

October 3, 2019

Mr. David Foster
Alta Planning + Design, Inc.
8 E Broadway Ste 203
Salt Lake City, UT 84111

Re: Miller Park Retaining Wall Investigation
1708 E 900 S, Salt Lake City, UT
ARW Job # 19075

David,

As requested, ARW Engineers has completed a limited investigation of a portion of the existing rock wall, concrete crib wall and timber retaining wall structures at the above referenced site. The investigation was limited to observing the existing conditions of the walls at various locations along the trail. Several locations were specifically observed on September 24, 2019 with the following people in attendance: David Foster (Alta Planning), Lewis Kogan (SLC Parks representative), Jay McQuivey (AGEC). The purpose for this investigation was to determine if the existing retaining structures are a life safety risk, what repairs (if any) can be done to the existing rock walls, what is causing past and current deterioration of the walls, and what options could be employed to mitigate the risk and further damage to the walls.

The investigation was limited to reviewing specific sections of the existing walls with the owner. Not all sections of existing wall were observed and no excavation behind walls or testing of wall materials was performed.

The rock walls are historic and generally appear to be in decent condition, considering their age and current loading conditions. If the walls were to be analyzed according to current code requirements, it is almost certain that they would not meet the required safety factors of 1.5 for sliding and overturning due to soil, seismic, water and wind loads. It is also unknown if they have any steel reinforcement or if they are just rubble walls. If the owner would like to meet current code requirements, the walls would need to be removed and replaced. If that is the owners intended objective, the structural measures for upgrading the existing walls can be discussed at a later time.

There are several maintenance items that need to be addressed along segments of the different walls. Addressing these items as soon as possible through preventative measures will help increase the longevity and safety of the existing wall structures. Below is a list of several of these preventative/maintenance measures:

- 1- Chain link fences above the existing rock walls need to be removed and/or regularly maintained. These fences add additional lateral wind loads to the wall that were not accounted for in the original wall design. Property owners above the fences have not maintained the chain link fences in several areas and there is a build-up of debris against the fence that is increasing the retaining wall height and soil loads on the retaining wall structure below.
- 2- Sprinkler systems above and below the wall (maintained by the city and homeowners) are causing excessive erosion behind the wall and in some cases the erosion is undermining the toe of the retaining walls. Retaining walls typically have a pipe drainage system and free draining material (gravel and/or water board) behind the wall so that water does not accumulate against the wall (creating a dam like structure with hydrostatic pressure on the wall). Weep holes are typically incorporated into new retaining wall designs to alleviate hydrostatic pressure behind walls. Eliminating water sources that create saturated soil conditions behind walls will help reduce soil/water loads on the wall and help extend its longevity. Saturated slopes are more prone to erosion and can cause unstable slopes above retaining walls.

- 3- Drainage pipes from property owners above the wall need to be addressed. There are several properties that are sending water from their gutters towards the existing retaining walls. This is causing excessive erosion above, behind and below the retaining wall structures. These drainage areas need to be remedied and the water needs to be piped around the wall as required. Addressing drainage issues will also help keep the soil less saturated above the walls.
- 4- Trees growing adjacent to the top of the walls need to be removed. The tall trees that occur behind walls can create additional lateral loads and damage to the walls during a wind event. It also appears that adjacent property owners have added excavated soil from their yards to the top of the existing walls. This additional soil load increases the horizontal loads on the wall which can exceed the initial design loads the wall was engineered to retain. This additional overburden from additional soil should be removed.
- 5- There are several locations where the neighboring property owners have encroached on the existing rock walls with new retaining wall structures or new building structures. This is not advisable because it can increase loads on the retaining wall and cause it to fail. These structures should be removed, or deep foundations should be installed to independently support these structures. This will alleviate the additional lateral loads on the existing walls caused by these structures.
- 6- There are several walls that need to be repaired or replaced due to excessive erosion from sprinklers, drainage pipes and/or poor trail drainage or maintenance. There are also several locations where the toe of the existing rock walls are exposed. These areas need to be repaired with structural fill (and geofabric where needed). Sprinklers above and below trails should be removed where possible to eliminate saturated soil conditions and reduce soil erosion from runoff.
- 7- Where walls are cracking or where rocks are missing, these areas should be re-pointed and the drainage above these walls should be addressed. The soil above these walls should remain as dry as possible throughout the year. It may also be prudent to add weep holes or drainage pipes behind walls that are bulging so that hydrostatic water pressures can be reduced.

The owner should inform adjacent property owners that the sprinklers, drainage pipes, retaining walls, building structures and un-maintained chain link fences that are retaining debris are creating un-safe conditions for the existing walls. Not addressing these conditions could cause the existing retaining walls to fail. If the walls fail, there could be issues with slope stability above and below the existing retaining walls. Failure of these walls could have an adverse effect on the structures above. See the attached appendix of photos for more information.

The conclusions and recommendations provided in this report are based on information observed while walking the park with the owner's representative. It should be understood that this investigation was not exhaustive and did not include any destructive testing or structural analysis. No lateral analysis was performed to determine the stability of the existing retaining walls. As additional information becomes available, the conclusions and recommendations contained in this report may need to be re-evaluated and amended.

If you have any questions, or if we can be of further assistance, please let us know.

Best Regards:



McKay Parrish, S.E.
Senior Project Structural Engineer

19075_itr_20191003

Photo Appendix



Photo #1 – Soil cover over toe of wall is not adequate



Photo #2 – erosion on the trail due to runoff and sprinklers has cause the crib walls to fail in several locations.



Photo #3 – Runoff from adjacent property owners' gutters is causing the wall to bulge and fail



Photo #4 – Runoff from adjacent property owners is undermining existing walls.



Photo #5 – Image of drainage pipe from neighboring property owners



Photo #6 – Image of drainage pipe from neighboring property owners, example of adjacent structures encroaching on the existing rock walls, and example of toe of retaining wall being undermined.



Photo #7 – Chainlink fences are collecting debris from runoff water and are retaining soil.



Photo #8 – Chainlink fences are collecting debris from runoff water and are retaining soil.



Photo #9 – Chainlink fences are collecting debris from runoff water and are retaining soil.



Photo #10 – Image of drainage from neighboring property owners and runoff from sprinklers causing the soil to erode and undermine the existing retaining wall structures.



Photo #11 – Erosion that has occurred from sprinklers and runoff from neighboring properties



Photo #12 – Example of neighboring property owners building structures above existing rock walls.



Photo #13 – Example of neighboring property owners building structures above existing rock walls. Trees that occur adjacent to the wall should be removed and the structural fill should be used to backfill over the toe of the existing rock wall.



Photo #14 – additional soil has been added above the wall and should be removed



Photo #15 – There is a retaining wall built above the original rock wall that has large rocks caught in the fence. This wall is an example of neighbors building structures above the existing walls and creating additional loads on the existing structure.



Photo #16 – There is a retaining wall built above the original rock wall that has large rocks caught in the fence. This wall is an example of neighbors building structures above the existing walls and creating additional loads on the existing structure.



Photo #17 – The existing wall is being undermined and the toe needs to be covered with structural fill.