NORTON CORROSION LIMITED

September 28, 2005

PARKING GARAGE /REPORTS/

2005

Mr. Joab Cochrane
City and Borough of Juneau
409 D Street
Douglas, AK 99824

Subject: **2005 OPERATIONAL INSPECTION
GALVANIC CATHODIC PROTECTION SYSTEM** *1/10/06*
**JUNEAU LIBRARY/PARKING FACILITY
STEEL SUPPORT PILES**

Dear Mr. Cochrane:

On August 23, 2005, Norton Corrosion Limited (NCL) personnel completed the operational inspection for the Library/Parking Facility's galvanic cathodic protection (CP) system. The CP system is designed to prevent external corrosion on the submerged surfaces of the parking facility's steel support piles. Your written authorization to perform this work was issued on August 15, 2005.

TESTING AND CRITERIA

NCL recorded structure-to-water potential measurements between the steel piling and a portable saturated silver-silver chloride (sat. Ag/AgCl) half-cell to evaluate the level of protection being obtained. The attached data sheet details the results of this testing. NACE International (National Association of Corrosion Engineers) has established criteria indicating whether adequate cathodic protection is being received, where adequate CP is indicated on a structure by obtaining:

- A polarized potential of -0.733 volts in reference to a sat. Ag/AgCl half-cell (-0.850 volts or more negative in reference to a copper-copper sulfate (CSE) half-cell)

Or,

- 100 millivolts of polarization as seen by the difference between the native (depolarized) and instant-off (polarized) potentials.

RESULTS

The potential measurements recorded indicate only partial protection is being achieved. The current output of two of the anodes has dropped significantly since last year. The anode located at "B.7" has a broken cable connection that should be repaired to provide additional protection, although full protection will still not be obtained.

NCL recommends upgrading this galvanic anode system so adequate protection can be obtained on the piles. A significant number of additional anodes will be required to obtain full protection. Several options are available for installing the anodes. New anodes may be welded

directly to the piling by divers. Anodes may be mounted on a sled set on the sea floor, with a cable brought to the top of the piling for connection. Anodes could also be welded at the low tide line from a boat, although these anodes would be out of the water and ineffective at times. There are benefits, costs and disadvantages associated with each type of installation. Please contact NCL at your convenience to discuss these options and determine which means for installation best suits your needs.

NCL would be pleased to provide you with materials and/or engineering to upgrade this CP system. The following are estimated costs:

Engineering: $2,500
⇒ Provide cost estimates and support to determine best method of installation per the City of Juneau's constraints
⇒ Installation drawings
⇒ Materials list

Materials:
10 year life $9,500-$12,500
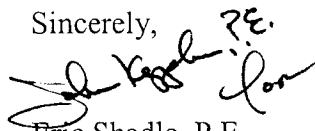
20 year life $19,000-$25,000

These estimates do not include freight charges and are based on a 75% coating efficiency.

Note: The CP only protects the submerged surfaces of the steel piles. The splash zone and above requires a high-build coating system to supply additional protection when those portions of the piles are not submerged. The piles have an existing coating; however, this coating requires periodic maintenance to prevent corrosion damage. Presently, the coating in the splash zone is beginning to deteriorate and corrosion is initiating. Consideration for repairing the coating should be given to avoid further corrosion on the piles in the tidal zone. The installation of anodes will help extend the life of the coating in the tidal zone and below.

NCL appreciates this opportunity to be of service to the City and Borough of Juneau. If you have any questions or require additional information, please do not hesitate to contact our office.

Sincerely,

Eric Shadle, P.E.
Corrosion Engineer

NORTON CORROSION LIMITED

CITY BOROUGH OF JUNEAU
GALVANIC CATHODIC PROTECTION
STEEL SUPORT PILES
PARKING FACILITY

POTENTIAL MEASUREMENTS:

Row	Bent	July 24, 2001 **CSE Ref** High Tide	July 11, 2002 **AgAgCl Ref** Low Tide	Aug. 2003 **AgAgCl Ref** High Tide	Aug. 2004 **CSE Ref** High Tide	Aug. 2005 **AgAgCl Ref** Mid Tide	Anode output (amps)
A	9	-0.564	-0.601	-0.622	-0.696	-0.575	
A	8	-0.555	-0.587	-0.597	-0.696	-0.565	
A	7	-0.544	-0.583	-0.597	-0.681	-0.565	
A	6	Not Submerged (N/S)	N/S	-0.597	-0.681	-0.566	
B	9.7	-0.591	N/A	-0.623	N/A	N/A	
B	9	No Access (N/A)	N/A	-0.615	N/A	-0.581	
B	8	-0.591	-0.602	-0.610	N/A	N/A	
B	7		N/A	-0.606	N/A	-0.575	A=N/A
B	6	N/S	N/S	-0.596	N/A	-0.570	
B.7	9.7	-0.591	-0.637	-0.632	-0.695	-0.588	
B.7	9	-0.591	-0.631	-0.629	-0.695	-0.589	A = 0.0
C	10	-0.600	-0.649	-0.630	-0.689	-0.583	
C	9.7	-0.611	-0.643	-0.629	-0.689	-0.586	
C	9	-0.587	-0.650	-0.634	-0.689	-0.583	A = 1.15
C	8	-0.565	-0.617	-0.621	-0.689	-0.570	
C	7		N/S				
C.5	11	-0.606	-0.686	-0.631	-0.693	-0.583	
C.5	10	-0.606	-0.685	-0.631	-0.693	-0.586	A = 0.08
C.5	9.7		-0.680	-0.637	-0.693	-0.584	
C.5	9		-0.671	-0.634	-0.693	-0.587	
C.5	8.5		-0.664	-0.627	-0.693	-0.588	
C.5	8	-0.584	-0.656	-0.631	-0.689	-0.587	
C.5	7.5		-0.631	-0.631	-0.689	-0.584	
C.5	7		N/S	-0.621	-0.689	-0.583	
C.5	6.5		N/S	-0.617	-0.689	-0.581	
C.5	6.3		N/S	N/S	N/S	N/S	
C.5	6	-0.567	N/S	N/S	N/S	N/S	
D	11	-0.601	N/A	-0.635	-0.695	-0.583	
D	10		-0.674	-0.637	-0.695	-0.587	
D	9.7		-0.682	-0.638	-0.695	-0.590	A = 0.08
D	9		-0.655	-0.633	-0.659	-0.588	
D	8.5		-0.636	-0.631	-0.659	-0.581	
D	8	-0.600	N/S	-0.617	-0.659	-0.580	
D	7.5		N/S	-0.620	-0.658	-0.580	
D	7		N/S	N/S	-0.658	N/S	
D	6.5		N/S	N/S	-0.658	N/S	
D	6.3		N/S	N/S	N/S	N/S	
D	6	-0.601	N/S	N/S	N/S	N/S	

Ref cell calibration, Ag-to-CSE   Start   104.1 mv
                                        Finish   101.4 mv