

October 1, 2014

BY RESS and COURIER

Ms. Kirsten Walli Board Secretary Ontario Energy Board Suite 2700, 2300 Yonge Street Toronto, Ontario M4P 1E4

Dear Ms. Walli:

Re: Union Gas Limited ("Union") 2015 Storage Enhancement Project Board File # EB-2014-0306

Enclosed please find two copies of Union's Vary Application and Pre-Filed Evidence for

the above-noted project.

Sincerely,

[original signed by]

Mark A. Murray, LL.B Manager, Regulatory Projects and Lands Acquisition :sb Encl.

cc: Zora Crnojacki, Project Advisor

ONTARIO ENERGY BOARD

IN THE MATTER OF the Ontario Energy Board Act, 1998, S.O. 1998, c.15, Schedule B; and in particular Sections 38(1) and 40(1) thereof;

AND IN THE MATTER OF an Application by Union Gas Limited for an Order varying the conditions of approval in the following proceedings EB-2008-0038 and EB-2009-0144 for Enniskillen 28, Oil City Pool, Oil Springs East, relating to the allowable pressure gradient in these three natural gas storage pools in the Townships of Enniskillen, and St. Clair, in the County of Lambton;

UNION GAS LIMTED

- 1. Union Gas Limited ("Union") wishes to operate the following natural gas storage pools: Oil City, Oil Springs East, Enniskillen 28 and Bickford Pools, at a maximum pressure gradient of 17.2 kPa/m (0.76 psi per foot) as permitted under the CSA Standard Z341.1-14.
- 2. Union therefore applies for leave to operate the natural gas storage pools above the 16.5 kPa/m (0.73 psi per foot) operating condition as set out in the Conditions of Approval issued in the EB-2008-0038 and EB-2009-0144 proceedings:
- 3. Union requests that the following condition be placed on Oil City, Oil Springs East, Enniskillen 28 and Bickford Pools:

Union Gas Limited shall not operate the storage pool above a pressure representing a pressure gradient of 17.2 kPa/m (0.76 psi/f) of depth without leave of the Board. Union Gas Limited shall file an engineering study and geological study in support of any leave application.

- 4. Attached as Schedule A is a map showing the general location of the four storage pools.
- 5. In order to meet the proposed in-service date, Union respectfully requests a Board Decision, no later than January 31, 2015.

Dated at the Municipality of Chatham-Kent, Ontario this 1st day of October, 2014.

UNION GAS LIMITED

[original signed by]

Per: Mark Murray Manager, Regulatory Projects/Land Acquisition

Comments respecting this Application should be directed to: Mark A. Murray, Manager, Regulatory Projects Union Gas Limited 50 Keil Drive North Chatham, Ontario N7M 5M1 Telephone: (519) 436-4601 Facsimile: (519) 436-4641





Vary Application

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BACKGROUND

- Union Gas Limited ("Union") proposes to increase the operating pressure in the Enniskillen 28, Oil Springs East, Oil City and Bickford Pools to 17.2 kPa/m (0.76 psi/ft) during the 2015 injection season.
- 2. In the past the Ontario Energy Board ("The Board") has imposed conditions of approval limiting the maximum operating pressure on certain storage pools operated by Union.
- 3. Union applied to the Board in 2008 and 2009 to vary the conditions of approval in 7 storage pools (Enniskillen 28, Oil Springs East, Payne, Dow A, Oil City, Bentpath East and Bluewater) to increase the operating pressure from 15.8 kPa/m (0.70 psi/ft) to 16.5 kPa/m (0.73 psi/ft). The Board approved Unions request in the EB-2008-0038 and EB-2009-0144 proceedings and imposed the following condition

"Union Gas Limited shall not operate the storage pool above a pressure representing a pressure gradient of 0.73 psi per foot of depth without leave of the Board. Union Gas Limited shall file an engineering study and a geological study in support of any leave application."

- 4. This Application is requesting leave to vary the conditions of approval, limiting the operating pressure it previously placed on Oil City, Oil Springs East and Enniskillen 28 Pools and replacing them with conditions allowing the Pools to be operated at a pressure gradient of 17.2 kPa/m (0.76 psi/ft).
- 5. Bickford does not have a condition of approval limiting its operating pressure, Union is including the Bickford Pool in this application for information purposes only. Union is requesting a condition allowing the Bickford Pool to be operated at a pressure gradient of 17.2 kPa/m (0.76 psi/ft).
- 6. Attached as Schedule 1 is a table identifying the Pools, subject to this application, the proceeding where the condition of approval was imposed and the exact wording of the condition.

