

TECHNICAL MEMORANDUM

To: Taylor Lancelot, PE, Associate Civil Engineer, City of Berkeley - Parks, Recreation, and Waterfront Department

From: Vern Phillips, PE, Pipeline Technical Lead, Harris & Associates

Cc: Dennis Sheil, Construction Manager, AnchorCM

Date: November 11, 2020

Subject: Aquatic Park Central Tide Tubes Maintenance Sediment Removal and Inspection Project Review of Final CCTV Videos for Pipe Condition and Long Term Service.

This memo is to summarize my observations of the final CCTV videos for the above project. As mentioned in my previous memo of September 23, 2020, the project objective is to restore the drainage function of 5 -24" diameter storm drains or tide tubes, which were to be cleaned and investigated to assess their current conditions. The tide tubes are segments of vitrified clay pipe (VCP), built in the 1930s, and concrete pipe (CP), built in the 1950s. The tide tubes run at relatively shallow depth of approximately 8 to 10 feet under the I-580 freeway of approximately 250 feet in total length. VCP extends 150 feet west from the inlet at Aquatic Park, and the approximately 100 feet to the Bay are CP.

All five tide tubes are exhibiting the same levels of deterioration and distress. The CP portions look to be in relatively good condition, although there may be some cracking that can't be observed clearly with marine encrustation covering much of the interior surface. However, the VCP pipe at all five locations are in extremely bad condition throughout their 150-foot length. All have similar crack patterns in this reach. Many cracks are mostly hairline or very small of less than 1/16- inch thickness. However, some are larger of maybe 1/8-inch or more in width. The cracks are at the pipe bells at random locations and many also run longitudinally along the length of the pipe segment.

As mentioned for my review of the first 50 feet of pipe of each tide tube, the longitudinal cracks at the soffit and sides of all the VCP pipe segments throughout their lengths and are exhibiting the classic "3-hinge collapse" mechanism. While the pipes are not ovaling, which would mean significant loss of structural strength, there are a couple areas of the pipe spalling, where some of the pipe wall is missing. This level of deterioration casts serious doubt for the continued near-term service of the pipe.

Recommendation. These pipeline are in immediate need of repair and in my opinion close to collapse. The fact that they are under a major freeway adds significant concern. How long before serious problems occur is unknown, but these pipes should be high priority as a capital improvement. There are a couple lining techniques that would restore the structural capacity of the pipelines, including cured-in-place and spiral-wound linings, but they are only effective if the pipe retains its round shape and is not missing too much pipe wall material.