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# TECHNICAL MEMORANDUM NO. 2

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| **Date:** | December 1, 2023 |
| **To:** | Nate Gillespie, Operations Manager |
| **From:** | Robert W. Miles |
| **Subject:** | Scotts Valley Water District<br>Bethany Reservoir<br>Analysis for Project Implementation |
| **Engineering Analysis:** | Robert W. Miles, Bob Riley |
| **Review:** | Rodney Cahill, Bob Riley |

## PURPOSE

The purpose of this memo is to develop, summarize, and record the development of the implementation plan for Bethany Reservoir.

## ANALYSIS OF ALTERNATIVES FOR PROJECT IMPLEMENTATION

The project selection will involve evaluation of the following four alternative plans:

1. Rehabilitation of the existing reservoir
2. Replacement of the existing reservoir with two new tanks sized to mitigate issues with ridgetop fracturing
3. Replacement of the existing reservoir with a new reservoir located at a site further up the ridge away from the threat of ridge fracturing, and
4. Replacement with a new reservoir anchored to a new concrete slab foundation.

The alternate plans have been developed following review of the construction history of the existing installation, field review of condition of the steel reservoir as summarized in the field assessment memorandum, field reviews of the existing and proposed sites, interviews with the geotechnical engineer and geologist who have provided services for the existing facility, and input and review from the District management and operations staffs.

Each plan would retain or install a storage capacity of approximately 400,000 gallons. In addition to the alternate plans listed above, four additional alternatives assume that bolted steel reservoirs would be constructed instead of welded steel reservoirs.

## Reservoir Alternative 1 – Rehabilitate Existing Reservoir

### Description

The existing reservoir would be rehabilitated on the existing foundation. The modifications would include reducing the shell height to eliminate shell anchorage as a necessity for seismic resistance. A second smaller tank would be constructed at the site to restore the storage lost by the reduction in shell height of the existing reservoir. The existing reservoir would have a reduced capacity of approximately 300,000 gallons and the new smaller tank would store 100,000 gallons. The second tank water height would be 26 feet and the diameter would be 26 feet. The second tank would be designed to resist the effects of additional fracturing of the bedrock foundation by using a thick, mat-type foundation. Both the welded steel and bolted versions of the smaller tank would be anchored to the concrete foundation to resist the effects of earthquakes.

### Advantages

This alternative would provide a modified existing reservoir with an enhanced cone roof. It would provide for optimal protection against the MCE (Maximum Considered Earthquake) and minimum future coating maintenance costs. The new smaller second tank would remain in service during outage of the existing reservoir for maintenance. No additional property would be required.

### Disadvantages

The modified existing reservoir would still be subject to future issues with ridgetop fracturing. The new smaller tank would be designed to resist the effects of potential additional fracturing of the bedrock foundation, but would not be completely secure from the issues. The service life and maintenance painting cycles for the bolted tank would be significantly shorter.

### Estimated Initial Capital Cost

The new replacement reservoir would require the following costs to be expended, indexed to the year 2023.

| Items | Estimated Comparative Project Budget Cost, Welded $ | Estimated Comparative Project Budget Cost, Welded and Bolted$ |
|---|---|---|
| **Rehab and New Roof for Existing Reservoir – 300,000 gallons** | | |
| **Sitework** | | |
| Earthwork, paving | 96,000 | |
| **Structural** | | |
| Removal of exist roof | 114,000 | |
| Enhanced cone roof | 467,000 | |
| Fittings, appurtenances, and CP | 137,000 | |
| Stairway, ladder, and platform | 114,000 | |
| Shell and bottom | 278,000 | |

| | | |
|---|---|---|
| Overflow and drain | 21,000 | |
| Retrofit inlet/outlet piping | 82,000 | |
| **Coatings** | | |
| Interior roof coatings | 66,000 | |
| Exterior roof coatings | 41,000 | |
| Interior shell/bottom coatings | 164,000 | |
| Exterior shell coatings | 75,000 | |
| Other | 134,000 | |
| Subtotal for Existing Reservoir | 1,789,000 | 1,789,000 |
| **Second New Tank, 100,000 gallons, welded** | | **Second New Tank, 100,000 gallons, bolted** |
| **Sitework and Foundation** | | |
| Earthwork, piping, foundation | 568,000 | 580,000 |
| **Structural** | | |
| Dome roof | 158,000 | |
| Fittings, appurtenances | 137,000 | |
| Stairway, ladder, and platform | 115,000 | 100,000 |
| Shell and bottom | 205,000 | |
| Bolted steel tank and fittings | | 381,000 |
| Overflow and drain | 22,000 | 22,000 |
| Inlet/outlet piping | 82,000 | 84,000 |
| **Coatings** | | |
| Interior roof coatings | 14,000 | |
| Exterior roof coatings | 12,000 | |
| Interior shell/bottom coatings | 60,000 | |
| Exterior shell coatings | 32,000 | |
| Sealant stripe coatings | | 28,000 |
| Other | 38,000 | |
| Subtotal for Second Tank | 1,443,000 | 1,195,000 |
| **Project totals** | 3,232,000 | 2,984,000 |

