



STAFF REPORT

Meeting Type: Board of Directors
Title: Update on the Water Supply Roadmap – Local Storage Alternatives
From: Paul Sellier, Water Resources Director
Through: Ben Horenstein, General Manager
Meeting Date: April 30, 2024

AS *B*

TYPE OF ACTION: Action X Information Review and Refer

RECOMMENDATION: Receive an update on Water Supply Roadmap Local Storage Alternatives

SUMMARY: On February 28, 2023, the Board selected the Integrated Roadmap for improved water supply resiliency (Roadmap); and since that time, staff has been implementing the early action projects, while in parallel working to advance the longer term, more complex projects. The project team has refined and added to the alternatives described in the Strategic Water Supply Assessment and will describe the screening process leading to a proposed shortlist of projects. The team intends to analyze the shortlisted projects in more detail to allow the Board to select a preferred project. Staff will provide a presentation illustrating the process leading to the proposed shortlist.

DISCUSSION: The team has developed the Local Storage alternatives to allow a screening process to occur that narrows the options from 11 to a potential shortlist of three. These remaining shortlist projects can then be considered in greater detail before a preferred project alternative is identified and designed to a level that can support the necessary environmental review. The project team has completed the initial screening process and developed a proposed shortlist for consideration. During the meeting project team members will review the alternatives, screening process and criteria used to arrive at the proposed shortlist.

The process of screening from 11 alternatives to a shortlist of three involves weighing each alternative against the project goal which is supported by a set of criteria. Each criterion aids in the assessment of specific aspects of an alternative including its performance relative to project goals, and its feasibility.

SCREENING PROCESS:

The overall project goal is to enhance the reliability, flexibility and resiliency of the water system to improve service to Marin Water customers. In order to provide a basis for comparison between storage alternatives during the screening process, each alternative (with the exception of the spillway modifications) was sized to provide an additional 20,000 AF of new storage. Conceptual layouts were established for each alternative in order to understand key aspects such as constructability and cost. That information provided a basis for evaluation against these criteria: Water Reliability and Sustainability, Flexibility and Resiliency, Schedule and Implementation, Water Quality, Environmental and Social Stewardship and Economic-Financial. The criteria evaluation shows that several of the alternatives are infeasible and/or do not meet the project goals. A number of alternatives were found to be economically or financially infeasible to the extent that regardless of how they may score in other criteria categories the project would remain infeasible. Economic feasibility requires that the alternative would provide benefits commensurate with its costs, while financial feasibility requires that the alternative be within the District's means.

Spillway Modifications alternatives, while not infeasible, do not meet the project goal. However, these alternatives could provide some additional permanent or temporary storage and can be constructed more quickly than any of the alternatives that require raising existing dams or constructing new dams. In particular, Nicasio dam is different from the other three dams in this category because potential spillway gates were considered in the original design of the dam and spillway and as such the project is both economically and financially feasible. For this reason, staff is proposing to transition the Spillway Modification projects to the short term category of Roadmap projects and begin work to further evaluate these alternatives as soon as possible. This approach reduces the number of remaining alternatives to eight, as summarized below.

Dredging of Reservoirs

The team reviewed the dredging of Nicasio Reservoir as a representative example of reservoir dredging, as many of the same challenges at Nicasio would need to be addressed at any other reservoir. The dredging of Nicasio Reservoir would require removal of 32.3 million cubic yards of material from the reservoir in order to increase the storage capacity by 20,000 AF. The years-long large-scale dredging, dewatering, off-hauling, and disposal of dredged materials would pose substantial construction challenges that would greatly affect the project's cost. During that long construction period, measures would need to be taken to manage released water quality and avoid adverse water quality downstream in Lagunitas creek. At an estimated cost in excess of \$1,000 M, dredging Nicasio, and by extension dredging of any of the District's reservoirs, is not economically or financially feasible due to extreme cost and complexity.

Devil's Gulch

The Devil's Gulch reservoir and dam site is in a narrow canyon off Sir Francis Drake Boulevard, about 3 miles north of Kent Reservoir. The site is within state and federally owned land that is part of Samuel P. Taylor State Park and the Golden Gate National Recreation Area. The area is forested open space used for recreation. A 270-foot-high, 1,400-foot-long zoned earth and rock fill dam on Devil's Gulch Creek, a tributary to Lagunitas Creek, would impound a 20,000-acre-foot reservoir. Construction of this new dam would require about 3.6 M cubic yards of fill and necessitate work in a very space-constrained area in the vicinity of Sir Francis Drake Boulevard. Devils Gulch was found to be infeasible as it is highly

unlikely that the District would be able to acquire the land since it is situated in Samuel P. Taylor State Park and the Golden Gate National Recreation Area (federal land).

