

**Utility Coordination Guidelines in Strathcona County's
Industrial Heartland Area**

**Bosco Tong, MScE, MBA, P.Eng., P.E., C.Eng., P.T.O.E., FICE
Senior Transportation Engineer
Strathcona County, AB**

**Paper prepared for presentation
at the "Implementing Utility Coordination" Session
of the 2016 Conference of the
Transportation Association of Canada
Toronto, ON**

Abstract

Strathcona County (County), with a population of about 95,600 (2015 census), is the fourth largest municipality in the Province of Alberta. Set in the centre of Alberta's energy and agricultural heartland, and situated immediately adjacent to the central eastern part of the City of Edmonton, the County is a thriving, successful and vibrant community.

The transportation of oil and gas and its by-products via utility pipelines in the Industrial Heartland Area is an important part in Strathcona County's economy. To promote the safe and efficient operations in the installation of these utility pipelines with respect to other municipal utility services, the County has studied into the sound engineering standards and guidelines to streamline and fast track these applications and their implementation. It is however recognized that utility pipeline routing in the Industrial Heartland needs to be approached in a different way than conventional utility services. Industrial lands are valuable from an economic and space efficiency perspective. Industrial lands that cannot accommodate pipeline corridors and pipeline routing opportunities have been identified using a different methodology. In this area transport of product by pipeline is a commercial contract and the goal is to get from a point outside of the Heartland to a specific industrial site. The intent of the proposed methodology is to provide certainty and options for pipeline access to industrial sites while ensuring optimal industrial development. Creative, innovative and industry leading approaches to existing and emerging challenges is one of the principles behind the methodology proposed.

This paper identifies the objectives of setting up the transportation guidelines of utility pipelines and describes the rationale behind the promulgation of subsequent guiding principles. Specific pipeline routing models are identified. Future widenings of County roadways with right-of-way's and minimum setbacks are explored. Feasibility of under or over ground installations including possibly bridge structures is examined. Pipeline right-of-way widths will be minimized to respect the value and need for developable land and to allow maximum number of pipelines in the setback. Their possible conflict with other utility services and its mitigation will be studied. The importance of cooperation between landowners, utility providers, and relevant levels of government is highlighted in the analyses.

1.0 Introduction & Background

Strathcona County (County or SC), with a population of about 95,600 (2015 census), is the fourth largest municipality in the Province of Alberta. Set in the centre of Alberta's energy and agricultural heartland, and situated immediately adjacent to the central eastern part of the City of Edmonton, the County is a thriving, successful and vibrant community.

To the north of the County, and located in the northeast Greater Edmonton region, is AIHA, or Alberta's Industrial Heartland Area (Figure 1 - AIHA Location Map), it is one of the world's most attractive locations for chemical, petrochemical, oil, and gas investment. AIHA is Canada's largest hydrocarbon processing region with operating investments of over \$30 billion. The region has more than 40 companies, several of which being of world size, including Imperial Oil, Sasol Canada Holdings Limited, Williams Energy, Atco Power, Air Products, and Gibson Energy, etc.; which provide fuels, power, petrochemicals and other related products to provincial and global consumers. The region presently accounts for 43% of Canada's basic chemical manufacturing.

AIHA is a 582 square kilometers (225 square miles) area made up of portions of five (5) municipalities (Figure 2 - Alberta's Industrial Heartland Area): the City of Edmonton, City of Fort Saskatchewan, Sturgeon County, Lamont County, and Strathcona County; with SC occupying a large chunk of the land (194 square kilometer or 75 square mile). As a significant part of the AIHA, the transportation of oil and gas and its by-products via utility pipeline is an important part of the County's economy. To promote the safe and efficient operations in the installation of these utility pipelines with respect to other municipal utility services such as water, wastewater, power and communication cable lines, the County has studied into the sound engineering standards and guidelines to streamline and fast track applications submitted by different companies and agencies, and to expedite project implementation. It is recognized however that utility pipeline routing in the Industrial Heartland needs to be approached in a different way than conventional municipal utility services found in the urban service area (USA) and in the rural service area (RSA). Industrial land is a finite commodity, valuable from an economic and space efficiency perspective. Industrial lands that cannot accommodate pipeline corridors and pipeline routing opportunities have been identified using a different methodology. In the Heartland Area transport of product by pipeline is a commercial contract and the goal is to get from a point outside of the Heartland to a specific industrial site. The intent of designing a carefully planned methodology is to provide certainty and options for pipeline access to industrial sites while ensuring optimal industrial development. Creative, innovative and industry leading approaches to existing and emerging challenges is one of the principles behind the methodology proposed.

2.0 Strathcona County Goals and Objectives

Strathcona County's goal in the industrial heartland region is to maximize the use of developable land while preserving culture with as little disturbance as possible to the environment. In general, utility pipelines and facilities can either be publicly or privately owned and operated. Public owned utilities such as water-mains, storm water drains, and sewers which can be either shallow or deep are under municipal jurisdiction. Privately owned utilities such as cable TV (shallow utility) and electric transmission power lines (overhead or underground), can be used either to serve the public or they are used for commercial purposes such as the pipelines generally laid over land by the oil and gas companies in the Industrial Heartland Area. Public and private utilities are regulated and operate under different rules.