- It is Union's understanding that Board approvals will require the applicant to conform to CSA Standard Z341.1-14 storage of Hydrocarbons in Underground Formations to the satisfaction of the Ministry of Natural Resources ("MNR").
- 8. The following technical information has been provided to the Petroleum Resources Section of the MNR:
 - Engineering studies completed by Geofirma Engineering Ltd. ("Geofirma") confirming that the maximum safe operating pressure exceeds 17.2 kPa/m for each of the four pools. The approach used by Geofirma is consistent with previous studies completed for Bentpath, Rosedale, Dawn 167 and Dawn 47-49 currently operated at the elevated pressure gradient of 17.2 kPa.m (0.76 psi/ft).
 - A review of each pool as prescribed by CSA Z341.1-14 Clause 7.2 assessing: a) wells within 1 kilometre; b) operations within 5 kilometres and; c) the integrity of all wells penetrating the storage zone.
 - An analysis of hazards and operability issues ("HAZOP") for each of the storage pools.
- Union's request will result in an average increase in pool pressure of approximately 350 kPa (50 psi). This increase is within the limits as prescribed by CSA Z341.1-14.
- 10. Union proposes to increase the operating pressure of the Pools to increase their working capacity by 51,300 10³m³. The capacity created will be used to meet the requirements of Union's storage service customers and specifically the needs of customers seeking storage services dealt with in Board decision EB-2005-0551 Natural Gas Electricity Interface Review ("NGEIR").
- 11. If this application is approved, Union will begin operating the Pools at higher pressure gradients during the 2015 injection season.

- 12. As there are no pipelines to be constructed or wells to be drilled, a leave to construct order from the Board and a report from the Board to the MNR are not required for approval of this application.
- 13. No directly affected landowner has raised any concerns regarding these changes.
- 14. There are no environmental impacts as a result of the proposed changes in operating pressure.
- 15. Union is proposing to increase the pressures in these Pools by September 1, 2015. In order to meet this timetable, a Board Decision on Union's Application is respectfully requested by January 31, 2015.
- 16. Union will review and update operating procedures and Emergency Response Plans prior to operating the Pools at the increased pressure levels.
- 17. Emergency shut-down valves ("ESD") capable of isolating the storage facility from the transmission pipeline are currently in place at each pool station with remote operation from the Dawn Operations Centre in accordance with CSA Z341.1-14, Clause 9.3. In addition, Union proposes to install ESD valves on each injection/withdrawal well at each pool with the exception of UE 40, UE 58 and UE 63 in the Enniskillen 28 Pool, due to the proximity to the Bear Creek and the potential for flooding. Instead, a single ESD valve will be installed for these three wells located on the gathering pipeline system at a collection point above the flood plain.
- 18. All above ground piping and wells have been reviewed to ensure compliance with all codes and standards at the increased operating pressures.

GEOLOGY AND RESERVOIR ENGINEERING

19. Schedule 2 is a table summarizing the latest pressuring history of Union's storage pools.

Enniskillen 28 Pool

20. The Enniskillen 28 Pool was discovered in 1954 with the drilling of the Union Enniskillen 28 well and was converted to natural gas storage in 1977. A location map showing the

Enniskillen 28 Pool in relation to the surrounding area is shown in Schedule 3. Currently, the Pool is operated and monitored using eight injection/withdrawal wells and three observation wells. The Enniskillen 28 Pool has a total capacity of $130,900 \ 10^3 \text{m}^3$ and a working capacity of $99,100 \ 10^3 \text{m}^3$. The Pool operates between a cushion pressure of 2,413 kPaa and a maximum pressure of 8,730 kPaa.

