

SHELL CANADA LIMITED

Quest Carbon Capture and Storage Project

UPDATE TO THE ENVIRONMENTAL ASSESSMENT

July 2011

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Acronyms and Abbreviations

AENV	Alberta Environment
AOI	area of interest
ASRD	Alberta Sustainable Resource Development
BCS	Basal Cambrian Sands
CCS	carbon capture and storage
CEA Agency	Canadian Environmental Assessment Agency
CEAA	<i>Canadian Environmental Assessment Act</i>
CEPA	<i>Canadian Environmental Protection Act</i>
DOW	dangerous oilfield waste
EA	Environmental Assessment
EIA	environmental impact assessment
EPEA	<i>Environmental Protection and Enhancement Act</i>
EPZ	emergency planning zone
ERCB	Energy Resources Conservation Board
ERP	Emergency Response Plan
FEP	fracture extension pressure
FGR	flue gas recycle
HDD	horizontal directional drilling
HFE	human factors engineering
HMU	hydrogen manufacturing unit
InSAR	interferometric synthetic aperture radar
MDT	Modular Dynamic Tester
MMV	measurement, monitoring and verification
NCIA	Northeast Capital Industrial Association
NMR	nuclear magnetic resonance
OSCA	<i>Oil Sands Conservation Act</i>
OWM	oilfield waste management
PLA	Pipeline Agreement
ppmw	parts per million by weight
PSA	pressure swing adsorber
PTRC	Petroleum Technology Resource Centre
RAP	restricted activity period
RNMP	Regional Noise Management Plan
ROW	right-of-way
Shell	Shell Canada Limited
SCR	selective catalytic reduction
SNCR	selective non-catalytic reduction
TDS	total dissolved solids
the Project	Quest Carbon Capture and Storage Project
VEC	valued environmental component
VSP	vertical seismic profile
Well 3-4	Shell Redwater 3-4-57-20W4 well
Well 8-19	Shell Radway 08-19-059-20W4 well
Well 11-32	Shell Redwater 11-32-55-21W4 well
WWTP	waste water treatment plant
ZOI	zone of interest

1 Summary of Project Updates

Shell Canada Limited (Shell) has continued to undertake additional work to support refinement of engineering and design aspects of the Quest Carbon Capture and Storage (CCS) Project (the Project). This has resulted in updates to the Project components, including the CO₂ capture infrastructure, the CO₂ pipeline and the CO₂ storage. These Project updates are not substantial and are not predicted to affect the conclusions of the Environmental Assessment (EA) for the Project, previously submitted in November 2010, particularly the conclusions regarding the significance of potential adverse environmental effects on the Project.

The purpose of this report is to:

- document updates to the Project since the submission of the EA in November 2010
- provide updates to activities carried out by Shell since submission of the EA

Key updates include:

- refinement of range of number of proposed injection wells (see Section 1.1)
- status of regulatory approvals (see Section 1.2)
- refinements to CO₂ capture infrastructure, including capture infrastructure orientation and the CO₂ vent stack (see Section 2.1)
- minor reroutes to the CO₂ pipeline (see Section 2.2)
- selection of locations for the remaining three candidate injection wells (see Section 1.1.2)
- additional information regarding the geological setting of the BCS storage complex (see Section 2.3.1)
- provision for supply of electrical power to the Project injection well locations (see Section 2.3.2)
- Project schedule (see Section 4)
- public and Aboriginal consultation activities (see Section 5)
- status of the Emergency Response Plan (ERP) for the Project (see Section 6.1.1)
- management of NO_x emissions at the CO₂ capture infrastructure (see Section 6.2.3)
- environmental assessment associated with the identified Project updates (see Section 7)

1.1 Project Overview

1.1.1 Project Description

The November 2010 EA stated that the proposed CO₂ pipeline is approximately 84 km long. Due to a change in routing through the section of the pipeline immediately south of the North Saskatchewan River crossing, the total length of the proposed CO₂ pipeline is now approximately 80 km (see Figure 1-1).

Further subsurface analysis (analysis of results from the Radway 08-19-059-020 W4M well [Well 8-19] and from the recent 3D seismic program) has resulted in Shell reducing the number of injection wells proposed in the storage scheme from a range of three to ten injection wells, to a range of three to eight injection wells.

1.1.2 Project Location

The general location of the Project components has not changed, although alterations and refinements have been made.

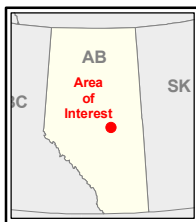
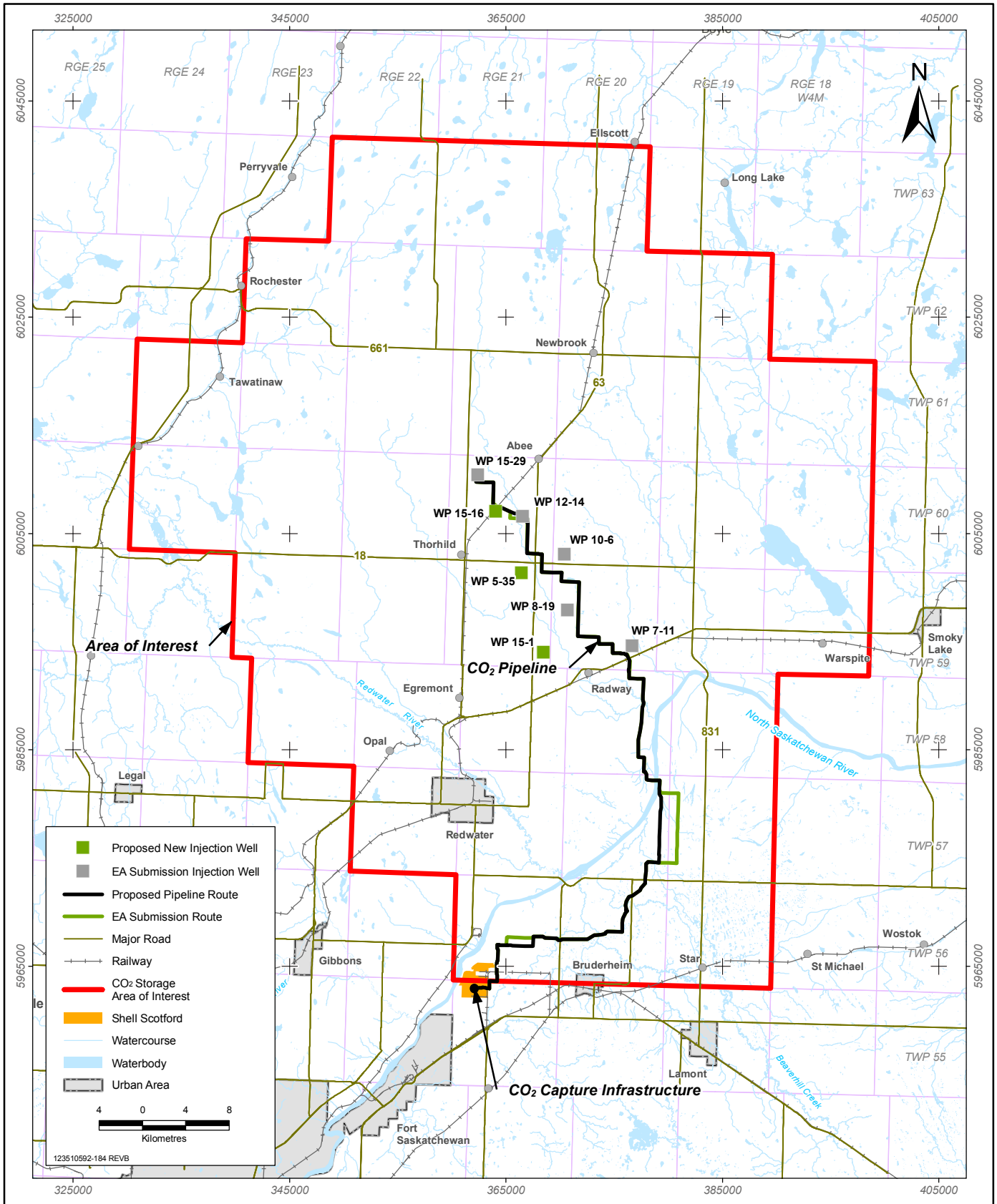
The CO₂ capture infrastructure continues to be located on developed lands within the Shell Scotford footprint.

Shell has rerouted portions of the CO₂ pipeline east of Shell Scotford to accommodate landowner concerns and development constraints. For changes in the proposed routing, see Figure 1-1.

The locations of the five candidate wells identified in the November 2010 application have not changed. Coordinates for the three remaining candidate injection wells have been determined within the area of interest (AOI) (see Figure 1-1 and Table 1-1).

Table 1-1 Candidate Injection Well Locations

Well UWI	Candidate Injection Well Drilling Order	NAD 27 UTM Zone 12 Easting	NAD 27 UTM Zone 12 Northing
08-19-059-20W4	1	370705	5997747
07-11-059-20W4	2	376674	5994416
05-35-059-21W4	3	366423	6001157
15-16-060-21W4	4	364049	6006879
102/10-06-060-20W4	5	370401	6002874
15-01-059-21W4	6	368542	5993780
15-29-060-21W4	7	362409	6010249
12-14-060-21W4	8	366539	6006367



QUEST CARBON CAPTURE AND STORAGE PROJECT

Quest CCS Project Components and Area of Interest

Acknowledgements: Original Drawing by Stantec
Proposed Pipeline: Sunstone Engineering March 18, 2011, Wells: Shell May 13, 2011, Basedata: National Road Network, Carvec, Altalis

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Last Modified - June 03, 2011 By: aelson

1.2 Regulatory Approvals

1.2.1 Canadian Environmental Assessment Act

As part of federal permitting for the CO₂ pipeline, Shell submitted crossing details for the five named crossings along the CO₂ pipeline route to Transport Canada for review under the *Navigable Waters Protection Act*. Transport Canada determined that four of these crossings were not subject to the *Navigable Waters Protection Act*. Additionally, Transport Canada issued an approval pursuant to Subsections 5(1) and 5(3) of the *Navigable Waters Protection Act* for the proposed horizontal directional drilling (HDD) crossing of the North Saskatchewan River. For communication from Transport Canada regarding the CO₂ pipeline crossings, see Appendix A.

1.2.2 Alberta Environmental Impact Assessment and ERCB Approvals

In addition to the EA submitted for the Project, the following regulatory applications, for each of the Project components, were submitted to the Energy Resources Conservation Board (ERCB) in November 2010:

- *Quest Carbon Capture and Storage Project, Directive 56: Application for a CO₂ Pipeline Licence*
- *Quest Carbon Capture and Storage Project, Directive 65: Application for a CO₂ Acid Gas Storage Scheme*
- *Quest Carbon Capture and Storage Project, Amendment to OSCA and EPEA Approvals for the Carbon Capture Infrastructure*

A description of the updates to these applications is provided below.

1.2.2.1 CO₂ Capture Infrastructure Applications

As a result of the updates to the Project CO₂ capture infrastructure, an update to the previously filed *Amendment to OSCA and EPEA Approvals for the Carbon Capture Infrastructure* (November 2010) was submitted to the ERCB in June 2011.

1.2.2.2 CO₂ Pipeline Applications

The update to *Directive 056: Application for a CO₂ Pipeline Licence* (November 2010) was submitted to the ERCB for review in May 2011. It described updates to the proposed pipeline route, updates regarding public consultation activities, and updates to technical pipeline specifications and emergency response planning. As part of this submission, *Directive 056: Application for a CO₂ Pipeline Licence* (November 2010) was refiled with the ERCB.

In November 2010, the Directive 056 Application provided details about the required *Public Lands Act* application for the North Saskatchewan River. Since then, Shell has also consulted with Alberta Sustainable Resource Development (ASRD) on the *Public Lands Act* requirements for the following four additional key Crown watercourse crossings:

- Astotin Creek
- Beaverhill Creek

- Lower Namepi Creek
- Upper Namepi Creek

On March 21, April 18 and April 20, 2011, applications for Pipeline Agreements (PLAs) under the *Public Lands Act* were submitted to ASRD through the Enhanced Approval Process. An application was submitted for each of the five named watercourse crossings along the pipeline route. ASRD issued PLAs for the five crossings (see Table 1-2 and Appendix B).

Table 1-2 PLA Numbers for Named Watercourses

Watercourse	PLA Number	Date Issued
Astotin Creek	PLA110611	April 1, 2011
Beaverhill Creek	PLA110737	April 26, 2011
North Saskatchewan River	PLA110614	May 26, 2011
Lower Namepi Creek	PLA110749	May 25, 2011
Upper Namepi Creek	PLA110615	April 4, 2011

Shell will continue to consult with ASRD on PLA requirements related to water withdrawal for hydrostatic testing.

On March 28, 2011, notification forms (under the Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body, and the Code of Practice for Watercourse Crossings) were submitted to AENV for 17 of the 18 major and minor proposed watercourse crossings. This submission included pipeline and vehicle crossings for the watercourses.

A separate Code of Practice notification was submitted for the North Saskatchewan River crossing because no vehicle crossing was required.

Alberta Environment does not issue reference numbers or approvals under the Code of Practice.

1.2.2.3 CO₂ Storage Applications

As a result of obtaining additional subsurface data and analytical results for the CO₂ storage component, Shell submitted to the ERCB, in June 2011, an update to *Directive 65: Application for a CO₂ Acid Gas Storage Scheme* (November 2010). On April 27, 2011, the Government of Alberta passed the Carbon Sequestration Tenure Regulation, an appendix to the *Mines and Minerals Act*. This allowed Shell to submit a Sequestration Lease Application for the CO₂ storage component. The Sequestration Lease Application identifies the proposed CO₂ storage AOI, the proposed CO₂ storage zone of interest (ZOI), and the six separate leases, ranging from six to eight townships each, which support the single Quest CCS Project. As part of the Sequestration Lease Application, the Quest CCS Project Closure Plan (see Appendix C) and the Measuring Monitoring and Verification (MMV) Plan were provided as appendices. Shell requested the exclusive right for the following:

1. Drill wells, conduct evaluation and testing, inject captured carbon dioxide into subsurface reservoirs and otherwise develop all horizons within the ZOI, within the requested AOI. Restriction of third-party access will ensure that exclusive right to the ZOI is for the sole purpose of the Quest CCS Project and associated MMV.

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2. Test and sample all zones from surface to basement for the sole purpose of MMV, within the requested AOI, for the duration of the Carbon Sequestration Leases.

On May 27, 2011, Alberta Energy issued Shell six Carbon Sequestration Leases for the Quest CCS Project. The storage scheme has been updated to reflect changes associated with this approval (see Appendix D for the six Carbon Sequestration Leases). The AOI has been reduced with the removal of Sections 1 to 24 from Township 56-21-W4M (see Table 1-3).

Table 1-3 Townships Included Within the Approved CO₂ Storage AOI

Township	Ranges (West of 4th Meridian)
63	22, 21, 20
62	23, 22, 21, 20, 19
61	24, 23, 22, 21, 20, 19, 18
60	24, 23, 22, 21, 20, 19, 18
59	23, 22, 21, 20, 19, 18
58	23, 22, 21, 20, 19
57	22, 21, 20, 19
56	20, 19 and 21 (Sections 25 to 36 only)

2 Project Description Updates

2.1 CO₂ Capture Infrastructure

2.1.1 CO₂ Capture Infrastructure Location

Since submitting the *Amendment to OSCA and EPEA Approvals for the Carbon Capture Infrastructure* in November 2010, Shell has conducted ongoing optimizations to the plot plan for the CO₂ capture infrastructure. During early engineering work conducted since November 2010, Shell reviewed the plot plan, considering operability, maintainability, human factors engineering (HFE) and constructability factors. During the review, Shell identified a rotated configuration for the amine regeneration, CO₂ compression and dehydration area.

After further design work, Shell determined that the 90 degree clockwise rotation of the CO₂ capture infrastructure plot plan provided substantial benefits to the Project. The location of the CO₂ capture infrastructure within the Scotford Upgrader site has not changed (see Figure 2-1 for the updated layout). Instead of the primary axis being oriented north–south, an east–west orientation is currently proposed. The rotation of the CO₂ capture infrastructure plot plan will not change the air dispersion modelling results, because the modelling considered only the hydrogen manufacturing unit (HMU) stacks as emission sources. The locations of these stacks do not change as part of the updates to the CO₂ capture infrastructure. No other notable changes have been made to the plot plan.

2.1.2 CO₂ Vent Stack

After the changes to the CO₂ capture infrastructure layout, Shell re-examined the CO₂ vent stack to optimize the stack design. For the release scenarios considered in the air dispersion modelling for the CO₂ vent stack, a 50-m high, 500-mm diameter CO₂ vent stack is predicted to result in safe working platforms for Shell Scotford personnel. Ground level concentrations would also be safe for areas of public access. As a result, the design height of the vent stack has been increased from 44 m to 50 m.

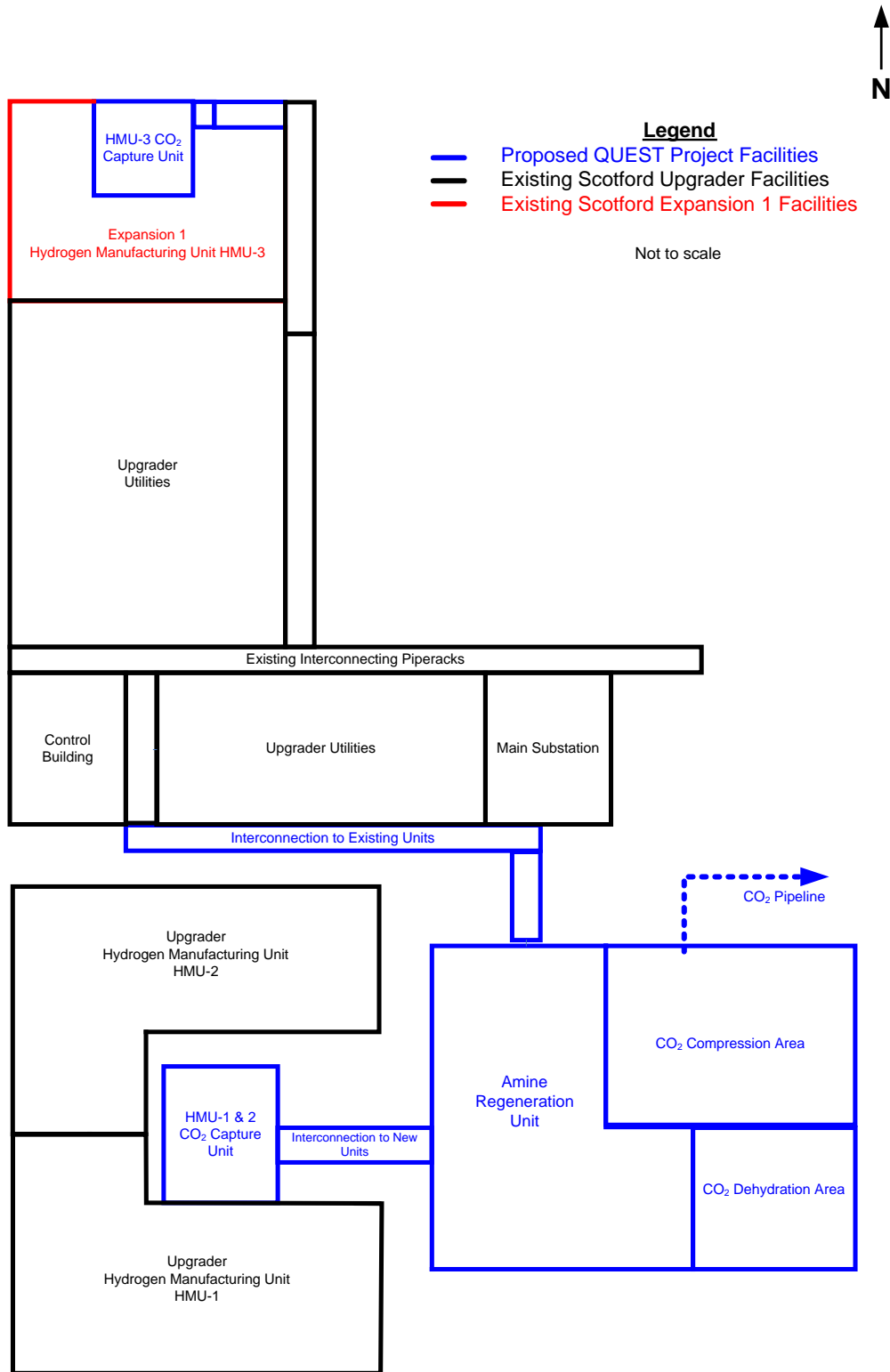


Figure 2-1 Schematic of Proposed Layout for the CO₂ Capture Infrastructure

2.2 CO₂ Pipeline

Since submission of the November 2010 EA, Shell has made two changes to the pipeline route. The first occurred immediately northeast of Shell Scotford in response to existing development constraints and pipeline congestion (see Figure 1-1). The second reroute occurred immediately south of the North Saskatchewan River crossing (see Figure 1-1). The reroute was made following a successful negotiation with a landowner and allows the pipeline to follow a shorter, more direct course. This reroute will reduce costs and surface disturbance, while still meeting the routing criteria outlined in the Pipeline Route Selection report submitted as Appendix H in the November 2010 EA. The routing criteria include:

- limiting the potential for line strikes and infrastructure crossings
- aligning with the proposed CO₂ storage area
- using existing pipeline rights-of-way and other linear disturbances, where possible, to limit physical disturbance
- limiting the length of the pipeline to reduce the total area of disturbance
- avoiding protected areas and using appropriate timing windows
- avoiding wetlands and limiting the number of watercourse crossings

The rerouted pipeline is approximately 80 km long, 4 km shorter than in the November 2010 EA submission. Additional environmental fieldwork will be conducted along this route during the spring and summer of 2011, to refine specific pipeline segment locations and to select site-specific mitigation measures. Because the reroute is located in an agricultural area, similar to the previous route option, the methods outlined in the Conservation and Reclamation Plan and Environmental Protection Plan, previously submitted in November 2010 (as Appendix E to Volume 1 in the November 2010 filing), will address potential conditions encountered during construction, operation and reclamation along this route.