This paper deals with and identifies the objectives of setting up the transportation guidelines of privately owned oil and gas utility pipelines in SC and describes the principles and rationale behind the promulgation of subsequent guiding principles. Specific pipeline routing models are identified. Federal, provincial, municipal and international legislation with their policy and rules of governance are described. To accommodate for the growth and expansion in the future in the area, potential widenings of County roadways with right-of-way's and minimum setbacks are explored. Feasibility of under or over ground installations including the possible construction of above-grade bridge structures is examined. Pipeline right-of-way widths will be minimized to respect the value and need for developable land and to allow maximum number of pipelines in the setback. Their possible conflict with other utility services and its mitigation will be studied. The importance of cooperation between stakeholders, landowners, utility providers, and the different levels of government is highlighted in the analyses.

3.0 Codes of Practice, Regulations and Standards

All aspects of the life cycle of a utility pipeline; from planning, design, and construction, to operation, maintenance, and discontinuation (abandonment); are strictly controlled by a number of regulatory agencies and government departments. These entities ensure that Canada's utility services are operated safely, responsibly and in the best interest of the general public.

In the oil and gas industry, the transmission of chemical and related products, such as those operating in the AIHA, is based on rigorous standards developed by the Canadian Standards Association (CSA), which is the result of the culmination of over 40 years of pipeline standards development experience. CSA has published its first guiding document in this area in 1994, CSA Z662 – Oil and Gas Pipeline System, with the latest edition being released in 2015. The current Z662-15 [Reference 1] is now described in legislation by provinces, territories and the federal government, and serves as a comprehensive resource document when working on pipeline projects in compliance with prevalent industry standard.

Within the AIHA and inside SC, utility pipelines and their co-ordination, which are contained entirely within Alberta, will typically fall under the province and the County's regulatory jurisdiction. Alberta Energy Regulator [Reference 2] is the province's regulatory agency. It publishes the Pipeline Act under Alberta Regulation 91/2005 amended up to 4/2015 [Reference 3]. SC promulgates Bylaw 65-2001 adopting Alberta's Industrial Heartland Area Structure Plan [Reference 4] which sets out rules and standards, code of practice and regulations on land use patterns in the area, as well as the control of utility services. Bylaw 38-98 Strathcona County Municipal Development Plan forms the basis for the land uses proposed in the area. To further improve efficiency and to streamline the approval of development permit applications, the County is currently in the process of updating the 2001 Area Structure Plan which will provide updated guiding principles governing the installation of new and the relocation of existing oil and gas pipelines. The document is scheduled for release by the end of 2016. As well, Land Use Bylaw 6-2015, Part 3 [Reference 5] outlines the general regulations on all developments within the County, with Section 3.12 specifically addressing on pipeline setbacks.

Utility pipelines that cross provincial or international boundaries are regulated by the federal government, primarily under the authority of the National Energy Board (NEB) [Reference 6]; as well as by other relevant agencies including Natural Resources Canada, Environment Canada, Fisheries and Ocean Canada, Transport Canada, and the Transportation Safety Board, depending on the type and ownership of the land which the utility pipeline crosses. These agencies publish rules and regulations such as: the Food and Rural Development's Code of Practice for Responsible Livestock Development and Manure Management set by Alberta Agriculture; the maintenance, reclamation and/or restoration of landscapes associated with plant sites and areas contained within Natural Areas as defined by the Public Lands Act set by Alberta Environment; setbacks from utility pipelines and transmission corridors set by Alberta Energy and Utility Board; water intake and discharge parameters associated with the North Saskatchewan River set by both Alberta Environment and Environment Canada; air emissions set by Alberta Environment; lighting requirements for towers and stacks set by the Canadian Transportation Agency and Transport Canada; etc. The Province of Alberta, Office Consolidation, publishes the Responsible Energy Development Act, under the Statutes of Alberta, 2012, Chapter R-17.3, which is current as of December 17, 2014.

Professional and technical institutions, as well as industrial associations, have also researched and contributed extensively in this area. Transportation Association of Canada (TAC), for example, has recently completed a document entitled "Guideline for the Coordination of Utility Relocations" [Reference 7], which is approved by TAC's Chief Engineers' Council. The document can be viewed as a best practice document designed for road authorities, utility agencies and consulting engineers. It deals with utility relocation in a variety of areas but seems to be more focused on conventional utility pipelines such as water-mains and sewers, etc. for municipal infrastructure. TAC has also published a document in the past entitled "Management of Utilities in and adjacent to the Public Right-of-Way: Survey of Practices" in August 2008 [Reference 8].

Canadian Energy Pipeline Association (CEPA) has been actively involved in the CSA process to develop standards to improve pipeline performance.