- 21. A map showing the Enniskillen 28 Pool Designated Storage Area ("DSA"), Guelph structure and depth-to-crest is included in Schedule 4. The geological interpretation was completed using 3D seismic data and well information. The map is contoured in 10 m intervals and shows the reef reaching approximately 115 m above the regional Guelph surface. The minimum depth-to-crest is established at 554.1 m.
- 22. A cross section illustrating the reef structure of the Enniskillen 28 Pool is provided as Schedule 5. The cross section illustrates the relationship of the pinnacle reef to the surrounding formations. The A2 Salt, A1 Carbonate and A1 Anhydrite units pinch out against the flank of the reef providing lateral seals. The A2 Anhydrite, A2 Shale, and A2 Carbonate drape over the reservoir forming an effective caprock seal ranging in thickness from 29.7 to 35.5 m. The A2 Anhydrite overlying the crest of the reef ranges in thickness from 1.7 to 6.3 m.
- 23. Union is proposing to operate the Ennsikillen 28 Pool at 9,090 kPaa. This equates to a pressure gradient of 17.2 kPa/m. This will increase the working capacity from 130,900 10³m³ to 137,100 10³m³ which is an incremental capacity gain of 6,200 10³m³.
- 24. In order to ensure the proposed maximum pressure gradient complies with CSA Z341.1-14 an engineering study was conducted by Geofirma for the Enniskillen 28 Pool. This engineering study incorporated data from geomechanical and in-situ tests completed on the reservoir and caprock formations.
- 25. In addition, a review of well casings, wellheads, gathering pipelines, storage pipelines and other related surface facilities was completed. As a result of this review, all wells in the Enniskillen 28 Pool will receive new master valves and seven wells will be receiving new wellheads. This work is scheduled to be completed prior to increasing the pressure in the

pool. No other upgrades to the wells or pipelines are required. The Maximum Operating Pressure ("MOP") of the physical facilities in the Pool is 10,030 kPaa WH.

Oil Springs East Pool

- 26. The Oil Springs East Pool was discovered in 1974 with the drilling of the Husky Union Enniskillen 4-22-II well and was converted to natural gas storage in 1990. A location map showing the Oil Springs East Pool in relation to the surrounding area is shown in Schedule 6. Currently, the Pool is operated and monitored using six injection/withdrawal wells and two observation wells. The Oil Springs East Pool has a total capacity of 136,400 10³m³ and a working capacity of 105,000 10³m³. The Pool operates between a cushion pressure of 2,100 kPaa and a maximum pressure of 8,060 kPaa.
- 27. A map showing the Oil Springs East Pool DSA, Guelph structure and depth-to-crest is included at Schedule 7. The geological interpretation was completed using 3D seismic data and well information. The map is contoured in 10 m intervals and shows the reef reaching greater than 80 m above the regional Guelph surface. The minimum depth-to-crest is established at 509.6 m.
- 28. A cross section illustrating the reef structure of the Oil Springs East Pool is provided as Schedule 8. The cross section illustrates the relationship of the pinnacle reef to the surrounding formations. The A2 Salt, A1 Carbonate and A1 Anhydrite units pinch out against the flank of the reef providing lateral seals. The A2 Anhydrite, A2 Shale, and A2 Carbonate drape over the reservoir forming an effective caprock seal ranging in thickness from 23.0 to 26.2 m. The A2 Anhydrite overlying the crest of the reef ranges in thickness from 0.8 to 9.5 m.
- 29. Union is proposing to operate the Oil Springs East Pool at 8,390 kPaa WH. This equates to a pressure gradient of 17.2 kPa/m. This will increase the working capacity from 136,400 10³m³ to 142,900 10³m³ which is an incremental capacity gain of 6,500 10³m³.

- 30. In order to ensure the proposed maximum pressure gradient complies with CSA Z341.1-14 an engineering study was conducted by Geofirma for the Oil Springs East Pool. This engineering study incorporated data from geomechanical and in-situ tests completed on the reservoir and caprock formations.
- 31. In addition, a review of well casings, wellheads, gathering pipelines, storage pipelines and related surface facilities was completed. As a result of this review, six wells in the Oil Springs East Pool will receive new master valves and four wells will be receiving new wellheads. This work is scheduled to be completed prior to increasing the pressure in the pool. No other upgrades are required. The MOP of the facility is 10,030 kPaa WH.

