Energy Corridors - An AESO Perspective

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- Transmission development life cycle
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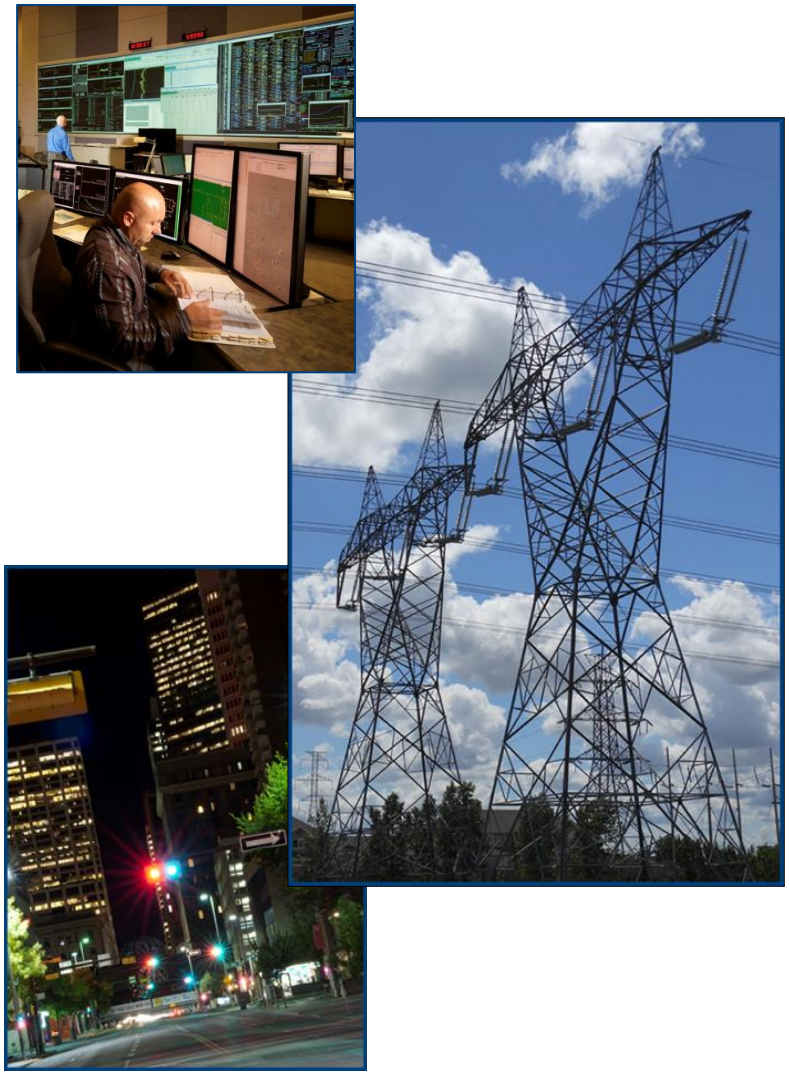
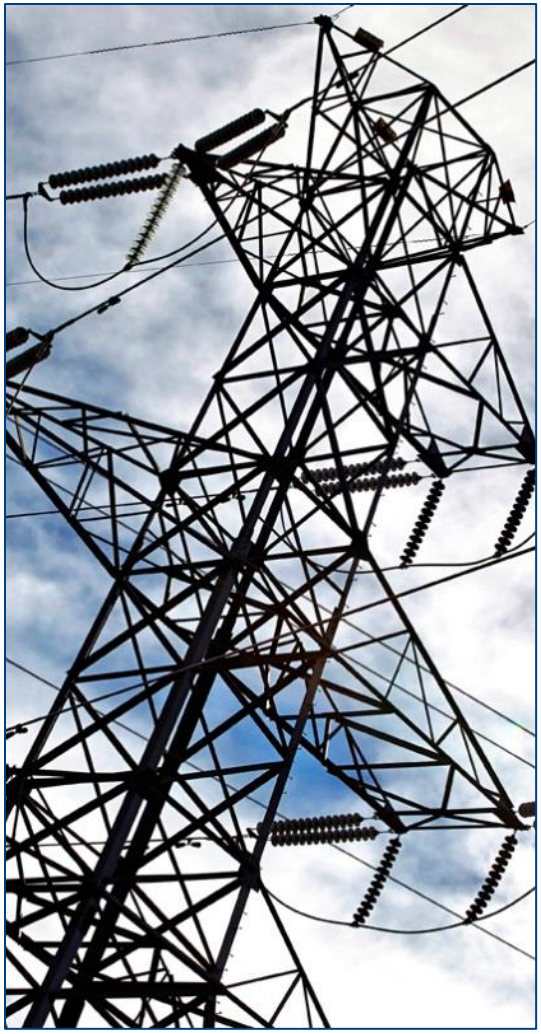
The AESO's core functions