As part of optimizing the pipeline ROW and minimizing surface disturbance in response to landowner concerns, Shell intends to use a variable-width ROW during construction. The expected permanent ROW width remains at 18 m, and the combined width of ROW with temporary workspace remains at approximately 25 m. However, in response to landowner feedback, the ROW in some locations may be as narrow as 10 m.

2.2.1 Pipeline Crossings

The CO₂ pipeline will cross four fish-bearing watercourses: Astotin Creek, Beaverhill Creek, the North Saskatchewan River and Namepi Creek (which is crossed twice). For the preferred crossing methods for both vehicles and pipeline installation on the fish-bearing watercourses, see Table 2-1, which is a revised version of Table 2-1 in the Application, Volume 1. Crossing methods will comply with the *Alberta Code of Practice for Pipelines and Telecommunication Lines Crossing a Waterbody*. Revisions to Table 2-1 include:

- Beaverhill Creek legal description has been corrected to NW-16-056-20
- the contingency pipeline crossing method for the North Saskatchewan River has been corrected to being a two-stage coffer dam to be constructed in the fall

Table 2-1 CO₂ Pipeline Fish-Bearing Watercourse Crossings

Watercourse Name	Channel Width (m)	Quarter Section	COP Class ¹	Restricted Activity Period	Proposed Vehicle Crossing Method	Pipeline Crossing Method
Astotin Creek	7.5	NE-13-056-21	C	April 16 to June 30	Ford when dry or frozen. Temporary bridge if flowing water	Open cut when dry or frozen as per the Operational Statement. Trenchless technique if flowing.
Beaverhill Creek	12	NW-16-056-20	C	April 16 to June 30	Ford when dry or frozen. Temporary bridge if flowing water	Open cut when dry or frozen as per the Operational Statement. Trenchless technique if flowing, as a contingency.
North Saskatchewan River	300+	NW-36-57-20	C	April 16 to July 31	No vehicle crossing permitted	Primary method is HDD. Contingency method is a two-stage coffer dam constructed in the fall.
Lower Namepi Creek ¹	16	SW-26-058-20	C	April 16 to June 30	Ford when dry or frozen. Temporary bridge if flowing water	Open cut when dry or frozen as per the Operational Statement. Trenchless technique if flowing.
Upper Namepi Creek ¹	12.5	NE-15-060-21	C	April 16 to July 31	Ford when dry or frozen. Temporary bridge if flowing water	Open cut when dry or frozen as per the Operational Statement. Trenchless technique if flowing.
NOTES: ¹ Source: ASRD (2006a), ASRD (2006b).						

2.2.2 Hydrostatic Testing

Shell's current plan is to test the pipeline hydrostatically in two segments, the longest of which will be 44 km (previously estimated, in November 2010, at 30 km).

The water requirement will be 3,200 m³ (previously estimated, in November 2010, at 2,500 m³). The hydrostatic test water from the first section will be reused in the second section, to limit water use.

2.3 CO₂ Injection and Storage

2.3.1 Geology of the Storage Complex

Since drilling and completing the first Project injection well, Shell Radway 8-19-52-20W4 (Well 8-19), additional information on the geology of the Basal Cambrian Sands (BCS) storage complex has been collected and analysed. Where this additional information augments or confirms information previously presented about the BCS storage complex in the November 2010 submission of the Project Description in the EA, a description is provided below.

Characterization of the petrophysical properties of the BCS in the AOI were primarily based on the results of the Quest CCS Project appraisal wells, Shell Redwater 11-32-55-21W4 (Well 11-32) and Shell Redwater 3-4-57-20W4 (Well 3-4), with additional input from offset legacy wells (previously drilled wells within the AOI). The routine core analyses from Well 8-19 agree with the results from Wells 11-32 and 3-4.

2.3.1.1 Porosity and Permeability of the Target Storage Zone

Although the methodology for calculating porosity has not changed from the November 2010 submission, the method for determining the average permeability has changed. This method was updated to incorporate core plug data, instead of using previously submitted permeability data based on uncalibrated nuclear magnetic resonance (NMR) results. The changes result in the predicted porosity and permeability of the BCS being within, or slightly better than, the range of uncertainty provided in the EA. The updated data increases Shell's confidence and confirms the accuracy of the modelled results.

2.3.1.2 Fluid Type in the Target Storage Zone

Although the fluid in the BCS was known to be highly saline water, the BCS fluid analysis results from Well 8-19 were not available at the time the EA was submitted in November 2010. Through calibration with Well 8-19 fluid results, a sampling error was identified in the original Well 11-32 dataset that has since been accounted for. Using the potassium iodide from the drilling fluid as a tracer, the native reservoir fluid could be back-calculated to 325,897 mg/L for total dissolved solids (TDS). The updated Well 11-32 results and the new Well 8-19 results are consistent with the regional dataset, showing that the BCS reservoir fluid is a heavily sodium/chloride dominated brine, which confirms the expected composition of BCS fluid.

In September 2010, six Modular Dynamic Tester (MDT) samples were taken at a depth of 2,084.9 m MD in Well 8-19. Based on full compositional fluid analyses, the calculated level of TDS in the formation water from Well 8-19 is 311,000 mg/L (higher than the 269,000 mg/L estimated in November 2010). This salinity aligns with the average dead water density of 1,201 kg/m³ at ambient conditions, measured on the six samples in the laboratory, and slightly lighter than the in situ gradient of 11.71 KPa/m measured by the MDT. These values are consistent with the re-calculated Well 11-32 data and within the range of regional fluid data TDS values.

An average pH of 7.1 was measured from six pressurized samples immediately after they were flashed in the laboratory. Only one sample had a low gas-to-water ratio, but had indications of air contamination. All other samples showed no gas, suggesting no vapour phase was present in the original live water samples. The formation water viscosity was measured at 0.75 cP at reservoir conditions, lower than that measured in Well 11-32. However, the expected viscosity for the BCS formation water would be approximately 1 cP at reservoir conditions and the measured variance is believed to reflect measurement error rather than intrinsic viscosity differences between the two wells.

2.3.2 Injection Wells

2.3.2.1 Operations Phase

Since filing the EA in November 2010, Shell has determined that the injection wells will require a low voltage power supply from the local power grid during the operations phase. This can be supplied through the local electrical service provider. The power lines to supply the grid will follow existing rights-of-way or access roads, and will not require additional ROW clearing. Some local brush or tree limb clearing may be required for installation and safety setbacks from live power lines.

Bottom-hole Injection Pressure Validation

Based on the available offset data from the appraisal wells, and validated by log-derived minimum horizontal stress estimates for Well 8-19, the bottom-hole injection pressures for the commercial well design will be limited to 90% of the lowest observed fracture extension pressure (FEP) in the Lower Marine Sands at 17.4 kPa/m. For a top BCS reservoir depth in Well 8-19 at 2,041.3 m MD, this would correspond to a bottom-hole pressure constraint of 31,967 kPa. This value:

- is 16%, or almost 6 MPa, below the regulatory requirement to stay below 90% of the formation fracture pressure in the injection zone. For reference, 90% of the formation fracture pressure would be 37,846 kPa at the top of the BCS in Well 8-19.
- is well below the FEP observed in the BCS of 20.7 kPa/m in Well 11-32
- is lower than the log-derived minimum horizontal stress interpreted for the first seal (the Middle Cambrian Shale) of 18.1 kPa/m in Well 11-32

Pressure constraints will be implemented on a well-by-well basis, rather than for the entire development, as fracture pressures are depth dependent.

The bottom-hole injection pressures are in alignment with surface design, assuming a 12-inch pipeline and 7 km well spacing. The current facility design is expected to deliver CO₂ to the wellheads at a pressure of between 12 and 14 MPa and a temperature of between 0 and 18°C. At these conditions, the maximum achievable bottom-hole pressure would vary between 31 and 32 MPa, depending on the density of the CO₂. Surface monitoring and control will be implemented to avoid the bottom-hole pressure exceeding the fracture pressure limit.

3 Renewable Resources

As per the Terms of Reference for the Quest CCS Project (issued in November 2010), Shell is required to address Section 16(2)(d) of the *Canadian Environmental Assessment Act (CEAA)*. Section 16(2)(d) requires that an EA must consider whether the capacity of renewable resources to meet the needs of the present and those of the future is likely to be significantly affected by the Project. Renewable resources include the soils and terrain, vegetation, wildlife, and aquatics valued environmental components (VECs) assessed as part of the November 2010 EA. Because the adverse environmental effects predicted to occur as a result of the Project are not significant, the Project will not affect the capacity of these renewable resources to meet the needs of the present and those of the future.

4 Project Schedule and Execution Plan

There are modifications to three components of the Project schedule outlined in the November 2010 EA:

- Main Pipeline – the November 2010 EA indicated that construction of the main CO₂ pipeline would begin in Q4 2013. This specifically addresses clearing and excavating work associated with the CO₂ pipeline and laterals, exclusive of the watercourse crossings and connection to Shell Scotford. Construction of the portion of the pipeline within the Shell Scotford fenceline will occur in Q3 2012. Setup and initiation of the HDD of the North Saskatchewan River is now expected to start in Q3 2013. This work will still be conducted outside the restricted activity period (RAP) of April 16 to July 31.
- Lateral Pipelines – the November 2010 EA did not identify a construction start time for the lateral pipelines. The lateral pipeline construction activities are now expected to begin in Q4 2013 (concurrent with pipeline construction), and could continue through 2015.
- Well Drilling and Completion – the November 2010 EA indicated that well drilling and completions would occur between Q3 2013 and the end of Q3 2014. These activities are now expected to begin as early as Q2 2012, and could continue through 2015.

5 Stakeholder Engagement and Aboriginal Consultation

Since the EA was filed in November 2010, Shell has continued to conduct public consultation and notification activities on the Quest CCS Project. Shell is committed to working cooperatively and communicating openly with all participants throughout the life of the Project.

5.1 Stakeholders

5.1.1 Identified Stakeholders

Shell has identified no new stakeholders for the Project since the EA was filed in November 2010.

Shell has determined a 450 m radius CO₂ capture infrastructure emergency planning zone (EPZ) around Shell Scotford. There are no stakeholders within this 450 m consultation radius, as the EPZ contains Shell-owned land around Shell Scotford.

Since the EA was filed in November 2010, Shell has continued to consult with landowners and occupants within a 5 km radius of Shell Scotford (i.e., Shell Scotford's 5 km primary communication area) about the Project.

5.1.2 Landowner, Occupant and Resident Consultation

Between November 11, 2010 and March 21, 2011, Shell continued to consult with stakeholders in Shell Scotford's 5 km primary communication area, and sent them the following:

- Shell Scotford Community Connections newsletter (November and February editions), featuring an update on the Quest CCS Project, and a brochure featuring the 2010 community survey results showing residents' perceptions of Shell Scotford
- a printed copy of the November 17, 2010 PowerPoint presentation (including a Quest CCS Project update) made at the Shell Scotford community meeting by the Scotford General Manager
- a letter, mailed on December 1, 2010, notifying residents and occupants that the Quest CCS Project application and environmental assessment had been filed

Shell also contacted Shell Scotford neighbours, who in the past had expressed an interest in Shell projects, to confirm that they had received the Quest CCS Project Information Package and the December 1, 2010 notification letter. Shell offered a face-to-face meeting with all neighbours contacted. One neighbour met with a Shell representative on April 25, 2011 and was given a copy of the Quest CCS Project overview and a CD of the Quest CCS Project regulatory applications. The neighbour had no concerns about the Quest CCS Project.

One landowner contacted Shell and asked if gas would be injected down the well that will be drilled close to his land and if Shell intended to fracture the well. The landowner had concerns about the effects that this might have on his family and the effects that seismic activity in the area might have on his water well. Shell contacted the landowner by telephone to discuss these concerns and thereafter provided the landowner with:

- information about the safety and monitoring measures Shell will have in place
- a copy of the landowner’s water well test results from the seismic testing conducted in early 2010

5.1.2.1 Industry

On December 1, 2010, Shell sent a letter to industry stakeholders who are within a 5 km radius of the Shell Scotford site (see Appendix E). The letter provided an update on the Quest CCS Project and notification that regulatory applications had been filed. Shell received no additional questions or concerns from these industry stakeholders.

5.1.2.2 Municipal Presentations

Shell representatives made a presentation, followed by a discussion, to county councillors during the monthly county meetings. See Table 5-1 for specific dates and locations of each Quest CCS Project update presentation.

Table 5-1 Municipal Consultation

Municipality	Date
Thorhild County	January 12, 2010
Lamont County	January 12, 2010
Strathcona County	January 26, 2010
Sturgeon County	February 9, 2010
Thorhild County	February 8, 2011
Sturgeon County	February 8, 2011
County of Lamont	February 8, 2011
Strathcona County	March 8, 2011
City of Fort Saskatchewan	March 8, 2011
Town of Bruderheim	April 6, 2011
Thorhild County	April 29, 2011

5.1.3 Aboriginal Consultation

On February 24, 2011, Shell conducted a face-to-face meeting with the Saddle Lake Cree Nation in response to the Nation’s request to address concerns that the Nation had expressed about the Quest CCS Project. On March 16, 2011, Shell sent a letter to the Saddle Lake Cree Nation with a summary of the meeting and responses to several of the issues raised during the meeting. On April 11, 2011, this was followed by a letter from the Saddle Lake Cree Nation, outlining concerns related to consultation with the Saddle Lake Cree Nation, specifically in reference to traditional use of lands crossed by the pipeline. Shell responded to these concerns on May 2, 2011. For copies of correspondence from Shell to the Saddle Lake Cree Nation, see Appendix F.

5.1.4 Ongoing Consultation

Shell is committed to ongoing consultation with its stakeholders throughout the life of the Project. Shell hosted a Quest Café event in June 2011, where municipal leaders, emergency responders and key community leaders discussed key facets of the proposed Quest CCS Project and had the opportunity to ask independent experts from the University of Alberta questions about CCS technology.

To provide project information and updates, Shell representatives also plan to attend several local events throughout the spring and summer of 2011, including:

- Fort Saskatchewan Trade Show
- Thorhild 4H Cattle Show
- Thorhild Sunflower Festival
- Bruderheim Ag Days

A series of open houses is planned for fall 2011, and a Quest CCS Project newsletter will be developed and delivered to members of the public in Q3 2011.

6 Environmental and Socio-Economic Management

6.1 Health, Safety, Security, Environment and Social Performance Management

6.1.1 Emergency Response Planning

On January 14, 2011, the ERCB requested that Shell amend its existing corporate-level Shell Canada Limited Core ERP to include CO₂ as a hazard. Shell responded to this request on February 18, 2011 by forwarding to the ERCB the amendments to the Shell Canada Limited Core ERP. (See Appendix G for the reply to the ERCB and the amended sections.)

The amendment to Shell's Core ERP included information about CO₂ as a hazard and included pre-planned response actions that will:

- aid in effective response
- protect public safety if an emergency involving CCS operations occurs

The ERCB advised Shell on December 3, 2010, that Shell is not required to prepare a site-specific ERP for the Quest CCS Project pipeline and well operations under *Directive 071: Emergency Preparedness and Response Requirements for the Petroleum Industry* (November 2008) (Directive 71). However, Shell has decided to continue preparing a site-specific ERP for the CO₂ capture and compression infrastructure, CO₂ pipeline and CO₂ injection wells. Shell intends that the site-specific ERP will be consistent with Directive 71 requirements. The site-specific ERP will:

- focus on preparedness and response to CO₂ emergencies
- outline the responsibilities and duties of Shell and government agencies in the unlikely event of a CO₂ emergency

The primary goal of both the Shell Core ERP and the Quest CCS Project site-specific ERP is to provide an effective, comprehensive response to prevent injury or damage to the public or to site personnel in an emergency.

Through modelling, Shell has determined an EPZ with a radius of 450 m around the CO₂ capture and compression infrastructure, the CO₂ pipeline and the CO₂ injection wells. Shell will consult on emergency response planning with all landowners and occupants within the EPZ. Shell will also, on a good-neighbour basis, which is consistent with existing commitments, notify all landowners and occupants within a 5 km radius of Shell Scotford (i.e., the Scotford 5 km Primary Communication Area) about emergency planning for the Quest CCS Project.

6.1.2 Reported Substances

As per the *Canadian Environmental Protection Act (CEPA)* E2 requirements, a 10% or greater increase in weight of any reported substance would require an update to Environment Canada. Shell does not anticipate that the Quest CCS Project will increase the weight of any currently reported substances by these amounts.

Shell also does not anticipate any additional substance will be added to the current reported substance list for the Scotford Upgrader. However, if additional substances were to be added during ongoing Project planning, and these substances meet the reporting criteria under the *CEPA* E2 regulation, Shell will update Environment Canada on the anticipated changes.

6.2 Environmental Management Initiatives

6.2.1 Noise Management

As Shell is a member of Northeast Capital Industrial Association (NCIA), Shell's noise models, which are based on *ERCB Directive 038: Noise Control* (Directive 38), will be incorporated into the regional noise model. The regional noise model is a component of the Regional Noise Management Plan (RNMP), which in turn is being used by Shell to develop the Site Noise Management Plan.

Specifically, in keeping with provisions of Section 5.2 of Directive 38 and meeting the RNMP requirements described above, Shell will update the Site Noise Management Plan to incorporate noise management policy, best management practices, monitoring, and complaint response procedure for monitoring and investigation at the fence line.

6.2.2 Amine Management

The amine make-up quantity is 36 kg/h or about 25 m³ per month.

Treated gas from each amine absorber is further treated in a wash water vessel to reduce amine carry-over to the pressure swing adsorber (PSA) units. The concentration of amine in the carry-over will be less than 1 part per million by weight (ppmw) amine, and the gas temperature will be reduced from 39°C to 35°C. Each wash section consists of a wash water vessel, circulating water wash pumps and a circulating water cooler.

A continuous flow of fresh make-up water is supplied to the wash water vessel, while a continuous purge of wash water is removed from the system by the pumps. This maintains the amine concentration in the circulating water at a low level, to facilitate removal of entrained amine from the gas stream. The purge water that is pumped from the water wash system is sent to the Shell Scotford waste water treatment plant (WWTP). Maximum expected amine loss into waste water is 36 kg/h of amine from the three wash water systems. The maximum monthly amine make-up requirement is 25 m³.

The less than 1 ppmw amine, which potentially could carry over from the wash water section to the PSA, is less than 0.115 kg/h. Once captured in the PSA, this amine flows along with the tail gas from the PSA to the HMU furnaces, where it is incinerated by the HMU furnace burners.

6.2.3 Capture Infrastructure

6.2.3.1 Air Quality Management

Shell has continued its investigation into alternative technologies for reducing NO_x emissions from the Quest CCS Project. Ultra-low NO_x burners were examined as an alternative to the proposed low-NO_x burner option. Shell determined that, due to an inherent longer flame from the burner, the ultra-low NO_x burner would require substantial furnace modifications. In parallel, Shell also investigated post-combustion technologies, such as selective non-catalytic reduction (SNCR) and selective catalytic reduction (SCR).

SNCR has limited NO_x benefit and has increased health and safety risks by involving chemicals such as urea. SCR was rejected because it would have required rebuilding the entire convection sections of three HMU process units, as well as relocating the HMU stacks to accommodate the addition of the SCR equipment. The numerous mechanical changes required, coupled with limited plot space and limited turn-around time to make the changes, renders SCR impractical and inefficient to implement.

In addition to the technologies mentioned above, Shell also looked at the possibility of including flue gas recycle (FGR) as an option for the HMUs. FGR is commonly used as a NO_x mitigating option for conventional boilers, but has not to date been used on heaters or an HMU application. A pilot test to quantify the NO_x reductions achievable by using both low-NO_x burners and FGR was initiated, and showed very promising results and will be included in the Quest CCS Project design. However, as using FGR in the HMU is novel, Shell anticipates requiring some time to optimize the performance. The change in the Project design is not anticipated to result in any adverse effects on air quality as assessed in the November 2010 EA. Once optimized, this Project change is expected to reduce NO_x emissions. The desired NO_x reductions are expected to be achieved three years after Project start-up.

6.2.3.2 Waste Water Management

The maximum hydraulic capacity of the Scotford Base Plant WWTP is approximately 280 m³/h and typical throughput is approximately 210 m³/h. The maximum hydraulic capacity of the expansion WWTP is approximately 200 m³/h, and typical throughput is expected to be approximately 140 m³/h (to be confirmed when the expansion plant is fully operational). Therefore, either WWTP should have sufficient capacity to accommodate the additional Project waste water streams.

New absorption media will result in new trace components being introduced by the Project waste water streams. However, the existing WWTPs are capable of treating these waste streams with minor additions (i.e., a continuous dosing system for the new absorption media). Although the Project waste water streams may contain traces of different absorption media, and in different concentrations, than those used in the Scotford Upgrader for sulphur recovery, the Project waste water streams are biodegradable.

6.2.3.3 Waste Management

Additional information is available regarding waste management strategies that will be implemented as part of the Project. At the Scotford Upgrader, Shell follows the Alberta User Guide for Waste Managers (AEP 1996), with proper documentation to track the movement of waste from where it is generated to where it is received for disposal. Proper documentation used to track waste includes:

- waste movement documents or waste manifest
- recycle dockets
- transport of dangerous goods documents
- bills of lading

During drilling, well pad construction and pipeline construction, Shell follows ERCB *Directive 58: Oilfield Waste Management Requirements for the Upstream Petroleum Industry (1996-11 incorporating revision 2006-02-11)* (Directive 58). Waste manifest and tracking requirements are included in that document. Proper documentation used to transport dangerous oilfield waste (DOW) and non-DOW in Alberta includes:

- ERCB oilfield waste manifest
- landfill waste manifest
- bill of lading
- recycle dockets

Shell has a tracking system (Oilfield Waste Management [OWM] Toolkit), developed to facilitate compliance with Directive 58 tracking requirements.

Waste generated is segregated and stored temporarily at designated locations (e.g., the waste yard) at the Scotford Upgrader site.

Drilling waste must comply with *Directive 050: Drilling Waste Management* (Directive 50).

