



Since 1959

Norton Corrosion Limited, LLC

8820 222nd Street SE, Woodinville, WA 98077
Phone (425) 483-1616 • Fax (425) 485-1754
sales@nortoncorrosion.com
www.nortoncorrosion.com

August 13, 2018

Port of Olympia
Attn: Don Bache
606 Columbia Street NW, Suite 300
Olympia, WA 98501
donb@portolympia.com

Subject: **2018 CATHODIC PROTECTION SYSTEM INSPECTION
SHORELINE CONTAINMENT WALL
CASCADE POLE SITE
OLYMPIA, WASHINGTON**

Dear Mr. Bache:

On August 3, 2018, Norton Corrosion Limited (NCL) personnel completed an inspection of the impressed current cathodic protection (CP) system that protects the buried environmental containment wall at the Cascade Pole site from corrosion. Written authorization to perform this work was issued on July 19, 2018.

Work Performed

NCL thoroughly inspected all accessible components of the CP system to ensure safe and reliable operation. The rectifier was tested to ensure proper operation of all of its components. Current output measurements were recorded for each of the individual anodes. Structure-to-soil potential measurements were recorded at representative test locations along the wall to evaluate the level of CP being received. Both on and instant-off potential measurements were obtained along the inboard and outboard sides of the wall while interrupting the output of the rectifier. Adjustments and maintenance were performed as deemed necessary.

Criteria

NACE International has established criteria that indicate, when used separately or in combination, that adequate CP is being provided. NCL has evaluated your CP system based on the following criteria:

- Adequate CP is indicated by a potential difference of -0.850 volts or more negative between a steel structure and a saturated copper/copper sulfate (CSE) half-cell. This criterion requires all voltage drops, other than those across the structure-to-electrolyte boundary, to be considered for a valid interpretation of the potential data. Instant-off potential measurements were recorded to account for the voltage drops (IR drop) and have been used to evaluate the level of protection achieved. The equivalent criterion applicable to a saturated silver/silver chloride (sat. Ag/AgCl) half-cell is -0.750 volts.

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- Adequate protection is also indicated by a cathodic polarization shift of not less than 100 millivolts. This is equivalent to the difference between the instant-off (polarized) and native (depolarized) potential measurements.

Results and Conclusions

The attached data sheets detail the results of the inspection. Survey data indicated the CP system was functioning properly. All equipment was in good and operable condition with the exception of two anodes and the two half-cells that have been previously reported as inoperable. The system had a total current output of 24.0 amps as compared to 20.0 amps reported during last year's inspection. The greater current output can be attributed to a high tide during the time of inspection.

NCL increased the output of the CP system during last year's inspection to compensate for some lower potentials. As a result of this increase in current output, structure-to-soil potential measurements indicated adequate protection being received at all locations tested.

Both permanent half-cells are out of acceptable limits and are no longer accurate enough for use.

Recommendations

NCL recommends monitoring the rectifier voltage and current output at least once every 60 days. The system should operate near 6 volts and have a minimum current output of 20 amps. The current varies with the tide, increasing as more water covers the anodes located offshore of the wall in the tidal flat.

This system should be inspected by a Corrosion Professional on an annual basis; the next inspection should be scheduled for summer 2019.

NCL appreciates the opportunity to serve the Port of Olympia. If you have any questions or additional concerns, please contact our office.

Sincerely,



Tye Ritz
NACE CP Specialist #9745

PORT OF OLYMPIA
CASCADE POLE SITE
SHORELINE CONTAINMENT WALL
CATHODIC PROTECTION SYSTEM

DATA SHEET: 1 OF 3
NCL JOB: O-22677-M
DATE: 8/3/2018
BY: T. RITZ

SHORELINE CONTAINMENT WALL

Structure

Description: Buried sheet pile containment wall.
Length: 400 feet long
Depth: 25 feet
Drawings: NCL, 21015

Rectifier

Manufacturer: Universal Rectifiers
Model No: CSA-ASAI 20-40
Serial No: 011757
AC Input Rating: 115/230 V, 9.9/4.9 A, 1Ø
DC Output Rating: 20 V, 40 A
Anode Bed: 24 – 1 ½ "Ø x 60" cast iron canister anodes

