49-25-4 is currently operated by Plains Midstream Canada– no impacts are anticipated to this line as it is beyond the tie-in point for construction.
- 6.63" Natural Gas discontinued pipeline along the southern boundary of the NE14 49- 25-4 is owned by Quattro Exploration and Production Ltd. – no impacts are anticipated to this line as it is beyond the tie-in point for construction.

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ENVIRONMENT AREAS

HIGHWAY 2A FUNCTIONAL PLAN UPDATE

EXHIBIT 5.4



ALTA Gas

- A local gas line runs parallel to the west side of SE22, splitting to the west towards Grant MacEwan Boulevard, and to the southeast across Highway 2 near the interchange location then travelling south parallel to Range Road 252 as two lines. The lines branches out to provide service to the local residences. The travels along the southern boundary of NW14 and NE14, where it splits again to travel north along the western side of Range Road 251, into the local farmstead, and across Highway 2A where it continues along the quarterline to the east and to the north and south, parallel to Highway 2A. It is anticipated that much of this line will be affected by the realignment and interchange construction; however, with the ultimate redevelopment of these lands into urban subdivisions it is anticipated that these lines would be removed and replaced anyway. For this reason, no costs have been included in the project estimate.

Power

- An overhead powerline serves the Vehicle Inspection Station from the south, parallel to Highway 2. If the VIS is relocated prior to construction, the power supply would likely be removed from the site and this project would bear no costs. If the VIS is retained, some of the power poles may need to be relocated. For estimating purposes, we have assumed that 10 wooden poles will need to be relocated at a cost of \$250 per pole.
- An overhead powerline serves the local residences along Range Road 252 from the south. As these residences will be removed as part of the interchange construction, seven poles will need to be removed, and the powerline discontinued to the area. For estimating purposes, we have assumed a nominal fee of \$1,050 for this work.
- An overhead powerline serves the local residences along Highway 2A from the south, with two crossings of the Highway 2A to service the residence and church along Range Road 251. The northern crossing of Highway 2A will no longer be required in the long term, resulting in the removal of 2 poles. For estimating purposes we have assumed a nominal fee of \$300 for this work.
- An overhead powerline parallels the east side of the CP Railway from the north, then turns east to run along the municipal boundary. Realignment of this line will be required for the construction of the East Boundary Road, but there is no cost related to this project.

Communications

- There is a Telus line that runs parallel to Highway 2 within the highway right-of-way from the north to the Vehicle Inspection Station. If the VIS is relocated, it is anticipated that this line would be abandoned, and there would be no cost to the project. If the VIS is retained, the line would need to be relocated outside of the embankment fills, but this cost would be the responsibility of the owner since the line is within highway right-of-way.
- There is a Telus line that runs parallel to Range Road 252 from the south, servicing the local residences. The local connections to residences will no longer be required, and the lines will be removed. For estimating purposes a nominal fee of \$1,000 has been included for this work.
- There are two Telus lines that run parallel to Range Road 251 from the south, to the municipal boundary where it crosses Highway 2A and connects to a Telus line that runs between the highway and the CP Railway. New Highway 2A will cross the lines that parallel Range Road 251, and we have assumed that a new 250m section of line will be run parallel to the new 50 Street before tying into the line near the railway. We have assumed that the northern 500m will be removed. For estimating purposes a fee of \$7,250 has been included for this work.

Total cost for utility relocation/mitigation is \$67,100.

5.3.7 Attenuation

Noise attenuation along the realigned Highway 2A will be required when noise levels are in excess of Alberta Transportation guideline criteria of 65 dBa Leq₂₄. As per Alberta Transportation's noise attenuation policy, areas that are subdivided with no development are viewed as undeveloped and therefore noise attenuation is the responsibility of the developers and/or the City.

Since the City of Leduc's guideline criteria requires noise attenuation above 55 dBa Leq₂₄, it is anticipated that some attenuation will be required within the residential subdivisions adjacent to Highway 2A. The typical cross-section shown on Exhibit 5.1 includes noise berms as a continuation of the backslope; however, the exact requirements for a berm or noise fence are currently unknown since a noise study has not been completed.

It is recommended that a noise study be completed for the corridor so that the noise attenuation requirements can be confirmed, and included in the designs for Highway 2A and adjacent developments.



6.0 Traffic Analysis

Intersection capacity analysis was undertaken in accordance with the methodology outlined in the *Highway Capacity Manual*. For unsignalized (stop-controlled) intersections, the Level-of-Service (LOS) is based on the computed delays on each of the critical movements, LOS ‘A’ represents minimal delay and LOS ‘F’ represents a failure scenario with vehicles experiencing excessive delay and congestion.