Solid non-DOW waste that meets landfill criteria is disposed of at a Class II landfill. Any solid DOW waste is hauled to a Class I landfill. Additionally, any landfill used to dispose of oilfield waste must be approved by Shell. Non-DOW or non-hazardous waste may be sent to any facility approved by ERCB or AENV to accept that waste. The ERCB regularly provides industry with a listing of ERCB-approved facilities (ERCB 2010).

Generally, little to no waste is generated for well pad construction or pipeline construction. Trees are typically logged or mulched with shrubs and incorporated into the topsoil. Any contaminated soil is disposed of in a designated and approved landfill, such as those used in drilling waste disposal.

7 Environmental Review

An overview of the interaction between the Project updates and the relevant environmental components, i.e., air quality, sound environment and the terrestrial environment, are discussed in this section. As previously stated, the Project updates are not predicted to affect the assessment of potential environmental effects or the conclusions of the EA filed in November 2010.

7.1 Air Quality

Although the orientation of the CO₂ capture infrastructure has been rotated within the Scotford Upgrader footprint, the location of the HMUs within the Upgrader have not changed because they will be developed separately from the CO₂ capture infrastructure. The assessment of potential environmental effects on air quality is based on the output of the HMUs, not the CO₂ capture infrastructure. Therefore, the change in the layout of the CO₂ capture infrastructure within the Upgrader does not affect the conclusions of the air quality assessment.

7.1.1 CO₂ Vent Stack

After the changes to the CO₂ capture infrastructure layout, Shell re-examined the CO₂ vent stack to optimize stack design. For the release scenarios considered in the air dispersion modelling for the CO₂ vent stack, a 50-m high, 500-mm diameter CO₂ vent stack is predicted to result in ground-level concentrations that will be within safe limits for Shell Scotford personnel and the public.

7.1.2 NO₂ Concentrations

No changes are proposed to the modelled emissions of the HMUs. As a result, there are no changes to the results of the assessment of potential environmental effects on air quality, although NO_x emissions from the Scotford Upgrader are expected to decrease below modelled levels in the future.

7.2 Sound Environment

Although the configuration of the CO₂ capture infrastructure has been altered within the Scotford Upgrader layout, there are no changes to the assessment of environmental effects on the sound environment. The sound contribution from the CO₂ capture infrastructure will remain well below the permissible sound level at each of the residences within 3 km of the facility.

7.3 Terrestrial Environment

Changes to the Project that have the potential to affect the terrestrial environment are limited to the minor reroute to the pipeline, east of the Scotford Upgrader. However, this reroute is situated within disturbed agricultural land with no apparent high value wildlife habitat, high potential for native vegetation or wetlands. Shell will conduct additional baseline field surveys in the spring and summer of 2011 as follow-up to the EA.

8 Measurement, Monitoring and Verification Plan Summary

The MMV Plan, presented as Appendix A in the EA filed in November 2010, provides detailed plans for the safe permanent storage of CO₂ within the BCS storage complex. For additional MMV commitments, see Table 8-1, which describes the components that are now sufficiently mature to be included in the current MMV Plan.

Table 8-1 Components Sufficiently Mature to be Included in the Monitoring, Measurement and Verification Plan

Item	Description
MMV Plan updates	<ul style="list-style-type: none"> • The MMV Plan will be site-specific and adaptive; this means it remains subject to change in response to new information from: <ul style="list-style-type: none"> • technical feasibility studies • baseline measurements • monitoring during the injection and closure periods • An update to the MMV Plan will be submitted for review before commencing baseline measurements, and thereafter every three years, coincident with the required submission of the updated Closure Plan to Alberta Energy.
Deep monitoring wells	<ul style="list-style-type: none"> • Shell proposes to drill a minimum of three deep monitoring wells. • The planned target is the Winnipegosis Formation. The suitability of this formation will be verified by logging and testing these deep monitoring wells. • Monitoring within these wells will include continuous pressure measurements.
Distributed temperature sensing	<ul style="list-style-type: none"> • Shell will install a distributed temperature sensing system outside the production casing in all injection wells.
Groundwater monitoring wells	<ul style="list-style-type: none"> • Shell proposes to drill three groundwater monitoring wells for each injection well. • Each of these groundwater monitoring wells will include a continuous water electrical conductivity measurement system. • Annual fluid sampling and analysis will be performed. • At least one of these groundwater wells will be located on each injection well pad; the remaining groundwater wells may be located elsewhere.
Time-lapse seismic	<ul style="list-style-type: none"> • Shell will acquire time-lapse seismic surveys designed to monitor the CO₂ plume. • A 3D surface seismic baseline survey has been acquired already. • Repeat 3D vertical seismic profile (VSP) surveys designed to monitor the CO₂ plume will be acquired until the CO₂ plume exceeds the radius of investigation for a VSP seismic survey. Thereafter, at least one repeat 3D surface seismic survey will be acquired.
Interferometric synthetic aperture radar (InSAR)	<ul style="list-style-type: none"> • Shell will acquire InSAR data designed to monitor surface heave induced by CO₂ storage.
Remote sensing	<ul style="list-style-type: none"> • Shell will acquire remote sensing data designed to detect environmental change. This will include multi-spectral image analysis.
Line of sight CO ₂ gas flux monitoring	<ul style="list-style-type: none"> • A field trial of the line-of-sight CO₂ gas flux monitoring technology will be deployed in Q4 2011. It will verify the technical capability of this technology for continuous detection and mapping and any CO₂ emissions from the BCS storage complex into the atmosphere.

**Table 8-1 Components Sufficiently Mature to be Included in the Monitoring,
Measurement and Verification Plan (cont'd)**

Item	Description
BCS water tracers	<ul style="list-style-type: none"><li data-bbox="483 344 1378 457">• Water geochemistry appraisal work has identified that the BCS brine has a unique formation fluid chemistry. In the unlikely event of a potential loss of containment, water geochemistry analysis is expected to verify the presence or absence of BCS brine within protected groundwater resources.

9 References

- Alberta Environmental Protection (AEP). 1996. *Alberta User Guide for Waste Managers*. Alberta Environmental Protection, Air and Water Approval Division. Edmonton, AB.
- Alberta Sustainable Resource Development (ASRD). 2006a. *Camrose Management Area Map*. Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body – Code of Practice for Watercourse Crossings – Code of Practice for Outfall Structures on Water Bodies. Finance and Administration Division – Resource Information Management Branch. Edmonton, AB.
- Alberta Sustainable Resource Development (ASRD). 2006b. *St. Paul Management Area Map*. Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body – Code of Practice for Watercourse Crossings – Code of Practice for Outfall Structures on Water Bodies. Finance and Administration Division – Resource Information Management Branch. Edmonton, AB.
- Energy Resources Conservation Board (ERCB). 2010. *ERCB Approved Oilfield Waste Management Facilities*. Updated August 31, 2010. Available at:
<http://www.ercb.ca/docs/data/waste/WasteMgmtFacilities.pdf>

Appendix A *Navigable Waters Protection Act* Approvals for Watercourse Crossings



Transport
Canada

Transports
Canada

Navigable Waters Protection
1100 9700 Jasper Avenue
Edmonton, AB T5J 4E6

Your file Votre référence

March 10, 2011

Our file Notre référence
See Appendix B

Shell Canada Limited
Shell Centre, 400 – 4 Avenue SW
Calgary, AB T2P 2H5

Attention: Kathy Penney

**Re: Application for approval of a pipeline crossing various waterways, Shell Quest CCS
Project, Province of Alberta**

Reference is made to your application received on December 23, 2010.

Please be advised that our office has determined that the proposed/existing works at the sites indicated in Appendix B are not subject to the *Navigable Waters Protection Act* (NWPA). Consequently, the NWP Program has no interest in any works at this location.

If you have any questions concerning the foregoing, please contact our office at 780-495-8215 or by email at NWP-PEN.PN@tc.gc.ca.

Sincerely,

Allen Cadenhead
A/Regional Manager
Navigable Waters Protection Program
Transport Canada
Prairie and Northern Region

Shell Quest CCS Project – Pipeline
Appendix B

Watercourse	Legal Land Description	Our File Number
Astotin Creek	NE Section 13, Township 56, Range 21, W4M	8200-2010-600671-001
Beaverhill Creek	NW Section 16, Township 56, Range 20, W4M	8200-2010-600671-002
Lower Namepi Creek	SW Section 26, Township 58, Range 20, W4M	8200-2010-600671-003
Upper Namepi Creek	NE Section 15, Township 60, Range 21, W4M	8200-2010-600671-004

Navigable Waters Protection Program
Programme de protection des eaux navigables
1100 9700 Jasper Avenue
Edmonton, AB T5J 4E6

Your File Votre référence

Our File Notre référence
8200-2010-600671-005

PRIORITY COURIER

MAR 22 2011

Shell Canada Ltd
400 - 4th Avenue S.W.
Calgary, AB T2P 0J4

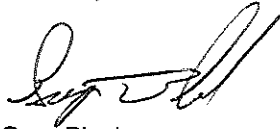
Attention: Kathy Penney

Re.: Application under the *Navigable Waters Protection Act* for a pipeline crossing the North Saskatchewan River, Northwest Section 36, Township 57, Range 20, W4M, Province of Alberta

Enclosed herewith is an Approval document signed on behalf of the Minister of Transport, Infrastructure and Communities pursuant to subsections 5(1) and (3) of the *Navigable Waters Protection Act* (R.S.C. 1985, c. N-22), as amended by Part 7 of the *Budget Implementation Act*, 2009, S.C. 2009, c. 2.

NOTE: Should you neither start nor finish construction of your work by the dates indicated in your Approval document, it will be necessary to notify the Navigable Waters Protection Program immediately at 780-495-8215 or by e-mail at NWP-PEN.PN@tc.gc.ca so that alternate dates may be specified.

Sincerely,



Greg Black
A/Regional Officer
Navigable Waters Protection Program
Transport Canada
Prairie and Northern Region

Enclosure

Canada

NAVIGABLE WATERS PROTECTION ACT (R.S.C. 1985, c. N-22) as amended by Part 7 of the *Budget Implementation Act*, 2009, S.C. 2009, c. 2 (*Navigable Waters Protection Act*), PART I
Subsections 5(1) and (3) – Other than substantial interference

8200-2010-600671-005

Approval

- APPLICANT:** Shell Canada Ltd
400 - 4th Avenue Southwest
Calgary, Alberta T2P 0J4
- WORK:** Pipeline
- SITE LOCATION:** Located at Approximately N 53° 58' 25" – W 112° 50' 46", Northwest Section 36, Township 57, Range 20, W4M, North Saskatchewan River, in the Province of Alberta
- IMPORTANT NOTICE:** This document approves the work in terms of its effect on marine navigation under the *Navigable Waters Protection Act*. The work must be built, placed, maintained, operated, used and removed in accordance with the approved plan(s), the *Navigable Waters Protection Act*, its regulations and the terms and conditions in the Approval. It is the applicant's responsibility to obtain any other forms of approval, including building permits, under any applicable laws.

WHEREAS the above-named applicant has made application to the Minister of Transport, Infrastructure and Communities under the *Navigable Waters Protection Act* for approval of the above-described work at the above-referenced site in accordance with the attached plan(s);

WHEREAS it is considered advisable to approve the said work at the said site and plan(s) thereof for a period of 50 years pursuant to the Schedule referred to in subsection 3(1) of the *Navigable Waters Works Regulations*.

THEREFORE, the Minister of Transport, Infrastructure and Communities, pursuant to subsections 5(1) and (3) of the *Navigable Waters Protection Act*, hereby approves the said work at the said site and plan(s) thereof for the period of time aforesaid, providing:

1. The construction of the work is started by October 2013 and finished by June 2014.
2. Warning signs shall:
 - Be posted during all periods of in stream activity.
 - Be legible at a minimum distance of 100 meters.
 - Be placed 200 meters upstream and/or downstream of the site and on each bank until completion of the project.
 - Display black lettering on a yellow background.
3. The placement of "Tru-track" or equivalent wires across the North Saskatchewan River prior to the river freezing shall be weighted to ensure they lie on the bed of the river.



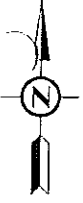
4. All wires and weights or other devices used for monitoring the HDD shall be removed from the river prior to April 30, 2014.
5. Any temporary equipment used during the horizontal drilling operation:
 - Placed into the river to supply water shall not extend more than 10 meters beyond the shoreline. Equipment shall be removed from the waterway upon completion of the HDD.
 - Submersible electric pumps or steel pipes with a suction basket attached required to withdraw water from the North Saskatchewan River for supplying mud mixing equipment at the drill rig, and for the hydrostatic test of the entire pipeline project shall be within approximately 10 meters of the river bank.
6. Any proposed changes or works across the waterway will be subject to a separate application for 'Approval' under the provisions of Section 5 of the *Navigable Waters Protection Act*.

Edmonton, Alberta

Date: MAR 22 2011

Greg Black
A/Regional Officer
Navigable Waters Protection Program
Marine Safety
Transport Canada
Prairie and Northern Region

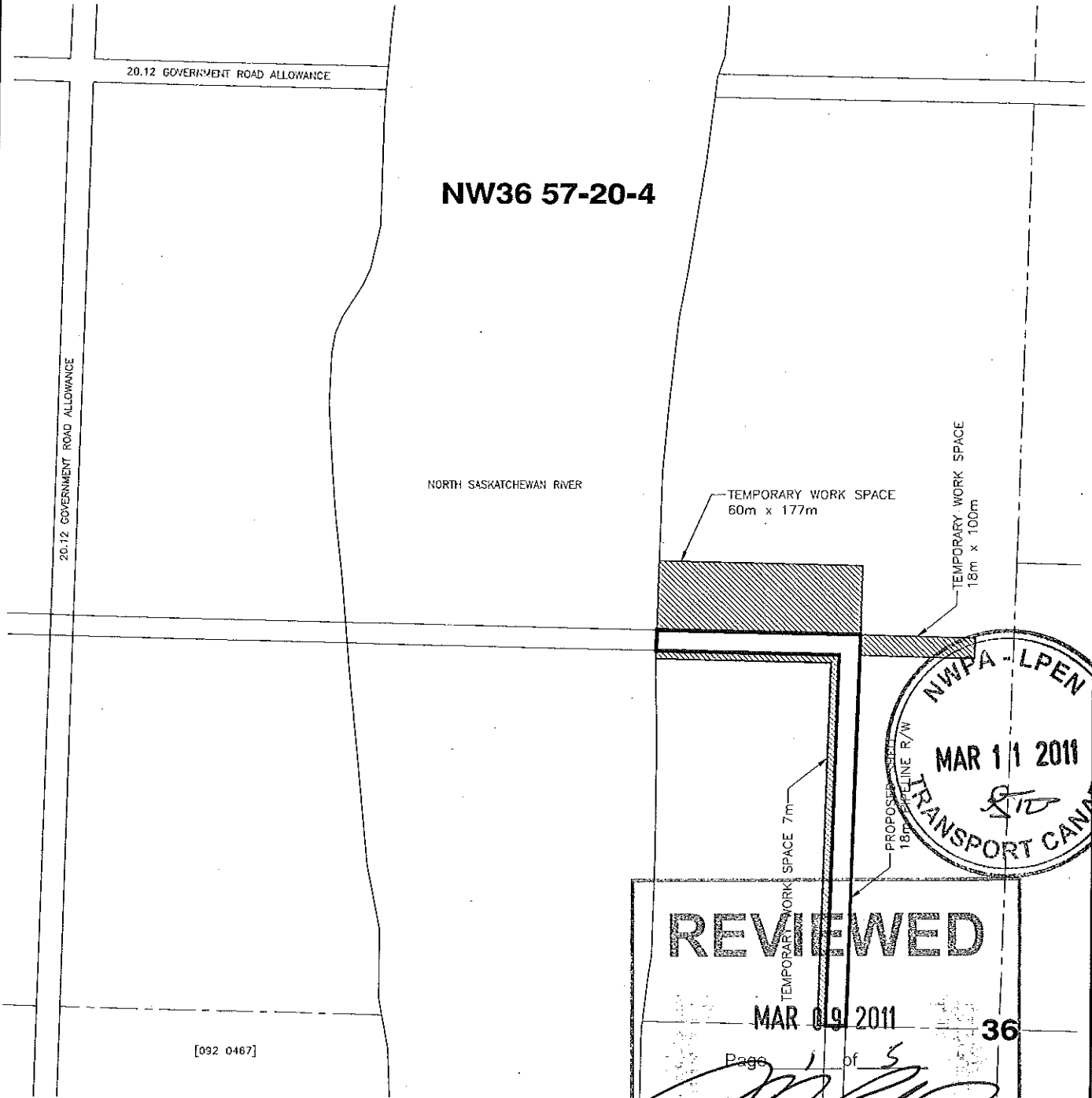
for the Minister of Transport, Infrastructure and
Communities



SHELL QUEST
 PROPERTY SKETCH
 SHOWING LOCATION FOR
 PROPOSED NEW PIPELINE

COUNTY OF: LAMONT

LEGAL DESCRIPTION: NW36 57-20 W4M



[092 0467]

OWNER:
 BERNIE KOTYLAK and LINDA KOTYLAK

C. of T. No.:
 082 125 977

REVIEWED
 MAR 09 2011
 Page 1 of 5
 By: [Signature]
 NWP Program

PERMANENT EASEMENT = 0.90 ho (2.22 acres)

TEMPORARY WORK SPACE = 1.57 ho (3.88 acres)

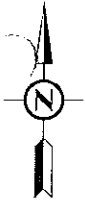


ALL DISTANCES AND AREAS ARE APPROXIMATE AND ARE BASED ON A.E.P. DIGITAL PARCEL MAPPING DATA FILES.

PLG DATE 10/07/13 Rev 0	BY AB	CDP FILE 354-0863-42057NW36A	DWG. SCALE 1:5000
PROJECT NO. 200863	DRAWING NO. 354-0863-42057NW36A		

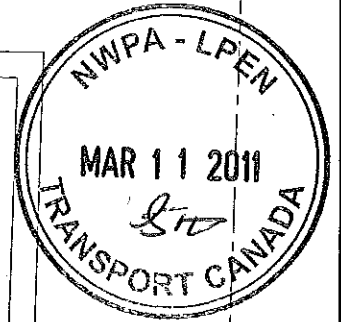
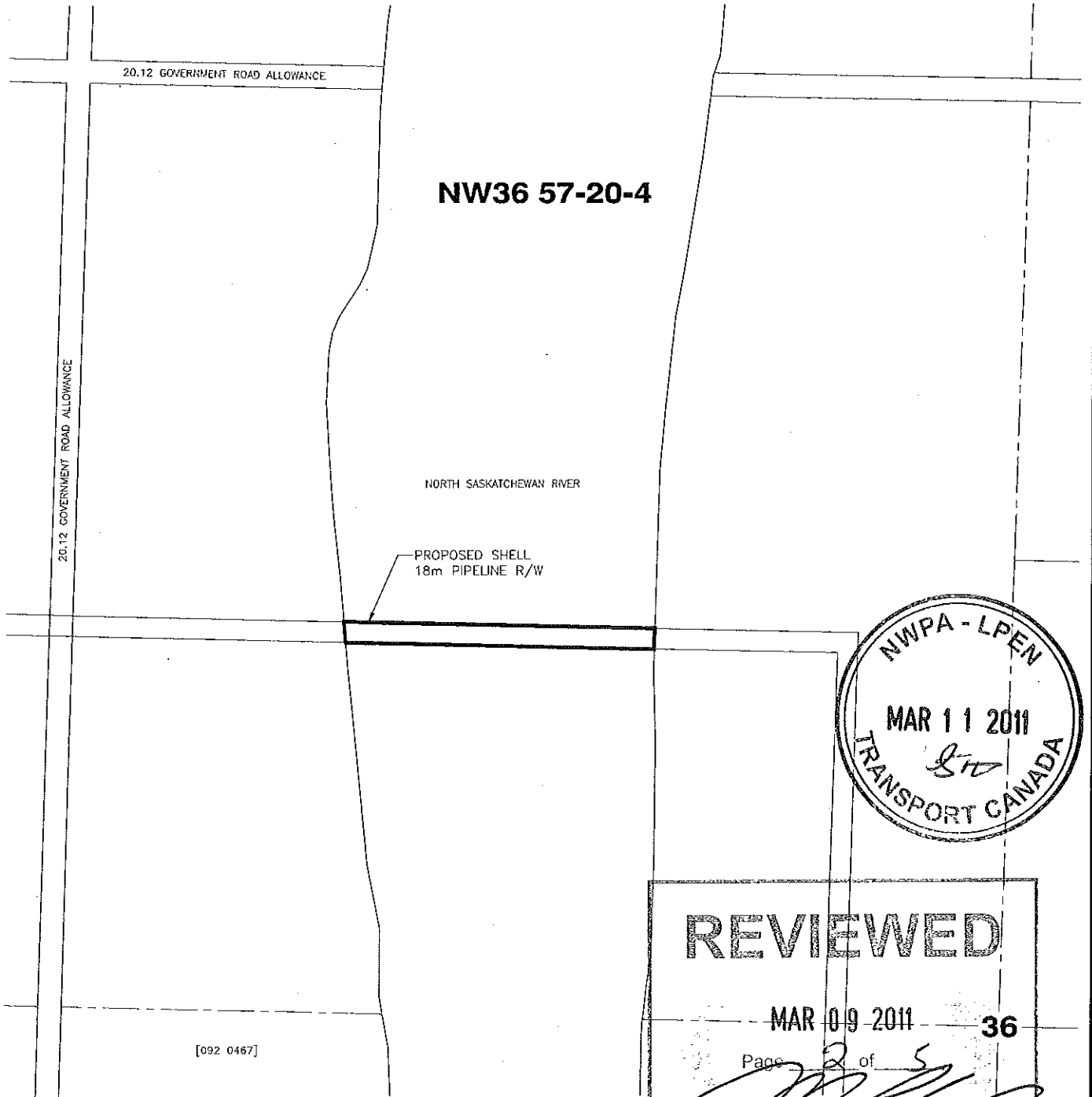
SHELL QUEST

PROPERTY SKETCH
SHOWING LOCATION FOR
PROPOSED NEW PIPELINE



COUNTY OF: **STURGEON**

LEGAL DESCRIPTION: **NW36 57-20 W4M**



REVIEWED

MAR 09 2011 36

Page 2 of 5

By: *[Signature]*
NWP Program

OWNER:
NORTH SASKATCHEWAN RIVER CROSSING
C. of T. No.:

- PERMANENT EASEMENT = 0.49 ha (1.20 acres)
- TEMPORARY WORK SPACE = 0.00 ha (0.00 acres)



ALL DISTANCES AND AREAS ARE APPROXIMATE AND ARE BASED ON A.E.P. DIGITAL PARCEL MAPPING DATA FILES.

