

Appendix H Pipeline Route Selection

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Acronyms

AOSPL Alberta Oil Sands Pipeline
HDDhorizontal directional drilling

H.1 Pipeline Route Selection Criteria

The route selection for the pipeline involved careful review and consideration of selected criteria to determine preferred and optional routing (see [Table H-1](#)).

Table H-1 Pipeline Route Selection Criteria

Criteria	Considerations
Health and safety	<ul style="list-style-type: none"> limiting the number of infrastructure crossings limiting the potential for line strikes
Environment	<ul style="list-style-type: none"> limiting pipeline and tie-in length using existing corridors where possible limiting the number of watercourse and wetland crossings crossing waterbodies at appropriate locations and during appropriate timing windows, where feasible avoiding the Northwest of Bruderheim Natural Area
Regulatory and landowner access requirements	<ul style="list-style-type: none"> responding to public and landowner input on route coordinating with existing and planned land use along the proposed route avoiding potential future development possibilities
Cost	<ul style="list-style-type: none"> limiting pipeline and tie-in length limiting construction costs by avoiding identified obstacles and locations with additional construction challenges

H.2 Route Options Considered

H.2.1 Initial Five Route Options

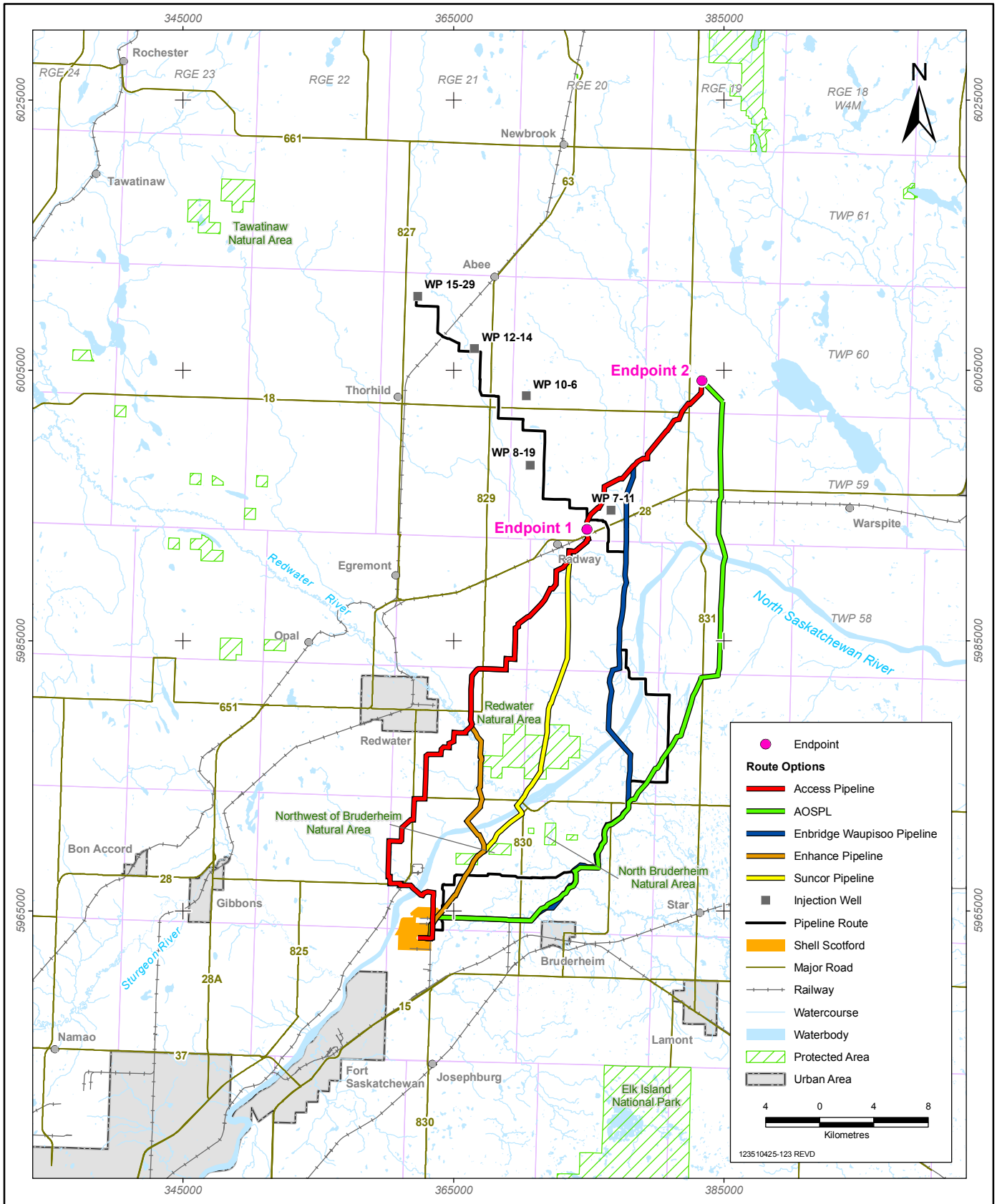
Prior to public disclosure, five pipeline routes were identified for further study (see [Figure H-1](#)). These routes generally paralleled existing corridors and were identified, west to east, as the Access, Enhance, Suncor Oil Sands Pipeline, Enbridge Waupisoo and Alberta Oil Sands Pipeline (AOSPL) routes.

