

MEMORANDUM

TO: RIVANNA WATER & SEWER AUTHORITY
BOARD OF DIRECTORS

FROM: JENNIFER A. WHITAKER, CHIEF ENGINEER

REVIEWED BY: THOMAS L. FREDERICK, EXECUTIVE DIRECTOR

SUBJECT: REPORT: IMPLICATIONS OF EARTH DAM SELECTION

DATE: JULY 27, 2010

Background

At the May 2010 Board Meeting, Schnabel Engineers presented the results of their Preliminary Design of the Ragged Mountain Dam. Based on an analysis of the respective benefits of an earthfill dam compared to the originally proposed RCC dam, it was determined that the earthfill dam approach offers a number of significant benefits, including lower cost. During the discussion of selection of an earthfill dam, a question was raised as to how much additional reservoir storage volume would result from the removal of borrow material (earth) from areas upstream of the new dam. Schnabel has considered this question, as well as addressing the question of how much “dead storage” would be required within the new pool. This memorandum discusses the ramifications of increased volume from using borrow material from within the new pool area and from reducing the volume to be reserved for dead storage. The primary effect of this additional volume is to allow lowering the elevation of the new normal pool from 686 feet to 683 feet, while still maintaining the goal approved by the Board in 2006 to deliver 2,189 million gallons (MG) of water supply volume. Primary benefits of this modification to the design are a significant reduction in the length of streams which will be inundated by the new reservoir pool, and a reduction in the total number of trees which will need to be cleared for the new reservoir.

Discussion

“Dead storage” is a term which in dam design is precisely defined as the amount of storage below the lowest outlet of a dam, or the drain. This is water which cannot be drained from the reservoir by gravity means. In multiple-use dams, which might be used for flood control and irrigation, in addition to drinking water, a distinction is made between “inactive storage” and “dead storage”. Inactive storage is defined as the volume of water between the bottom of the lowest “service outlet” and the drain outlet, which determines the top of “dead storage”. Locally, in discussing RWSA water supply dams, the term “dead storage” has been used to include both “inactive” and “dead” storage volumes. This is the terminology which will be used for the remainder of this memorandum, and all volume below the lowest drinking water withdrawal elevation will be considered dead storage.

Dead storage is a necessary portion of the volume stored behind a dam to allow for a minimal amount of fish habitat once the level has dropped below useable volume (to avoid a fish kill); and to provide storage for accumulated sediments below the active volume of the reservoir. In a drinking water reservoir, it is also beneficial to have a volume of water below the lowest withdrawal point so all of the water which is withdrawn for drinking water purposes comes from the surface of a calm pool of water and therefore is well-oxygenated and is not impacted by bottom materials (sediments) which would be washed into the intake if withdrawals were coming from the very bottom of the original channel.

In the case of the Ragged Mountain reservoir, a dead storage volume of 10% of future volume has been proposed by Schnabel. This is a smaller percentage than originally suggested by Gannett Fleming (15%), but will amount to 258 million gallons (MG) of remaining volume below the lowest drinking water withdrawal point. Since nearly the entire Ragged Mountain watershed is protected and fully forested, natural sediment loads are and will continue to be minimal. Water pumped into the new reservoir from South Rivanna will be pre-treated to remove sediments, so the total sediment loads from this source will also be small. As a consequence of these considerations, 10% dead storage volume is recommended by Schnabel as sufficient for the new reservoir.

By removing borrow (earth) materials from the pool area of the new reservoir, additional storage volume is created within the normal pool. While some of this additional volume will be occupied by the sloping upstream embankment, and there will be a small amount of lost volume “trapped” between the new dam and the existing dam, there will be a net gain of approximately 76 MG, or 3%, of additional storage.

With the reduction in dead storage, from 15% to 10% of total volume, and with the additional volume obtained by removing borrow materials from the pool area, it will be possible to obtain the necessary useable storage volume of 2,189 MG with a dam which is 3 feet lower than originally proposed. Instead of requiring a new normal pool elevation of 686 feet, the new pool above the earth dam will only need to be 683 feet. This reduction in normal pool elevation has two primary beneficial aspects: Stream impacts will be reduced by more than 250 feet; and forested areas needing to be cleared will be reduced by 3 acres.

Board Action Requested:

This report is submitted to the Board for discussion and feedback. Unless directed otherwise by the Board, staff will use Schnabel’s recommended normal pool elevation of 683 feet in further discussion of the water supply plan approved in 2006 for long-term needs of the community through expanding the Ragged Mountain Reservoir.