PLOT DATE 10/07/13 Rev 0	BY AB	DWG FILE 355-0863-42057NW36B	DWG. SCALE 1:5000
PROJECT No. 200863	DRAWING No. 355-0863-42057NW36B		

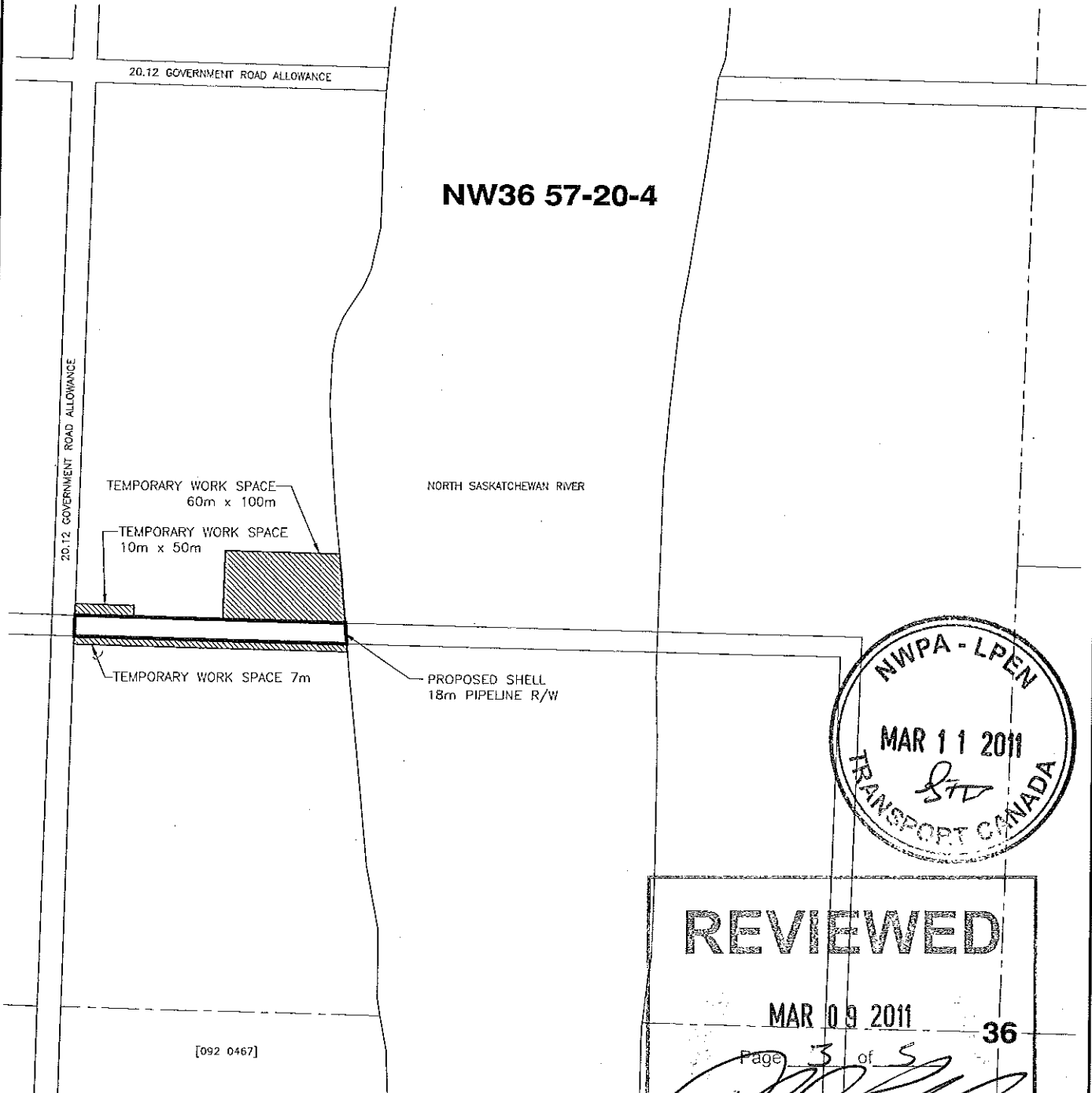
SHELL QUEST

PROPERTY SKETCH
SHOWING LOCATION FOR
PROPOSED NEW PIPELINE



COUNTY OF: **STURGEON**

LEGAL DESCRIPTION: **NW36 57-20 W4M**



REVIEWED

MAR 09 2011 **36**

Page 3 of 5

By: *[Signature]*
NWP Program

OWNER:
IAN ELMORE
C. of T. No.:
962 188 585

PERMANENT EASEMENT = 0.42 ha (1.05 acres)

TEMPORARY WORK SPACE = 0.84 ha (2.08 acres)



ALL DISTANCES AND AREAS ARE APPROXIMATE AND ARE BASED ON A.E.P. DIGITAL PARCEL MAPPING DATA FILES.

POST DATE 10/07/13 Rev 0	BY AB	DWG FILE 356-0863-42057/NW36C	DWG SIZE 1:5000
PROJECT NO 200863	DRAWING NO 356-0863-42057NW36C		

Appendix B Pipeline Agreements for Watercourse Crossings

PLA110611 – Short Term Approval – Astotin

PLA110737 – Short Term Approval – Beaverhill Creek

PLA110614 – Short Term Approval – North Saskatchewan River

PLA110749 – Short Term Approval – Lower Namepi Creek

PLA110615 – Short Term Approval – Upper Namepi Creek

Appendix C Closure Plan

Quest Carbon Capture and Storage Project

CLOSURE PLAN

April 2011

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Acronyms and Abbreviations

ADOE	Alberta Department of Energy
AENV	Alberta Environment
AOI	area of interest
AOR	area of review
AOSP	Athabasca Oil Sands Project
BCS	Basal Cambrian Sands
BGWP	base of ground water protection
C&R	conservation and reclamation
CCS	carbon capture and storage
<i>CCS Act</i>	<i>Carbon Capture and Storage Act</i>
<i>CEAA</i>	<i>Canadian Environmental Assessment Act</i>
CO ₂	carbon dioxide
DNV	Det Norske Veritas
EA	environmental assessment
<i>EPEA</i>	<i>Environmental Protection and Enhancement Act</i>
EPP	Environmental Protection Plan
ERCB	Energy Resources Conservation Board
HMU	hydrogen manufacturing unit
InSAR	Interferometric Synthetic Aperture Radar
IPCC	Intergovernmental Panel on Climate Change
MCS	Middle Cambrian Shale
MMV	measurement, monitoring and verification
Mt/a	million tonnes per year
RFA	Regulatory Framework Assessment
ROW	right-of-way
Shell	Shell Canada Limited
Shell Scotford	Shell Scotford Complex
TDS	total dissolved solids
the Project	injection and storage of CO ₂ in the BCS saline aquifer
UWI	unique well identifier

1 Introduction

1.1 Scope of Closure Plan

Shell Canada Limited (Shell), on behalf of the Athabasca Oil Sands Project (AOSP), which is a joint venture between Shell Canada Energy, Chevron Canada Limited, and Marathon Oil Canada Corporation, has applied to construct, operate and reclaim the Quest Carbon Capture and Storage (CCS) Project (the Project). The Project will capture, transport and store carbon dioxide (CO₂) from the existing Scotford Upgrader, which is located about 5 km northeast of Fort Saskatchewan, Alberta (see Figure 1-1).

As part of the Project, Shell is applying to the Alberta Minister of Energy, pursuant to Section 116 of the *Mine and Minerals Act*, for six (6) Carbon Sequestration Leases that together comprise the single proposed Quest Carbon Capture and Storage (CCS) Project. This requires the submission of an associated Project closure plan.

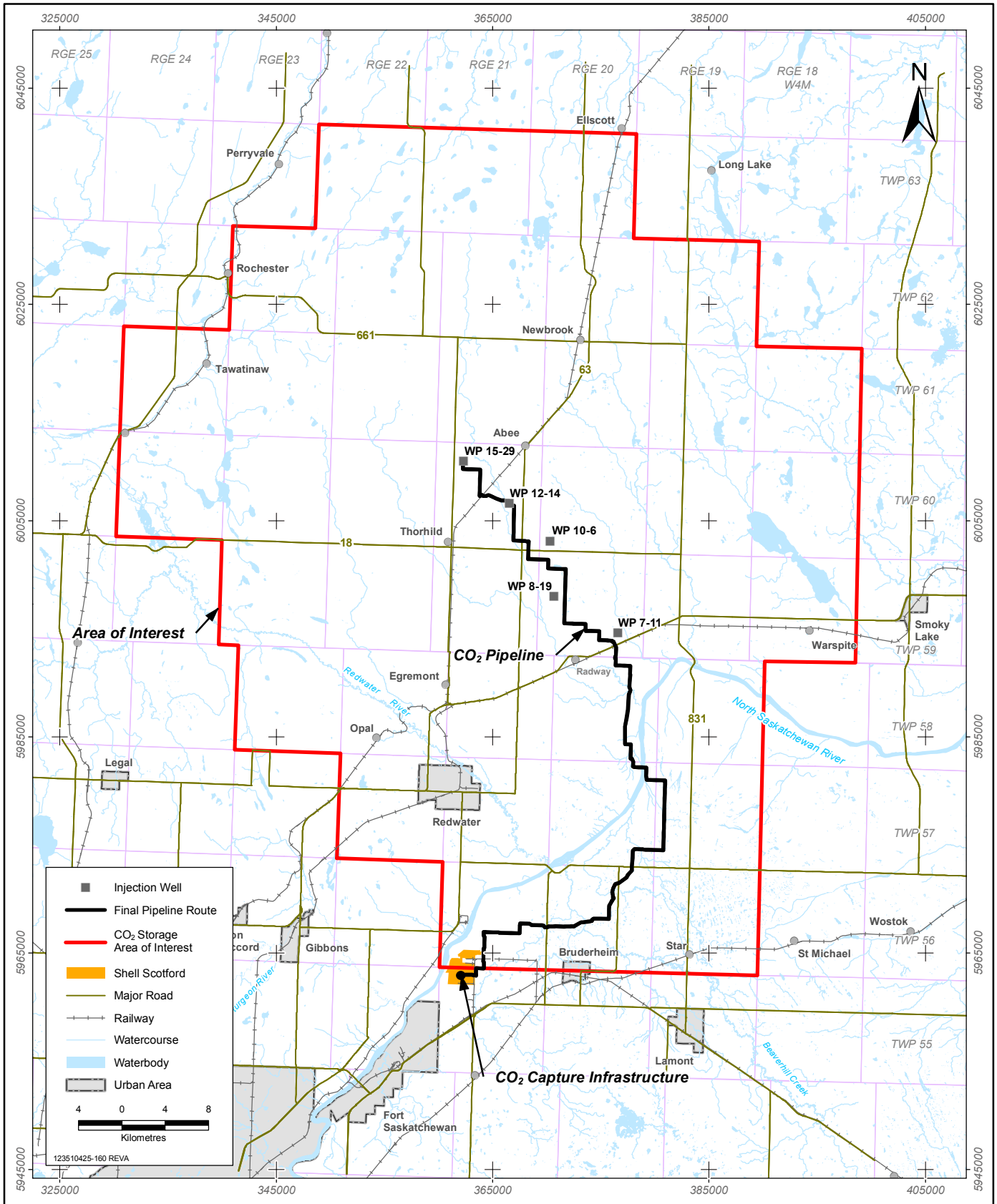
The scope of this closure plan is limited to the storage component of the Project, which includes well pads, injection wells, observation wells, monitoring infrastructure and the storage complex, for the permanent storage of CO₂ in a deep saline geological formation.

Shell has completed drilling several exploration appraisal wells, and gathered and assessed geophysical data to confirm the technical aspects of the site. Based on the current results, the proposed storage scheme will comprise 3 to 10 injection wells designed for the injection of CO₂ into the Basal Cambrian Sands (BCS) at a depth of approximately 2 km below the surface. These wells are all located within the CO₂ storage area of interest (AOI) located within 15 km of the CO₂ pipeline (see Figure 1-1). To date, the locations of five potential injection wells have been determined.

The Project will achieve full, sustained operations by the fourth quarter of 2015 and injection will continue for the life of the Scotford Upgrader (greater than 25 years). At that time, CO₂ injection will cease and site closure activities will take place throughout the closure period, which Shell anticipates will occur over a period of 10 years.

The scope of this closure plan is limited to the period following the cessation of CO₂ injection into the storage complex (see Figure 1-2).

Following the completion of site closure activities, Shell will apply for a Site Closure Certificate, in accordance with prescribed criteria. The post-closure period will begin with the issue of a Site Closure Certificate, which will transfer the long-term liability and any further post-closure activities from Shell to the Crown.



QUEST CARBON CAPTURE AND STORAGE PROJECT

Quest CCS Project Components and Area of Interest

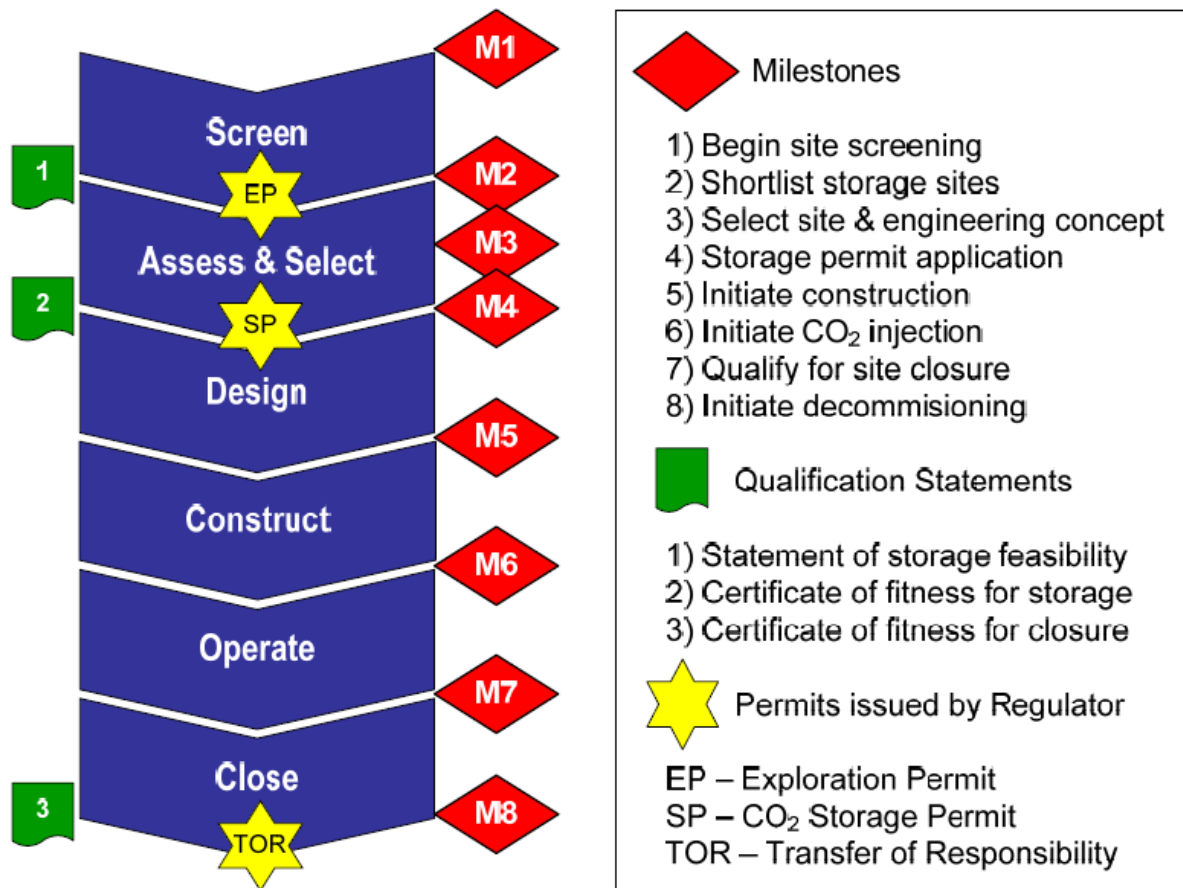
Acknowledgements: Original Drawing by Stantec
 Pipeline: Sunstone Engineering October 15, 2010, Wells: Shell August 26, 2010, Basedata: National Road Network, Carvec, Altair

PREPARED BY

PREPARED FOR

FIGURE NO. **1-1**

Last Modified: Nov 18, 2010 By: jeko



SOURCE: DNV 2010a

Figure 1-2 Carbon Capture and Storage Project Life-Cycle, Qualification Statements, Permits and Milestones

1.2 Timeline of Proposed Closure Activities

Commissioning and start of operations ramp-up of the full Project is anticipated to begin in the first quarter of 2015. Full, sustained operations will be achieved by the fourth quarter of 2015 and will continue for the life of the Scotford Upgrader, which will be greater than 25 years. Around that time, CO₂ injection will cease and closure activities will begin. The injection wells and storage infrastructure will remain in place to continue the monitoring and verification processes as planned throughout the closure period, which Shell anticipates will occur over a period of 10 years.

Towards the end of the closure period, Shell will abandon the injection wells and reclaim the surface in accordance with the regulatory requirements in place at the time. Shell will work with the Crown to determine if select wells would be needed by the Crown for continued monitoring.

Following site closure activities, Shell expects to apply for a site closure certificate provided no significant issues arise from Project operations and that storage performance and CO₂ and brine containment in the BCS storage complex are demonstrated to the satisfaction of the Crown in accordance with pre-agreed upon criteria.

The post-closure period will occur following the issuance of a site closure certificate, which will transfer the long-term liability from Shell to the Crown. Shell is committed to advising the Government of Alberta on its long-term monitoring approach and sharing its accrued knowledge and experience with the government before this transfer. Figure 1-3 shows a timeline for the proposed closure activities.

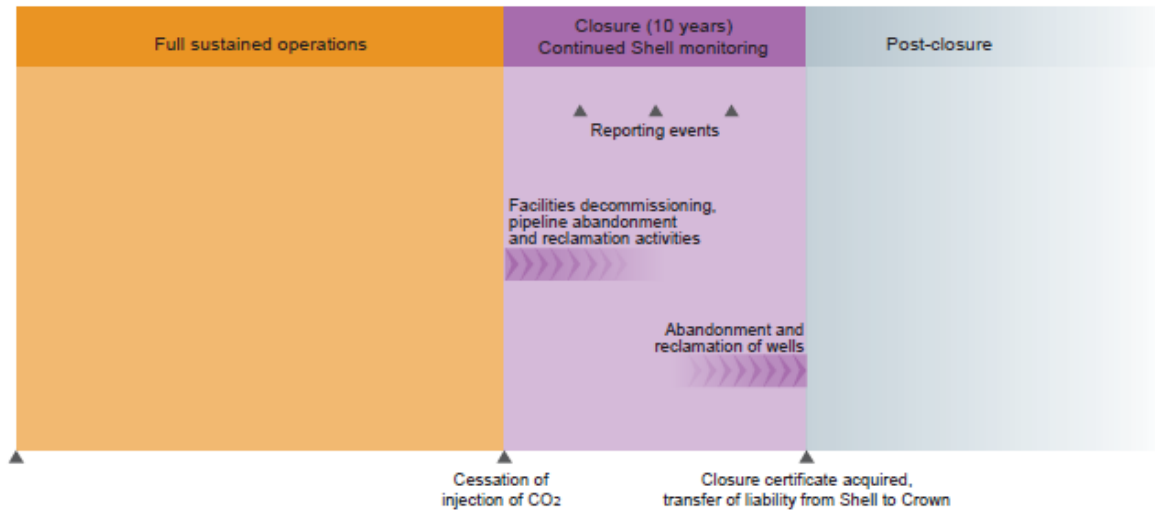


Figure 1-3 Proposed Timeline for Project Operations, Closure and Post-Closure

1.3 Regulatory Framework Process and Closure requirements

Shell is committed to closure of the Project in accordance with applicable regulatory requirements in force at the time of closure. Current obligations to the Government of Alberta are outlined in Alberta's *CCS Act* and include:

- submitting a measurement, monitoring and verification (MMV) plan for approval
- complying with the approved MMV plan
- providing ongoing reporting, which describes compliance with the MMV plan
- submitting an updated closure plan every three years during the lease, and a final closure plan for approval three years before planned cessation of injection

The outcome of Alberta Energy's Regulatory Framework Assessment (RFA) is pending, which will advance technical understanding of CCS storage (and closure) requirements. This review may result in new regulatory requirements. It is expected that any pending regulations under the *CCS Act* will provide further information about closure plans and MMV plans, such as:

- form and content of plans
- submission and approval of plans
- amendment of plans
- reporting requirements within plans

Shell is committed to meet the requirements of all applicable regulations under the *CCS Act* or other new requirements that apply to CCS projects.

2 Project Overview

The Project is a fully integrated CCS project that will result in the capture and storage of up to 1.2 million tonnes per year (Mt/a) of CO₂ from the Scotford Upgrader. The three components of the Project are:

- CO₂ capture infrastructure, which involves a modification to the existing Scotford Upgrader
- a CO₂ pipeline to transport CO₂ to the CO₂ storage area
- injection well storage infrastructure for permanent storage of CO₂ in a deep saline geological formation

2.1 CO₂ Capture Infrastructure

Up to 1.2 Mt/a of CO₂ will be captured from three existing hydrogen manufacturing units (HMUs) at the Upgrader. These HMUs manufacture hydrogen to upgrade oil sands bitumen. The method of CO₂ capture will be based on a commercially proven activated amine technology called Shell ADIP-X. The CO₂ capture and compression infrastructure also includes multistage compression of the captured CO₂ into a dense phase ready for transportation. The dense-phase composition will contain CO₂ in quantities higher than 95% by volume.