Notes on cost levels: All the estimated budget costs in this memo are concept-level costs for the year 2023 developed using preliminary project concepts and criteria. An allowance for engineering, construction, environmental, and City administration services; changes during construction; and project contingency have been included at 45 percent for structural work and 33 percent for coatings.

## Reservoir Alternative 2 – Replace Existing Reservoir with Two New Tanks

### Description

The existing reservoir would be removed and replaced with two new tanks with diameters of approximately 28 feet. Both of the new tanks would require shell anchorage as a necessity for seismic resistance. The water heights of the new tanks would be approximately 44 feet, and each would have a storage capacity of approximately 200,000 gallons. Due to the presence of existing ridgetop fracturing, each tank would be founded on a thick mat-type foundation. The new tanks would provide for optimal protection against the MCE and minimum future coating maintenance costs.

Both the welded and bolted versions of the tanks would be anchored to the concrete foundation.

There are two potential site layouts for this alternative. The first layout would locate one tank at approximately the center of the existing one, and the second tank at the site of the existing auxiliary tanks. A second layout would locate the two new tanks at the site of the auxiliary tanks, and would require about 40 feet of additional property towards the northeast direction.

## Advantages

This alternative would provide two new reservoirs with optimal protection against the MCE and the minimum future coating maintenance costs. Each of the two new smaller tanks would remain in service during outage of the other for maintenance.

## Disadvantages

The new smaller tanks would be designed to resist the effects of potential additional fracturing of the bedrock foundation, but would not be completely secure from the issues. Some additional property would be required. The service lives and maintenance painting cycles for the bolted tanks would be significantly shorter.

## Estimated Initial Capital Cost

The new replacement reservoir would require the following costs to be expended, per additional tank, indexed to the year 2023.

| Items | Estimated Comparative Project Budget Cost, Welded, $ | Estimated Comparative Project Budget Cost, Bolted, $ |
|---|---|---|
| **Sitework and Foundation** | | |
| Earthwork, piping, foundation | 1,299,000 | 1,299,000 |
| **Structural** | | |
| Dome roof | 165,000 | |
| Fittings, appurtenances | 92,000 | |
| Stairway, ladder, and platform | 154,000 | 134,000 |
| Shell and bottom | 337,000 | |
| Bolted tank and fittings | | 515,000 |
| Overflow and drain | 25,000 | 25,000 |
| Inlet/outlet piping | 80,000 | 80,000 |
| **Coatings** | | |
| Interior roof coatings | 17,000 | |
| Exterior roof coatings | 14,000 | |
| Interior shell/bottom coatings | 113,000 | |
| Exterior shell coatings | 68,000 | |
| Sealant stripe coatings | | 54,000 |
| Other | 44,000 | |
| **Project totals** | 2,408,000 | 2,107,000 |

The estimated cost for two tanks would be twice that shown in the table, $4,816,000 for welded construction and $4,214,000 for bolted construction.

## Reservoir Alternative 3 – New Reservoir

### Description

The existing reservoir would be replaced with a new 400,000-gallon reservoir constructed on the same ridge approximately 450 feet north of the existing reservoir. The bolted reservoir version would have a concrete bottom and embedded shell ring.

### Advantages

This alternative would provide a new reservoir with an enhanced cone roof. It would provide for optimal protection against the effects of earthquakes and the minimum future coating maintenance costs.

### Disadvantages

The new reservoir structure would be secure against future issues with ridgetop fracturing but the connecting piping would still be vulnerable, as it would have to cross the ridge to connect with the site piping at the existing facility. New property would be required for the new reservoir site and connection pipeline. The service life and maintenance painting cycles for the bolted tank would be significantly shorter.