4.0 Policy and Guidelines

As well as satisfying all statutory regulatory stipulations, SC has devised its own set of rules and policy guidelines for the coordination of utility pipelines in the AIHA. By nature of the potential hazardous products being carried, the County recognized that pipeline routing in the Industrial Heartland needs to be approached in a different way, and have to be carefully monitored. Based on the County's own requirements, and the needs of industry players and key stakeholders, guidelines are set and principles established to ensure that land resources are best used; and to enhance efficiency. The intent is to provide certainty and options for pipeline access to industrial sites while striving for optimal industrial development. Creative, innovative and industry leading approaches to existing and emerging challenges is one of the principles behind the modus operandi proposed.

The primary objectives of these guidelines are as follows:

- Land will be made accessible for pipeline access to industrial sites.
- Land use and planning will be optimized for industrial development and product transportation by pipeline.
- Options for a pipeline routing model(s) are identified and pipeline routing of projects are timely, cost effective for all parties, efficient and adhere to a defined process.

The guidelines stipulated are that industrial lands and pipeline development are approached using a mechanism for solutions that is balanced and fair for all parties in this area. All parties will accept shared burden of land use as a benefit of locating in the Alberta Industrial Heartland and will take a holistic and solutions based approach to pipeline routing. Relationships with landowners are respected and a collaborative approach is taken toward a mutually beneficial solution.

To meet the above guidelines the following pipeline routing model and methodology is prescribed for the area:

- Use of development setback areas (30 metres) will be available for pipelines (and outside of future road widening requirements). Where conceptual plans indicate the 30 metre setback is not feasible for pipeline rights-of-ways an alternate pipeline route locations will be provided by the landowner. In addition and as part of this option:
 - Above ground facilities should not be planned on industrial sites (i.e. valve sites), where the site is not part of the pipeline commercial contract.
 - Pipeline right-of-way widths will be minimized to respect the value and need for developable land and to allow maximum number of pipelines in the setback.
 - Cooperation between users of the setback area is required.

- Industrial landowners should provide a conceptual land plan with development areas outlined and, if possible, inclusive of the industrial landowner pipeline right-of-way requirements. This will assist in directing pipeline development.
 - Where future industrial accesses and other concerns are identified pipelines should be planned at increased depth and/or increased wall thickness.
- Biophysical mapping in the Area Structure Plan will be used for reference in pipeline planning.
- Undeveloped road allowances are under the jurisdiction of SC and can be taken into account for pipeline rights-of-ways. Where those roads are within an industrial land holding alternate locations will be considered. Regulatory and Council approvals are required for the re-designation of all roads to titled lands.
- In striving to be creative and innovative pipeline industry approaches for this area should incur minimal interruption and minimal invasion on the industrial business. This may include:
 - Allowing pipes to cross over each other in specific instances and to alleviate pinch point and/or otherwise inaccessible routing.
 - Pipeline companies should provide a commitment to facilitate installation of adjacent pipelines including permission for temporary workspace over pipes in service.
 - Provision of a standard right-of-way and temporary workspace agreement with allowance for addendums for specific considerations is recommended.
 - Coordinate timing to allow for co-location of more than one project where those project construction timelines are within same year.
 - Emergency response plans need to be coordinated and shared between landowner and pipeline company.
- SC encourages industrial development and movement of product by pipeline in the Heartland Area and will consider:
 - Angle crossing of roads by pipelines including intersections under exceptional circumstances. This however is to be avoided if at all possible.
 - Pipelines routing requests to parallel roads outside the road widening and where road widening is known or complete. Alternatively pipeline routing requests to parallel railroad lines outside of and close to their right-of way.
 - Development of a “master plan” site that posts proposed pipeline projects. This may allow for better planning by landowners.
- Pipeline crossings to County roadways are to be kept to a minimum.
- Above ground pipeline crossings over roadways via a land bridge will be considered under exceptional circumstance and only as approved by the County and satisfying all relevant technical standards.
- Pipeline crossings on rural County grid roads will confirm to Strathcona County’s Design and Construction Standard Document Section 5.17 and Drawing 51111 [Reference 9].

Some of these provisions are further explored in the following Section 5.0.

5.0 Profiles, Longitudinal and Traverse Alignment

In the oil and gas industry, operations are often categorized as upstream, midstream, and downstream. Upstream operations, which is also known as E&P or exploration and production, are the searching for, recovery and production of crude oil and natural gas; midstream operations are the collection and transportation of crude oil and natural gas & refined products; while downstream operations are the manufacturing, selling and distribution of natural gas products derived from crude oil.

Strathcona Industrial Heartland Area is inundated with midstream operators, with their extensive network of utility pipelines transporting oil, gas and industrial water in various forms. Coordinating these infrastructures is hence an important but complex task to ensure that potential conflicts and future relocations are minimized; and that activities are conducted in a safe and efficient manner. Figure 3 - Existing Pipelines within SC's Industrial Heartland Area, is a map showing the many existing utility pipelines in the area carrying different products ranging from crude oil, fresh water, miscellaneous gas, miscellaneous liquids, low vapour pressure (LVP) product (such as oil, synthetic oil and heavy oil), high vapour pressure (HVP) product (such as propane, butane and other natural gas liquids), to natural gas. These pipelines are owned and operated by large and some smaller size companies, many of which are of world scale, including Kinder Morgan, Pembina Marketing Limited, Shell Canada Limited, Keyera Energy, TransCanada Corporation, Enbridge Pipelines, TransCanada, Plains Midstream, Inter Pipeline Limited, Access Pipeline, to name just a few.