- Direct reliable 24/7 operation of Alberta's power grid
- Operate wholesale energy market to facilitate open, fair, efficient competition
- Plan/develop transmission system to provide reliability, a competitive market and investment in new supply
- Provide system access: connect new generation/load
- Develop rules and standards and administer compliance

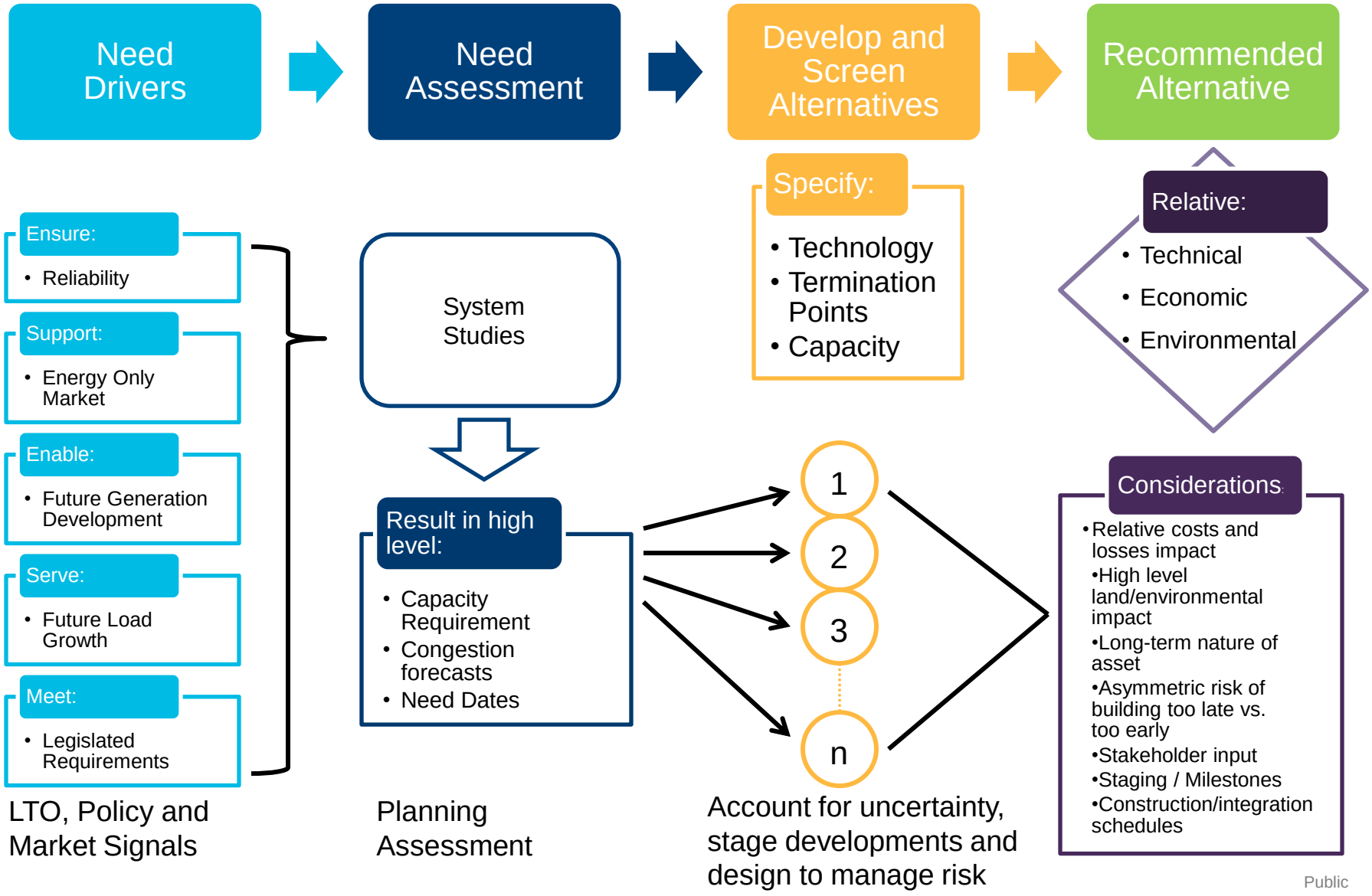


Transmission adequacy: vital for reliability, economic prosperity and a successful renewable energy transition

- Transmission network function is to enable generation to serve load
- Ensure transmission network can meet near-term and long-term needs reliably
- As load demand increases (or forecast to increase) or new generation is proposed, new transmission capacity is assessed (need)
- Continuously monitors the transmission system performance, forecasted load and generation needs
- Proposes transmission developments that can efficiently meet the identified need



Transmission development life cycle



Transmission planning – corridor considerations