For signalized intersections, the methodology considers the intersection geometry, traffic and pedestrian volumes (negligible in this case), and the traffic signal timing plan. The LOS delay criteria for signalized intersections are slightly higher than those for unsignalized intersections because drivers are more tolerant of delay at signalized intersections. The LOS criteria for both unsignalized and signalized intersections as defined by the *Highway Capacity Manual* are presented in Table 6.1.

Table 6.1: Level-of-Service (LOS) Criteria

Level-of-Service (LOS)	Average Delay for Movement (seconds per vehicle)		Description
	Unsignalized Intersections	Signalized Intersections	
A	0 – 10	0-10	Very good operation
B	>10 – 15	>10 – 20	Good operation
C	>15 – 25	>20 – 35	Acceptable operation
D	>25 – 35	>35 – 55	Limited congestion
E	>35 – 50	>55 – 80	Significant congestion
F	>50	>80	Unacceptable/ failure

The operating conditions can also be expressed in terms of Volume to Capacity (v/c) ratio, where the theoretical maximum v/c ratio of 1.00 indicates that the movement is operating at capacity. Values below this threshold indicate that the movement has remaining capacity to accommodate additional traffic, whereas values above this threshold show that the movements are operating over capacity (failure).

Finally, the Intersection Capacity Utilization (ICU) reflects the overall LOS of the intersection, providing insight into the intersection’s volume related to capacity. The ICU LOS criteria are summarized in Table 6.2.

Table 6.2: Intersection Capacity Utilization (ICU) LOS Capacity

ICU LOS	ICU	Description
A	<55%	No congestion
B	>55% - 64%	Minimal congestion
C	>64% - 73%	No major congestion
D	>73% - 82%	Acceptable congestion
E	>82% - 91%	Verge of congestion
F	>91% - 100%	Congested /at capacity
G	>100% - 109%	Over capacity
H	>109%	Over capacity

Following the methodology of the *Highway Capacity Manual*, Synchro 7 traffic analysis software was used to complete the capacity analysis of the intersections within the road network.

6.1 Short-term – Stage 1

Traffic operation results for Stage 1 are shown below for 2029. Results indicate that twinning of Highway 2A and the East Boundary Road will likely be required around this horizon.

Table 6.3: Stage 1 Traffic Analysis Results for Existing Highway 2A at the East Boundary Road

Turning Movement	AM Peak Hour			PM Peak Hour		
	LOS	v/c	95%ile Queue (m)	LOS	v/c	95%ile Queue (m)
EBL	D	0.62	39.1	C	0.27	19.6
EBT	C	0.06	7.8	B	0.22	19.5
EBR	B	0.10	6.3	A	0.04	3.7
WBL	D	0.68	42.3	C	0.41	26.9
WBT	C	0.04	5.7	B	0.04	6.0
WBR	A	0.40	0.0	A	0.63	19.2
NBL	B	0.04	5.0	C	0.18	8.6
NBT	C	0.85	#124.1	C	0.60	43.4
NBR	A	0.18	9.5	A	0.28	11.2
SBL	D	0.90	#110.1	C	0.90	#99.8
SBT	A	0.18	15.0	A	0.39	32.2
SBR	A	0.10	3.9	A	0.15	5.1
Overall LOS	C			B		
ICU	E			C		

indicates that the volume for the 95th percentile cycle exceeds capacity.

6.2 Short Term – Stage 2

Traffic operation results for Stage 2 are shown below. This scenario only applies if twinning of Highway 2A and the East Boundary Road occur prior to the realignment.

Table 6.4: Stage 2 Traffic Analysis Results for 50 Street at the Boundary Road

Turning Movement	AM Peak Hour			PM Peak Hour		
	LOS	v/c	95%ile Queue (m)	LOS	v/c	95%ile Queue (m)
EBL	B	0.24	18.0	B	0.15	11.0
EBT	B	0.23	18.0	B	0.14	11.0
EBR	A	0.06	4.9	A	0.03	3.0
WBL	C	0.47	30.8	B	0.32	20.0
WBT	B	0.02	4.1	B	0.03	4.6
WBR	A	0.40	0.0	A	0.30	0.0
NBL	B	0.04	3.8	B	0.15	6.5
NBT	C	0.83	#88.4	B	0.49	31.9
NBR	A	0.18	7.7	A	0.24	8.9
SBL	C	0.82	#32.2	B	0.69	21.5
SBT	A	0.21	16.0	A	0.46	33.7



Turning Movement	AM Peak Hour			PM Peak Hour		
	LOS	v/c	95%ile Queue (m)	LOS	v/c	95%ile Queue (m)
SBR	A	0.11	4.6	A	0.17	5.9
Overall LOS	B			A		
ICU	C			A		

indicates that the volume for the 95th percentile cycle exceeds capacity.

