Memorandum

Nevada Tahoe Conservation District

To: Kahle Water Quality Basin Implementation Project Technical Advisory Committee (TAC)

From: Meghan Kelly, P.E and Monica Grammenos, P.E.

Date: 1/16/2018

Re: 50 Percent Design Considerations

INTRODUCTION

The Kahle Water Quality Basin Implementation Project (Project) is a high priority project that was identified in the *Final Burke Creek-Rabe Meadow Complex Master Plan, Development of Capital Improvement Projects and Alternatives Evaluation Report*, dated November 2014 (Master Plan Document). The project background, need, conceptual design alternatives, and preliminary hydrology/hydraulics are discussed in detail in the Section 8 of the Master Plan Document. NTCD has composed this memorandum to present changes from the conceptual design developed through the Master Plan process and this current iteration of design, the 50 percent design level, as well as to provide valuable design information in advance of a full design report.

EXISTING CONDITIONS

The existing basin was constructed as part of the 1992 Burke Creek/Kahle Ditch Restoration Project with an estimated capacity of 0.2 acre-feet and a surface area of approximately 4,600 square feet. The Tahoe Regional Planning Agency (TRPA) design storm (20 year, 1 hour) estimates a capacity of 2.2 acre-feet for the basin. This design standard has become somewhat outdated for large stormwater projects with the development of the Tahoe TMDL and the PLRM model, however, the initial estimates indicate a basin in excess of 1 acre-feet would provide considerable treatment for sediment-laden runoff. The PLRM model for the Project will be updated at the 90 percent iteration to estimate the possible credits.

The existing undersized basin is also filled with willows and sediment and is inaccessible for the annual maintenance and monitoring required under the Tahoe TMDL. Furthermore, the conveyance system that feeds the basin along Kahle Drive is undersized as determined by the Burke Creek-Rabe Meadow Complex Master Plan Existing Conditions Report (NTCD and Wood Rodgers, June 2014). Douglas County standards require the conveyance of the peak flow from the 24 hour, 25 year storm. For 50% design, the 2014 report as well as the existing hydrologic HEC-HMS model (Wood Rodgers 2014) was reviewed by NTCD and 116.1 cfs was selected as a conservative number to design the capacity of the storm drain conveyance system. The current pipe configuration was calculated by NTCD to have a capacity that varies from 26 cfs to 89 cfs and is therefore undersized. Finally, because the system was installed nearly 20 years ago, technologies in the capture of pollutants like oil and grease is outdated and ineffective.

CONCEPTUAL DESIGN DEVELOPMENT

The Nevada Tahoe Conservation District (NTCD) met with US Forest Service (USFS) staff at the project site in June 2015 to discuss increasing the footprint of the existing basin and updating the basin to a more effective treatment type; specifically changing the basin from a dry basin to a wet basin. The onsite meeting revealed the US Forest Service's preference for screening the view of the basin from

adjacent residential and recreation uses as much as possible. During subsequent meetings, the USFS has also expressed the desire for the basin to blend in with the surrounding meadow as much as possible. A conceptual design was developed by NTCD with the USFS preferences in mind had a treatment capacity of 1.0 acre-feet and utilized wet basin design features. The conveyance pipe in the conceptual design was upsized from a 30 and 36 inch reinforced concrete pipe (RCP) to a 48 inch RCP as an initial estimate at achieving the conveyance necessary to meet the Douglas County standard.

50 PERCENT BASIN DESIGN

The shifted location of the basin proposed in the conceptual design moved the location closer to Burke Creek and into an area with a historically higher groundwater table. Through a groundwater depth study completed by NTCD and the Natural Resource Conservation Service in 2014, the seasonally high groundwater table was found to be 6 to 9 inches below the surface in this area. Additionally, this shift moved the basin closer to land with a TRPA Class 1B Land Capability, which is considered highly sensitive land. The design team visited the site and looked for opportunities to shift the basin away from these sensitive lands and blend the basin in with the surrounding environment. The resulting footprints of the 50 percent design basin in comparison to the existing basin, and the conceptual basin proposed to the USFS in 2015, are shown in Figure 1. The proposed 50% design basin represents a compromise between the conceptual design proposed in the Master Plan Document and the conceptual design proposed in after the June 2015 meeting with the USFS.