Halleck Reservoir

The new Halleck Reservoir would be located on Halleck Creek, in unincorporated Marin County east of the town of Nicasio and about 3 miles east of Nicasio Reservoir. The Halleck dam and reservoir site is within the Nicasio Reservoir watershed off Old Rancheria Road and current land uses include agricultural, forest (mostly hardwood) land, and residential. A 278-foot-high, 2,200-foot-long zoned earth and rock fill dam would impound a 20,000-acre-foot reservoir. Construction of this new dam would require about 10.4 M cubic yards of fill. At an estimated cost of \$753M, a reservoir located at Halleck Creek was found to be economically and financially infeasible due to the size of the dam needed and technical risks arising from unfavorable geologic conditions.

Upper Nicasio Reservoir

The Upper Nicasio Reservoir would be in the northwestern portion of the existing Nicasio Reservoir watershed, to the north of Point Reyes-Petaluma Road. Existing land uses include agricultural (ranch) land, several building complexes including residences, and private access roads. The new 20,000-acre-foot upper reservoir would be impounded by a 103-foot-high, 3,900-foot-long zoned earth and rock fill dam. The new dam would be constructed immediately north of Point Reyes-Petaluma Road. Construction of this new dam would require about 4.8 M cubic yards of fill. The reservoir is unlikely to be entirely self-filling and would require conveyance of water either from Nicasio or Soulajule Reservoirs. At an estimated construction cost of \$606M, the alternative is potentially economically feasible and potentially financially feasible. Should this alternative move forward, the team would look in greater detail to understand the optimum capacity that maximizes water supply while minimizing other issues at this location.

Alpine Reservoir

Alpine Reservoir is unincorporated Marin County located on Lagunitas Creek in the Mount Tamalpais Watershed, immediately downstream of Bon Tempe Reservoir. Alpine Dam is a concrete arch gravity dam that was originally completed in 1919 and then raised in 1941. The dam is approximately 137 feet high with a crest length of 700 feet. The dam impounds Alpine Reservoir which has a maximum storage capacity of approximately 8,891 acre-feet. Most of the land surrounding the existing reservoir and dam is forested (mostly conifer). There are numerous publicly accessible roads and trails nearby, including the Fairfax-Bolinas Road which crosses Alpine Dam. Steps were left in the downstream face of the dam when it was raised in 1941 to allow another raise of the dam at a later date. Raising the dam by 75 feet and bringing the maximum operating level to match that of Bon Tempe Reservoir would provide an additional 23,000 acre-feet of storage. Bon Tempe Dam would be breached and the two reservoirs would be operated as one. The raise would also require the construction of a small saddle dam in a canyon to the north to protect the Meadow Club Golf Course from flooding. Also, the spillway would have to be rebuilt as part of the dam raise. Of special concern is a large, ancient landslide on the eastern side of the reservoir that requires additional consideration if the alternative is further advanced. The amount of new material required for the raise would be 240,000 cubic yards of concrete for the dam and 200,000 cubic yards of fill for the new saddle dam. The 23,000-AF size of this alternative is based on an identified threshold point that protects the toe of Bon Tempe dam from wave action. The team examined lesser capacities and they tended to either pose concerns for the safe operation of Bon Tempe, or require substantially the same engineering and permitting complexity as

the larger project but with significantly less water supply benefit. At a construction cost of \$1,295M, the raise of Alpine dam is both economically and financially infeasible.

Soulajule Dam

Soulajule Dam is located on Arroyo Sausal Creek in unincorporated western Marin County north of the town of Point Reyes Station. The dam, built in 1979, is a zoned earth fill dam, approximately 122 feet high and 700 feet long. The dam impounds Soulajule Reservoir, which has a normal maximum storage capacity of approximately 10,300 acre-feet. The reservoir expansion area includes land owned by Marin Water and privately owned land. The existing reservoir and dam are surrounded by forest land (hardwood with patches of conifer) and agricultural land (typically used for grazing). Raising the dam nominally 39 feet would provide an additional storage of about 20,000 acre-feet. The volume of material needed to complete the raise of Soulajule is approximately 1.2 M cubic yards of fill. At a cost of \$291M, this alternative appears economically and financially feasible.