6.3 Long Term

Traffic operation results for the long-term plan are shown below.

Table 6.5: Traffic Analysis Results for 50 Street at the Boundary Road

Turning Movement	AM Peak Hour			PM Peak Hour		
	LOS	v/c	95%ile Queue (m)	LOS	v/c	95%ile Queue (m)
EBL	A	0.04	2.9	B	0.00	0.9
EBT	A	0.03	3.2	B	0.02	3.3
EBR	A	0.03	2.4	A	0.02	2.4
WBL	B	0.64	#47.5	B	0.53	45.0
WBT	B	0.66	#49.0	B	0.54	45.1
WBR	A	0.20	6.5	A	0.11	6.1
NBL	A	0.02	2.3	A	0.04	m0.6
NBT	A	0.27	15.3	A	0.17	m3.4
NBR	A	0.56	12.6	A	0.55	m25.1
SBL	A	0.19	8.7	B	0.29	19.9
SBT	A	0.07	4.8	A	0.13	11.4
SBR	A	0.00	0.5	A	0.02	2.5
Overall LOS	A			A		
ICU	A			A		

m indicates that the volume for the 95th percentile queue is metered by an upstream signal.

indicates that the volume for the 95th percentile cycle exceeds capacity.

Table 6.6: Traffic Analysis Results for Highway 2A at 50 Street

Turning Movement	AM Peak Hour			PM Peak Hour		
	LOS	v/c	95%ile Queue (m)	LOS	v/c	95%ile Queue (m)
SEBL	C	0.86	#63.2	C	0.76	#53.9
SEBT	A	0.21	32.7	A	0.41	33.4
SEBR	A	0.06	6.9	A	0.05	3.0
NWBL	B	0.01	1.8	B	0.01	1.1
NWBT	C	0.85	#82.3	C	0.58	41.6
NWBR	A	0.27	10.6	A	0.21	9.3
NEBL	C	0.38	25.8	C	0.52	34.1

Turning Movement	AM Peak Hour			PM Peak Hour		
	LOS	v/c	95%ile Queue (m)	LOS	v/c	95%ile Queue (m)
NEBT	B	0.27	23.9	B	0.17	16.4
NEBR	B	0.01	1.6	A	0.02	2.7
SWBL	C	0.32	21.0	B	0.47	16.4
SWBT	B	0.11	11.6	B	0.18	m8.5
SWBR	A	0.63	21.6	A	0.47	25.0
Overall LOS	C			B		
ICU LOS	C			B		

m indicates that the volume for the 95th percentile queue is metered by an upstream signal.

indicates that the volume for the 95th percentile cycle exceeds capacity.

Table 6.7: Traffic Analysis Results for Highway 2A at Southfork South Access

Turning Movement	AM Peak Hour			PM Peak Hour		
	LOS	v/c	95%ile Queue (m)	LOS	v/c	95%ile Queue (m)
EBL	C	0.88	m#23.8	C	0.74	#46.9
EBT	A	0.34	m6.0	A	0.50	39.8
EBR	A	0.04	m0.0	A	0.05	3.0
WBL	A	0.02	m0.2	B	0.01	m0.2
WBT	B	0.91	m#88.9	C	0.80	53.7
WBR	A	0.01	m0.0	A	0.02	m0.3
NBL	C	0.35	24.9	C	0.49	33.3
NBT	B	0.01	2.4	B	0.01	2.5
NBR	A	0.25	12.7	B	0.20	13.7
SBL/T	B	0.03	4.0	B	0.02	3.0
SBR	B	0.74	#24.7	A	0.49	15.3
Overall LOS	B			B		
ICU LOS	C			B		

m indicates that the volume for the 95th percentile queue is metered by an upstream signal.

indicates that the volume for the 95th percentile cycle exceeds capacity.

Table 6.8: Traffic Analysis Results for Highway 2A Highway 2 Interchange East Ramp Terminal

Turning Movement	AM Peak Hour			PM Peak Hour		
	LOS	v/c	95%ile Queue (m)	LOS	v/c	95%ile Queue (m)
EBT/R	C	0.73	48.0	B	0.80	41.6
WBT	C	0.79	#64.1	A	0.39	21.9
NBL	B	0.91	#157.3	B	0.49	26.5
NBR	A	0.24	0.0	C	0.87	#79.3
Overall LOS	C			B		
ICU LOS	G			C		

indicates that the volume for the 95th percentile cycle exceeds capacity.