<u>Field Measurements</u>	<u>Units</u>	<u>Readings</u>
<u>Panel Meters and Settings</u>		
Output:	V dc	5.75
	A dc	24.0
Primary Input:		Low V
Taps (4/5max):		1/5
<u>Portable Meter</u>		
Input:	V ac	119.1
Secondary:	V ac	7.53
Output:	V dc	5.430
	A dc	24.0
Shunt (50 A/50 mV):	mV	24.0

Conditions: 1000 hrs, mid 60°s F, dry, high tide.
Notes: Fluke 28. Interruption: 2 sec. off, 10 sec. cycle.

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CASCADE POLE SITE
SHORELINE CONTAINMENT WALL
CATHODIC PROTECTION SYSTEM

DATA SHEET: 2 OF 3
NCL JOB: O-22677-M
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Anode Output Measurements

<u>Anode Location</u>	<u>Shunt Reading</u>	<u>Current Output</u>
1 - West	7.4 mV	0.74 A
2	0.0	0.00
3	4.5	0.45
4	5.6	0.56
5	12.3	1.23
6	14.4	1.44
7	12.2	1.22
8	12.7	1.27
9	12.1	1.21
10	11.1	1.11
11	12.2	1.22
12	12.8	1.28
13	12.6	1.26
14	12.6	1.26
15	12.4	1.24
16	11.7	1.17
17	11.8	1.18
18	12.5	1.25
19	11.9	1.19
20	11.8	1.18
21	0.0	0.00
22	4.7	0.47
23	8.6	0.86
24 - East	6.2	0.62

Note: Shunts are 0.01 ohm.

PORT OF OLYMPIA
 CASCADE POLE SITE
 SHORELINE CONTAINMENT WALL
 CATHODIC PROTECTION SYSTEM

DATA SHEET: 3 OF 3
 NCL JOB: O-22677-M
 DATE: 8/3/2018
 BY: T. RITZ

Cathodic Protection Readings

Location	<u>Structure-to Soil Potential Measurements (V dc)</u>					
	<u>Onshore of Wall (ref. CSE)</u>		<u>Offshore of Wall (ref Ag/AgCl [sat])</u>			
Portable Cell:	<u>Native*</u>	<u>On</u>	<u>Instant Off</u>	<u>Native*</u>	<u>On</u>	<u>Instant Off</u>
Fence post 1		-1.155	-0.970	-0.750	-1.303	-1.021
Post 5, adj. E TS	-0.600	-1.144	-0.971	-0.696	-1.294	-1.020
Post 10	-0.665	-0.896	-0.863	-0.806	-1.326	-1.025
Post 15	-0.692	-0.943	-0.908	-0.814	-1.377	-1.040
Post 20	-0.692	-1.021	-0.983	-0.820	-1.383	-1.044
Post 25	-0.644	-1.006	-0.962	-0.833	-1.411	-1.045
Post 27, adj. rect	-0.630	-0.945	-0.898	-0.832	-1.417	-1.046
Post 30	-0.656	-0.940	-0.911	-0.840	-1.426	-1.048
Post 35	-0.699	-0.940	-0.914	-0.843	-1.416	-1.048
Post 40	-0.710	-0.954	-0.927	-0.844	-1.425	-1.026
Post 45	-0.691	-0.955	-0.898	-0.810	-1.330	-1.036
Post 50		-1.127	-0.997	-0.756	-1.275	-1.028
East T.S. (Post 5): Port. Cell	-0.560	-1.025	-0.951			
West T.S. (Post 48): Port. Cell	-0.741	-1.115	-1.032			

Note: Native potentials recorded in March, 2012. Both permanent sat. Ag/AgCl cells had previously failed.

RECTIFIER LOG

OWNER: PORT OF OLYMPIA – Cascade Pole Site

STRUCTURE: Shoreline Environmental Containment Wall

RECOMMENDED CURRENT OUTPUT: 20 to 26 amps (may vary with tide)

DATE	VOLTS	AMPS	TAPS	INITIAL	COMMENTS
8/3/2018	5.75	24.0	1/5	TR	NCL annual inspection.

For assistance, contact NCL at 425-483-1616.