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# MEMO

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| ***To:*** | Tom Blackman (Lockheed Martin) |
| ***Cc:*** | Steve McGee, Steve Ernst, Dan Sullivan, Katie Young, Cannon Silver, Michael Martin, Senda Ozkan |
| ***From:*** | Michael Byle |
| ***Date:*** | February 5, 2020 |
| ***Subject:*** | Outfall Sealing East End of Blocks D and F |

Since completion of the bulkhead walls along Dark Head Cove in Block D and Block F, settlement of the granular fill has been noted. This has primarily been attributed to loss of granular fill through openings in the original sheet piling. In the anticipation that these losses would stabilize as the existing voids became filled, it was decided to restore the settled areas with additional granular fill and restore the surface as needed with additional granular fill should settlments recur. For the majority of the walls, the settlement of the granular fill has been small, on the order of a few inches, except in the immediate areas surrounding Outfalls OF-0005W and OF-00X. Recent inspections in April 2019 after grade restoration in March 2019, indicate areas of granular fill loss to depths greater than 24-inches immediately adjacent to outfalls OF-0005W and OF-00X.

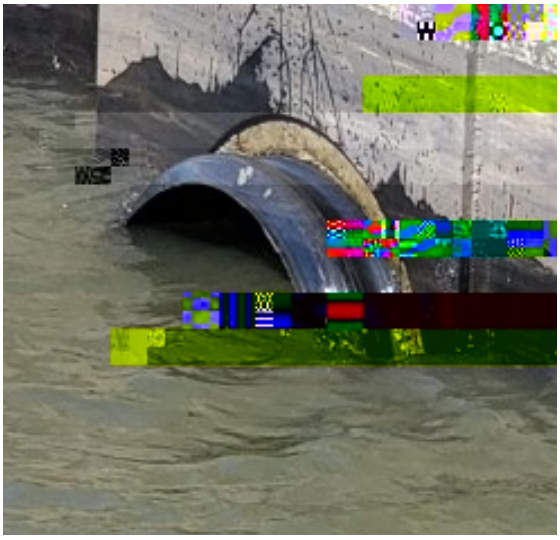

Figure 1 - Recess in anular concrete at OF-00X

**Discussion:**

Observations of the outfall penetrations indicate that the concrete surrounding the corrugated HDPE pipe appears to be displaced and cracked. Probing in the cove adjacent these outlets indicates the presence of mounded granular soil that appears to be consistent with the volumes of material lost surrounding the culvert. Inspection of the inverts of the pipes is not possible, since they are partially submerged, but it appears likely that the conditions observed for the exposed portions are representative of the full circumference of the pipe.

Based on these observations, it appears that tidal action is flushing granular fill through openings around the circumference of the pipes at the two outfalls. The openings appear to be the result of fracturing and displacement of the concrete where it adjoins the steel wall components. Because the area over the pipes consists of concrete cast to the sloping granular fill surface, the concrete is in a trapezoidal shape and the granular fill loss is occurring in an hour-glass fashion concentrated along the contact between the granular fill and the concrete. This results in the surface expression appearing as a sinkhole several feet off the centerline of each pipe.



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The mechanical seal option would be expected to be much higher to include design and fabrication of the plates, support vessels, divers, lifting equipment, etc. The cost would be expected to be in the range of $15,000 to $20,000.

**Recommendations:**

Based on the above discussion, the recommended approach is the