Oil City Pool

- 32. The Oil City Pool was discovered in 1975 with the drilling of the McClure Enniskillen 1-16-IV well and was converted to gas storage in 2000. A location map showing the Oil City Pool in relation to the surrounding area is contained in Schedule 9. Currently the Pool is operated and monitored using two injection/withdrawal wells and one observation well. The Oil City Pool has a total capacity of 62,800 10³m³ and a working capacity of 48,800 10³m³. The Pool operates between a cushion pressure of 2,100 kPaa and a maximum pressure of 8,280 kPaa.
- 33. A map showing the Oil City Pool DSA, Guelph structure and depth-to-crest is included at Schedule 10. The geological interpretation was completed using 3D seismic data and well information. The map is contoured in 10 m intervals and shows the reef reaching greater than 80 m above the regional Guelph surface. The minimum depth-to-crest is established at 523.7 m.
- 34. A cross section illustrating the reef structure of the Oil City Pool is provided as Schedule 11. The cross section illustrates the relationship of the pinnacle reef to the surrounding formations. The A2 Salt, A1 Carbonate and A1 Anhydrite units pinch out against the flank of the reef providing lateral seals. The A2 Anhydrite, A2 Shale, and A2 Carbonate drape over the reservoir forming an effective caprock seal ranging in thickness from 23.4 to 32.0 m. The A2 Anhydrite overlying the crest of the reef ranges in thickness from 1.8 to 3.9 m.

- 35. Union is proposing to operate the Oil City Pool at 8,610 kPaa WH. This equates to a pressure gradient of 17.2 kPa/m. This will increase the working capacity from 62,800 10³m³ to 65,700 10³m³ which is an incremental capacity gain of 2,900 10³m³.
- 36. In order to ensure the proposed maximum pressure gradient complies with CSA Z341.1-14 an engineering study was conducted by Geofirma for the Oil City Pool. This engineering study incorporated data from geomechanical and in-situ tests completed on the reservoir and caprock formations.
- 37. In addition, a review of well casings, wellheads, gathering pipelines, storage pipelines and other related surface facilities was completed. As a result of this review, two wells in the Oil City Pool will receive new master valves and new wellheads. This work is scheduled to be completed prior to increasing the pressure of the pool. No other upgrades are required. The MOP of the physical facilities constructed in the Pool is 8,720 kPaa WH.

Bickford Pool

- 38. The Bickford Pool was discovered in 1954 with the drilling of the Imperial 421-Bickford 19 well and was converted to gas storage in 1972. A location map showing the Bickford Pool in relation to the surrounding area is contained in Schedule 12. Currently the Pool is operated and monitored using five injection/withdrawal wells and six observation wells. The Bickford Pool has a total capacity of 762,600 10³m³ and a working capacity of 592,800 10³m³. The Pool operates between a cushion pressure of 2,198 kPaa and a maximum pressure of 8,650 kPaa.
- 39. A map showing the Bickford Pool DSA, Guelph structure and depth-to-crest is included at Schedule 13. The geological interpretation was completed using 3D seismic data and well information. The map is contoured in 10 m intervals and shows the reef reaching greater than 110 m above the regional Guelph surface. The minimum depth-to-crest is established at 548.7 m.
- 40. A cross section illustrating the reef structure of the Bickford Pool is provided as Schedule 14. The cross section illustrates the relationship of the pinnacle reef to the surrounding formations. The A2 Salt, A1 Carbonate and A1 Anhydrite units pinch out against the flank of

the reef providing lateral seals. The A2 Anhydrite, A2 Shale, and A2 Carbonate drape over the reservoir forming an effective caprock seal ranging in thickness from 27.4 to 44.2 m. The A2 Anhydrite overlying the crest of the reef ranges in thickness from 1.5 to 11.0 m.

- 41. Union is proposing to operate the Bickford Pool at 9,000 kPaa WH. This equates to a pressure gradient of 17.2 kPa/m. This will increase the working capacity from 762,600 10³m³ to 798,300 10³m³ which is an incremental capacity gain of 35,700 10³m³.
- 42. In order to ensure the proposed maximum pressure gradient complies with CSA Z341.1-14 an engineering study was conducted by Geofirma for the Bickford Pool. This engineering study incorporated data from geomechanical and in-situ tests completed on the reservoir and caprock formations.
- 43. In addition, a review of well casings, wellheads, gathering pipelines, storage pipelines and other related surface facilities was completed. As a result of this review, eight wells in the Bickford Pool will receive new master valves and four wells will be receiving new wellheads. This work is scheduled to be completed prior to increasing the pressure in the pool. No other upgrades are required. The MOP of the physical facilities constructed in the Pool is 10,030 kPaa WH.