- A core consideration to enable successful transmission plan execution is feasibility of implementation and cost
- The AESO transmission planning process identifies
  - a point-to-point connection (for transmission lines)
  - needed capacity
  - target in-service date
- Corridor analysis (for feasibility) enables a first glance impression on the route, length and consequently impact (social, land use, environmental and cost)
  - allows for further refinement of considered alternatives
- Final routing and siting exercise is the responsibility of the Transmission Facility Owner (TFO) building the line

Transmission planning – corridor considerations

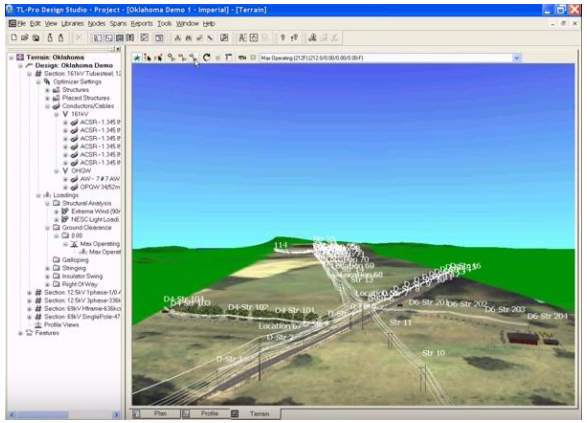
- Availability of a low impact route potentially
  - shortens route lengths
  - enables efficient solution (cost)
  - shortens consultation and regulatory process, and
  - ultimately reduces time needed to place facilities in service
- Usually, a challenging task in urban areas and for long length transmission lines
- An available utilities corridor can be an asset

