

Liner Documentation Report

Nelsen Pond

Otter Tail Power Company - Coyote Station

Introduction

This plan presents the Liner Documentation Report for the Nelsen Pond at Coyote Station located near Beulah, North Dakota. The Nelsen Pond is considered an existing coal combustion residual (CCR) impoundment. This document addresses the requirements of 40 CFR §257.71.

Liner Documentation §257.71(a)(1)

Nelsen Pond was constructed in 1992 with a 24-inch thick compacted clay liner. A search for construction documentation yielded no records of thickness verification or permeability testing from the time of construction. As such, clay liner thickness and permeability verification was performed by Carlson McCain, Inc. in 2016. Frequencies for thickness verification and permeability determination were chosen based on industry standards for Construction Quality Assurance (CQA).

Thickness Verification

Clay liner thickness verification tests were conducted on a 100-foot by 100-foot grid on the Nelsen Pond using a hand auger. The hand auger was advanced a minimum of 24 inches at each grid location. Samples collected by the auger bucket were examined to verify that the extracted soils consisted of clay and were a minimum of 24-inches deep. Auger holes were backfilled and sealed with granular bentonite.

Thickness verification testing was conducted on the interior slopes and bottom of the Nelsen Pond as indicated on the figure in Appendix A.

Permeability Tests

Three thin-wall tube samples were retrieved from the existing clay liner, two on the Nelsen Pond bottom (sample number TW1 and TW3), one on the slope (TW2), for laboratory determination of in-place permeability. Sample locations are shown on the figure in Appendix A. Permeability testing on the extracted thin-wall tube samples was conducted using the American Society of Testing and Materials (ASTM) D5084 Method C, which is the standard method used for materials with permeability less than 1×10^{-4} centimeters per second (cm/sec).

The test results for samples TW1, TW2, and TW3 were 3.32×10^{-8} cm/sec, 2.02×10^{-8} cm/sec, and 1.78×10^{-7} cm/sec, respectively, for an average permeability of 7.71×10^{-8} cm/s. Due to the nature of the Cole Harbor Till present in the region and the permeability values of samples TW1 and TW2, it was believed that the 1.78×10^{-7} cm/s permeability value for TW3 is an indication of an unrepresentative sample or error in sample collection or handling. An additional thin-wall sample was extracted near the original sample location for retesting. The results of the fourth permeability test, labeled TW3A, was 1.00×10^{-8}


cm/sec. This result better correlates with the results for samples TW1 and TW2, and with typical values expected for Cole Harbor Till clay. Laboratory test reports are provided as Appendix B.

Results

Based upon the thickness and permeability of the in-place compacted soil liner, as determined by the investigation described above, the Nelsen Pond clay liner satisfies the requirements of §257.71(a)(1)(i). The Nelsen Pond is thus deemed a lined surface impoundment.

Certification §257.71(b)

I hereby certify under penalty of law that this report was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment.