LANDS ISSUES

- 44. Union implemented a landowner consultation and notification program to inform the directly affected landowners about the proposed changes in operating pressure in the Pools.
- 45. During this consultation process, no significant issues in regard to the change in operating pressures were identified.
- 46. Union will continue to meet with landowners in these Pools to address the concerns that have been identified and any new issues that may be brought forward.

Operating Pressure Conditions

Pool	Order	Condition
Enniskillen 28	EB-2008-0038 2008 Storage Enhancement Project	Union Gas Limited shall not operate the storage pool above a pressure representing a pressure gradient of 0.73 psi per foot of depth without leave of the Board. Union Gas Limited shall file an engineering study and a geological study in support of any leave application.
Oil Springs East	EB-2008-0038 2008 Storage Enhancement Project	Union Gas Limited shall not operate the storage pool above a pressure representing a pressure gradient of 0.73 psi per foot of depth without leave of the Board. Union Gas Limited shall file an engineering study and a geological study in support of any leave application.
Oil City	EB-2009-0144 2009 Storage Enhancement Project	Union Gas Limited shall not operate the storage pool above a pressure representing a pressure gradient of 0.73 psi per foot of depth without leave of the Board. Union Gas Limited shall file an engineering study and a geological study in support of any leave application.
Bickford		No pressure limitation

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Limits S
Pressure

Storage Pool	Current Pressure	Year Pressure	Discoverv Gradient	Discovery Pressure	Maximum Operating
)	(kPa/m)	Changed	(kPa/m)	(Wellhead) (kPaa)	Pressure (kPaa)
Dawn 167	17.2	2014	14.3	6,461	10,600
Bentpath	17.2	2013	12.7	6,077	8,200
Rosedale	17.2	2013	13.8	6,661	8,210
Bickford	16.5	2001	12.9	6,801	8,650
Terminus	16.5	2001	13.6	6,310	7,720
Dawn 156	16.5	2001	12.7	6,153	7,960
Waubuno	16.5	2004	12.7	6,619	8,670
Dawn 47-49	17.2	2014	13.3	6,165	8,800
Oil Springs East	16.5	2008	13.3	6,477	8,060
Enniskillen 28	16.5	2008	10.4	5,488	8,730
Payne	16.5	2008	11.1	6,247	9,250
Dow A	16.5	2008	0.0	5,819	10,690
Oil City	16.5	2009	13.3	6,718	8,280
Bentpath East	16.5	2009	13.3	6,098	7,560
Bluewater	16.5	2009	8.4	5,148	6,780
Heritage	16.5	2009	12.2	7,269	10,620
Storage Pool	Current Pressure	Year Pressure	Discovery Gradient	Discovery Pressure	Maximum Operating
	(psi/ft)	Changed	(psi/m)	(Wellhead) (psia)	Pressure (psia)
Dawn 167	0.76	2014	0.63	937	1,537
Bentpath	0.76	2013	0.56	881	1,189
Rosedale	0.76	2013	0.61	996	1,190
Bickford	0.73	2001	0.57	986	1,255
Terminus	0.73	2001	0.60	915	1,120
Dawn 156	0.73	2001	0.56	892	1,155
Waubuno	0.73	2004	0.56	960	1,258
Dawn 47-49	0.76	2014	0.59	894	1,276
Oil Springs East	0.73	2008	0.59	939	1,169
Enniskillen	0.73	2008	0.46	796	1,266
Payne	0.73	2008	0.49	906	1,342
Dow A	0.73	2008	0.40	844	1,551
Oil City	0.73	2009	0.59	974	1,201
Bentpath East	0.73	2009	0.59	884	1,097
Bluewater	0.73	2009	0.37	747	1,419
Heritage	0.73	2009	0.54	1,054	1,540

EB-2014-0306 Schedule 3





EB-2014-0306 Schedule 4



EB-2014-0306 Schedule 6





EB-2014-0306 Schedule 7



EB-2014-0306 Schedule 9





EB-2014-0306 Schedule 10







EB-2014-0306 Schedule 13