All five route options began at the Scotford Upgrader and ended north of the village of Thorhild, at the CO₂ storage area. The number and location of injection wells had yet to be determined when these five route options underwent a review based on available information. Therefore, two potential endpoints were considered in the routing selection.

Endpoint 1 (03-059-20 W4M) was the meeting point for the four more westerly routes (Access, Enhance, Suncor and Enbridge), all of which then followed the same route proceeding northeast to Endpoint 2 (09-060-19 W4M). The most easterly route, AOSPL, bypassed Endpoint 1, terminating north at Endpoint 2.

All five route options had the potential for further commercial options and phased capital expansion, through the use of the CO₂ pipeline for enhanced oil recovery in the Redwater Reef.

The Suncor route was removed from consideration because the Suncor pipeline corridor is highly congested, requiring multiple line crossings and increasing the potential for a line strike. Additionally, this route passes directly through the Hamlet of Radway and the Redwater Natural Area, which would potentially increase environmental effects, as well as increasing regulatory requirements and emergency response planning.



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Original Route Options

Acknowledgements: Original Drawing by Stantec
 Pipeline: Sunstone Engineering August 11, 2010, Wells: Shell August 26, 2010, Basedata: National Road Network, Canvec, Altalis. Pipelines: Shell Canada

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FIGURE NO.
H-1

Last Modified: Nov 08, 2010 By: asdon

The Access and Enhance routes are similar, following the same route from the Redwater River north to Endpoint 1. However, the Access route is shorter and more direct between the Scotford Upgrader and the Redwater River. Therefore the Access route was chosen.

The AOSPL route closely follows the Enbridge Waupisoo route until diverging at the town of Bruderheim. The Enbridge Waupisoo route was preferred, because the AOSPL route bypasses Endpoint 1 and would not be able to access any potential injection well sites between Endpoint 1 and Endpoint 2.

The Enbridge Waupisoo (east) and Access (west) routes remained as the preferred options.

H.2.2 Final Route Selection

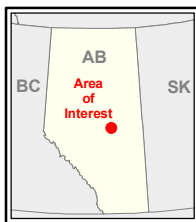
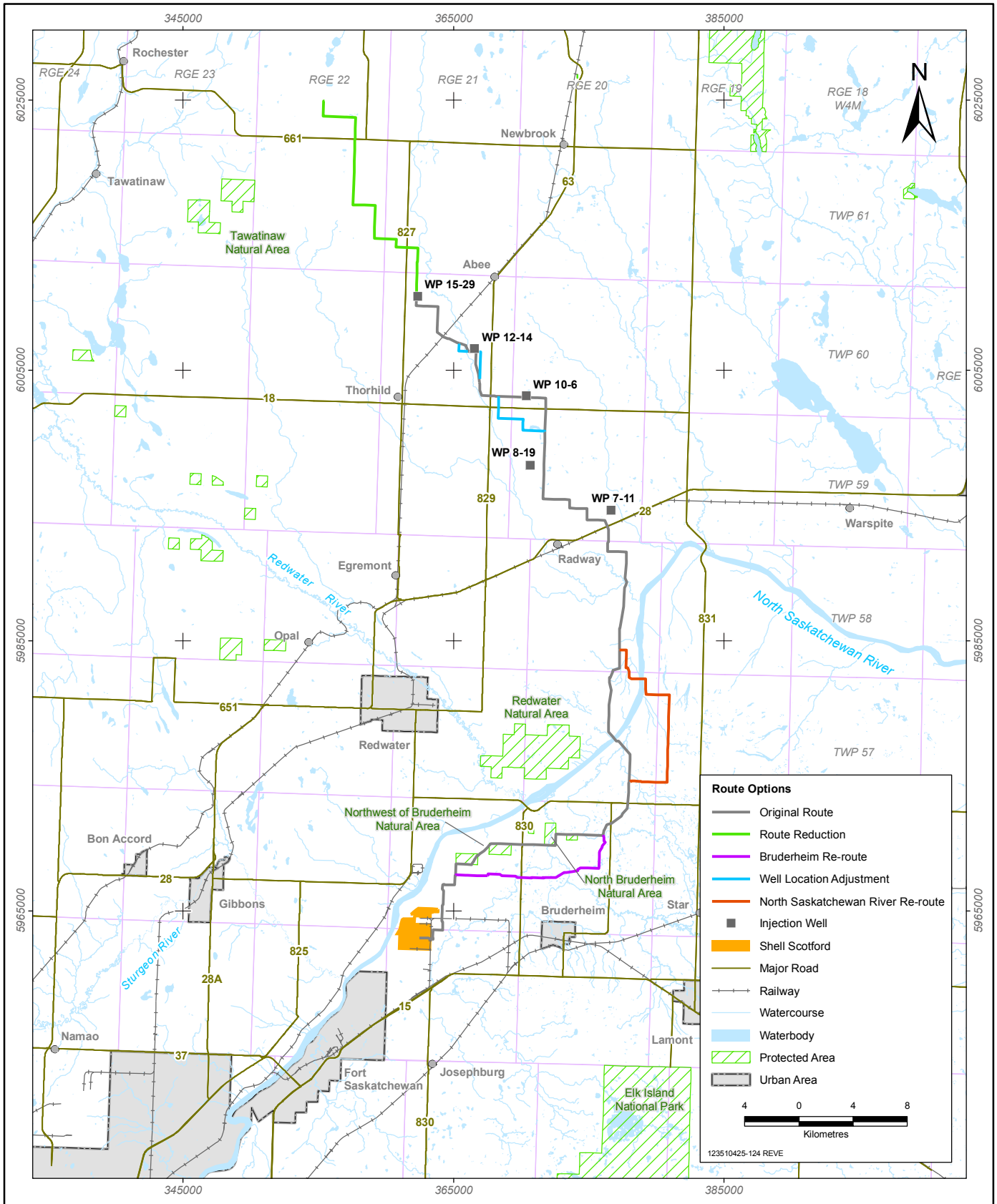
The east (Enbridge) and west (Access) routes were compared using route selection criteria (see [Table H-2](#)). Based on these criteria, the east (Enbridge) route was chosen.