For the installation of new or the relocation of existing pipelines, the primary concern as they affect transportation is the pipelines' longitudinal alignment and route, where and how these pipelines cross controlled access highways and freeways, and their minimum setback right-of-way requirements.

Historically pipeline routing approaches in the AIHA were the same as those taken on agricultural lands: right-of-way was typically wide and there was no special regard to the industrial land uses or adjacent right-of-way needs. Conditions in the Heartland have however significantly changed. Land is no longer available in abundance, so that pipeline right-of-way widths nowadays are minimized to allow for optimum and other future development. Land fragmentation is avoided by requiring pipelines to make bends and turns, to follow alignments along the County two-mile-long/one-mile-wide rural grid system so that there is minimal sterilization of land, instead of adhering to the shortest straight line distance between the two points of origin and destination.

On general routing, longitudinal installations of pipelines within provincial or county highways' right-of-way are strongly discouraged unless they are at all unavoidable. The exception is the use of pipeline or utility corridors which are zones within the right-of-way of highways specifically set aside where multiple longitudinal utility services installations are allowed. As well as that pipelines are not to intrude into the highway's existing and planned future right-of-way, minimum setbacks (generally 15m) from the right-of-way of a petroleum or natural gas product pipeline with a prescribed operating pressure (3447.5 kPa) are required. Pipelines operating with a lesser pressure will

have lesser setback requirements. For convenience of access, construction, and future maintenance, pipeline alignments are generally parallel of the highway alignment, offset to the requisite distance, or they will run parallel to existing railroad tracks, again offset to a safe distance prescribed under prevailing regulation by Canadian Pacific/Canadian National Rail.

Traverse crossings of pipelines across highways are generally allowed but have to be minimized. They also need to satisfy certain crossing standards. Some of the rules that SC has set aside include:

- To allow for an unimproved or undeveloped County grid road within the rural service area to be upgraded in the future, right-of-way needs to be preserved. This upgrading will typically require a 20.0 metre for a Class I or II County grid road; or 10.0 metre for a Class III or IV County grid road road right-of-way widening, which may fall on one side or the other of the original Government Road Allowance, or a combination of the two. SC designates hot mix paved roads as Class I roadways; cold mix roads as Class II roadways; gravel roads as Class III roadways; and dust suppressed gravel roads as Class IV roadways. Therefore, in order to facilitate future roadway improvement work with a minimum disturbance to the pipeline, a future road right-of-way zone of 60.0 or 40.0 metres (depending on roadway class) will be examined.
- All pipeline crossings within County jurisdiction are to conform to SC's Design & Construction Standards document Section 5.1.7 and drawing 51111, specifically:
 - a) Roadway centreline profile information for 200 metres in either direction from the proposed crossing location is required to be submitted for review and acceptance to confirm minimum crossing elevations as compared to future profile improvements;
 - b) The 60.0/40.0 metre right-of-way zone width is based on perpendicular pipeline crossings to the government road allowance, skewed pipelines increase the length of pipe within the future right-of-way zone;
 - c) If no depth is specified, the proposed top of pipe elevation is to be a minimum of 1.8 metres below the single most lowest ground elevation within the 60.0/40.0 metre wide right-of-way zone;
 - d) All elevations are to be geodetic;
 - e) The pipe is to be level throughout the 60.0/40.0 metre wide right-of-way zone (with the current HDD or horizontal directional drilling technology resulting in a parabolic pipe profile across the highway, the requirement of the pipe being level is now lifted);
 - f) The proposed top of pipe elevation is to be labelled on the cross-section and profile;
 - g) Heavy-wall pipe is to be utilized throughout the 60.0/40.0 metre wide right-of-way zone;
 - h) Open cuts are not permitted (water courses and County roads in SC should be a trenchless crossing utilizing boring or HDD techniques. The goal is to prevent environmental degradation and habitat loss at watercourse crossings,

unless the sub-surface ground conditions are such that a trenchless crossing is not achievable) and;

- i) Pipeline crossing signs are to be installed on both sides of the roadway at property (fence) line.