Table 6.9: Traffic Analysis Results for Highway 2A Highway 2 Interchange West Ramp Terminal

Turning Movement	AM Peak Hour			PM Peak Hour		
	LOS	v/c	95%ile Queue (m)	LOS	v/c	95%ile Queue (m)
EBT	A	0.50	23.8	A	0.22	18.4
EBR	A	0.30	0.0	C	0.98	#252.1
WBL	A	0.47	3.8	D	0.76	#57.5
WBT	A	0.58	0.0	A	0.21	0.0
Overall LOS	A			C		
ICU LOS	B			E		

Table 6.10: Traffic Analysis Results for Highway 2A at Knie Lands Access

Turning Movement	AM Peak Hour			PM Peak Hour		
	LOS	v/c	95%ile Queue (m)	LOS	v/c	95%ile Queue (m)
EBL	A	0.02	1.0	A	0.00	0.6
EBT	A	0.47	31.5	B	0.81	86.7
EBR	A	0.01	1.1	A	0.01	1.0
WBL	B	0.35	10.8	B	0.38	11.3
WBT	B	0.81	69.2	A	0.38	28.4
WBR	A	0.07	3.7	A	0.05	3.1
NBL/T	B	0.01	2.2	B	0.01	2.6
NBR	A	0.01	1.6	B	0.01	2.2
SBL/T	B	0.33	21.0	C	0.48	33.3
SBR	A	0.01	1.3	A	0.02	3.0
Overall LOS	B			B		
ICU	C			C		

indicates that the volume for the 95th percentile cycle exceeds capacity.

Table 6.11: Traffic Analysis Results for Highway 2A at Grant MacEwan Boulevard

Turning Movement	AM Peak Hour			PM Peak Hour		
	LOS	v/c	95%ile Queue (m)	LOS	v/c	95%ile Queue (m)
EBL	B	0.02	1.7	B	0.01	1.0
EBT	B	0.44	34.0	C	0.90	#103.1
EBR	A	0.01	1.7	A	0.01	1.9
WBL	B	0.33	13.7	C	0.44	#17.7
WBT	C	0.81	70.4	B	0.43	38.0
WBR	A	0.60	17.0	A	0.40	14.2
NBL	B	0.01	2.5	C	0.02	2.9
NBT	B	0.00	0.5	C	0.00	0.8
NBR	B	0.01	2.0	B	0.01	2.4
SBL	C	0.73	#39.4	D	0.88	#77.2

Turning Movement	AM Peak Hour			PM Peak Hour		
	LOS	v/c	95%ile Queue (m)	LOS	v/c	95%ile Queue (m)
SBT	A	0.00	0.6	A	0.00	0.6
SBR	A	0.00	1.0	A	0.01	2.0
Overall LOS	B			C		
ICU	B			C		

indicates that the volume for the 95th percentile cycle exceeds capacity.

Traffic operations will operate acceptably at all locations. While an ICU LOS of E and G are undesirable, this is a result of the high volumes on the west leg of the interchange, which was developed using the regional travel model volumes on the service level interchange. Geometric changes such as a northbound to westbound loop on the interchange, and a freer flow ramp for the eastbound movement would resolve these operational issues. Once the function of the interchange is confirmed, the traffic generation should be recalculated to determine what the interchange requirements really are.

6.4 Roundabouts

As per AT’s Design Bulletin, roundabouts were considered at all intersections where two-way stop control was not sufficient and additional control measures were being considered. All of the peak hour circulating volumes exceeded the capacity of a two-lane roundabout, except the following locations:

Existing Hwy 2A (50 Street) / Boundary Road / Southfork Access

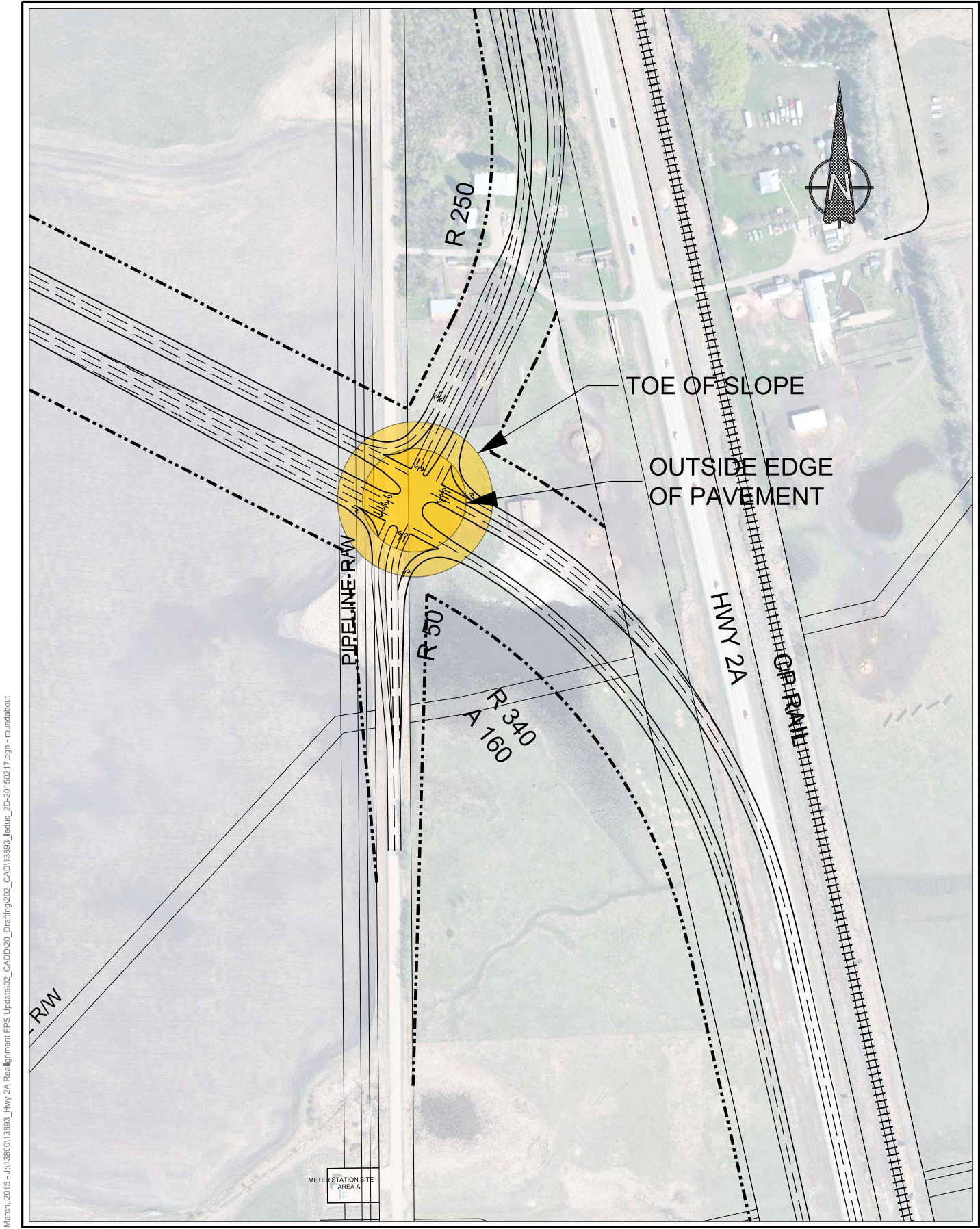
This location is immediately adjacent to the CP Railway line and includes a crossing at the Boundary Road. Asidra analysis shows that the intersection will ideally operate acceptably with as a roundabout; however, the proximity of the railway is problematic. When the Boundary Road is blocked by a train, vehicles unable to exit at the Boundary Road will remain in the roundabout and restrict all other movements, causing the roundabout to fail operationally. For this reason, a signal is recommended at this location. Discussion with Bill Kenny at Alberta Transportation’s Technical Services Branch confirm that this location is not suitable for a roundabout.

Future 50 Street / Highway 2A

Asidra analysis shows that the intersection will operate acceptably with a two-lane roundabout; however, there is a 6-lane cross-section planned to the west of the roundabout. Discussion with Bill Kenny at Alberta Transportation’s Technical Services Branch confirm that the province is currently not considering 3-lane roundabouts.

While it is possible to add a bypass lane from 50 Street headed westbound, there is no opportunity to drop the extra eastbound lane unless it was a dedicated exit to RR 251 (which is not warranted by volumes). At this time, the long-term recommendation for this location is a signal. Traffic analysis in Synchro shows that the intersection will operate at Level-of-Service C or better in the peak hours.

In the near term, it is possible that the realigned Highway 2A will be constructed as a 4-lane cross-section initially, which would allow for a roundabout to operate. To provide flexibility for a roundabout option, ISL has ensured that sufficient right-of-way is protected as part of this study to allow for roundabouts to be considered in the future (refer to Exhibit 6.1), and a decision regarding intersection treatments can be confirmed at the design stage.



March, 2015 - J:\1380013893_Hwy 2A Realignment\FPS Update\02_CADD\20_Drafting\202_CAD\13893_Leduc_20-20150217.dgn - roundabout

EXHIBIT 6.1



ROUNDABOUT

HIGHWAY 2A FUNCTIONAL PLAN UPDATE

MARCH, 2015
SCALE 1:1 500



7.0

Stakeholder and Public Consultation

A Technical Review Committee (TRC) was formed for the purpose of this study and included the following representatives:

- Mike Pieters, City of Leduc
- Kevin Cole, City of Leduc
- Ryan Graham, City of Leduc
- Lorne Stadnick, Leduc County
- Dean Litke, Alberta Transportation
- Hassan Shaheen, ISL
- Shelly Moulds, ISL

The TRC was consulted several times throughout the study to review the study findings and provide direction at key decision points. Meeting minutes are included in Appendix E.