2.2 CO₂ Pipeline

The CO₂ pipeline is approximately 84 km in length. Approximately 28 km of this pipeline will be parallel to existing pipeline rights-of-way (ROWs).

2.3 CO₂ Storage

Wells will be designed for injection of CO₂ into the BCS, at a depth of approximately 2 km below the surface. The BCS contains no hydrocarbons and is 35 to 46 m thick within the AOI. The CO₂ will be contained within the BCS storage complex by a combination of three main regionally extensive geological seals. The total thickness of these seals is over 120 m, and available seismic data indicate that no faults transect the seals. Between the seals and the base of groundwater protection (BGWP) are more than 1,500 m of overlying strata over the AOI.

The transport and storage volumes are based on the design of the CO₂ capture infrastructure, which will have:

- a stream day (or nameplate) capacity of up to 1.2 Mt/a of CO₂
- a calendar day capacity of 1.08 Mt/a of CO₂ (assuming an on-stream factor of 90%)

The cumulative stored volume is expected to be greater than 27 Mt of CO₂ over a period of 25 years.

A measurement, monitoring and verification (MMV) plan will be implemented to verify storage performance associated with the two key storage requirements:

- conformance of predicted and observed CO₂ and pressure build-up inside the BCS storage complex
- containment of CO₂ and brine within the BCS storage complex

2.4 Project Location

The CO₂ capture infrastructure will involve a process modification to the existing Scotford Upgrader, on lands within the developed area of the Scotford Upgrader. The CO₂ pipeline will extend a distance of 84 km from Shell Scotford, north across the North Saskatchewan River and will terminate north of the village of Thorhild.

The 3 to 10 injection wells will be situated in the CO₂ storage AOI, occupying about 40 townships in area, ranging from Townships 56 to 63 and Ranges 18 to 24, all west of the Fourth Meridian. For the location of the proposed CO₂ capture infrastructure, the CO₂ pipeline and the proposed location of the first five candidate injection wells, see Figure 1-1.

The CO₂ would then be stored permanently about 2 km below surface in the BCS. The extent of the AOI has been determined as the amount of pore space required in the BCS to inject and store the CO₂ for the expected life of the Project.

2.5 Project Schedule

The timing for the construction start-up and operation of the Quest CCS Project is expected to be as follows:

- Construction of the CO₂ capture infrastructure will begin in Q3 2012 and continue until the end of Q4 2014.
- Construction of the CO₂ pipeline will begin in Q4 2013 and end in Q2 2014.
- Construction of the lateral pipelines and drilling of the injection wells will take place between receiving project approval and Q3 2014. The Radway 8-19 well drilled in 2010 is expected to be the first CO₂ injection well.
- Commissioning and start of operations ramp-up of the full Quest CCS Project is anticipated to begin in 2014.
- Full sustained operation will be achieved by Q4 2015

Final investment decision on the Quest CCS Project is anticipated in Q1 of 2012.

The integrated Quest CCS Project will become operational in conjunction with the commissioning and start-up of the CO₂ capture infrastructure. The Quest CCS Project is expected to operate for the expected life of the Scotford Upgrader (greater than 25 years).

These timelines are subject to change, pending regulatory approval, market conditions and internal and joint venture Project approvals.

3 Storage Performance Targets for Site Closure

The Alberta Department of Energy (ADOE) RFA process will examine and potentially develop technical criteria for site closure. Until that time, the following high-level qualification goals for site closure have been used, adapted from guidelines developed by an international third-party organization in collaboration with industry partners (DNV 2010a) and a directive developed by the European Parliament and Council regarding the geological storage of CO₂ (European Parliament and the Council of the European Union 2009).

To meet these high-level goals, MMV activities will be designed to deliver against the following targets during the site closure period.

3.1 CO₂ Inventory Accuracy Target

To establish confidence that the conditions for site closure have been met, the accuracy of the reported inventory of CO₂ stored will comply with regulations and protocol.

3.2 Containment Performance Target

It is essential to assess whether any migration of injected CO₂ or BCS brine has occurred and whether any identified migration has damaged the environment or human health. The following performance target has been adopted:

- Measurements of any changes within the hydrosphere, biosphere, and atmosphere caused by CO₂ injected into the BCS storage complex are sufficient to demonstrate the absence of any significant impacts as defined by the Environmental Assessment.

The approved MMV Plan (see Appendix A) will provide more details regarding performance targets for containment.

3.3 Conformance Performance Target

It is also essential to assess whether injected CO₂ and BCS brine behave as expected and how site performance evolved relative to the predictions. As such, the following performance targets have been adopted:

- Actual storage performance conforms to predicted storage performance within the range of uncertainty.
- Knowledge of actual storage performance is sufficient to distinguish between two classes of possible future performance: those that result in permanent stable storage of the target mass of CO₂ inside the BCS, and those that do not.

4 Storage Performance Data

In the future, this section will provide a summary of

- the activities that have taken place on the storage site
- the quantity of captured CO₂ that has been injected
- an evaluation of whether the injected captured CO₂ has behaved in a manner consistent with the geological interpretations and calculations made by Shell in terms of both containment and conformance
- changes that have been made in the operating plan to ensure continued containment and conformance, either in terms of mitigation measures that have been applied or changes in operating procedures to increase storage efficiency
- an update prediction of the storage site behaviour based on additional data gathered in the preceding period and any operational changes made

However, because CO₂ injection has not begun yet, the following describes Shell's current plans to acquire that information. This section will be updated to provide the aforementioned data regularly in accordance with reporting requirements prescribed by appropriate regulatory agencies.

4.1 Well Inventory

4.1.1 Injection Wells

The storage infrastructure consists of 3 to 10 injection wells to inject CO₂ into the BCS. Shell has currently identified five candidate injection well locations (see Table 4-1). Confirmation of both the number and location of the injection wells will be made by Shell in 2011 and will be based in part on the results of the subsurface appraisal program.

Table 4-1 Injection Well Locations Included in the CO₂ Storage Scheme Application

Unique Well Identifier	NAD 27 UTM Zone 12 North	NAD 27 UTM Zone 12 East
08-19-059-20 W4	5997747.399	370705.482
07-11-059-20 W4	5994416.66	376674.14
10-06-060-20 W4	6002873.82	370401.14
12-14-060-21 W4	6006367.36	366539.42
15-29-060-21 W4	6010249	362408.94

4.1.2 Deep Observation Wells

Based on Shell's preliminary monitoring schedule, several observation wells are planned targeting the Winnipegosis formation to provide direct monitoring opportunities. Up to one observation well per injection well is planned, resulting in 3 to 10 deep observation wells, depending on the number of injection wells selected.

Appraisal activities for site characterization are not yet complete; therefore, the target depths for observation wells remain subject to change.

4.1.3 Groundwater Observation Wells

Based on Shell's preliminary monitoring schedule several observation wells are planned in the groundwater protection zone which will provide direct monitoring opportunities to verify the absence of any adverse impacts to groundwater quality or provide early warning of the need for corrective measures to protect groundwater quality. Up to three groundwater observation wells per injection well are planned.

Groundwater monitoring wells will be completed about two years prior to CO₂ injection to establish a baseline against which to verify the absence of adverse impacts to groundwater quality throughout the injection and closure periods. Again, appraisal activities for site characterization are not complete yet, therefore, the target depths for these observation wells remain subject to change.

4.2 CO₂ Inventory

4.2.1 Mass and Volume of CO₂ Injected per Well

Shell proposes to inject up to 1.2 Mt/a of CO₂ into the BCS through a maximum of 10 injection wells.

The cumulative stored volume is expected to be greater than 27 Mt of CO₂ over a 25 year period.

4.2.2 CO₂ Emission Measurements

Following the Intergovernmental Panel on Climate Change (IPCC) guidelines on CO₂ inventory reporting (IPCC 2006), the mass of CO₂ held within a geological storage complex is the difference between the mass of CO₂ injected into the complex and the mass of any CO₂ unexpectedly emitted from the storage complex. Therefore, uncertainty about the CO₂ inventory depends on uncertainties in the measured mass of injected and emitted CO₂.

The Energy Resources Conservation Board (ERCB) Bulletin 2010-22: ERCB Processes Related to Carbon Capture and Storage (CCS) Projects (June 29, 2010) recommends the general provisions of Directive 007: Volumetric and Infrastructure Requirements (December 2007) and Directive 017: Measurement Requirements for Upstream Oil and Gas Operations (draft release June 8, 2010) for CO₂ emissions monitoring.

4.3 Containment Performance

The Project is designed for permanent secure containment of CO₂ and BCS brine within the BCS storage complex.

4.3.1 Project Area of Review

The Project area of review (AOR) is of sufficient extent to include any potential material impacts due to CO₂ storage including the displacement of brine. This area spans four distinct environmental domains.

- **Geosphere:** The subsurface domain below the base of the groundwater protection zone including the BCS storage complex. The geological storage complex comprises a primary storage formation (Basal Cambrian Sands, BCS), a primary seal (Middle Cambrian Shale, MCS), a secondary seal (Lower Lotsberg Salt), and an ultimate seal (Upper Lotsberg Salt). Above the storage complex, the geosphere also contains two additional deep saline aquifers, the Winnipegosis and the Cooking Lake, that provide important opportunities for MMV.
- **Hydrosphere:** The subsurface domain within the groundwater protection zone where water salinity measured as the concentration of total dissolved solids is less than 4,000 mg/L (a concentration greater than this is defined in the Alberta Environment (AENV) *Water Act* as saline groundwater).
- **Biosphere:** The domain containing ecosystems where living organisms exist.
- **Atmosphere:** The local air mass where any changes to air quality matter and the global air mass where any changes influencing climate matter.

4.3.2 Model-Based Forecasts

Shell has run several models to evaluate the potential risk of events that might lead to a loss of containment. These are discussed in more detail in the regulatory application that Shell submitted to the ERCB for a CO₂ acid gas storage scheme and are summarized as follows:

- Several abandoned third party wells in the Project area of review (AOR) penetrate all the seals of the BCS storage complex and may constitute a threat to containment of CO₂ and displaced brine due to any potential degradation of the abandonment. However, models of CO₂ plume development within the BCS indicate the size of the plume is insufficient to reach any of these wells.
- Models of pressure build-up within the BCS due to CO₂ injection indicate the abandoned legacy wells within the BCS are all sufficiently offset and are not expected to experience sufficient pressure to lift BCS brine above the base of groundwater protection.
- Models of pressure build-up within the BCS due to CO₂ injection indicate pressures throughout the BCS storage complex are insufficient to cause fracturing that leads to a loss of containment.
- Any early indication of an unexpected loss of containment gained through an approved monitoring program would trigger prompt intervention to prevent any further fluid migration and protect groundwater.

Also, see discussion of Field Development Plan (Section 5.1).

4.3.3 Monitoring

The monitoring program comprises:

- base-case activities that follow a planned schedule
- contingent activities that only occur in the event of detecting potential loss of containment of BCS brine or injected CO₂ from the storage complex

As new information about storage and monitoring performance becomes available through time, the MMV base-case plan will be adapted to ensure it continues to be effective. The initial base-case monitoring plan described below is conceptual. This conceptual plan will be subject to change in response to the final appraisal information. These changes will affect the shape and content of the MMV plan but not the outcomes, which must meet the performance targets.

The conceptual MMV base-case plan covers four monitoring domains (atmosphere, biosphere, hydrosphere and geosphere) and wells associated with the Project that crosscut all these domains.

The geosphere monitoring system comprises a balance between non-invasive remote sensing methods and in-well measurements directly above the ultimate seal within the Winnipegosis or other suitable formation.

- Sensors inside observation wells located in the Winnipegosis or other suitable formation provide continuous pressure monitoring to detect any early signs of fluids escaping above the ultimate seal.
- Down-hole microseismic monitoring is expected to detect any early signs of fractures propagating towards the ultimate seal or fault re-activation.

Contingency monitoring may arise through adaption of the MMV plan in response to changing circumstances. The role of contingency monitoring plans is:

- to replace a monitoring method that unexpectedly failed to perform as required
- to verify and characterize any potential environmental impacts subsequent to their initial detection
- to verify the effectiveness of any subsequent recovery measures

Contingency monitoring plans will be held in reserve and only deployed if detecting potential loss of containment.

4.3.4 Discussion of Mitigation Measures

Shell has identified several potential risks resulting in the loss of containment and has developed a comprehensive framework to manage these risks using the “bowtie” method. As outlined in its MMV Plan (see Appendix A), the bowtie method is a systematic risk assessment of events with the potential to affect storage performance, which has been used by Shell to identify how a risk might arise and the effectiveness of each control response option for preventing events arising or mitigating any consequences.

In the future, this section will document if any of the preventative measures that Shell has identified for avoiding, limiting, or recovering from any loss of containment have been put into operation. The potential mitigation measures are:

- injection controls to change the manner of CO₂ injection into the storage complex: These include re-distributing injection rates across existing wells, drilling additional injectors, drilling producers and re-injectors to manage reservoir pressures, and stopping injection.
- well interventions to restore well integrity: These include repairing the cement bond, replacing the completion, or abandoning a well that cannot be repaired.
- exposure controls to prevent contaminants reaching sensitive environmental domains where significant impacts might occur such as the protected groundwater zone. Examples of such controls include interim provision of potable water supplies and hydraulic barriers to contain any groundwater contamination.
- Remediation measures to recover from any significant impacts in the unlikely event of an uncorrected loss of containment, e.g., pump and treat, air sparging or vapour extraction, multiphase extraction, chemical oxidation, and bioremediation (see Appendix A, Section 6.3).

4.3.5 Forecast Updates

This section will be updated at three-year intervals upon resubmission of the updated closure plan, as required. It will be based on updated and recalibrated models as results and data become available. Once this information is available, Shell will revise its bowtie risk assessment depending on the results.

4.4 Conformance Performance

Conformance means that the storage complex is behaving in a predictable manner, consistent with the subsurface model-based predictions. Conformance monitoring tasks verify storage performance, that the build-up and migration of pore fluid pressures and CO₂ through time remain consistent with the range of forecasts and provide the necessary information to revise and narrow the range of forecasts whenever appropriate.

4.4.1 Model-Based Forecasts

Monitoring the CO₂ plume and pressure front may be achieved with a combination of direct and indirect techniques selected according to site-specific requirements.

Reservoir modelling incorporating the results of the latest well and data is currently ongoing to determine expected CO₂ and pressure plume extents. An expected range of outcomes will be developed for both the CO₂ plume and pressure front reflecting (in order of priority) the number of wells, the sweep efficiency, maximum CO₂ saturation, porosity, BCS reservoir thickness and heterogeneity, the CO₂ relative permeability and other reservoir parameters of minor effect. These results will form the baseline against which conformance will be history matched and updates made during the operating life of the field.

The pressure front associated with the CO₂ injection will extend beyond the area of the CO₂ plume. The radius of influence for pressure will depend mainly on the total injected volume, the maximum allowable bottom-hole pressure and the formation compressibility.

4.4.2 Monitoring

The monitoring program comprises:

- base-case activities that follow a planned schedule
- contingent activities that only occur if conformance monitoring does not perform to expectations or changes to the monitoring system need to be made due to non-conformance

For its base-case monitoring activities, Shell is considering the use of Interferometric Synthetic Aperture Radar (InSAR) and time-lapse seismic. InSAR is expected to provide essentially continuous monitoring of the footprint of pressure changes inside the BCS and time-lapse seismic is expected to track the CO₂ front moving behind this pressure front.

InSAR requires two years of monitoring prior to CO₂ injection to establish a baseline. Time-lapse seismic requires a single survey prior to CO₂ injection as a baseline and the last survey is scheduled two years before site closure to ensure the interpreted results are available to support the site closure process.

Shell's contingency monitoring plan for conformance focuses on the preparation of alternative monitoring systems as potential replacements for any under-performing monitoring technologies, as follows:

- If InSAR or time-lapse seismic prove insufficient within the first five years of injection, Shell may drill observation wells into the BCS to acquire direct measurements of pressure and ultimately CO₂ build-up at a very limited number of discrete locations.
- If InSAR monitoring proves insufficient, Shell may deploy corner reflectors at the surface to ensure sufficient reliable monitoring targets.

4.4.3 Reconciliation

Consistency between predicted and observed storage performance is required. This means demonstrating that no significant discrepancy exists between model-based predictions, the observed behaviour of the CO₂ plume and the region of significantly elevated fluid pressure inside the BCS storage complex. The definition of significance in the above remains to be discussed between the regulator and the Project proponents. One possible measure of a significant discrepancy indicating a loss of conformance could be that the discrepancy must exceed a certain threshold representing the combined uncertainties associated within an agreed detectable range of modelling and monitoring results. Otherwise, unsuitably large modeling or monitoring uncertainty may lead to undetected fluid migration within the storage complex.

It is expected that over time and with additional data availability the understanding of the reservoir will improve narrowing the range of predicted results so that by the time of closure all parties will be satisfied with the level of understanding of the reservoir and conformance has been achieved.

4.4.4 Forecast Updates

This section will be updated at regular intervals as agreed upon with the appropriate regulatory agencies and will be based on updated and recalibrated models as results and data become available.

5 Operating Plan Updates

5.1 Field Development Plan and Asset Management Plan

Shell is also in the process of finalizing the Field Development Plan (FDP) for the Project, which includes an Asset Management Plan. The FDP and future updates will form the key inputs to the closure plan. It contains the following elements that will be updated based on the injection history and monitoring results:

Field Development Plan

- capacity and injectivity estimates
- static and dynamic models and predicted long-term evolution of the storage site
- well locations, design, and construction or status changes
- uncertainty and risk assessment

Asset Management Plan

- integrated activity planning including monitoring frequency and scheduling with estimated sustainable injection rates and other operating data
- injection procedures including contingency plans for shut-ins and well failures
- schedule for modeling, simulation and risk and uncertainty assessments including calibration and update of static and predictive models through history matching of monitoring data
- schedule for updating of performance targets with up-to-date injection history and the results of modeling and monitoring

5.2 Measurement, Monitoring and Verification Plan

MMV activities aim to verify the absence of any significant environmental impacts due to CO₂ storage and if necessary, provide additional safeguards to prevent or correct any loss of containment before adverse impacts occur.

The MMV Plan (see Appendix A) is adaptive in nature and will be updated as needed. For example, if storage performance or the performance of monitoring technologies does not meet expectations, Shell will alter the MMV Plan and associated activities as appropriate.

6 Proposed Closure Activities

The stages of planning, implementing and closing of CCS projects have been developed by several organizations and government agencies to ensure that these projects are approached and executed in a safe and sustainable way, that is clear and transparent, and acceptable to stakeholders and regulators. Shell has contributed to the development of one such joint industry project lead by DNV in collaboration with other industry partners (DNV 2010a). The Det Norske Veritas (DNV) Report identifies and defines the systematic approach and objectives associated with closure activities of CCS projects.

6.1.1 Integrated System

The three components of the Project are:

- CO₂ capture infrastructure, which involves a process modification to the existing Scotford Upgrader
- a CO₂ pipeline, about 84 km in length, which will transport the CO₂ from the Scotford Upgrader to the injection wells. The CO₂ injection well locations are in the CO₂ storage AOI.
- a storage scheme consisting of 3 to 10 injection wells, which will inject the CO₂ into the BCS for permanent storage

This closure plan focuses on the storage component of the Project. However, this section provides a brief overview of the anticipated closure activities for the CO₂ capture infrastructure and the CO₂ pipeline.

CO₂ Capture Infrastructure

The CO₂ capture infrastructure is intended to be decommissioned at the end of the life of the Project (greater than 25 years), as part of the decommissioning of the Scotford Upgrader. Closure activities will be done in accordance with the regulatory requirements in place at the time and in alignment with the conceptual Conservation and Reclamation (C&R) Plan submitted as part of the Scotford Upgrader Applications.

CO₂ Pipeline

Construction of the pipeline will be guided by Shell's Environmental Protection Plan (EPP) with the goal of minimizing the environmental effects of the installation of the pipeline on lands along the ROW. Shell will execute its C&R Plan to carry out surface reclamation of the pipeline following construction. The goals of post-construction reclamation of the CO₂ pipeline are to achieve a surface landscape that is as similar to pre-disturbance conditions as practical, with respect to topography, equivalent land capability and vegetation community structure and distribution. It is not expected that the pipeline will require additional surface reclamation at the time of site closure.

The pipeline will be discontinued or abandoned in accordance with the regulatory requirements in place at the time. The remaining area of disturbance will be reclaimed and revegetated according to surface reclamation criteria in place at the time.

6.1.2 Storage Site

The subsurface infrastructure will be abandoned in accordance with the ERCB's Directive 020: Well Abandonment and Directive 072: Well Abandonment Notification Requirements, and any other requirements that are applicable at the time of closure.

The surface abandonment of the wells, well sites and access roads will be completed in accordance with the regulatory requirements of the day.

6.2 Well Decommissioning

Shell has developed a conceptual completion design for the Project wells, which includes a section on well decommissioning. It covers testing, subsurface isolation requirements and surface decommissioning procedures that adhere to both the regulatory requirements and Shell's internal requirements. The emphasis is on ensuring conformance and containment by using a phased approach as follows:

Pre-decommissioning period

- After CO₂ injection ends, an observation period will take place to monitor the BCS storage complex, during which time the injection wells will be suspended with the exception of their monitoring systems, which will continue to operate. The monitoring wells will continue to operate.
- The pre-decommissioning period ends once the observed behaviour of the BCS is in line with model-based predictions.

BCS isolation period

- Once the pre-decommissioning period ends, a cement plug will be set inside each injector to isolate the BCS. At this time, monitoring inside the BCS ends but the injectors can still be re-entered at this stage if necessary.
- Another observation period follows to confirm successful isolation of the BCS. Monitoring within injection wells will likely measure pressure and temperature changes above the cement plug.
- The BCS isolation period ends once monitoring demonstrates the isolation of the BCS has been effective.

Full decommissioning period

- Once the BCS isolation period ends, cement plugs will be set inside all project wells (injectors and MMV wells) and then these will be abandoned according to the regulatory requirements of the day.
- All in-well monitoring will end at this time.