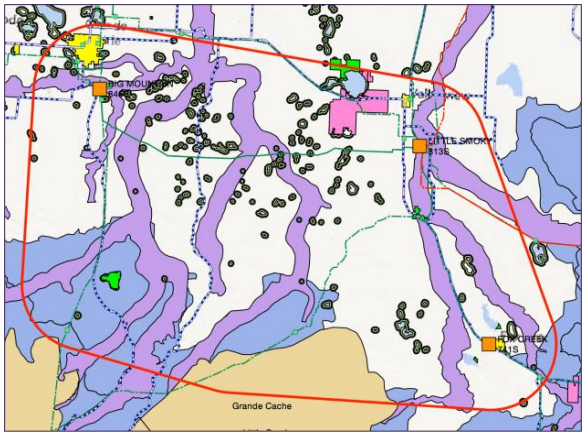
Corridors – planning and challenges

- An ultimate condition would be
  - to have a suitably-sited utility corridor at the time the transmission need is identified (or earlier)
  - the corridor has sufficient allowance for utilities, transportation, pipelines, etc.
- Establishing an approved transmission line route requires a well-defined need and regulatory approval
- Corridor planning is a long-term vision exercise that can assist with enabling transmission development once its need is established
  - specific transmission needs may not be well established when the utility corridor is planned.
  - legislative authority to establish/designate corridors
- In some cases a utility corridor is established/designated but may not be utilized for a long time
  - Public and private development encroachment towards the utility corridor can still make the routing exercise (utilization) difficult

AESO alternative selection and evaluation

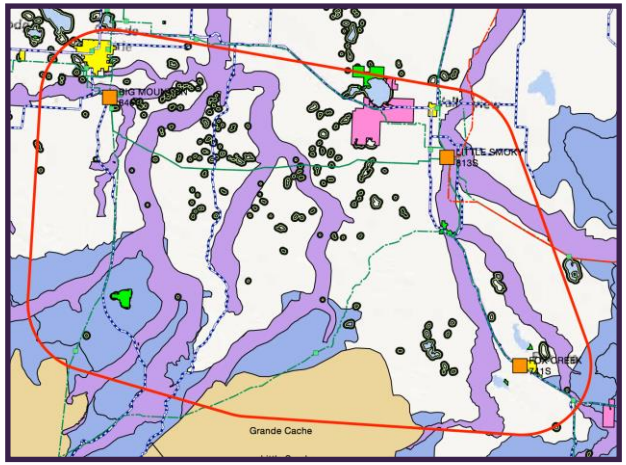
- Well-established process to evaluate development alternatives at a high level
  - increases accuracy in cost estimates at planning stage
  - improves land aspect information for planners
- Informs alternative selection between planning options under consideration
- All work completed in-house
  - GIS data is public domain - no cost
  - quick turnaround
- Based on stakeholder-sourced data model
  - consulted with government/NGOs/industry groups