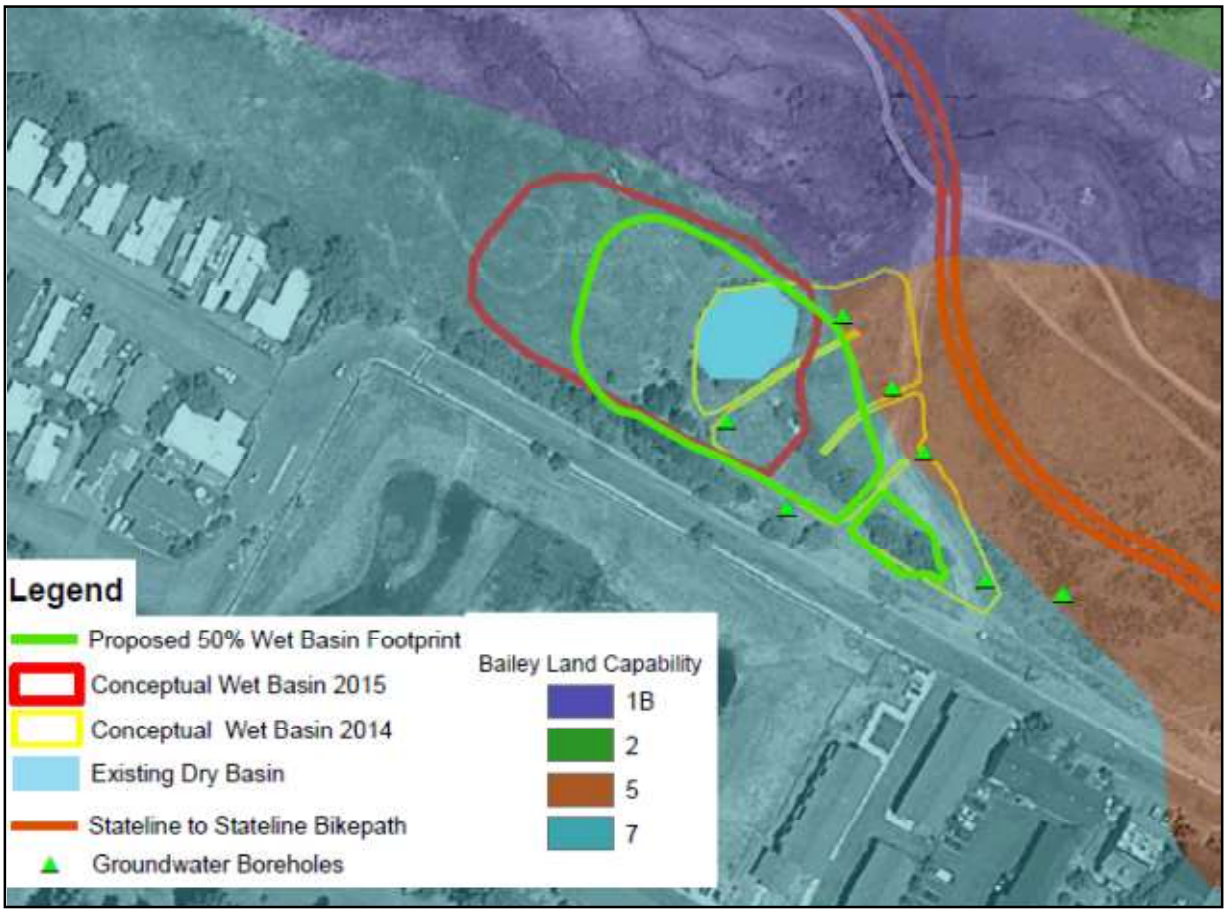

Figure 1. Proposed 50 percent design basin location relative to existing basin and conceptual design basins.

Because of the shallow groundwater table, the basin is being designed as a wet basin using components of constructed wetland design. Constructed wetlands have been found to be one of the most effective treatment methods for achieving reduction of pollutants identified in the Tahoe TMDL (Qualls and Hayvaert, 2017). Multi-stage treatment that includes elements like filtration, retention, soil processes, microorganisms, and plant uptake are effective in capturing both fine sediment and nutrients (Greene, 2006, Hayvaert, 2006). Design elements that should be included in a wet basin design include pretreatment, filtration, and detention that facilitate physical, biological, and chemical processes. A constructed wetland designed for the 20 year, 1 hour storm in Tahoe City had a design life of 16 years without any major maintenance and provided a substantial reduction in nutrients during this time.

Design elements for the Kahle Basin include a pretreatment forebay with a capacity equal to ten percent of total basin capacity (approximately 5,000 cubic feet). The forebay is designed as a hardened surface (open cell pavers or articulated blocks) for easy annual maintenance. The forebay is located at an existing gated access point to the area and is sited to maintain a user-created trail in the area. The open cell pavers can be planted with native grasses in order to blend into the surrounding meadow, but the hard surface makes it easy for a maintenance crew to remove the accumulated course sediments with common equipment. Adequate pre-treatment will prolong period of time between major maintenance endeavors within the wet basin.