Nicasio Reservoir

Nicasio reservoir is in western Marin County located near the town of Nicasio and is impounded by Seeger Dam. The dam is a zoned earth and rock fill dam that was completed in 1961. The dam is approximately 115 feet high with a crest length of 400 feet. Nicasio Reservoir has a maximum storage capacity of approximately 22,430 acre-feet. The reservoir expansion area includes land owned by Marin Water and privately owned land. The existing reservoir and dam are surrounded by agricultural land with relatively few structures and limited forest land; affected infrastructure includes Pt. Reyes - Petaluma Road, Nicasio Valley Road, and private roads. Raising the dam by 18 feet would provide an additional storage of about 20,000 acre-feet. The raise would require building a new spillway in the left abutment but would only require about 180,000 cubic yards of new fill. Protecting the town from flooding would necessitate a 40-foot-high, 900-foot-long dike and a 2.6-mile diversion of Nicasio and Halleck Creeks around the eastern portion of the reservoir. A diversion of inflow from 3 drainage channels flowing from the north would also be required. Construction of these diversions, each with its own diversion dam, intake, and flood pool area, is likely to be very complicated given the existing infrastructure. The alternative would also require reconstruction of almost 8 miles of roads. The complexity of protecting the town increases the cost of the project to over \$1,242 million and it is not economically or financially feasible.

Kent Reservoir

Kent Reservoir is in unincorporated Marin County near the communities towns of Lagunitas and Forest Knolls and is impounded by Peters Dam. The dam is a zoned earth and rock fill dam that was originally completed in 1953. The dam was raised during 1980 and 1981. The raise was also a zoned embankment dam. The dam is approximately 230 feet high with a crest length of 700 feet. The dam retains Kent Reservoir, which has a maximum storage capacity of approximately 33,300 acre-feet. Kent Reservoir is within watershed land managed by Marin Water. Most of the land surrounding the existing reservoir and dam is forested (a mix of conifer and hardwood). There are numerous publicly accessible roads and trails in the area. Raising the dam about 37 feet would provide additional storage of about 20,000 acre-feet. The raise would require removal of a substantial portion of the existing embankment to expose the various zones that need to be extended in the new embankment in a way that maintains their integrity. The crest of the new dam would be moved downstream, and a curved embankment would be necessary to tie into the left abutment while avoiding a side valley. The raise would also require building a new spillway in the left abutment that may have to be curved. The amount of new fill required for the raise is about 2.9 M cubic yards. The enlarged Kent Lake would be self-filling.

However, the alternative is technically challenging, and environmental factors such as Northern Spotted Owls would substantially increase the duration of construction. At an approximate cost of \$613M, the project may be economically feasible and is potentially financially feasible.

SUMMARY: The results of the alternatives screening indicate that many of the alternatives are infeasible:

- None of the spillway modifications can satisfy the goal of providing substantial additional local storage on their own. However, the addition of permanent gates at Nicasio Reservoir, although only providing 3,000 acre-feet of additional storage, is economically and financially feasible. Construction costs of spillway modifications at Nicasio Reservoir are estimated to be \$3M and could be carried forward as a near-term project because it can be constructed relatively quickly and economically. Implementation of spillway modifications at Nicasio Reservoir could incrementally reduce the capacity needed from another storage project(s).
- The dredging of Nicasio is not economically or financially feasible because of its construction complexity and extreme cost.
- Devil's Gulch is infeasible because it is entirely located on State and Federal Land: Samuel P. Taylor State Park and the Golden Gate National Recreation Area
- Halleck Reservoir is not economically or financially feasible because of the large size of the embankment required, technical challenges and the resulting construction cost.
- Alpine dam raise is not considered financially or economically feasible because of construction complexity and cost.
- Nicasio dam raise is not considered feasible due to cost and complexity.
- Kent dam raise is technically feasible but has constructability and cost challenges that will require further investigation if this alternative is advanced.

At this point in the evaluation, the team is considering the SoulaJule dam raise, Kent dam raise, and Upper Nicasio reservoir for further study. The next phase of work will begin immediately and staff will provide progress updates along the way. Additionally, Staff will begin work on the Nicasio spillway modifications which will move forward as its own shorter term project on a separate track to the longer term Local Storage projects.

ENVIRONMENTAL REVIEW: Not Applicable.

FISCAL IMPACT: None.

ATTACHMENT(S):

1. Draft Screening of Alternatives for Local Storage Improvements Memo