On occasions, instead of crossing a highway underground, it may be more expedient and safer to bring the utility pipeline across via an overhead bridge structure. An example is a proposed gas pipeline by Kinder Morgan crossing Baseline Road near the Anthony Henday Drive (Highway 216) in SC. This practice is however not generally encouraged but the following issues were addressed and resolved during the planning stage:

- Ownership has been an issue. Similar to that of a railway crossing in need of grade separation, the County has looked to the pipeline company to construct, and potentially own, maintain, and operate the entire structure(s) excepting the top road surface which was a negotiated condition.
- Safety for road users is a critical component to the design. Section 10 – Clearance of the proposed bridge structure - of 6.0m over Baseline Road (Page H3-4, AT Roadside Design Guide) and a 8.5m clear zone (Page 3.3.3.4, TAC Geometric Design Guide for Canadian Roads) [Reference 10] are within AT and TAC standards and are acceptable to SC. Notwithstanding design compliance with technical standards, any agreement between SC and Kinder Morgan (and thereby subsequent pipeline operators who may utilize the remaining pipe-rack capacity) must absolve the County of any and all liability for roadway operations and any damage to the structure(s) and pipelines contained within by errant vehicles (high load vehicles or vehicles running off the road); and by third party individuals, and by acts of nature or war.
- For maintenance purposes, assuming that the bridge will be owned by Kinder Morgan, the entire structure, including abutments and peripherals, will have to fall outside of the road R.O.W.
- Baseline Road is not designated as a high load corridor. With construction of the utility bridge, future planning is to note that the road cannot be considered for use as an alternative route for high load vehicles.

6.0 The 3C's of Coordination

Given SC's dual and sometimes conflicting goals in the IHA of (a) preserving the agricultural eco system (industry) reflecting the interests of the farming community and protecting the environment, and at the same time (b) promoting the region as a sustainable top destination for business investment opportunities in the energy sector (industry); the County has been facing existing and new challenges which require the development of innovative and consensus solutions that are acceptable to both industries over controversial transportation and land use matters.

Because utility installation requires land consumption which often interfaces with farming or roadway construction activities, and which also interacts with other

concurrent pipeline installation, its successful implementation hinges on how well the planning efforts are being coordinated. Despite its critical nature, coordination remains a major problem in the laying of utility pipelines in the IHA. In the past, coordination was mostly completed as an independent one-off, stand-alone task driven on a project-by-project or case-by-case basis, rather than as part of a holistic approach, or as part of an ongoing relationship amongst the interested parties. To the extent that this is true, there does not seem to be a well-established mechanism to manage multiple issues such as joint problem solving, universal development of clear standards and procedures, and development of clearly understood business procedures. This is obviously unsatisfactory.

Amongst some of the common issues facing utility coordinators on both the government and the private sector side include: inaccurate and insufficient information in the location and marking of existing utility facilities; short time frames to review and approve pipeline projects; lack of space in right-of-way; lack of collaboration with other land and utility owners, and with government entities in the same proximity; failure to recognize that utility relocation is an integral part of transportation design; uncertainties in transportation planning and purposed projects; other utilities in the vicinity unable to meet schedules due to workload and limited funding and available resources; lack of penalties for relocations not completed on time; lack of quality and timeliness of information and accurate as-built drawings on facility data; lack of cooperation with various contractors on site in the neighborhood; little or no communication between utility companies, contractors, stakeholders, and the general public; and other inter-municipal issues.

Rice and Salama [reference 11] have recognized that the above deficiencies can be grouped into what is referred to as the 3C's of lack of cooperation, communication and collaboration between all parties involved. Notwithstanding, better communication, coordination and cooperation remain the best tool and strategy for utility coordination. Getting the utility company and all other parties informed and involved at the outset is of topmost priority and key to project success. Although not mandated for all pipeline projects depending on size and land that they goes over, public hearings and thorough communication protocol are strongly encouraged by SC for all utility installation projects. To ensure a smooth process SC adopts the following checklist procedure: project notification; public consultation planning; check if pipeline setbacks have been provided to landowners; approved access consent; approved road use application; approved ROWCAP application; approved clubroot management plan as per SC protocol; environmental assessment received and approved; confirmation of wetland compensation; emergency response plan received and approved; approved reclamation plan received; creek crossing plans received and approved; land spray issues resolved.

Utility companies will also check the following: conduct a business case study of pipeline project; request a pre-application meeting with representation from all relevant SC departments offering initial comments and providing directions; conduct a preliminary routing investigation and design; submit development permit (DP) application; follow up with review comments by SC; arrange for land and property acquisition, and right-of-way purchase; organize public hearings and consultation where

appropriate or required; obtain DP issued by the County; and finally do construction and commission.

Throughout the entire development process, in addition to adhering to prescribed technical guidelines and regulations, the importance of 3C is emphasized and consensus solutions are reached before actual installation.

7.0 Summary and Conclusion

The Industrial Heartland Area forms an important part in Strathcona County's overall economy. Within this area, the transportation of oil and gas and its by-products via utility pipeline is an intense activity that demands careful attention and warrants constant monitoring to ensure a safe and efficiency operative environment. Installation of new and relocation of existing pipelines is part of the core business of midstream oil and gas companies. To promote and to provide a healthy business environment, the County has set out sound engineering standards and yet flexible enough guidelines to turn the region into one of the most attractive locations in the world for energy investment opportunities. Development project application processes are handled efficiently and permit application processes are streamlined and fast tracked with minimal government bureaucracy. It is also recognized that utility pipeline routing in the Industrial Heartland are different from conventional municipal utility service pipelines and hence should be treated differently. In the granting of utility pipeline right-of-way, it is noted that industrial land is a finite commodity and extremely valuable from an economic and space efficiency perspective.