A Public Open House was held on December 12, 2013 from 4pm to 7pm at the Leduc Recreation Centre. The event was attended by 77 people with 8 comment forms received. General feedback themes included:

- Relocation of Highway 2A would be welcome;
- Better access to Southfork is needed; and
- Timing of construction too far away.

A Public Information Session was held on December 16, 2014 from 5 pm to 7 pm at the Leduc Civic Center. The event was attended by 41 people. General feedback themes included:

- Relocation of Highway 2A would be welcome; and
- Interim improvements are needed (the sooner the better).

One landowner in the County expressed a concern about access to their property. The City met privately with this landowner and the plans were modified slightly to resolve the access issue.

Overall, the public consultation process for the study was considered successful. Feedback and suggestions were considered and incorporated into the plans where possible throughout the study. The full Public Consultation Summary is included in Appendix E.

8.0 Right-of-Way Requirements

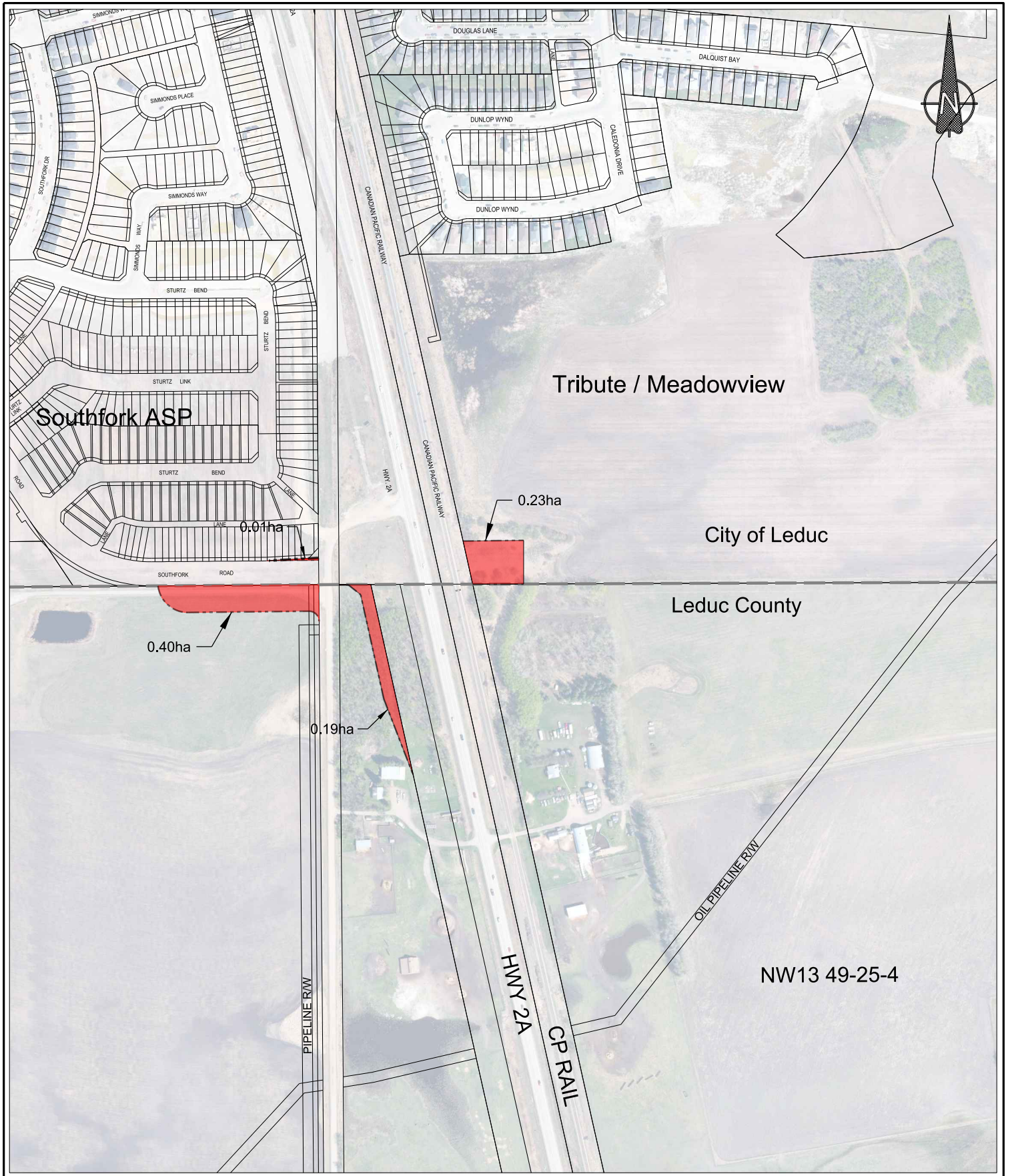
Required right-of-way for the Recommended Plan is shown on Exhibit 8.1, 8.2 and 8.3 on the following pages. Right-of-way costs were estimated in Table 8.1 using the following unit rates:

