



Since 1959

**Norton Corrosion Limited, LLC**

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June 19, 2017

Port of Olympia  
Attn: Rachael Jamison  
Email: [rachaelj@portolympia.com](mailto:rachaelj@portolympia.com)  
606 Columbia Street NW, Suite 300  
Olympia, WA 98501

Subject:       **2017 CATHODIC PROTECTION INSPECTION  
SHORELINE CONTAINMENT WALL  
CASCADE POLE SITE**

Dear Ms. Jamison:

On June 1, 2017, 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 April 12, 2017.

#### 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 12.7 amps as compared to 15.1 and 15.0 amps respectively during the prior two inspections.

Structure-to-soil potential measurements indicated adequate protection was being received at all locations tested with the exception of two test locations along the landside of the wall near center. NCL increased the tap setting of the rectifier by one step to provide a higher output. The final output current was 20.0 amps, well above that required to maintain adequate protection in the past. NCL is confident this level of output will restore adequate protection within a few days.

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 15 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 Engineer on an annual basis; the next inspection should be scheduled for June, 2018.

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

Sincerely,



John F. Keppler, P.E.  
Principal Engineer

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

DATA SHEET: 1 OF 3  
 NCL JOB: O-22315-M  
 DATE: JUNE 1, 2017  
 BY: J. KEPPLER

**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>Final</u>	<u>Initial</u>
<b>Panel Meters and Settings</b>			
Output:	V dc	6.6	4.9
	A dc	21.0	13.0
Primary Input:			Low V
Taps:		C1/F4-F5/5	C1/F4-F4/5
<b>Portable Meter</b>			
Input:	V ac	120.7	120.7
Secondary:	V ac	7.650	6.258
Output:	V dc	5.552	4.581
	A dc	20.0	12.7
Shunt (50 A/50 mV):	mV	20.0	12.7

Conditions: 0930 hrs, 62°s F, damp, recent rain, mid outgoing tide.  
 Notes: Fluke 28. Interruption: 2 sec. off, 15 sec. cycle.

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

DATA SHEET: 2 OF 3  
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**Anode Output Measurements**

<u>Anode Location</u>	<u>Shunt Reading</u>	<u>Current Output</u>
1 - West	3.05 mV	0.305 A
2	0.00	0.000
3	2.23	0.223
4	3.04	0.304
5	5.87	0.587
6	3.08	0.308
7	6.07	0.607
8	6.62	0.662
9	6.62	0.662
10	6.48	0.648
11	6.26	0.626
12	5.15	0.515
13	6.20	0.620
14	6.40	0.640
15	7.48	0.748
16	6.43	0.643
17	6.96	0.696
18	7.57	0.757
19	7.22	0.722
20	7.29	0.729
21	0.03	0.003
22	2.82	0.282
23	4.61	0.461
24 - East	2.15	0.215

Note: Shunts are 0.01 ohm.