According to any prior agreement, these plans may be modified to allow some in-well monitoring systems to be transferred to the Crown for monitoring during the post-closure period.

6.3 Well Pad Reclamation

Alberta's *Environmental Protection and Enhancement Act* and the Conservation and Reclamation Regulation require that, after an upstream oil and gas facility has been decommissioned, the operator must obtain a reclamation certificate.

Goals outlined by Shell in its C&R Plan for well pads include:

- returning the land disturbed by the Project to equivalent land capability at closure
- ensuring a stable, self-sustaining closure landscape (including landforms, soil, vegetation and hydrological regime)
- obtaining reclamation certificated for all disturbed areas after final decommissioning, abandonment and reclamation

The basic activities for final reclamation and establishing the closure landscape include, but are not limited to:

- abandoning and decommissioning facilities
- removing infrastructure
- remediating contaminated areas (if required)
- restoring grade and drainage
- alleviating compaction
- replacing subsoil and topsoil
- revegetating

Shell will monitor reclamation of soils and vegetation according to AENV's 2010 Reclamation Criteria for Wellsites and Associated Facilities for Forested Land.

6.4 Monitoring Infrastructure Decommissioning

Shell expects that monitoring infrastructure will be decommissioned at the end of the closure period with the exception of any monitoring infrastructure that will be transferred to the Crown by prior agreement.

All monitoring infrastructure is associated with wells or well pads and will be decommissioned as part of the well abandonment and well pad reclamation process described above.

7 Site Closure Certification

7.1 Post-Closure Monitoring Recommendations

Shell recognizes that the Government of Alberta may want Shell's advice and recommendations on the long-term monitoring approach following the closure of the Project. Experience with the MMV and finalized regulatory requirements regarding long-term monitoring will guide Shell's future advice to the Government of Alberta regarding any long-term post-closure monitoring requirements.

7.2 Transfer of Monitoring Infrastructure and Systems

Shell recognizes that the Government of Alberta may want select wells and associated monitoring infrastructure and systems to remain in place during the post-closure phase for continued monitoring by the government. Shell will work with the Crown to determine what infrastructure, if any, the government would like to maintain for monitoring purposes. Shell will abandon all other wells and infrastructure and reclaim the surface towards the end of the closure period, according to the regulatory requirements in place at the time.

7.3 Transfer of Measurement, Monitoring and Verification Capability

Shell will provide the Government of Alberta with its knowledge and experience of MMV activities and outcomes according to the terms in the CCS Funding Agreement for the Quest Project that is anticipated to successfully transfer MMV capability to the government, before the transfer of liability. This may take the form of workshops, provision of documents and/or presentations as determined by the appropriate parties at the time.

7.4 Site Closure Certificate

Shell will apply for a site closure certificate following the execution of site closure activities. The closure period before transfer of liability will be determined according to the strength of evidence obtained from the monitoring program that actual storage performance conforms to predicted performance. The performance metrics are described in Section 3.

Shell anticipates receipt of a site closure certificate 10 years after injection cessation, provided there are no significant issues arising from Project operations and that storage performance and CO₂ and brine containment in the BCS storage complex are demonstrated to the satisfaction of the Crown in accordance with pre-agreed criteria.

The post-closure period will occur following the issuance of a site closure certificate, which will transfer the long-term liability from Shell to the Crown.

8 Reporting and Documentation

8.1 Project Regulatory Applications

Shell will provide to ADOE an inventory of all Project reports and documents that have been submitted to provincial and federal government departments and agencies for the previous three years.

Shell has applied to the appropriate regulatory agencies for approval to construct, operate and reclaim the three components of the Project. Shell has also submitted an environmental assessment (EA) for the provincial and federal authorities.

8.1.1 CO₂ Storage

An application for the CO₂ storage scheme was submitted to the ERCB for a Class III disposal scheme pursuant to Part 6, Sections 11, 12 and 39 of the *Oil and Gas Conservation Act*, and Part 15 of the Oil and Gas Conservation Regulations, and in accordance with ERCB Directive 065: Resources Applications for Oil and Gas Reservoirs (Directive 65).

Shell has requested a Directive 65 CO₂ acid gas storage scheme approval that will provide Shell the ability to store Class III fluids by one well licence, provided all requirements of Directive 051: Injection and Disposal Wells – Well Classifications, Logging and Testing Requirements (Directive 51) are also met within specified periods.

8.1.2 Environmental Assessment

Government of Canada funding of the Project triggers the need for an EA, which will address all three components of the Project, under the *Canadian Environmental Assessment Act (CEAA; Section 5[1][b])*. The Canada–Alberta Agreement on Environmental Assessment Cooperation (the Agreement) guides federal-provincial cooperation for the environmental assessment of projects subject to both the *CEAA* and the Alberta *EPEA*. A single, cooperative EA consistent with the Agreement will be prepared by Shell to meet the requirements of both the *CEAA* and the *EPEA*.

9 References

- Det Norske Veritas (DNV). 2010a. *CO2QUALSTORE Report: Guideline for Selection, Characterization and Qualification of Sites and Projects for Geological Storage of CO₂*. Det Norske Veritas AS, Oslo, Norway.
- Det Norske Veritas (DNV). 2010b. *CO2QUALSTORE Workbook with examples of applications*. Det Norske Veritas AS, Oslo, Norway.
- European Parliament and the Council of the European Union. 2009. *Directive 2009/31/EC of the European Parliament and of the Council of 23 April, 2009 on the Geological Storage of Carbon Dioxide and Amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2204/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006*.
- Intergovernmental Panel on Climate Change (IPCC). 2006. *IPCC Guidelines for National Greenhouse Gas Inventories: Chapter 5 Carbon Dioxide Transport, Injection and Geological Storage*. S. Holloway, A. Karimjee, M. Akai, R. Pipatti, and K. Rypdal.

Appendix D Sequestration Leases

Government of Alberta ■

Energy

**CARBON SEQUESTRATION LEASE
NO. 5911050001**

Term Commencement Date: May 27, 2011

Lessee:

SHELL CANADA LIMITED

100.0000000%

WHEREAS Her Majesty is the owner of the pore space in respect of which rights are granted under this Lease;

THEREFORE, subject to the terms and conditions of this Lease, Her Majesty grants to the Lessee, insofar as Her Majesty has the right to grant the same, the right to drill wells, conduct evaluation and testing and inject captured carbon dioxide into deep subsurface reservoirs within the Location for the term of fifteen (15) years computed from the Term Commencement Date and renewable under and in accordance with the *Mines and Minerals Act* and *Carbon Sequestration Tenure Regulation* (AR 68/2011), and subject to the terms and conditions prescribed by the Minister in relation to each renewal;

RESERVING AND PAYING to Her Majesty, in respect of each year during which this Lease remains in effect, a clear yearly rental computed at the rate prescribed by and payable in accordance with the *Mines and Minerals Act*;

- 1.(1) In this Lease, a reference to the *Mines and Minerals Act* or to any other Act of the Legislature of Alberta referred to in section 2(2)(b) of this Lease shall be construed as a reference to
 - (a) that Act, as amended from time to time,
 - (b) any replacement of all or part of that Act from time to time enacted by the Legislature, as amended from time to time, and
 - (c) any regulations, orders, directives or other subordinate legislation from time to time made under any enactment referred to in clause (a) or (b), as amended from time to time.
- (2) In this Lease,
 - (a) "Her Majesty" means Her Majesty in right of Alberta, as represented by the Minister of Energy of the Province of Alberta;
 - (b) "Location" means the subsurface area or areas underlying the surface area of the tract or tracts of land described under the heading "Description of Location" in the Appendix to this Lease;
 - (c) "Term Commencement Date" means the date shown on the first page of this Lease as the Term Commencement Date;
2. This Lease is granted upon the following conditions:
 - (1) The Lessee shall pay to Her Majesty the rental reserved under this Lease.
 - (2) The Lessee shall comply with the provisions of
 - (a) the *Mines and Minerals Act*, and
 - (b) the *Oil and Gas Conservation Act* or any other Acts of the Legislature of Alberta that prescribe, apply to or affect the rights and obligations of a Lessee to inject captured carbon dioxide into a deep subsurface reservoir for sequestration, or that relate to, apply to or affect the Lessee in the conduct of its operations or activities under this Lease.

- (3) The provisions of the Acts referred to in subsection (2) are deemed to be incorporated in this Lease.
- (4) In the event of conflict between a provision of this Lease and a provision referred to in subsection (2), the latter provision prevails.
- (5) The Lessee shall not claim or purport to exercise any rights, prerogatives, privileges or immunities that would otherwise exempt the Lessee from compliance with any of the provisions of the *Mines and Minerals Act* or of any other Act of the Legislature of Alberta referred to in subsection (2)(b).
- (6) The Lessee does not have the right to win, work or recover any minerals found within the Location.
- (7) The Lessee shall keep Her Majesty indemnified against
 - (a) all actions, claims and demands brought or made against Her Majesty by reason of anything done or omitted to be done, whether negligently or otherwise, by the Lessee or any other person in the exercise or purported exercise of the rights granted and duties imposed under this Lease, and
 - (b) all losses, damages, costs, charges and expenses that Her Majesty sustains or incurs in connection with any action, claim or demand referred to in clause (a).
- (8) The use in this Lease of the word "Lessee", "Lease", or "rental," or of any other word or expression,
 - (a) does not create any implied covenant or implied liability on the part of Her Majesty, and
 - (b) does not create the relationship of landlord and tenant between Her Majesty and the Lessee for any purpose.
- (9) This Lease is also subject to the special provisions, if any, contained in the Appendix to this Lease.

EXECUTED on behalf of the Minister of Energy of the Province of Alberta at Edmonton, Alberta.



For Minister of Energy
on behalf of Her Majesty

APPENDIX

TO

CARBON SEQUESTRATION LEASE NO. 5911050001

TERM COMMENCEMENT DATE:

MAY 27, 2011

AGGREGATE AREA:

73 728 HECTARES

DESCRIPTION OF LOCATION:

4-18-059: 1-36

4-18-060: 1-36

4-18-061: 1-36

4-19-059: 1-36

4-19-060: 1-36

4-19-061: 1-36

4-19-062: 1-36

4-20-060: 1-36

PORE SPACE BELOW THE TOP OF THE ELK POINT GRP
AS DESIGNATED IN D00284

INTERVAL: 783.00 - 1370.00 METERS

KEY WELL: 02/06-13-063-08W4/00

LOG TYPE: COMPENSATED NEUTRON-LITHO DENSITY

SPECIAL PROVISIONS:

NIL

**CARBON SEQUESTRATION LEASE
NO. 5911050002**

Term Commencement Date: May 27, 2011

Lessee:

SHELL CANADA LIMITED

100.0000000%

WHEREAS Her Majesty is the owner of the pore space in respect of which rights are granted under this Lease;

THEREFORE, subject to the terms and conditions of this Lease, Her Majesty grants to the Lessee, insofar as Her Majesty has the right to grant the same, the right to drill wells, conduct evaluation and testing and inject captured carbon dioxide into deep subsurface reservoirs within the Location for the term of fifteen (15) years computed from the Term Commencement Date and renewable under and in accordance with the *Mines and Minerals Act* and *Carbon Sequestration Tenure Regulation (AR 68/2011)*, and subject to the terms and conditions prescribed by the Minister in relation to each renewal;

RESERVING AND PAYING to Her Majesty, in respect of each year during which this Lease remains in effect, a clear yearly rental computed at the rate prescribed by and payable in accordance with the *Mines and Minerals Act*;

- 1.(1) In this Lease, a reference to the *Mines and Minerals Act* or to any other Act of the Legislature of Alberta referred to in section 2(2)(b) of this Lease shall be construed as a reference to
 - (a) that Act, as amended from time to time,
 - (b) any replacement of all or part of that Act from time to time enacted by the Legislature, as amended from time to time, and
 - (c) any regulations, orders, directives or other subordinate legislation from time to time made under any enactment referred to in clause (a) or (b), as amended from time to time.
- (2) In this Lease,
 - (a) "Her Majesty" means Her Majesty in right of Alberta, as represented by the Minister of Energy of the Province of Alberta;
 - (b) "Location" means the subsurface area or areas underlying the surface area of the tract or tracts of land described under the heading "Description of Location" in the Appendix to this Lease;
 - (c) "Term Commencement Date" means the date shown on the first page of this Lease as the Term Commencement Date;
2. This Lease is granted upon the following conditions:
 - (1) The Lessee shall pay to Her Majesty the rental reserved under this Lease.
 - (2) The Lessee shall comply with the provisions of
 - (a) the *Mines and Minerals Act*, and
 - (b) the *Oil and Gas Conservation Act* or any other Acts of the Legislature of Alberta that prescribe, apply to or affect the rights and obligations of a Lessee to inject captured carbon dioxide into a deep subsurface reservoir for sequestration, or that relate to, apply to or affect the Lessee in the conduct of its operations or activities under this Lease.

- (3) The provisions of the Acts referred to in subsection (2) are deemed to be incorporated in this Lease.
- (4) In the event of conflict between a provision of this Lease and a provision referred to in subsection (2), the latter provision prevails.
- (5) The Lessee shall not claim or purport to exercise any rights, prerogatives, privileges or immunities that would otherwise exempt the Lessee from compliance with any of the provisions of the *Mines and Minerals Act* or of any other Act of the Legislature of Alberta referred to in subsection (2)(b).
- (6) The Lessee does not have the right to win, work or recover any minerals found within the Location.
- (7) The Lessee shall keep Her Majesty indemnified against
 - (a) all actions, claims and demands brought or made against Her Majesty by reason of anything done or omitted to be done, whether negligently or otherwise, by the Lessee or any other person in the exercise or purported exercise of the rights granted and duties imposed under this Lease, and
 - (b) all losses, damages, costs, charges and expenses that Her Majesty sustains or incurs in connection with any action, claim or demand referred to in clause (a).
- (8) The use in this Lease of the word "Lessee", "Lease", or "rental," or of any other word or expression,
 - (a) does not create any implied covenant or implied liability on the part of Her Majesty, and
 - (b) does not create the relationship of landlord and tenant between Her Majesty and the Lessee for any purpose.
- (9) This Lease is also subject to the special provisions, if any, contained in the Appendix to this Lease.

EXECUTED on behalf of the Minister of Energy of the Province of Alberta at Edmonton, Alberta.



For Minister of Energy
on behalf of Her Majesty

APPENDIX

TO

CARBON SEQUESTRATION LEASE NO. 5911050002

TERM COMMENCEMENT DATE:

MAY 27, 2011

AGGREGATE AREA:

64 512 HECTARES

DESCRIPTION OF LOCATION:

4-19-056: 1-36

4-19-057: 1-36

4-19-058: 1-36

4-20-056: 1-36

4-20-057: 1-36

4-20-058: 1-36

4-20-059: 1-36

PORE SPACE BELOW THE TOP OF THE ELK POINT GRP
AS DESIGNATED IN D00284

INTERVAL: 783.00 - 1370.00 METERS

KEY WELL: 02/06-13-063-08W4/00

LOG TYPE: COMPENSATED NEUTRON-LITHO DENSITY

SPECIAL PROVISIONS:

NIL

Government of Alberta ■

Energy

**CARBON SEQUESTRATION LEASE
NO. 5911050003**

Term Commencement Date: May 27, 2011

Lessee:

SHELL CANADA LIMITED

100.0000000%

WHEREAS Her Majesty is the owner of the pore space in respect of which rights are granted under this Lease;

THEREFORE, subject to the terms and conditions of this Lease, Her Majesty grants to the Lessee, insofar as Her Majesty has the right to grant the same, the right to drill wells, conduct evaluation and testing and inject captured carbon dioxide into deep subsurface reservoirs within the Location for the term of fifteen (15) years computed from the Term Commencement Date and renewable under and in accordance with the *Mines and Minerals Act* and *Carbon Sequestration Tenure Regulation* (AR 68/2011), and subject to the terms and conditions prescribed by the Minister in relation to each renewal;

RESERVING AND PAYING to Her Majesty, in respect of each year during which this Lease remains in effect, a clear yearly rental computed at the rate prescribed by and payable in accordance with the *Mines and Minerals Act*;

- 1.(1) In this Lease, a reference to the *Mines and Minerals Act* or to any other Act of the Legislature of Alberta referred to in section 2(2)(b) of this Lease shall be construed as a reference to
 - (a) that Act, as amended from time to time,
 - (b) any replacement of all or part of that Act from time to time enacted by the Legislature, as amended from time to time, and
 - (c) any regulations, orders, directives or other subordinate legislation from time to time made under any enactment referred to in clause (a) or (b), as amended from time to time.
- (2) In this Lease,
 - (a) "Her Majesty" means Her Majesty in right of Alberta, as represented by the Minister of Energy of the Province of Alberta;
 - (b) "Location" means the subsurface area or areas underlying the surface area of the tract or tracts of land described under the heading "Description of Location" in the Appendix to this Lease;
 - (c) "Term Commencement Date" means the date shown on the first page of this Lease as the Term Commencement Date;
2. This Lease is granted upon the following conditions:
 - (1) The Lessee shall pay to Her Majesty the rental reserved under this Lease.
 - (2) The Lessee shall comply with the provisions of
 - (a) the *Mines and Minerals Act*, and
 - (b) the *Oil and Gas Conservation Act* or any other Acts of the Legislature of Alberta that prescribe, apply to or affect the rights and obligations of a Lessee to inject captured carbon dioxide into a deep subsurface reservoir for sequestration, or that relate to, apply to or affect the Lessee in the conduct of its operations or activities under this Lease.

- (3) The provisions of the Acts referred to in subsection (2) are deemed to be incorporated in this Lease.
- (4) In the event of conflict between a provision of this Lease and a provision referred to in subsection (2), the latter provision prevails.
- (5) The Lessee shall not claim or purport to exercise any rights, prerogatives, privileges or immunities that would otherwise exempt the Lessee from compliance with any of the provisions of the *Mines and Minerals Act* or of any other Act of the Legislature of Alberta referred to in subsection (2)(b).
- (6) The Lessee does not have the right to win, work or recover any minerals found within the Location.
- (7) The Lessee shall keep Her Majesty indemnified against
 - (a) all actions, claims and demands brought or made against Her Majesty by reason of anything done or omitted to be done, whether negligently or otherwise, by the Lessee or any other person in the exercise or purported exercise of the rights granted and duties imposed under this Lease, and
 - (b) all losses, damages, costs, charges and expenses that Her Majesty sustains or incurs in connection with any action, claim or demand referred to in clause (a).
- (8) The use in this Lease of the word "Lessee", "Lease", or "rental," or of any other word or expression,
 - (a) does not create any implied covenant or implied liability on the part of Her Majesty, and
 - (b) does not create the relationship of landlord and tenant between Her Majesty and the Lessee for any purpose.
- (9) This Lease is also subject to the special provisions, if any, contained in the Appendix to this Lease.

EXECUTED on behalf of the Minister of Energy of the Province of Alberta at Edmonton, Alberta.



For Minister of Energy
on behalf of Her Majesty

APPENDIX

TO

CARBON SEQUESTRATION LEASE NO. 5911050003

TERM COMMENCEMENT DATE:

MAY 27, 2011

AGGREGATE AREA:

64 512 HECTARES

DESCRIPTION OF LOCATION:

4-20-061: 1-36

4-20-062: 1-36

4-20-063: 1-36

4-21-060: 1-36

4-21-061: 1-36

4-21-062: 1-36

4-21-063: 1-36

PORE SPACE BELOW THE TOP OF THE ELK POINT GRP
AS DESIGNATED IN D00284

INTERVAL: 783.00 - 1370.00 METERS

KEY WELL: 02/06-13-063-08W4/00

LOG TYPE: COMPENSATED NEUTRON-LITHO DENSITY

SPECIAL PROVISIONS:

NIL

**CARBON SEQUESTRATION LEASE
NO. 5911050004**

Term Commencement Date: May 27, 2011

Lessee:

SHELL CANADA LIMITED

100.0000000%

WHEREAS Her Majesty is the owner of the pore space in respect of which rights are granted under this Lease;

THEREFORE, subject to the terms and conditions of this Lease, Her Majesty grants to the Lessee, insofar as Her Majesty has the right to grant the same, the right to drill wells, conduct evaluation and testing and inject captured carbon dioxide into deep subsurface reservoirs within the Location for the term of fifteen (15) years computed from the Term Commencement Date and renewable under and in accordance with the *Mines and Minerals Act* and *Carbon Sequestration Tenure Regulation* (AR 68/2011), and subject to the terms and conditions prescribed by the Minister in relation to each renewal;

RESERVING AND PAYING to Her Majesty, in respect of each year during which this Lease remains in effect, a clear yearly rental computed at the rate prescribed by and payable in accordance with the *Mines and Minerals Act*;

- 1.(1) In this Lease, a reference to the *Mines and Minerals Act* or to any other Act of the Legislature of Alberta referred to in section 2(2)(b) of this Lease shall be construed as a reference to
 - (a) that Act, as amended from time to time,
 - (b) any replacement of all or part of that Act from time to time enacted by the Legislature, as amended from time to time, and
 - (c) any regulations, orders, directives or other subordinate legislation from time to time made under any enactment referred to in clause (a) or (b), as amended from time to time.
- (2) In this Lease,
 - (a) "Her Majesty" means Her Majesty in right of Alberta, as represented by the Minister of Energy of the Province of Alberta;
 - (b) "Location" means the subsurface area or areas underlying the surface area of the tract or tracts of land described under the heading "Description of Location" in the Appendix to this Lease;
 - (c) "Term Commencement Date" means the date shown on the first page of this Lease as the Term Commencement Date;
2. This Lease is granted upon the following conditions:
 - (1) The Lessee shall pay to Her Majesty the rental reserved under this Lease.
 - (2) The Lessee shall comply with the provisions of
 - (a) the *Mines and Minerals Act*, and
 - (b) the *Oil and Gas Conservation Act* or any other Acts of the Legislature of Alberta that prescribe, apply to or affect the rights and obligations of a Lessee to inject captured carbon dioxide into a deep subsurface reservoir for sequestration, or that relate to, apply to or affect the Lessee in the conduct of its operations or activities under this Lease.