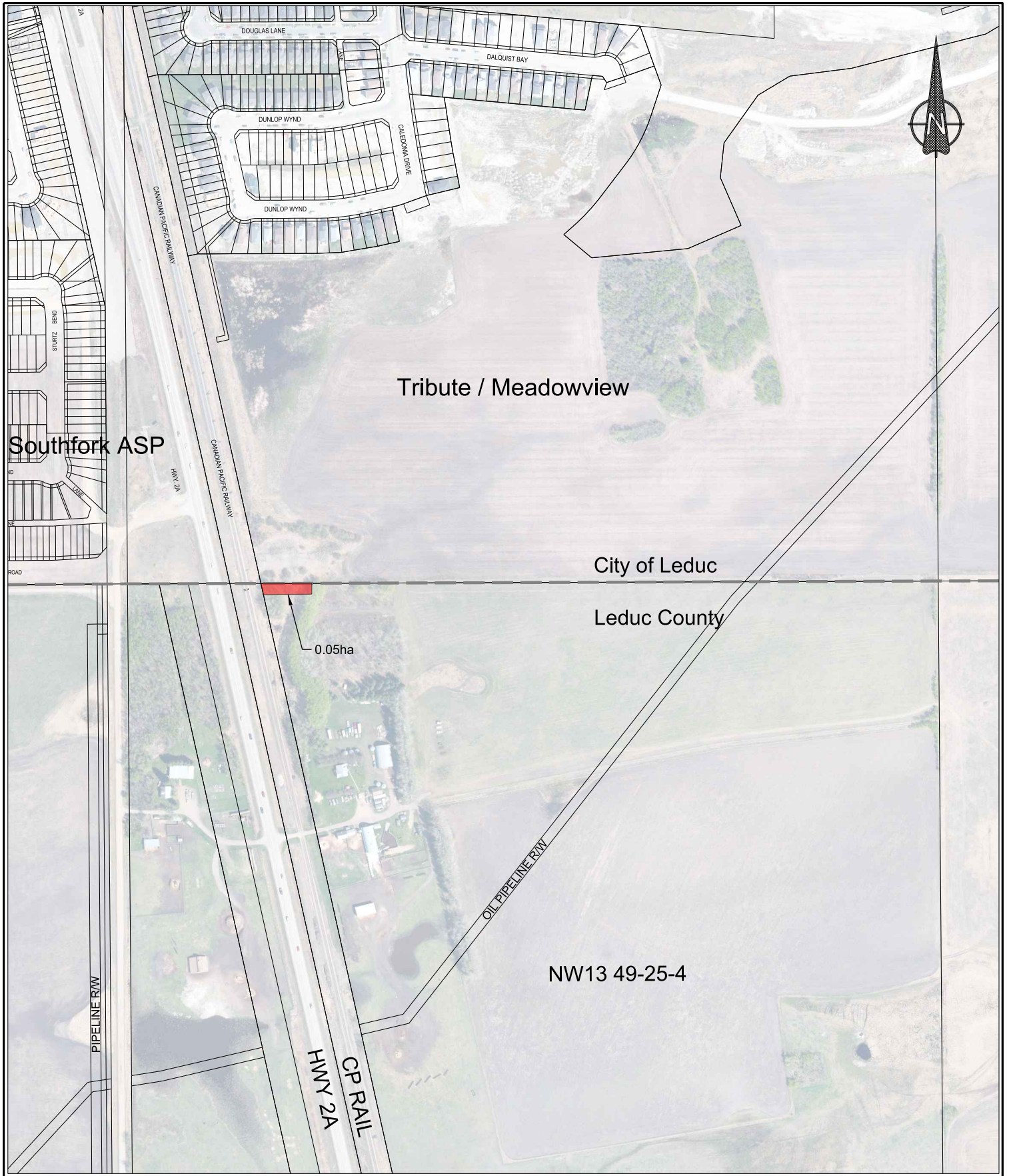
- \$65,000/acre for un-serviced City land;
- \$600,000/acre for serviced City land;
- \$65,000/acre for County land; and
- \$750,000 for an existing homestead/residence on parcel (purchase of the building plus damages).