Table H-2 Pipeline Route Selection Criteria

Criteria	East Route	West Route	Comments
Health and safety	Preferred	Not preferred	<ul style="list-style-type: none"> West route requires greater number of pipeline crossings in the Redwater Reef, with increased chance of a line strike
Environment	Preferred	Not preferred	<ul style="list-style-type: none"> East route has fewer watercourse crossings West route has challenging soil conditions at the Redwater and North Saskatchewan River crossing locations East route passes through Northwest of Bruderheim Natural Area
Regulatory and landowner access requirements	Preferred	Not preferred	<ul style="list-style-type: none"> East route has more established community relations
Cost	Both options viable		<ul style="list-style-type: none"> East route estimated at \$70 million West route estimated at \$66 million
Schedule	Both options viable		

The east (Enbridge) route was selected as the preferred route because it avoids the congested Redwater Reef area, and encounters more favourable geotechnical conditions at the North Saskatchewan River crossing location. The initial 10 km of the east (Enbridge) route passes through an area where Shell had existing community relations with landowners. However, the east (Enbridge) route originally passed through the Northwest of Bruderheim Natural Area.

The preferred route is east from Shell Scotford, before turning north to parallel the Enbridge Waupisoo pipeline. After crossing the North Saskatchewan River, the preferred route goes north for approximately 10 km before proceeding northwest to the CO₂ storage area (see [Figure H-2](#)).



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Re-Routes to Final Route

Acknowledgements: Original Drawing by Stantec
 Pipeline: Sunstone Engineering August 11, 2010, Original Route: April 7, 2010, Reroutes: August 11, 2010 Wells: Shell August 26, 2010, Basedata: National Road Network, Carvec, Altalis

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FIGURE NO.
H-2

Last Modified: Nov. 9, 2010 By: wilson

H.3 Re-Routes to Selected Route

H.3.1 Well Location Adjustments

Several minor route modifications were made near the injection wells located in 12-14-60-21 W4M and 10-6-60-20 W4M based on landowner responses and feedback (see [Figure H-2](#)).

H.3.2 Pipeline Length Optimized

The termination point for the pipeline was reviewed based on the following items:

- final section of pipeline route was located within traditional use areas identified by the Beaver Lake Cree Nation
- less favourable subsurface conditions would limit the effectiveness of CO₂ storage, as a result of discontinuities in the BCS in the northeast portion of the storage area

As a result of these factors, the pipeline termination point was moved to 15-29-60-21 W4M (see [Figure H-2](#)).

H.3.3 North Saskatchewan River Re-Route

The preferred route crosses the North Saskatchewan River at NW-14-57-20 W4M, parallel to the Waupisoo pipeline. This section of the river falls within the Beverly Channel, a subsurface palaeo-channel feature that is generally not suitable for horizontal directional drilling (HDD). To reduce the potential adverse environmental effects of the pipeline on the aquatic environment, Shell reviewed a number of alternative crossing locations for the North Saskatchewan River to determine if HDD was viable.

Geotechnical studies done in 2010 located a suitable HDD crossing location north of the Beverly Channel, at NW 36-57-20 W4M. Preliminary results of the geotechnical investigation indicated that this location would be suitable for a crossing, using either HDD (the preferred method) or alternatively by open cut. As a result, the pipeline was re-routed farther east by about 4 km.

H.3.4 Northwest of Bruderheim Natural Area Re-route

The preferred route passes through the Northwest of Bruderheim Natural Area east of the Scotford Upgrader. However, consultation with Alberta Tourism, Parks and Recreation indicated it preferred Shell re-route the pipeline away from the Northwest of Bruderheim Natural Area. The pipeline ROW was re-routed to the south of the natural area, paralleling the Inter Pipeline (Corridor) Inc. Corridor Pipeline route for about 2 km before intersecting the existing route farther to the east.