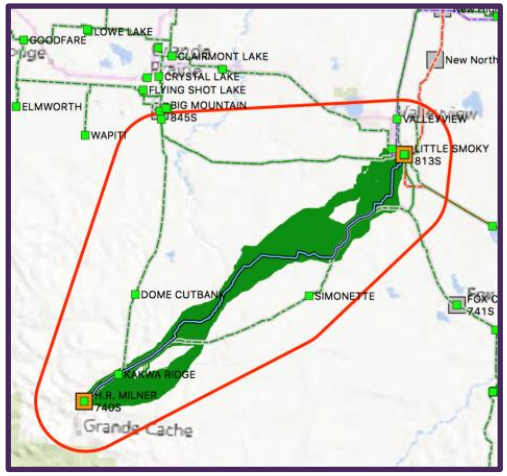


AESO alternative evaluation process

Planners Define Alternatives



Define Study Area
Analyze Visual Constraints



Analyze Study Area
Generate Corridor for Costing

Land Aspect Value Assessment Planning Area **NW** Voltage **240**

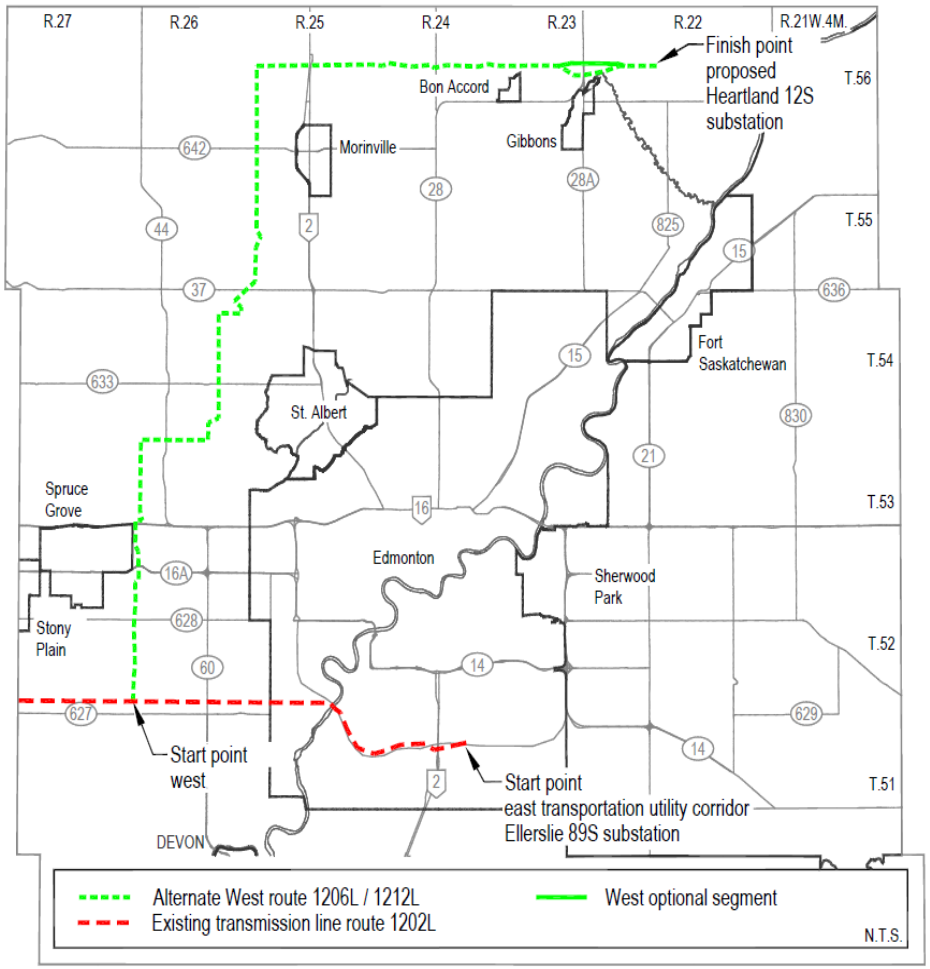
Options

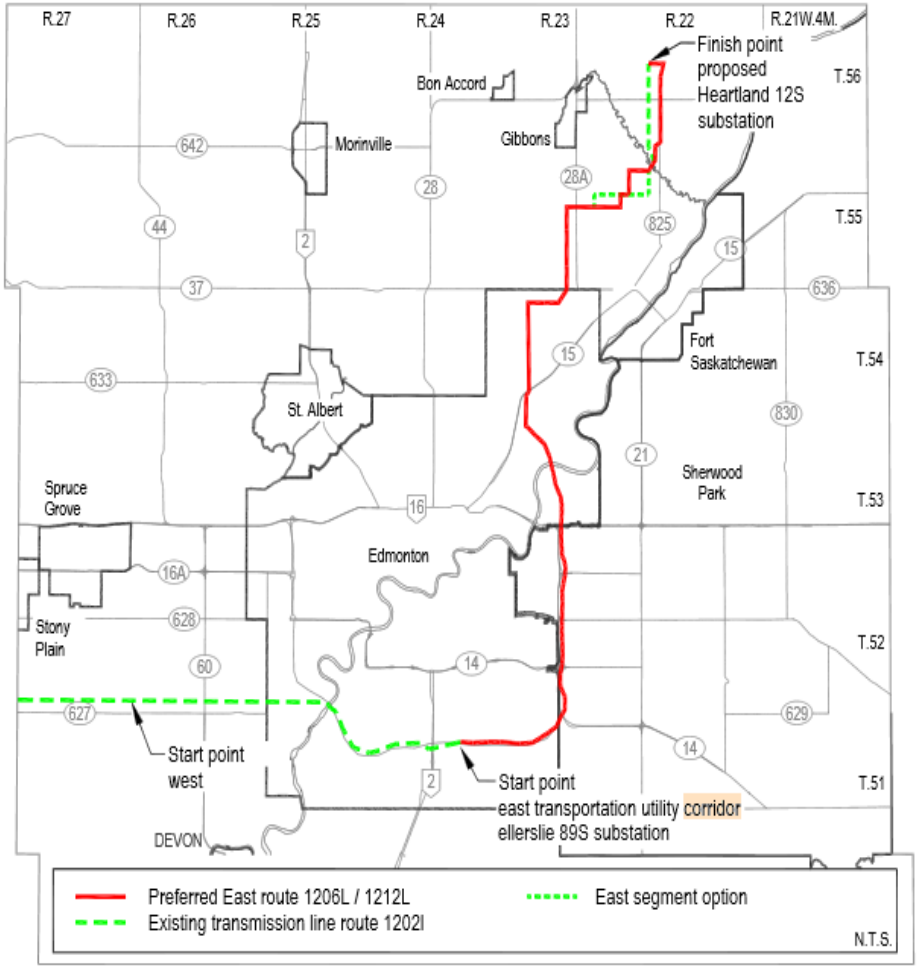
Connection Group	Planning Area	Voltage	Alternative	Line Length	A-B Straight Line Length	Divergence Ratio	River Crossings	Transmission Line Crossings	Deadend Structures	LAVA/km (1000)	Magma/km (1000)	Additional Risk Ratio	Benchmark Cost $MI	TL Pro Cost $MI
1	NW	240		165.1	149.2	1.11	1	4	10	138	175	1.3	$194.5	$0
	NW	240		164.7	122.4	1.35	3	2	23	136	145	1.1	$198.8	$0
	NW	240		233.4	208.1	1.12	3	6	17	143	233	1.6	$277.4	$0
	NW	240		239.5	174.9	1.37	4	2	53	137	156	1.1	$293.4	$0