- (3) The provisions of the Acts referred to in subsection (2) are deemed to be incorporated in this Lease.
- (4) In the event of conflict between a provision of this Lease and a provision referred to in subsection (2), the latter provision prevails.
- (5) The Lessee shall not claim or purport to exercise any rights, prerogatives, privileges or immunities that would otherwise exempt the Lessee from compliance with any of the provisions of the *Mines and Minerals Act* or of any other Act of the Legislature of Alberta referred to in subsection (2)(b).
- (6) The Lessee does not have the right to win, work or recover any minerals found within the Location.
- (7) The Lessee shall keep Her Majesty indemnified against
 - (a) all actions, claims and demands brought or made against Her Majesty by reason of anything done or omitted to be done, whether negligently or otherwise, by the Lessee or any other person in the exercise or purported exercise of the rights granted and duties imposed under this Lease, and
 - (b) all losses, damages, costs, charges and expenses that Her Majesty sustains or incurs in connection with any action, claim or demand referred to in clause (a).
- (8) The use in this Lease of the word "Lessee", "Lease", or "rental," or of any other word or expression,
 - (a) does not create any implied covenant or implied liability on the part of Her Majesty, and
 - (b) does not create the relationship of landlord and tenant between Her Majesty and the Lessee for any purpose.
- (9) This Lease is also subject to the special provisions, if any, contained in the Appendix to this Lease.

EXECUTED on behalf of the Minister of Energy of the Province of Alberta at Edmonton, Alberta.



For Minister of Energy
on behalf of Her Majesty

APPENDIX

TO

CARBON SEQUESTRATION LEASE NO. 5911050004

TERM COMMENCEMENT DATE:

MAY 27, 2011

AGGREGATE AREA:

49 152 HECTARES

DESCRIPTION OF LOCATION:

4-21-056: 25-36

4-21-057: 1-36

4-21-058: 1-36

4-21-059: 1-36

4-22-057: 1-36

4-22-058: 1-36

PORE SPACE BELOW THE TOP OF THE ELK POINT GRP
AS DESIGNATED IN D00284

INTERVAL: 783.00 - 1370.00 METERS

KEY WELL: 02/06-13-063-08W4/00

LOG TYPE: COMPENSATED NEUTRON-LITHO DENSITY

SPECIAL PROVISIONS:

NIL

**CARBON SEQUESTRATION LEASE
NO. 5911050005**

Term Commencement Date: May 27, 2011

Lessee:

SHELL CANADA LIMITED

100.0000000%

WHEREAS Her Majesty is the owner of the pore space in respect of which rights are granted under this Lease;

THEREFORE, subject to the terms and conditions of this Lease, Her Majesty grants to the Lessee, insofar as Her Majesty has the right to grant the same, the right to drill wells, conduct evaluation and testing and inject captured carbon dioxide into deep subsurface reservoirs within the Location for the term of fifteen (15) years computed from the Term Commencement Date and renewable under and in accordance with the *Mines and Minerals Act* and *Carbon Sequestration Tenure Regulation* (AR 68/2011), and subject to the terms and conditions prescribed by the Minister in relation to each renewal;

RESERVING AND PAYING to Her Majesty, in respect of each year during which this Lease remains in effect, a clear yearly rental computed at the rate prescribed by and payable in accordance with the *Mines and Minerals Act*;

- 1.(1) In this Lease, a reference to the *Mines and Minerals Act* or to any other Act of the Legislature of Alberta referred to in section 2(2)(b) of this Lease shall be construed as a reference to
 - (a) that Act, as amended from time to time,
 - (b) any replacement of all or part of that Act from time to time enacted by the Legislature, as amended from time to time, and
 - (c) any regulations, orders, directives or other subordinate legislation from time to time made under any enactment referred to in clause (a) or (b), as amended from time to time.
- (2) In this Lease,
 - (a) "Her Majesty" means Her Majesty in right of Alberta, as represented by the Minister of Energy of the Province of Alberta;
 - (b) "Location" means the subsurface area or areas underlying the surface area of the tract or tracts of land described under the heading "Description of Location" in the Appendix to this Lease;
 - (c) "Term Commencement Date" means the date shown on the first page of this Lease as the Term Commencement Date;
2. This Lease is granted upon the following conditions:
 - (1) The Lessee shall pay to Her Majesty the rental reserved under this Lease.
 - (2) The Lessee shall comply with the provisions of
 - (a) the *Mines and Minerals Act*, and
 - (b) the *Oil and Gas Conservation Act* or any other Acts of the Legislature of Alberta that prescribe, apply to or affect the rights and obligations of a Lessee to inject captured carbon dioxide into a deep subsurface reservoir for sequestration, or that relate to, apply to or affect the Lessee in the conduct of its operations or activities under this Lease.

- (3) The provisions of the Acts referred to in subsection (2) are deemed to be incorporated in this Lease.
- (4) In the event of conflict between a provision of this Lease and a provision referred to in subsection (2), the latter provision prevails.
- (5) The Lessee shall not claim or purport to exercise any rights, prerogatives, privileges or immunities that would otherwise exempt the Lessee from compliance with any of the provisions of the *Mines and Minerals Act* or of any other Act of the Legislature of Alberta referred to in subsection (2)(b).
- (6) The Lessee does not have the right to win, work or recover any minerals found within the Location.
- (7) The Lessee shall keep Her Majesty indemnified against
 - (a) all actions, claims and demands brought or made against Her Majesty by reason of anything done or omitted to be done, whether negligently or otherwise, by the Lessee or any other person in the exercise or purported exercise of the rights granted and duties imposed under this Lease, and
 - (b) all losses, damages, costs, charges and expenses that Her Majesty sustains or incurs in connection with any action, claim or demand referred to in clause (a).
- (8) The use in this Lease of the word "Lessee", "Lease", or "rental," or of any other word or expression,
 - (a) does not create any implied covenant or implied liability on the part of Her Majesty, and
 - (b) does not create the relationship of landlord and tenant between Her Majesty and the Lessee for any purpose.
- (9) This Lease is also subject to the special provisions, if any, contained in the Appendix to this Lease.

EXECUTED on behalf of the Minister of Energy of the Province of Alberta at Edmonton, Alberta.



For Minister of Energy
on behalf of Her Majesty

APPENDIX

TO

CARBON SEQUESTRATION LEASE NO. 5911050005

TERM COMMENCEMENT DATE:

MAY 27, 2011

AGGREGATE AREA:

55 296 HECTARES

DESCRIPTION OF LOCATION:

4-22-059: 1-36

4-22-060: 1-36

4-23-058: 1-36

4-23-059: 1-36

4-23-060: 1-36

4-24-060: 1-36

PORE SPACE BELOW THE TOP OF THE ELK POINT GRP
AS DESIGNATED IN D00284

INTERVAL: 783.00 - 1370.00 METERS

KEY WELL: 02/06-13-063-08W4/00

LOG TYPE: COMPENSATED NEUTRON-LITHO DENSITY

SPECIAL PROVISIONS:

NIL

**CARBON SEQUESTRATION LEASE
NO. 5911050006**

Term Commencement Date: May 27, 2011

Lessee:

SHELL CANADA LIMITED

100.0000000%

WHEREAS Her Majesty is the owner of the pore space in respect of which rights are granted under this Lease;

THEREFORE, subject to the terms and conditions of this Lease, Her Majesty grants to the Lessee, insofar as Her Majesty has the right to grant the same, the right to drill wells, conduct evaluation and testing and inject captured carbon dioxide into deep subsurface reservoirs within the Location for the term of fifteen (15) years computed from the Term Commencement Date and renewable under and in accordance with the *Mines and Minerals Act* and *Carbon Sequestration Tenure Regulation* (AR 68/2011), and subject to the terms and conditions prescribed by the Minister in relation to each renewal;

RESERVING AND PAYING to Her Majesty, in respect of each year during which this Lease remains in effect, a clear yearly rental computed at the rate prescribed by and payable in accordance with the *Mines and Minerals Act*;

1.(1) In this Lease, a reference to the *Mines and Minerals Act* or to any other Act of the Legislature of Alberta referred to in section 2(2)(b) of this Lease shall be construed as a reference to

- (a) that Act, as amended from time to time,
- (b) any replacement of all or part of that Act from time to time enacted by the Legislature, as amended from time to time, and
- (c) any regulations, orders, directives or other subordinate legislation from time to time made under any enactment referred to in clause (a) or (b), as amended from time to time.

(2) In this Lease,

- (a) "Her Majesty" means Her Majesty in right of Alberta, as represented by the Minister of Energy of the Province of Alberta;
- (b) "Location" means the subsurface area or areas underlying the surface area of the tract or tracts of land described under the heading "Description of Location" in the Appendix to this Lease;
- (c) "Term Commencement Date" means the date shown on the first page of this Lease as the Term Commencement Date;

2. This Lease is granted upon the following conditions:

(1) The Lessee shall pay to Her Majesty the rental reserved under this Lease.

(2) The Lessee shall comply with the provisions of

- (a) the *Mines and Minerals Act*, and
- (b) the *Oil and Gas Conservation Act* or any other Acts of the Legislature of Alberta that prescribe, apply to or affect the rights and obligations of a Lessee to inject captured carbon dioxide into a deep subsurface reservoir for sequestration, or that relate to, apply to or affect the Lessee in the conduct of its operations or activities under this Lease.

- (3) The provisions of the Acts referred to in subsection (2) are deemed to be incorporated in this Lease.
- (4) In the event of conflict between a provision of this Lease and a provision referred to in subsection (2), the latter provision prevails.
- (5) The Lessee shall not claim or purport to exercise any rights, prerogatives, privileges or immunities that would otherwise exempt the Lessee from compliance with any of the provisions of the *Mines and Minerals Act* or of any other Act of the Legislature of Alberta referred to in subsection (2)(b).
- (6) The Lessee does not have the right to win, work or recover any minerals found within the Location.
- (7) The Lessee shall keep Her Majesty indemnified against
 - (a) all actions, claims and demands brought or made against Her Majesty by reason of anything done or omitted to be done, whether negligently or otherwise, by the Lessee or any other person in the exercise or purported exercise of the rights granted and duties imposed under this Lease, and
 - (b) all losses, damages, costs, charges and expenses that Her Majesty sustains or incurs in connection with any action, claim or demand referred to in clause (a).
- (8) The use in this Lease of the word "Lessee", "Lease", or "rental," or of any other word or expression,
 - (a) does not create any implied covenant or implied liability on the part of Her Majesty, and
 - (b) does not create the relationship of landlord and tenant between Her Majesty and the Lessee for any purpose.
- (9) This Lease is also subject to the special provisions, if any, contained in the Appendix to this Lease.

EXECUTED on behalf of the Minister of Energy of the Province of Alberta at Edmonton, Alberta.



For Minister of Energy
on behalf of Her Majesty

APPENDIX

TO

CARBON SEQUESTRATION LEASE NO. 5911050006

TERM COMMENCEMENT DATE:

MAY 27, 2011

AGGREGATE AREA:

55 296 HECTARES

DESCRIPTION OF LOCATION:

4-22-061: 1-36

4-22-062: 1-36

4-22-063: 1-36

4-23-061: 1-36

4-23-062: 1-36

4-24-061: 1-36

PORE SPACE BELOW THE TOP OF THE ELK POINT GRP
AS DESIGNATED IN D00284

INTERVAL: 783.00 - 1370.00 METERS

KEY WELL: 02/06-13-063-08W4/00

LOG TYPE: COMPENSATED NEUTRON-LITHO DENSITY

SPECIAL PROVISIONS:

NIL

Appendix E Public Consultation and Notification – November 16, 2010 to May 13, 2011

E.1 Update of Public Consultation Activities

Table E.1-1 Consultation Activities, November 2010

Date	Activity	Stakeholder
16	Email to ASRD regarding First Nations group asserting that Shell's Quest CCS Project is affecting their traditional lands.	ASRD
17	Letter to stakeholder advising that Shell was sending a CD copy of the Quest CCS Project applications.	Local stakeholder
17	Shell email response to stakeholder's email after the Quest Project open house in Bruderheim.	Local stakeholder
26	Thank you letter received from Athabasca-Redwater Member of the Legislative Assembly (MLA) to a Shell representative after the Quest CCS Project community open houses.	Athabasca-Redwater MLA

Table E.1-2 Consultation Activities, December 2010

Date	Activity	Stakeholder
1	Notification letter to First Nations and Métis groups advising that the Quest CCS Project environmental impact assessment (EIA) and applications had been filed.	First Nations and Métis Groups
1	Letter notification to Scotford neighbours within 5 km, advising that Shell had submitted regulatory applications, where the applications could be viewed, and providing Shell contact information.	Scotford neighbours within 5 km
2	Consultation update sent to the Canadian Environmental Assessment (CEA) Agency via email, including copies of EIA notification sent to First Nations and Métis groups.	Canadian Environmental Assessment (CEA) Agency
6	Phone calls to local county offices requesting space to have the Quest CCS Project applications available for public viewing.	County offices within the Quest CCS Project boundary
7	Request from Athabasca-Redwater MLA for CD copies of the Quest CCS Project applications.	Athabasca-Redwater MLA
9	Local stakeholder called Quest toll-free telephone line requesting contact.	Local landowner
17	Email request for a copy of the Quest CCS Project update for a compendium report, sponsored by Natural Resources Canada, of Canadian activities related to CO ₂ capture and storage.	Consultant
21	Letter and copy of CD copy of Quest CCS Project applications sent.	Athabasca-Redwater MLA
31	Email from China to ask whether the Quest CCS Project offered any opportunity for the Chinese company to visit Shell's site. Inquiry was directed to the Quest CCS Project Group.	Individual

Table E.1-3 Consultation Activities, January 2011

Date	Activity	Stakeholder
6	Received copies of letter notification sent to First Nations and Métis groups about the Quest CCS Project EIA.	CEA Agency
7	Media call to the Quest toll-free telephone line about publishing a story on the Quest CCS Project. Shell communications department responded.	Media
17	Email request for a meeting to discuss the Quest CCS Project. Shell confirmed the meeting for February 24, 2011.	Saddle Lake Cree Nation
17	Telephone calls to local municipal representatives in response to Weyburn landowner concerns.	Local municipalities
21	Emails to local municipal representatives to provide a copy of the Petroleum Technology Resource Centre (PTRC) news release dated January 19, 2011.	Local municipalities
24	Letter notification to landowner and occupants and the County about surrendering well licence.	Local landowners, occupants and municipality
25	Law firm request, via the Quest toll-free telephone line, for a copy of the ERCB applications.	Interested party
27	Shell email to Lamont County representative, requesting a copy of the letter to the editor in the Lamont Leader newspaper about CCS concerns.	Lamont County representative

Table E.1-4 Consultation Activities, February 2011

Date	Activity	Stakeholder
7	Stakeholder called with concerns about the Quest CCS Project using hydraulic fracturing. Shell sent the stakeholder a letter and a copy of the Shell Measuring, Monitoring and Verification Plan, results of his water well testing from early 2010 after seismic activity, and the PTRC press release and report about Weyburn.	Local stakeholder
8	Shell provided Thorhild, Lamont and Sturgeon County Councils with a project update.	Local county councils
15	Email response by Shell to questions on February 8 about over-pressure protection design for the proposed CO ₂ pipeline.	Lamont County representative
21	Shell follow-up call to confirm that the stakeholder had received the Quest CCS Project Public Information Package and the December 1, 2010 notification letter about the Quest CCS Project application filing. Shell offered a face-to-face meeting with the stakeholder.	Local stakeholder
21	Follow-up call to confirm that the stakeholder had received the Quest CCS Project Public Information Package sent by mail to them in November 2010 and the December 1, 2010 notification letter about the Quest CCS Project application filing, where to find copies. Shell offered a face-to-face meeting with the stakeholder.	Local stakeholder
21	Follow-up call to confirm that the stakeholder had received the Quest CCS Project Public Information Package and the December 1, 2010 notification letter about the Quest CCS Project filing. Shell offered a face-to-face meeting with the stakeholder.	Local stakeholder
21	Follow-up call to confirm that the stakeholder had received the Quest CCS Project Public Information Package and the December 1, 2010 notification letter about the Quest CCS Project filing. Shell offered a face-to-face meeting with the stakeholder.	Local stakeholder
22	Follow-up call to confirm that the stakeholder had received the Quest CCS Project Public Information Package and the December 1, 2010 notification letter about the Quest CCS Project filing. Shell offered a face-to-face meeting with the stakeholder.	Local stakeholder
22	Follow-up call to confirm that the stakeholder had received the Quest CCS Project Public Information Package and the December 1, 2010 notification letter about the Quest CCS Project filing. Shell offered a face-to-face meeting with the stakeholder.	Local stakeholder
23	Shell sent a copy of the December 1, 2010 notification letter about the Quest CCS Project filing to a local stakeholder who was unsure if they had received the letter.	Local stakeholder
25	Follow-up call to confirm that the stakeholder had received the Quest CCS Project Public Information Package and the December 1, 2010 notification letter about the Quest CCS Project filing. Shell offered a face-to-face meeting with the stakeholder.	Local stakeholder

Table E.1-5 Consultation Activities, March 2011

Date	Activity	Stakeholder
1	Local county office emailed to ask how long they needed to have the Quest CCS Project applications available for the public.	Local county office
1	ASRD visited site where landowner had water well flow issues. ASRD could not support that seismic activity had affected well flow. Suggested support through water well recovery program.	Local landowner
7	Mailed the Quest CCS Project Public Information Package and the December 1, 2010 notification letter about the Quest CCS Project filing.	Local landowner
8	Shell provided project update to Strathcona County and City of Fort Saskatchewan Councils.	County and Town councils
10	Notification letters sent to 11 landowners and occupants advising them that Shell had rerouted the pipeline around their lands and they were no longer within the pipeline ROW.	Local landowners and occupants no longer within the pipeline ROW
15	Email request from educational institution interested in Quest EIA procedure. Quest CCS Project CD sent.	Interested party
15	Email inquiry about project information related to funding.	Interested party
16	Shell sent letter summarizing February 24 meeting.	Saddle Lake Cree
21	Notification letters sent to 14 landowners and occupants advising them that they were no longer within the 450 m EPZ of the Quest CO ₂ pipeline due to pipeline rerouting.	Local landowners and occupants

Table E.1-6 Consultation Activities, April 2011

Date	Activity	Stakeholder
6	Shell received a request for a copy of the Quest CCS Project EIA on CD. The CD and a cover letter were sent by mail on April 8, 2011.	Interested party
7	Landowner's well water is murky. ASRD inspector visited the site and discovered a leak from a pitless adapter. A Shell representative spoke with water well driller about options for the landowner.	Local landowner
14	Landowner contacted Shell seismic representative about water well problems (water shortage and discolouration) after seismic activity at the end of November 2010. Shell provided the name of the ASRD representative to initiate a claim. Water well was tested before and after seismic activity.	Local stakeholder
19	Discussion with a Shell Scotford neighbour (a nonresident landowner) about the concern of decaying trees on his land. Follow-up to occur later in later May when trees are in bloom, to determine the next steps.	Local landowner
25	Face-to-face meeting with the Shell Scotford neighbour to provide a Quest CCS Project overview and a CD of regulatory applications.	Local stakeholder
29	Shell representatives met with the Thorhild County Manager and emergency response coordinator to discuss local business opportunities, social investment and the upcoming Quest event on June 6, 2011 for key community members.	County representatives

Table E.1-7 Consultation Activities, May 2011

Date	Activity	Stakeholder
4	Shell representatives met with a landowner and hydrogeologist at the landowner's home about crevices in the landowner's land. Photos were taken and the expert was to provide a report of his findings. The expert could not determine the cause, but said it would not be due to Shell operations because of the distance from the site.	Local stakeholder
5	Landowner contacted Shell seismic to advise that he was going to drill a water well and was looking for recovery costs.	Local landowner
10	Letter report was hand delivered to landowner regarding crevices in his land. Expert advised that they were not due to Shell operations. Landowner had no further questions. He was invited to Shell's community meeting on May 12, 2011.	Local stakeholder
12	Shell hosts joint industry community meeting in Fort Saskatchewan for neighbours to provide Shell Scotford operations and Quest CCS Project updates.	Shell Scotford neighbours, industrial neighbours and industry groups (NRCAER, NCIA, AIHA, FAP)
13	Letter sent to one remaining landowner who has not signed the nonobjection, with a copy to ERCB advising that Shell is seeking ERCB facilitation.	Local landowner

Table E.1-8 Consultation Activities, June 2011

Date	Activity	Stakeholder
6	Quest World Café. A facilitated two-way dialogue session with community members, and community leaders to discuss storage containment and safety.	Local landowners, local stakeholders, County representatives, academics
10	Quest Newsletter sent out.	Local landowners, local stakeholders, Shell Scotford neighbours, municipalities, First Nations
11	Attended the Thorhild 4H Show and Sale. Displayed the Quest information pop-up and the geological pop-up display. Handed out the Quest Project Information Package as well as the Quest newsletter	Local stakeholders

E.2 Letter from Shell to its Neighbours



Shell Canada Limited
400 4th Avenue S. W.
P.O. Box 100, Station M
Calgary, Alberta T2P 2H5
Tel (403) 691-3111
Internet www.shell.ca

December 1, 2010

Dear Neighbour:

**Shell Canada Limited
Quest Carbon Capture and Storage (CCS) Project
EA and Regulatory Applications Filing Submission**

As previously communicated, Shell Canada Limited has plans to construct and operate the Quest Carbon Capture and Storage (CCS) Project, a fully integrated CCS project in the Alberta Industrial Heartland region of the province. Up to 1.2 million tonnes of CO₂ per year would be captured from the existing Scotford Upgrader. The Shell Quest CCS Project will include the following components: capture infrastructure, transport (pipeline) and storage.

We are writing to inform you that yesterday, Shell submitted its EA and regulatory applications for approval of the Quest CCS project.

The Government of Alberta directed Shell to prepare and submit an Environmental Impact Assessment (EIA) under the *Alberta Environmental Protection and Enhancement Act (EPEA)* for the carbon dioxide (CO₂) storage component of the project. Shell was also required to conduct an environmental assessment for all three components of the project under the federal Canadian Environmental Assessment Act (CEAA). Shell has prepared a single EA report that satisfies the requirements under both CEAA and EPEA and has submitted the EA to the Governments of Alberta and Canada.