Table 8.1: Right-of-way Requirements

Legal Land Description	Area	
	Ha	Acres
SE23 49-25-5 (St 1A)	0.01	0.03
SE23 49-25-4 (Ultimate)	0.81	2.2
NE14 49-25-4 (St 1A)	0.4	1.1
NE14 49-25-5 (Ultimate)	7.5	20.6
NW13 49-25-4 (St 1A)	0.19	0.5
NW13 49-25-5 (Ultimate)	2.6	7.1
SW24 49-25-4	0.23	0.6
NW13 49-25-4	0.05	0.1
NE21 49-25-4	2.8	7.7
SE 21 49-25-4	2.9	8.0
NW22 49-25-4	2.5	6.9
SW22 49-25-4	6.1	16.7
NE22 49-25-4	3.2	8.8
SE22 49-25-4	30.4	83.4
SE22 49-25-4	10.4	28.5
SE22 49-25-4	0.5	1.4
NE15 49-25-4	1.4	3.8
NE15 49-25-4 (titled to AT)	0.5	1.4
NW23 49-25-4	0.2	0.5
SW23 49-25-4	11.6	31.8
NW14 49-25-4	3.2	8.8

Costs for the above parcels have been included in the cost estimate for the project. Total cost for right-of-way is \$36.0M. Refer to Appendix D for more details.





STAGE 2 RIGHT-OF-WAY REQUIREMENTS

HIGHWAY 2A FUNCTIONAL PLAN UPDATE

EXHIBIT 8.2

March, 2015 - J:\1380013893_Hwy 2A Realignment FPS Update\02_CADD\20_Drafting\202_CADD\13893_leduc_2d-20150217.dgn - ROW



ULTIMATE STAGE RIGHT-OF-WAY REQUIREMENTS

HIGHWAY 2A FUNCTIONAL PLAN UPDATE

EXHIBIT 8.3



MARCH, 2015
SCALE 1:5 000



In addition to the required parcels, the plan will generate the following remnant parcels:

- 21.00 acres in NE14 49-25-4, including the well site; and
- 2.97 acres in NW13 49-25-4.

Planning documents should be reviewed at the design stage to determine if the remnant parcels should be purchased. Costs for these areas have not been include in the cost estimate for this project.

9.0

Opinion of Probable Costs

At the time of this report, tender drawings for the north, south, and west legs of the Stage 1 intersection were being prepared. The cost estimate from that project has been included within this report as Stage 1A.

Planning level cost estimates were prepared for the remaining stages of construction, including the remaining costs for the east leg of the Stage 1 intersection and the railway crossing treatment (referred to as Stage 1B). Improvements along Highway 2 were factored up to reflect current unit rates.

Table 9.1: Summary of Probable Costs by Stage

Stage	Opinion of Probable Costs
1A	\$7.1M
1B	\$1.3M
2	\$2.9M
Ultimate – Trumpet B with VIS	\$172.5M
Ultimate – Parclo AB without VIS	\$124.4M
Ultimate – Parclo AB with VIS	\$119.8M

Refer to Appendix D for detailed cost estimates by stage, right-of-way, and utility relocations/mitigation.



10.0

Conclusions and Recommendations

10.1 Conclusions

This functional planning study has refined the necessary right-of-way needed for the realignment of Highway 2A, based on input from stakeholders, landowners, and interested residents. While this study has identified the alignment and related right-of-way required for Highway 2A near Leduc, there are many unknowns that will ultimately affect this project. Alberta Transportation needs to assess their regional network to determine how and where regional highways such as the 170 Street extension will connect to Highway 2. If it is determined that the 170 Street extension is to serve as the west leg for the Highway 2A interchange at Highway 2, then Alberta Transportation should also initiate a new functional planning study to develop a systems level interchange at this location.

Until such time as these network issues are resolved, isolated studies such as this one will have limited significance since they are all based on unsubstantiated assumptions about traffic patterns, design standards, and permissible access opportunities.

10.2 Recommendations

In the short-term Alberta Transportation needs to identify the long-term network requirements for the region. Once the network issues have been resolved, the following will also need to be relooked at:

- Determine the long-term function of Highway 2A and develop the appropriate type of connection to Highway 2 (system versus service interchange);
- Quantify the long-term traffic volumes on Highway 2A thru the study area;
- Review the design standards for roads, particularly those not under provincial jurisdiction; and
- Complete traffic analysis to determine the most appropriate intersection treatment for the long-term Highway 2A/50 Street intersection (roundabout versus signals).
- Review the land use plans near the Highway 2A realignment to determine if remnant parcels should be purchased.
- Complete a Historical Resources Impact Assessment as per the HRO recommendations.
- Prepare a diversion plan for Deer Creek and seek approval from DFO, AENV, and APL.
- Look for opportunities to provide vegetation pockets within the corridor to replace vegetation lost during construction.
- Confirm Noise Attenuation requirements along the new alignment of Highway 2A.