2	NW	240		137.5	119.7	1.15	4	1	8	201	938	4.7	$164.5	$0
	NW	240		193.2	161.2	1.20	3	1	24	182	453	2.5	$231.6	$0
	NW	240		194.7	153.5	1.27	4	2	23	184	548	3.0	$234.3	$0
	NW	240		201.8	173.4	1.16	6	2	33	198	704	3.6	$247.0	$0
3	NW	240		70.3	63.7	1.10	1	3	7	155	535	3.5	$84.4	$0
	NW	240		81.8	77.0	1.06	2	4	10	151	208	1.4	$99.7	$0
	NW	240		113.3	98.9	1.15	4	1	7	168	890	5.3	$136.4	$0
	NW	240		115.3	100.4	1.15	1	1	18	157	369	2.2	$138.5	$0
	NW	240		122	100.5	1.21	1	2	11	148	274	1.9	$144.7	$0
	NW	240		172.1	141.4	1.22	6	3	12	160	826	5.2	$207.8	$0
4	NW	240		114.7	104.9	1.09	1	1	10	147	173	1.2	$135.8	$0
	NW	240		129.9	115.0	1.13	2	1	9	136	152	1.1	$154.0	$0
	NW	240		134.9	109.6	1.23	2	1	11	149	184	1.2	$160.3	$0
	NW	240		138	112.2	1.23	2	2	20	140	153	1.1	$166.3	$0
	NW	240		150.4	119.6	1.26	2	1	18	145	178	1.2	$179.9	$0
	NW	240		153.4	117.6	1.30	2	1	28	142	165	1.2	$185.8	$0