From the forebay, stormwater enters the wet basin across a shallow filtration area. This area is designed to have dense wetland vegetation with groundwater at or below the surface. From the filtration area, the water flows into the deep pool retention area. Constructed shallow islands provide additional filtration as well as help the basin blend into the surrounding topography. Because excavation in the deep pool is below the seasonally high groundwater table, this area will be wet during high groundwater years. The final treatment is a wetland bench that provides additional filtration and nutrient uptake before the treated water enters an outlet structure and exits into the existing conveyance ditch that currently serves as the outlet for the existing basin. Any remaining existing ditch upstream of the proposed outlet would be filled and plugged. An emergency spillway has also been added to the basin in the event the outlet structure fails and per Douglas County standards. Another gate near the western end of the basin provides access to the basin outlet area for any maintenance needs. This access is expected to be less frequent (every 5 to 10 years) and a temporary mat road is suggested for access as to minimize the visual impacts to the meadow. A long-term study of the Tahoe City Wetland showed an annual sediment accumulation of 3 cm/year and therefore maintenance to the deep pool would be recommended at 10 year minimum intervals (Qualls and Heyvaert, 2017). A more detailed maintenance plan will be included with the Final Design Report.

Because of the shallow depth to groundwater, excavation in the area is limited and a berm is necessary to create basin capacity. To maintain the meadows character, this berm is limited to 3 feet in height at the end of the basin and tapers off as it moves towards the inlet. The berm has 4:1 slopes with the exception of the access area which has 6:1 slopes per Douglas County Standards.

Existing vegetation surrounding the basin will be maintained whenever possible for screening. To the north of the basin, plantings such as willow or aspen are proposed to screen the basin from the bike trail. The design team proposes to work with USFS botanists and recreation staff to choose desirable screening vegetation. Vegetation within the basin will be carefully chosen to match the surrounding native vegetation as well as promote wet basin treatment processes. A mixture of emergent, floating and submerged macrophytes will be utilized within the treatment area. A qualified botanist will be retained to assist with a revegetation plan and specifications.

The proposed 50 percent design resulted in a net cut volume of 1,322 cubic yards. The basin deep pool is approximately 3 feet deep. The capacity of the proposed basin is approximately 1.3 acre-feet (55,700 cubic feet) with the treatment surface area being 24,700 square feet.

50 PERCENT CONVEYANCE DESIGN

This project is the first phase of a larger multi-phase project that will update Kahle Drive into a "Complete Street" that provides multimodal access and on-street parking. Although the Kahle Drive Complete Street Project is not fully funded, an assumption was made that the project will eventually increase the width of Kahle Drive. Currently the storm drain pipe feeding Kahle Basin is an average of five feet behind the back of the curb along Kahle Drive's north side. Improvements to Kahle Drive will result in the pipe eventually being under a paved portion of Kahle Drive. Coverage on the existing pipe is currently adequate and cover is expected to increase if the elevation of Kahle Drive is increased as proposed. Therefore, the design team is proposing that only the pipe be upgraded to allow for adequate conveyance and that the existing manholes are left unchanged. The existing manholes will eventually be upgraded during the construction of the Kahle Drive Complete Street through a modification to the existing manhole or replacement with a more appropriate feature such as a drainage inlet to match the new chosen Kahle Drive section. Upgrading the manholes now may result in completing work twice which is why it is necessary to these two phases of the project to coordinate.

As discussed in existing conditions as the Master Plan Document, the current 30 inch and 36 inch RCP cannot convey the 24 hour, 25 year peak flow as required by the Douglas County Standards. For pipes 48 inches and larger, the Douglas County standards require RCP, however, for pipes less than 48 inches, plastic pipe may be used. Using the existing pipe profile and manholes and replacing the existing 36 inch RCP with 42 inch gasketed plastic pipe provides the required conveyance for the section of pipe near the inlet. The 30 inch pipe upstream of this can be replaced with a 34 inch or 36 inch plastic pipe and meet the County standards.

The system installed in 1992 used corrugated metal pipes that pulled from the surface water in each drainage inlet as a way to achieve oil separation. This system is outdated and would not be considered adequate by today's standards. The design team proposes to update an existing 1500 gallon (approximately 200 cubic feet) vault prior to the final section of pipe and accessible through two 24 inch manhole openings with a functional sand/oil separator. The option exists to retrofit the vault in place with a $200 oil and grease sorbent mat that can be replaced annually or replace the vault with an updated sand/oil separator (estimated at $20,000). More design and input from the maintenance team is necessary to finalize this selection.

The current revegetation proposed for the disturbance caused by the pipe installation is a 3 inch layer of bark mulch for temporary erosion protection until the installation of the Kahle Drive Complete Street phase. If funding for this phase does not seem imminent, revegetation for the pipe trench may be updated to native grasses and plants to blend with the surrounding area.

NEXT STEPS

The accelerated pace of design and implementation necessitates efficient planning and design. With comments received through the Technical Advisory Committee process, NTCD will advance the design to a 90 percent level which will include engineering plans and specifications. NTCD will work with Douglas County and NDOT to evaluate the project's impact for the Tahoe TMDL requirements and any maintenance needs that need to be addressed.

REFERENCES

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