Acknowledgment

The author wishes to thank Ms. Lori Mills and Mr. Tyler Westover, both of Strathcona County, for information and advice on utility pipelines within Strathcona County's Industrial Heartland Area. The author also wishes to thank Ms. Danielle LeGrow, also of Strathcona County, for help in preparing the figures in this paper.

References

1. CSA Group, 2015. "CSA Z662 – Oil and Gas Pipeline Systems".
2. Alberta Energy Regulator, cited at <http://aer.ca/>.
3. Province of Alberta. "Pipeline Act – Pipeline Rules. Alberta Regulation 91/2005, with amendments up to and including Alberta Regulation 4/2015".
4. Strathcona County. "Strathcona County Alberta Industrial Heartland Area Structure Plan, Bylaw 65-2001, Schedule A". May 29, 2001.
5. Strathcona County. "Land Use Bylaw 6-2015, Part 3: General Regulations". 2015.
6. National Energy Board, cited at <http://www.neb-one.gc.ca/index-eng.html>.
7. Transportation Association of Canada. "Guideline for the Coordination of Utility Relocations (draft)". 2016.
8. Transportation Association of Canada. "Management of Utilities in and adjacent to the Public Right of Way: Survey of Practices". August 2008.
9. Strathcona County. "Design and Construction Standards Volumes 1 & 2".
10. Transportation Association of Canada. "Geometric Design Guide for Canadian Roads, 1999 Edition".
11. Rice and Salama 2016. "Effective Strategies to Reduce Project Delays and Cost on Highway Projects Caused by Utility Relocation" In TRB 2016 Annual Meeting, Washington DC, January 2016.
12. Alberta's Industrial Heartland Association. "Alberta's Industrial Heartland - Industrial Guide 2016". January 2016.
13. Highways Department, Research & Development Division. "Guidance Notes on Utilities Co-ordination under the Utility Management System". December 1998.
14. Imperial Oil Ltd. "Guidelines for the Preparation of a Pipeline Crossing Application". May 2003.
15. Kraus and Quirpaga 2016. "Innovations in Accommodation of Longitudinal Utility Installation along Controlled Access Highways". In Transportation Research Board 95th Annual Meeting, Paper No. 16-2421, January 2016.
16. Haruna Monri 2015. "A Survey of Utility Coordination Practices in the Toronto Area". In Conference of the Transportation Association of Canada, September 2015.
17. Lakkavalli, Poon and Dhanoa 2015. "Challenges in Utility Coordination and Implementation of Pavement Degradation Fees". In Conference of the Transportation Association of Canada, September 2015.
18. PLUS 663, Canadian Standards Association. "Land Use Planning for Pipelines: A Guideline for local Authorities, Developers, and Pipeline Operators". August 2004
19. Transportation Association of Canada. "Guidelines for Underground Utility Installations Crossing Highway Right-of-Way". 2013.
20. Transportation Association of Canada. "Study of Natural Gas Pipeline Placement in Rural Road Right-of-Way". 2001.
21. Transportation Association of Canada. "A Guide for the Accommodation of Utilities within Freeway Rights-of-Way". 2011.