In addition, the following applications have been submitted to the ERCB:

- D56 – Energy Application – application for the construction and operation of the pipeline
- D65 – Resource Application for Oil & Gas Reservoirs – application for a Class III disposal scheme

Shell has also submitted the following for approval to Alberta Environment (AENV):

- Conservation and Reclamation (C&R) Plan for a Class I pipeline as specified under the *Alberta EPEA Activities Designation Regulation*

- And integrated application to amend the Scotford Upgrader Energy Resources Conservation Board (ERCB) Approval No. 8522 (as amended) and the Scotford Upgrader Alberta Environment (AENV) Approval No. 49587-01-00 (as amended)

This letter is to notify you that these documents have been submitted to the respective agencies for review. Copies of both documents will be available on the Shell website at www.shell.ca/quest the first week of December. Alternatively, they will be available for review at the following:

- The offices of Alberta Environment in Edmonton
- City of Fort Saskatchewan City Hall
- Sturgeon County Centre
- Thorhild County Office Planning Department
- Strathcona County Heartland Hall
- Lamont County Administration Building

If you would like hard copies or a CD version or require further information about the Shell Quest CCS Project, please contact Kathy Penney, Regulatory and Environment Manager, Quest CCS Project at (403) 691-4542 or call the Quest 1-800 number at 1-800-250-4355.

Sincerely,

A handwritten signature in black ink, appearing to read 'Margit Phillips', written in a cursive style.

Margit Phillips, ABC
Sr. Community Affairs Representative - Scotford

Appendix F Communciations to Saddle Lake Cree Nation



Shell Canada Energy
400 – 4th Avenue S.W. T2P 0J4
P.O. Box 1480, Station M T2P 2L6
Calgary, Alberta
Tel (403) 691-3111
Fax (403) 264-7058
Internet www.shell.ca

March 16, 2011

Frank Cardinal, Land Use Consultation
Saddle Lake Cree Nation
P.O. Box 696
Saddle Lake, AB
T0A3T0

Dear Frank,

Re: Our meeting on February 24, 2011 in Fort Saskatchewan

Thank you again for meeting with Shell to discuss your concerns surrounding Shell's proposed Quest Carbon Capture and Storage (CCS) project. Following, as we agreed as next steps, I have provided a summary of our meeting and addressed the questions and concerns you raised on behalf of the Saddle Lake Cree Nation (SLCN).

Attendees for the meeting included:

- SLCN Traditional Land Use and Consultation, Frank Cardinal
- Quest Stakeholder Engagement Lead, Margit Phillips
- Quest Community Relations Representative Jennifer Downs
- Quest Aboriginal Engagement Lead, Jason Plamondon

In our meeting, you shared information with Shell about an historic reserve located east of Shell's proposed pipeline, including some history of the reserve and how the people of the area were relocated to the current SLCN reserve lands. According to Shell's chosen pipeline route, this historic reserve will not be directly impacted by the project.

You also suggested that SLCN members continue to practice traditional pursuits such as hunting, fishing and gathering in the area of the project. Shell pointed out that the pipeline was entirely located within private lands. You suggested that there were arrangements in place with private land owners that allowed these traditional pursuits to continue. Shell contends that impacts will be mitigated through freehold agreements with the landowner. Any such freehold agreements will not impact any agreements that SLCN members may have with private land owners to pursue traditional pursuits.

Shell suggested that since the pipeline was located on private lands, the Provincial Government did not consider Shell's project as impacting any known Aboriginal traditional use and therefore Aboriginal consultation was not required. You suggested a difference of opinion with the Government of Alberta (GOA) and noted that a TLU study was in progress and maps were shared with GOA.

In our meeting you stressed that the Victoria Trail, which members used traditionally and which is particularly important to SLCN, was an historic resource that should be protected. Since our meeting, it has been determined that the proposed pipeline crosses the historic Victoria Trail at one location. The location of the Trail was determined through an historic township map of the area; however, no evidence of the Trail was visible at the crossing location. If any cultural or historical resources are identified during construction, Shell will contact the Regional Planner at Alberta Culture and Community Spirit (ACCS) for guidance and additional mitigation measures.

You also suggested that SLCN members used the North Saskatchewan River (NSR) as a source of drinking water and therefore were concerned about potential impacts resulting from the proposed river crossing. Shell shared its plans to directionally drill beneath the river and predicted that there would be no impacts to water quality. In response to your query regarding the success of previous similar crossings of the NSR Shell suggested that significant geotechnical testing had been completed in choosing the most appropriate river crossing location to provide the greatest chance of success. Further, in the unlikely event that Shell must conduct an open cut crossing of the NSR, Shell would mitigate and minimize impacts through compliance with the relevant respective provincial and DFO code of practice and operational policy statement.

During our discussion, you expressed concern surrounding the recent news stories regarding Weyburn Saskatchewan. Shell discussed the long running nature of the project and the magnitude of scientific study and monitoring surrounding their activities. Additional questions can be directed to the Petroleum Technology Research Centre, the group overseeing the international monitoring program for the Weyburn-Midale CO₂ project.

Petroleum Technology Research Centre
6 Research Drive
Regina, SK, Canada
S4S 7J7
Phone: 306-787-7497
Fax: 306-798-0408

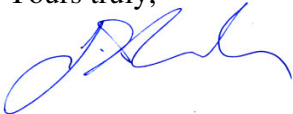
During our discussion surrounding this topic, Shell offered that we are confident that CO₂ can be stored safely underground and believe that CCS is one of the most promising technologies available to make substantial reductions in global CO₂ emissions. To confirm that the CO₂ remains in the storage formation we will be using multiple technologies to monitor both the subsurface and the surface. In combination, site selection, well design, injection operations, monitoring, measurement and verification all play a role in safe, long term storage of CO₂. Shell will ensure that these parameters, including third party expert peer reviews, are included in the Quest CCS project.

You suggested that Shell should consider holding an Open House in the community of Saddle Lake. Shell suggested that community members were welcome to attend one of the Open Houses planned in May of 2011. The locations for these Open Houses (Bruderheim, Fort Saskatchewan, Thorhild and Radway) were chosen based on their proximity to the project.

In our meeting you inquired as to the nature of a building located near to our Scotford facility. Shell shared that the building was a fire hall and provided some information about Emergency Response Plans and mutual aid agreements with the municipality.

If I have inadvertently missed anything in my meeting summary which you feel should be addressed, or if you have additional questions or concerns in respect of Shell's proposed Quest CCS Project please let me know.

Yours truly,



Jason Plamondon
Advisor, Aboriginal and Community Relations
Shell Canada Energy

Cc - Margit Phillips, Shell
Jenn Downs, Shell

2800 Scotia Place
10060 Jasper Avenue
Edmonton, Alberta
Canada T5J 3V9

Telephone (780) 428-6036
1-800-782-9409
Fax (780) 428-9683

E-mail duncanraig@dcllp.com
Internet www.dcllp.com

founded 1877

DUNCAN & CRAIG LLP

LAWYERS & MEDIATORS

FACSIMILE

Our File: 343-171716

Your File: Unknown

April 15, 2011

TO: Shell Canada Energy
ATTENTION: Jason Plamondon
ADDRESSEE FAX: (403) 264-7058

CC TO: Sustainable Resource Development
ATTENTION: Henri Soulodre
ADDRESSEE FAX: (780) 849-3299

CC TO: Shell Canada Energy
ATTENTION: Margit Phillips
ADDRESSEE FAX: (403) 264-7058

CC TO: Shell Canada Energy
ATTENTION: Jenn Downs
ADDRESSEE FAX: (403) 264-7058

CC TO: Saddle Lake Cree Nation
ATTENTION: Frank Cardinal
ADDRESSEE FAX: (780) 726-3788

NO OF PAGES: 3

COMMENTS: Saddle Lake Cree Nation

JOHN A. KOSOLOWSKI
Direct Phone: (780) 441-4307
Direct Fax: (780) 969-6368
e-mail: jkosolowski@dcllp.com

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If you do not receive this transmission clearly, please telephone (780) 428 6036 immediately.

2800 Scotia Place
10060 Jasper Avenue
Edmonton, Alberta
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Telephone (780) 428-6066
1 800 782-9409
Fax (780) 428-9686

E-mail: duncanecraig@dellp.com
Internet: www.dellp.com

FOUNDED 1994
DUNCAN & CRAIG LLP
LAWYERS & MEDIATORS

Our File: 38-171716

Your File: UNKNOWN

April 11, 2011

Via Fax - (403) 264-7058

Shell Canada Energy
400 - 4th Ave. S.W.
Calgary AB T2P 0J4

Attention: Jason Plamondon

Dear Sir:

Re: Saddle Lake Cree Nation

Please be advised that our office acts on behalf of the Saddle Lake Cree Nation ("SLCN") with respect to the above noted matter. We are in receipt of your correspondence to Frank Cardinal, Land Use Consultation Manager, dated March 16, 2011, with respect to a meeting between Mr. Cardinal and representatives of Shell Canada Energy ("Shell") which took place February 24, 2011, in Fort Saskatchewan.

As you have been informed by Mr. Cardinal, our clients exercise their Aboriginal and Treaty 6 rights to hunt, fish, trap, gather and carry out their traditional pursuits within the whole of their Traditional Lands, including the private lands on which the pipeline proposed by Shell is to be located. You are aware that SLCN disagrees with the Provincial Government's decision not to require consultation with SLCN on this project, as the Supreme Court of Canada has held that the Duty to Consult applies to all lands for which the knowledge of the potential existence of aboriginal rights exists and the conduct contemplated affects these rights. Mr. Cardinal provided you several examples of both direct and indirect effects this project will have on the Aboriginal and Treaty rights of SLCN members, and as such it is our position that regardless of the direction of the Provincial Government, the duty to consult with SLCN is triggered. Our clients expect that Shell will fulfill this obligation.

As you are aware, disagreements regarding adequacy of consultation can result in considerable delay in project approvals and expense to project proponents. Our clients are committed to developing a workable approach to consultation on this project, however continued failure by Shell to engage SLCN on this project will leave SLCN with no choice but to consider direct action through regulatory objections.

EDMONTON ALBERTA WILKINSON DRAYTON VALLEY

Duncan & Craig LLP

DUNCAN & CRAIG LLP

April 11, 2011

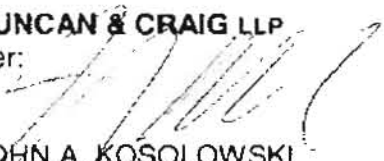
Page 2

We look forward to confirmation from our clients that they have been engaged by Shell on this issue and that an appropriate consultation process is in place. I trust that Mr. Cardinal's request that Shell hold an Open House in the community of Saddle Lake will be reconsidered.

Yours truly,

DUNCAN & CRAIG LLP

Per:


JOHN A. KOSOLOWSKI

Direct Phone: (780) 441-4307

Direct Fax: (780) 969-6368

e-mail: jkosolowski@dcllp.com

JAK/CP/nh

**cc: Sustainable Resource Development
Attention: Henri Soulodre
Via Fax - (780) 849 3299**

Margit Phillips, Shell Canada Energy

Jenn Downs, Shell Canada Energy

**Saddle Lake Cree Nation
Attention: Frank Cardinal
Via Fax - (780) 726-3788**

DCLLP-#719681



Shell Canada Energy
400 – 4th Avenue S.W. T2P 0J4
P.O. Box 1480, Station M T2P 2L6
Calgary, Alberta
Tel (403) 691-3111
Fax (403) 264-7058
Internet www.shell.ca

May 2, 2011

Duncan & Craig LLP
2800 Scotia Place 10060 Jasper Avenue
Edmonton, AB
T5J 3V9

Attention: John Kosolowski

Dear Sir,

Subject: Your letter of April 11, 2011 regarding Saddle Lake Cree Nation (SLCN) and the proposed Shell Quest Carbon Capture and Storage (CCS) Project

Thank you for your letter dated April 11, 2011 which was sent via fax to (403) 264-7058 under cover dated April 15, 2011. Please note that Shell received a copy of this letter April 21, 2011 via email from the offices of Alberta Sustainable Resource Development (ASRD), as it appears your office had forwarded the correspondence to an incorrect fax number. Please record the fax number (403) 384-5988 for use in any future correspondence via fax.

Pursuant to Shell's letter dated March 16, 2011, Shell has met with SLCN to discuss their concerns and has subsequently responded to each of those concerns in writing. To the extent that SLCN has outstanding concerns which they feel have not been addressed, Shell remains open to ongoing engagement in hopes that those concerns can be addressed. Shell has been proactive in providing information to SLCN in respect of the proposed development, and has responded to all requests from SLCN. Any suggestion that Shell has failed to engage SLCN is not reflective of the facts. This engagement has been meaningful, and has included SLCN member attendance at an Open House, a face to face meeting with Shell project personnel, and written exchanges of concerns and responses to those concerns.

Shell plans to host additional Open Houses in the communities nearest to our proposed development in the Fall of 2011. Once confirmed, Shell will inform SLCN of the time and location of those Open Houses and again invite SCLN to attend these sessions. If SLCN feels that there are outstanding concerns that need to be addressed, or if SLCN have additional questions in respect of Shell's proposed Quest CCS Project, Shell remains open to continuing our ongoing discussions at their request.

Yours truly,



Jason Plamondon
Advisor, Aboriginal and Community Relations
Shell Canada Energy

Cc - Henri Soulodre, ASRD
Tim Burggraaff, ASRD
Frank Cardinal, SLCN
Dan Kolenick, Shell
Kathy Penney, Shell

Appendix G Amended Sections of Shell Canada Limited Core Emergency Response Plan



TO:
Alanda Allum
Applications Specialist
Facilities Applications Nonroutine Section
Energy Resources Conservation Board
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Calgary, Alberta
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February 18, 2011

Re: Shell Corporate Emergency Response Plan (ERP)- Registration Number #1469- Carbon Capture and Storage

Dear Ms. Allum:

As per the Shell January 28, 2011 letter to the ERCB, and in response to your letter of January 14, 2011, please find attached the following information for inclusion in the Shell Canada Limited Core Emergency Response Plan:

Section 4.10- Carbon Dioxide Release

Section 4.24.5- Carbon Dioxide (CO₂) Toxicity Table

Hard copies of these materials are being forwarded to you as well.

Please include these two sections in your review of Shell Canada Limited Core Emergency Response Plan- Registration Number #1469.

Please feel free to contact me directly if you have any additional questions on this matter.

Sincerely,

For: Kathy Penney
Regulatory and Environmental Manager, Quest CCS Venture
Shell Canada Energy

CC: Linda Manka (Linda.Manka@shell.com)



4.10 Carbon Dioxide Release

4.10 Carbon Dioxide Release

Carbon dioxide (CO₂) is naturally present in the atmosphere at levels of approximately 0.039%. Short-term exposure to CO₂ at levels below 1.5% (15,000 ppm) has not been reported to cause harmful effects. Higher concentrations can affect respiratory function and the central nervous system. High concentrations of CO₂ can displace oxygen that may cause an oxygen deficiency in poorly ventilated, enclosed or low-lying areas.

The following sources have been used to compile this information:

- American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Value (TLV) documentation for Carbon Dioxide, 2001
- Canadian Centre for Occupational Health and Safety, 1997

4.10.1 General Information

- Carbon dioxide is non-flammable, colorless and odourless
- At low pressure and low concentrations can only be detected using CO₂ detection.
- When pressurized CO₂ is released to the atmosphere it is very cold and causes a temperature drop in the vicinity of the release. This temperature drop freezes the moisture in the air and gives the appearance of a white vapour cloud. If cold enough, the CO₂ may also freeze, forming a white snow-like appearance and further contributing to the visible release.

Product releases may be indicated by:

- notification from personnel at or near the release or leak site.
- leaks noticed while conducting aerial or ground right of way patrols, or
- alarm conditions announced from the SCADA system or leak detection system.
- notification from outside sources of any of the following indicators:
 - sound of the escaping vapour
 - appearance of a white vapour cloud near the release point. In the supercritical state, a leak can be identified by the formation of a “snow” cloud, composed of dry ice and water vapour.
 - stalling engines if high concentrations of CO₂ displace the oxygen in the air
 - ice build-up on exposed pipe and frozen ground around an underground pipe
 - brown vegetation, which is an indication of soil saturation



4.10 Carbon Dioxide Release

4.10.2 General Spill or Leak Response

- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- In the supercritical state, a leak can be identified by the formation of a “snow” cloud, composed of dry ice and water vapour.
- The cloud does not necessarily indicate the full extent of the CO₂ release; therefore, personnel shall always move upwind from the “snow” cloud.
- Prevent spreading of vapours through sewers, ventilation systems and confined areas.
- Isolate area until CO₂ has dispersed.

CAUTION: When in contact with refrigerated cryogenic liquids, many materials become brittle and are likely to break without warning.

4.10.3 Health Effects

- The concentration of CO₂ in the Earth’s atmosphere is approximately 0.039% (390 ppm).
- Carbon dioxide is non-flammable, colorless and odourless
- CO₂ gas is not irritating to the skin, however contact with stored or transported liquid CO₂ can cause frostbite.
 - Symptoms of mild frostbite include numbness, prickling and itching in the affected area. Symptoms of more severe frostbite include a burning sensation and stiffness of the affected area. The skin may become waxy white or yellow. Blistering, tissue death and gangrene may also develop in severe cases.
- Carbon dioxide is heavier than air and high concentrations of CO₂ could displace the oxygen that may cause asphyxiation in poorly ventilated, enclosed or low-lying areas.
- Refer to details regarding health effect by concentration in Section 4.24 Toxicity Tables

4.10.4 First Aid

- Move the affected person to fresh air.
- Call 911 or emergency medical service.
- Apply artificial respiration if the affected person is not breathing.
- Administer oxygen if breathing is difficult.
- In case of contact with liquefied CO₂, thaw frosted area with lukewarm water.
- Keep the affected person warm and comfortable.
- Ensure that medical personnel are aware of the materials involved and take precautions to protect themselves.



4.10 Carbon Dioxide Release

4.10.5 CO₂ Defensive Response

- Complete First on the Scene Checklist (Section 8.0) - ensure personnel safety.
 - Immediately evacuate area to fresh air (upwind, upslope).
 - Activate alarm and isolate immediate area, if possible.
 - Seek medical attention if exposed to gas.
 - Use portable CO₂ gas detector.
 - Determine wind direction & short-term forecast.
 - Check health-effects table.
 - Obtain CO₂ MSDS sheet (ShellNet or other location).
 - Shelter or evacuate area immediately at risk.
 - Extend shelter or evacuation as circumstances dictate.
 - Establish Response Zones:
 - Hot (restricted) area.
 - Warm (limited access) area.
 - Cold (support) area.
 - Emergency escape route & safe haven.
 - Command, staging and beacon locations.
 - Entry to areas where a CO₂ release is known or suspected use PPE and SCBA.
 - Work in open, unconfined areas only (upwind, upslope).
- Contact and assemble emergency repair team.

4.10.6 Public Safety Actions

- Take Public Safety actions as required to shelter or evacuate those closest and those immediately downwind of the release as circumstances dictate.
 - Stakeholders within a defined Emergency Planning Zone (EPZ) for a CO₂ release will be contacted immediately and given advice/instructions (e.g. shelter or evacuation). They will be kept updated and given further advice/instructions if conditions change.
- Continually reassess hazard, wind direction & short-term forecast.



4.24.5 Carbon Dioxide – CO₂

Table 1 - Health Effects based on Concentration

GENERAL HEALTH EFFECTS OF CARBON DIOXIDE	
Concentration (%)	Effects
0.039% (390 ppm)	The concentration of CO ₂ in the Earth's atmosphere is approximately 0.039% (390 ppm). Carbon dioxide is a colourless and odourless gas.
<1.5%	Short-term exposure to CO ₂ at levels below 1.5% (15,000 ppm) has not been reported to cause harmful effects.
2%	Upon several hours of exposure, headache and difficulty breathing on mild exertion.
3%	Upon an hour of exposure, headache, sweating and difficulty breathing at rest.
4 – 5%	Within a few minutes, headache, dizziness, confusion, increased blood pressure, laboured breathing.
6%	Upon 15 minutes of exposure, headache, difficulty breathing, and hearing and visual disturbances. Tremors may occur after several hours of exposure.
7 – 10%	Headache, increased heart rate, shortness of breath, sweating, dizziness, and possible loss of consciousness.
10 – 15%	Dizziness, drowsiness, severe muscle twitching, and unconsciousness after a few minutes of exposure. Continued exposure may result in coma and death.
17 – 30%	Within 1 minute of exposure, loss of controlled and purposeful activity, unconsciousness, convulsions, coma, and possibly death.

Table 2 - Exposure Guidelines

EXPOSURE GUIDELINES FOR CARBON DIOXIDE	
<p>The following sources have been used to compile this information:</p> <ul style="list-style-type: none"> ➤ American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Value (TLV) documentation for Carbon Dioxide, 2001 ➤ Canadian Centre for Occupational Health and Safety, 1997 	
Concentration	Exposure Guideline - 2010
5,000 ppm	8-hour TLV-TWA ¹ , ACGIH ³
30,000 ppm	15-minute TLV-STEL ² , ACGIH ³
40,000 ppm	IDLH ⁴
<p>¹ Threshold Limit Value – Time-Weighted Average: The TWA concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, for a working lifetime without adverse effect.</p> <p>² Threshold Limit Value – Short-Term Exposure Limit: A 15-minute TWA exposure that should not be exceeded at any time during a workday, even if the 8-hour TWA is within the TLV-TWA. The TLV-STEL is the concentration to which it is believed that workers can be exposed continuously for a short period of time without suffering from 1) irritation, 2) chronic or irreversible tissue damage, 3) dose-rate-dependent toxic effects, or 4) narcosis of sufficient degree to increase the likelihood of accidental injury, impaired self-rescue, or materially reduced work efficiency.</p> <p>³ American Conference of Governmental Industrial Hygienists</p> <p>⁴ Immediately Dangerous to Life and Health: The IDLH represents a maximum concentration at which an individual could escape within 30-minutes without any escape-impairing symptoms or any irreversible health effects.</p>	