Provide Cost Estimates/Land Impact Metrics Reports to Planners

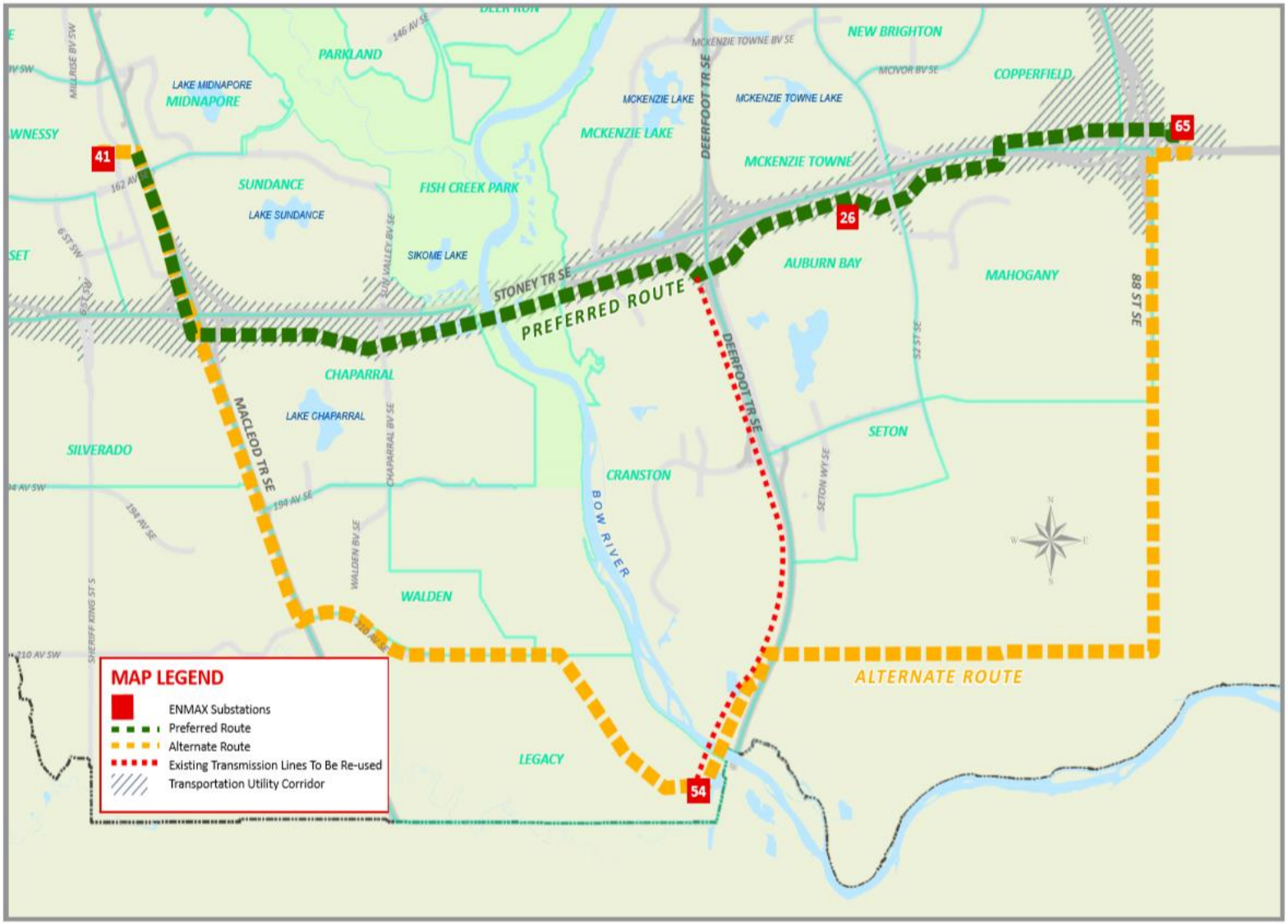
Heartland Transmission Development

- The Heartland Transmission Project was approved in 2011 by the AUC along the east Transportation Utility Corridor (TUC)





Calgary: ENMAX 138 kV SS-65 to SS-41 Development



Final words

- Transmission line routing and siting is a critical component of transmission development process
- Availability of utility corridors, especially in heavily developed areas, assists with developing cost efficient and timely implementation of transmission projects
- Dialogue and continuous consideration of establishing new utility corridors is important
  - as urban areas grow and expand, need for additional utility corridors will be more pronounced
- Soliciting input and consideration of future expansion plans (from industry, developers and stakeholders) will assist in developing utility corridors that enable Alberta's growth and economic prosperity while minimizing impacts

Questions?