John McCain, PE
License No. PE-4345

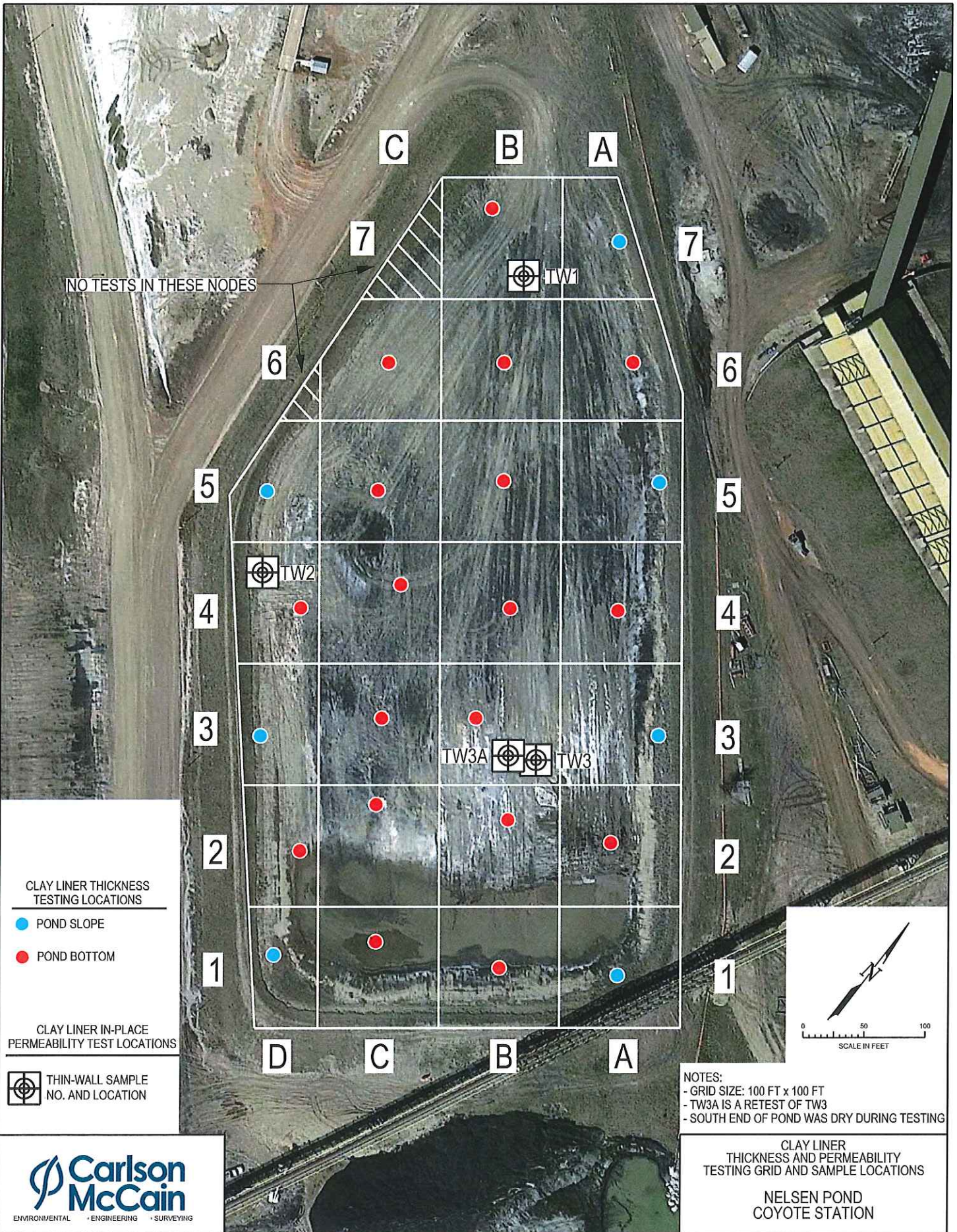
October 17, 2016
Date

Attachments:

Appendix A – Thickness and Permeability Test Locations

Appendix B – Permeability Test Results

Appendix A – Thickness and Permeability Test Locations



NO TESTS IN THESE NODES

TW1

TW2

TW3A

TW3

CLAY LINER THICKNESS TESTING LOCATIONS

- POND SLOPE
- POND BOTTOM

CLAY LINER IN-PLACE PERMEABILITY TEST LOCATIONS

- THIN-WALL SAMPLE NO. AND LOCATION

NOTES:
 - GRID SIZE: 100 FT x 100 FT
 - TW3A IS A RETEST OF TW3
 - SOUTH END OF POND WAS DRY DURING TESTING

CLAY LINER THICKNESS AND PERMEABILITY TESTING GRID AND SAMPLE LOCATIONS

NELSEN POND COYOTE STATION



Appendix B – Permeability Test Results

HYDRAULIC CONDUCTIVITY REPORT



1555 N. 42nd St., Unit B
Grand Forks, ND 58203
701-772-2832

Service Date: 9/9/2016
Report Date: 9/12/2016
Revised 10/12/2016

Client

Carlson McCain, Inc.
15650 36th Ave N
Suite 110
Plymouth, MN 55446

Project

Coyote Station

Project Number: M2165107

Test Method: ASTMD5084 Method C Sample No.: TW-1
 Sample Type: Shelby Tube Location: _____
 Date Sampled: _____ Operator: RAB
 Soil Type: SANDY LEAN CLAY with trace GRAVEL
 Proctor Results: N/A pcf Molded @: N/A % compact
 % % M.C.