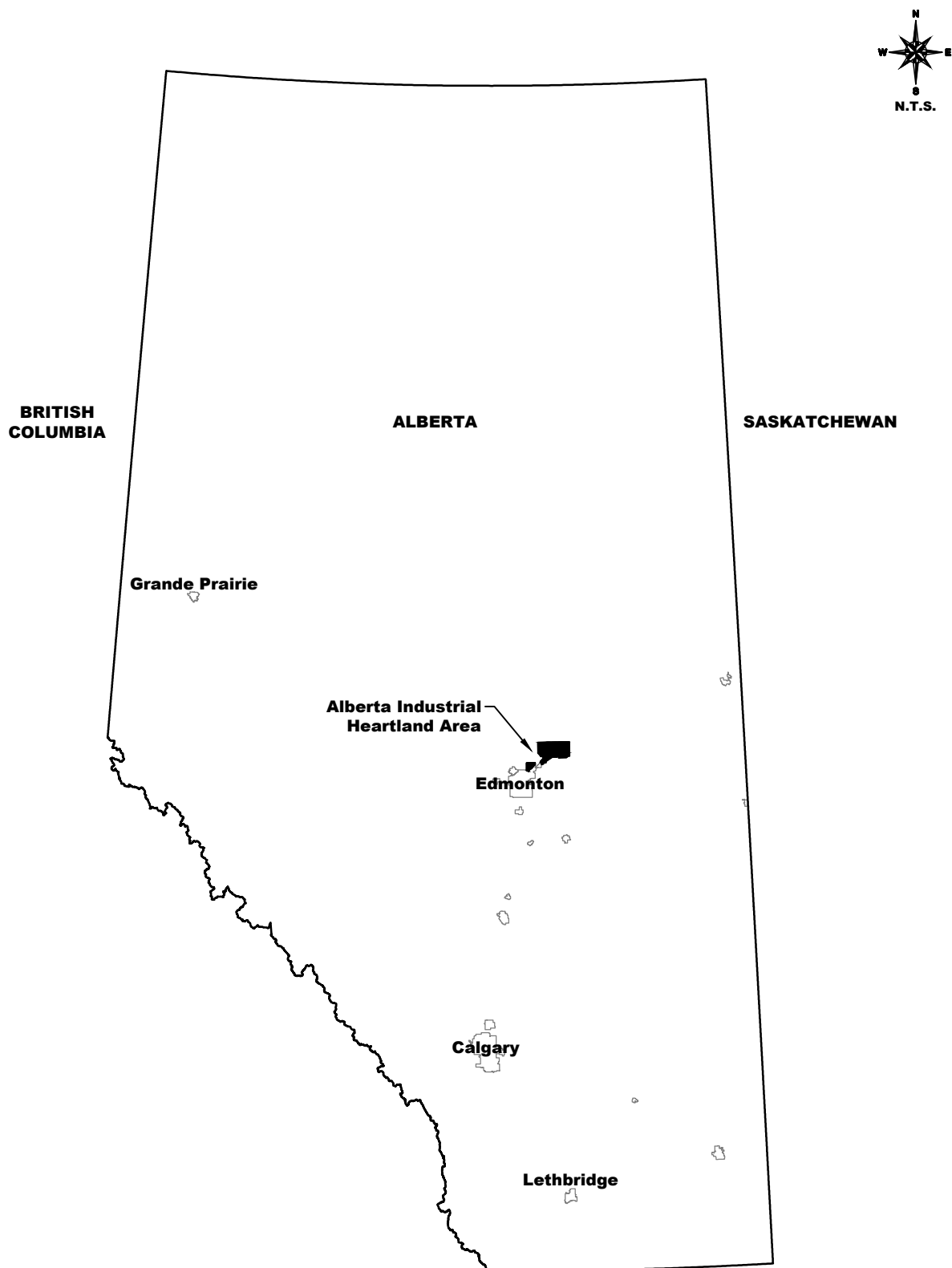
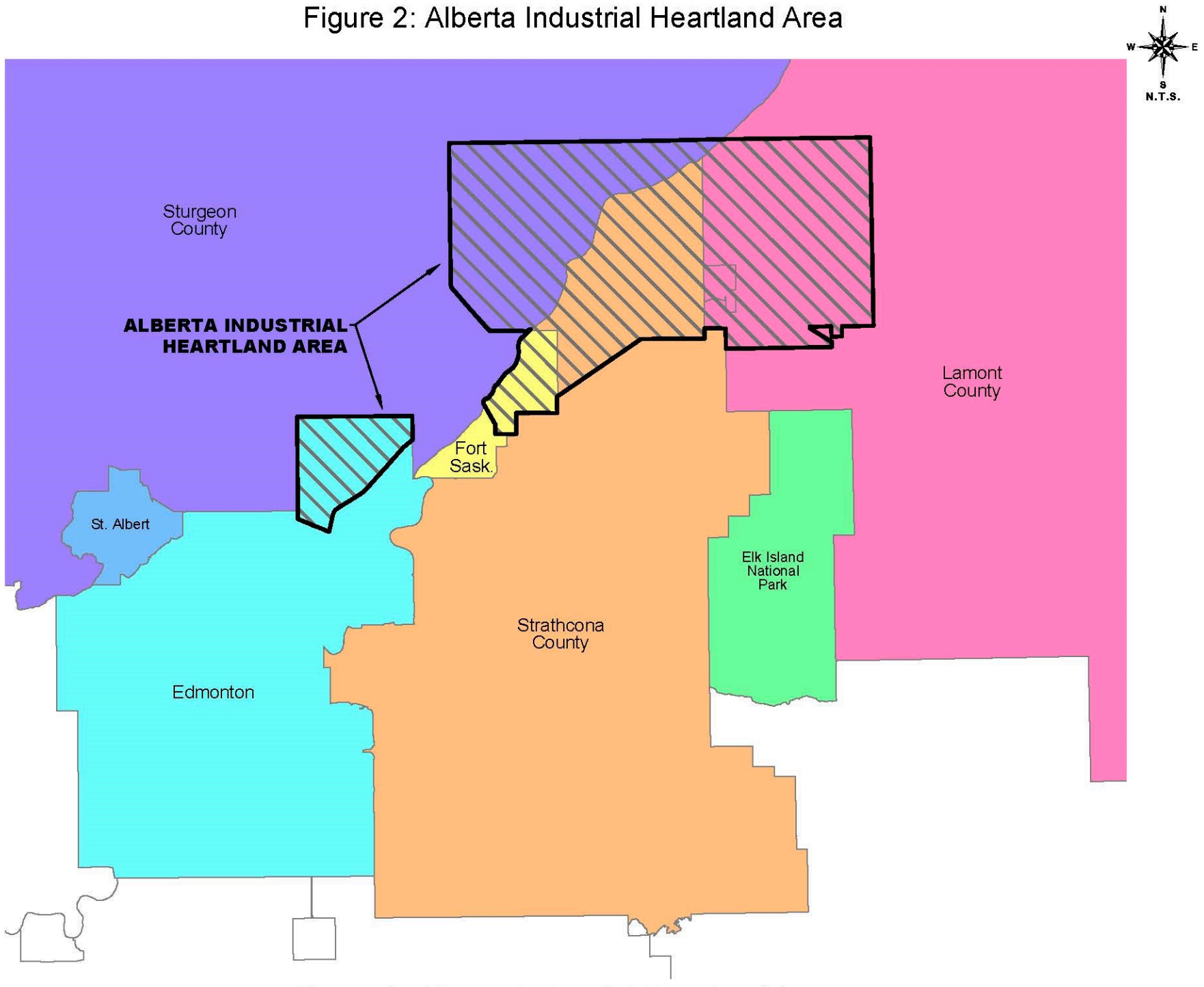