Initial Sample Parameters

Wet Wt. (g)	<u>754.78</u>	Diameter (in)	<u>2.861</u>	Height (in)	<u>3.389</u>	Water Content	
Dry Wt. (g)	<u>632.59</u>		<u>2.869</u>		<u>3.390</u>	Pan No.:	<u>34</u>
Area (cm ²)	<u>41.553</u>		<u>2.861</u>		<u>3.397</u>	Wet Wt.	<u>115.51</u>
Area (in ²)	<u>6.441</u>	Average (in)	<u>2.864</u>	Average(in)	<u>3.392</u>	Dry Wt.	<u>99.20</u>
Density (pcf)	<u>110.2</u>					Pan Wt.	<u>14.76</u>
Assumed Sp.G.	<u>2.7</u>	Void Ratio:	<u>0.528</u>			W.C. (%)	<u>19.3</u>
Vol Wet (cc)	<u>358.01</u>	Vol. Solids Vs(cc)	<u>234.29</u>	Porosity n (%)	<u>35</u>	% Saturation	<u>98.5</u>

Final Sample Parameters

Wet Wt. (g)	<u>763.34</u>	Diameter (in)	<u>2.862</u>	Height (in)	<u>3.414</u>	Water Content	
Dry Wt. (g)	<u>630.90</u>		<u>2.894</u>		<u>3.421</u>	Pan No.:	<u>2</u>
Area (cm ²)	<u>41.989</u>		<u>2.880</u>		<u>3.403</u>	Wet Wt.	<u>113.15</u>
Area (in ²)	<u>6.508</u>	Average (in)	<u>2.879</u>	Average(in)	<u>3.413</u>	Dry Wt.	<u>96.23</u>
Density (pcf)	<u>108.1</u>					Pan Wt.	<u>15.63</u>
						W.C. (%)	<u>21.0</u>
						% Saturation	<u>101.4</u>

Panel No.: 3 Chamber No.: 5 Hydraulic Gradient: 20.7
 Cell Press.(psi) 47.0 Back Press.(psi) 42.7 Tail Press. (psi) 40.2
 Pipette Burette Pipe Area (cm²) 0.079 Fluid: De-aired tap water

Date and Time	Temp	Head (h1)	Tail (h2)	Elapsed Time (S)	Total Head	k (cm / s)	k ₂₀ (cm/sec)	dt / dh
9/9/16 13:03	23	6.60	36.55		211.78			
9/9/16 13:35	22.9	7.40	35.70	1920	209.93	3.74E-08	3.49E-08	1.06
9/9/16 14:07	23	8.10	34.90	1920	208.25	3.43E-08	3.19E-08	1.14
9/9/16 14:37	23	8.80	34.10	1800	206.57	3.69E-08	3.43E-08	1.14
9/9/16 15:39	23.1	10.15	32.60	3720	203.38	3.43E-08	3.19E-08	1.11

HYDRAULIC CONDUCTIVITY (k₂₀) = **AVERAGE 3.32E-08 cm/sec**

Reviewed by:

HYDRAULIC CONDUCTIVITY REPORT



1555 N. 42nd St., Unit B
Grand Forks, ND 58203
701-772-2832

Service Date: 9/13/2016
Report Date: 9/14/2016
Revised 10/12/2016

Client

Carlson McCain, Inc.
15650 36th Ave N
Suite 110
Plymouth, MN 55446

Project

Coyote Station

Project Number: M2165107

Test Method:	ASTM D5084 Method C	Sample No.:	TW-2
Sample Type:	Shelby Tube	Location:	
Date Sampled:		Operator:	RAB
Soil Type:	LEAN CLAY with SAND and trace GRAVEL		
Proctor Results:	N/A pcf	Molded @:	N/A % compact
	%		% M.C.


Initial Sample Parameters				Water Content			
Wet Wt. (g)	811.04	Diameter (in)	2.872	Height (in)	3.641	Pan No.:	126
Dry Wt. (g)	682.33		2.861		3.637	Wet Wt.	81.40
Area (cm ²)	41.572		2.860		3.620	Dry Wt.	70.95
Area (in ²)	6.444	Average (in)	2.864	Average(in)	3.633	Pan Wt.	15.55
Density (pcf)	110.9					W.C. (%)	18.9
Assumed Sp.G.	2.68	Void Ratio:	0.507			% Saturation	99.5
Vol Wet (cc)	383.59	Vol. Solids Vs(cc)	254.60	Porosity n (%):	34		