Figure 1: Alberta Industrial Heartland Area Location Map

Figure 2: Alberta Industrial Heartland Area



INDUSTRIAL HEARTLAND AREA

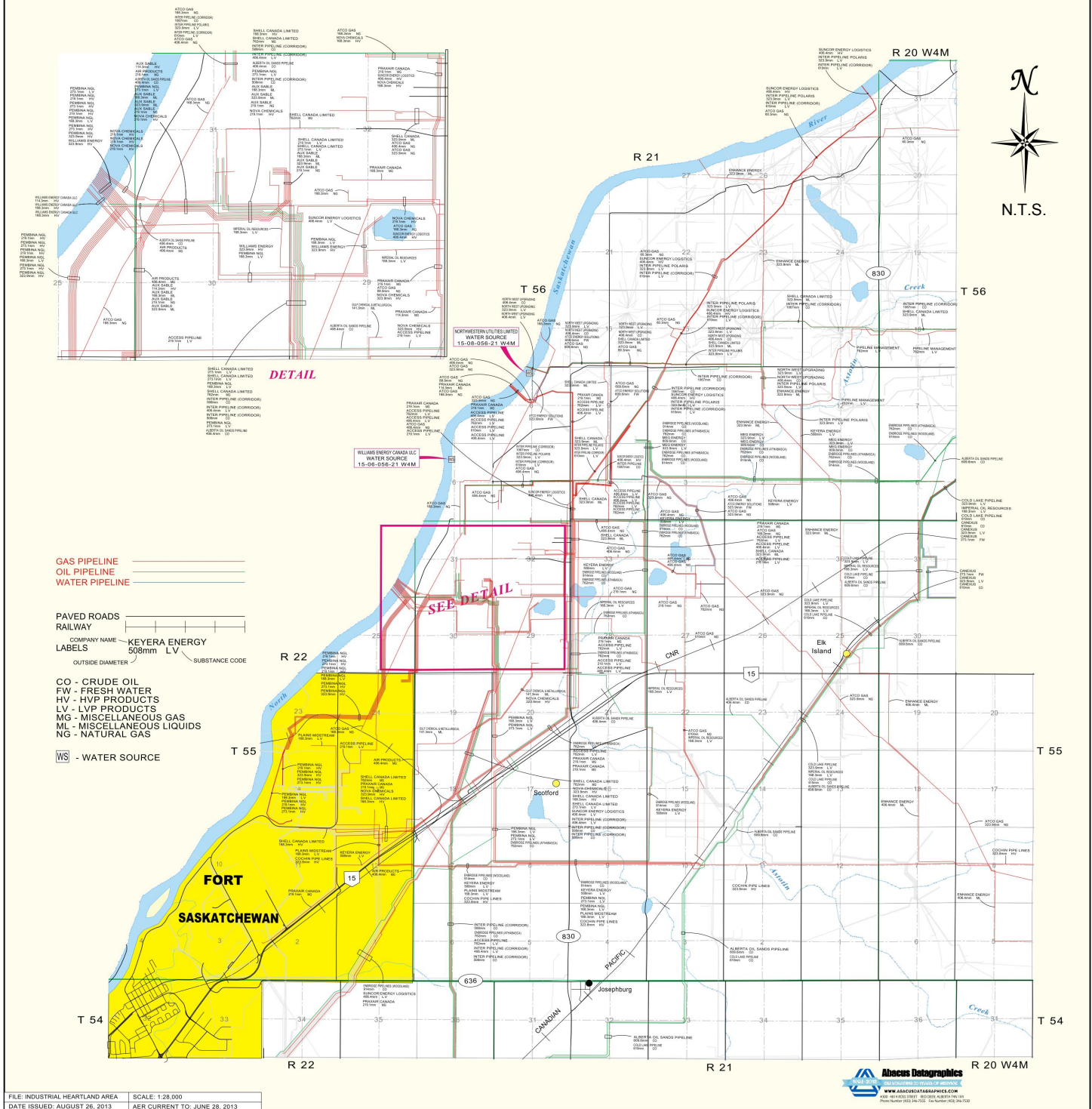


Figure 3: Existing Pipelines within Strathcona County's Industrial Heartland Area
Source: Abacus Datagraphics, 2013