Final Sample Parameters				Water Content			
Wet Wt. (g)	820.99	Diameter (in)	2.880	Height (in)	3.668	Pan No.:	12
Dry Wt. (g)	681.21		2.892		3.660	Wet Wt.	107.34
Area (cm ²)	42.262		2.892		3.658	Dry Wt.	91.63
Area (in ²)	6.551	Average (in)	2.888	Average(in)	3.662	Pan Wt.	15.07
Density (pcf)	108.1					W.C. (%)	20.5
						% Saturation	100.4

Panel No.: 1 Chamber No.: 2 Hydraulic Gradient: 20.0
 Cell Press.(psi) 51.5 Back Press.(psi) 47.7 Tail Press. (psi) 45.1
 Pipette Burette Pipe Area (cm²) 0.079 Fluid: De-aired tap water

Date and Time	Temp	Head (h1)	Tail (h2)	Elapsed Time (S)	Total Head	k (cm / s)	k ₂₀ (cm/sec)	dt / dh
9/13/16 9:21	22.9	23.20	22.55		183.85			
9/13/16 10:08	21.4	23.75	21.95	2820	182.56	2.19E-08	2.11E-08	1.09
9/13/16 10:57	21	24.30	21.35	2940	181.28	2.11E-08	2.06E-08	1.09
9/13/16 11:35	21	24.70	20.95	2280	180.38	1.91E-08	1.86E-08	1.00
9/13/16 12:45	21	25.50	20.15	4200	178.59	2.08E-08	2.03E-08	1.00

HYDRAULIC CONDUCTIVITY (k₂₀) = **AVERAGE 2.02E-08 cm/sec**

Reviewed by: 

HYDRAULIC CONDUCTIVITY REPORT



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Client

Carlson McCain, Inc.
15650 36th Ave N
Suite 110
Plymouth, MN 55446

Project

Coyote Station

Project Number: M2165107

Test Method:	ASTM D5084 Method C	Sample No.:	TW-3
Sample Type:	Shelby Tube	Location:	
Date Sampled:		Operator:	RAB
Soil Type:	SANDY LEAN CLAY with GRAVEL		
Proctor Results:	N/A pcf %	Molded @:	N/A % compact % M.C.

Initial Sample Parameters				Water Content			
Wet Wt. (g)	813.13	Diameter (in)	2.863	Height (in)	3.621	Pan No.:	7
Dry Wt. (g)	700.67		2.871		3.616	Wet Wt.	99.72
Area (cm ²)	41.659		2.868		3.637	Dry Wt.	88.14
Area (in ²)	6.457	Average (in)	2.867	Average(in)	3.625	Pan Wt.	15.99
Density (pcf)	113.9					W.C. (%)	16.0
Assumed Sp.G.	2.69	Void Ratio:	0.472			% Saturation	91.1
Vol Wet (cc)	383.54	Vol. Solids Vs(cc)	260.47	Porosity n (%):	32		

Final Sample Parameters				Water Content			
Wet Wt. (g)	824.77	Diameter (in)	2.883	Height (in)	3.619	Pan No.:	114
Dry Wt. (g)	696.70		2.885		3.598	Wet Wt.	110.50
Area (cm ²)	42.204		2.890		3.605	Dry Wt.	95.81
Area (in ²)	6.542	Average (in)	2.886	Average(in)	3.607	Pan Wt.	15.90
Density (pcf)	112.4					W.C. (%)	18.4
						% Saturation	100.0

Panel No.: 2 Chamber No.: 3 Hydraulic Gradient: 17.4
 Cell Press.(psi) 46.1 Back Press.(psi) 42.6 Tail Press. (psi) 40.3
 Pipette Burette Pipe Area (cm²) 0.079 Fluid: De-aired tap water

Date and Time	Temp	Head (h1)	Tail (h2)	Elapsed Time (S)	Total Head	k (cm / s)	k ₂₀ (cm/sec)	dt / dh
9/9/16 9:18	23.4	9.40	39.10		193.19			
9/9/16 9:30	23.4	10.70	37.70	720	190.16	1.91E-07	1.76E-07	1.08
9/9/16 9:47	23.4	12.60	35.80	1020	185.91	1.94E-07	1.79E-07	1.00
9/9/16 9:59	23	13.90	34.40	720	182.88	1.99E-07	1.85E-07	1.08
9/9/16 10:32	23.1	17.25	31.00	1980	175.32	1.86E-07	1.73E-07	1.01

HYDRAULIC CONDUCTIVITY (k₂₀) = **AVERAGE 1.78E-07 cm/sec**

Reviewed by: 