### Estimated Initial Capital Cost

The new replacement reservoir would require the following costs to be expended, indexed to the year 2023.

| Items | Estimated Comparative Project Budget Cost, Welded $ | Estimated Comparative Project Budget Cost, Bolted $ |
|---|---|---|
| **Sitework and Foundation** | | |
| Earthwork, piping, foundation | 1,325,000 | 2,174,000 |
| Connecting pipeline | 325,000 | 330,000 |
| **Structural** | | |
| Enhanced cone roof | 466,000 | |
| Fittings, appurtenances | 93,000 | |
| Stairway, ladder, and platform | 112,000 | 80,000 |
| Shell and bottom | 667,000 | |
| Bolted steel reservoir and fittings | | 725,000 |
| Overflow and drain | 21,000 | 21,000 |
| Inlet/outlet piping | 80,000 | 81,000 |
| **Coatings** | | |
| Interior roof coatings | 65,000 | |
| Exterior roof coatings | 41,000 | |
| Interior shell/bottom coatings | 162,000 | |
| Exterior shell coatings | 74,000 | |
| Sealant stripe coatings | | 99,000 |
| Other | 132,000 | |
| **Project totals** | 3,563,000 | 3,510,000 |

## Reservoir Alternative 4 – Replacement of Reservoir at Existing Site

### Description

The existing reservoir would be replaced by a new reservoir on a new foundation. The new reservoir would have similar dimensions as the existing, but would be anchored to the foundation. The foundation would consist of a thick, reinforced concrete, mat-type foundation with an outer diameter of 50 feet. Since the existing ridge fractures are only about 30 feet apart, the new foundation would extend outside of the fractures and be potentially subject to continuation of sliding from beneath the periphery of the slab.

### Advantages

This alternative would provide a new reservoir at the existing site with an enhanced cone roof. It would provide for optimal protection against the MCE and minimum future coating maintenance costs. No additional property would be required.

### Disadvantages

The new replacement reservoir would still be subject to future issues with ridgetop fracturing. The new foundation would be designed to resist the effects of potential additional fracturing of the bedrock foundation to the extent feasible, but would not be completely secure from the issues. The probability of the new reservoir to remain in service following a damaging earthquake would be unknown due to the potential sliding away of the foundation rock. The service life and maintenance painting cycles for the bolted tank would be significantly shorter.

### Estimated Initial Capital Cost

The new replacement reservoir would require the following costs to be expended, indexed to the year 2023.

| Items | Estimated Comparative Project Budget Cost, Welded $ | Estimated Comparative Project Budget Cost, Bolted $ |
|---|---|---|
| **Sitework and Foundation** | | |
| Earthwork, piping, foundation | 2,188,000 | 2,427,000 |
| Connecting pipeline | 60,000 | 61,000 |
| **Structural** | | |
| Enhanced cone roof | 464,000 | |
| Fittings, appurtenances | 92,000 | |
| Stairway, ladder, and platform | 112,000 | 80,000 |
| Shell and bottom | 665,000 | |
| Bolted steel reservoir and fittings | | 727,000 |
| Overflow and drain | 21,000 | 21,000 |
| Inlet/outlet piping | 80,000 | 81,000 |
| **Coatings** | | |
| Interior roof coatings | 65,000 | |
| Exterior roof coatings | 40,000 | |
| Interior shell/bottom coatings | 161,000 | |
| Exterior shell coatings | 74,000 | |

| | | |
|---|---|---|
| Sealant stripe coatings | | 99,000 |
| Other | 132,000 | |
| **Project totals** | 4,154,000 | 3,497,000 |

## Other Alternatives Considered

Other alternatives are possible, as variations on the three presented above. As examples, both Alternative 1 and 2 could have phased construction, so that one reservoir is constructed at an earlier date with the second constructed at a later time. These types of refinements could be examined if either of those alternatives are selected for implementation.

Another alternative considered has been the concept of splitting the 400,000 gallons of storage between the Bethany site and a site at lower elevation. This plan would require a new variable speed pumping station at the lower site, with a standby generator and a hydropneumatic pressure tank. The lower site would not be as susceptible to geologic hazards as the Bethany site. If the new Bethany reservoir were to be out of service, then the new system would still provide the storage and pressure needed for continuation of service by use of the variable speed pumping system and hydropneumatics tank. The pumping station would need to be able to pump fire flows. The concept-level cost estimate would be about $4,000,000 for this type of plan using welded reservoirs. Identification and purchase of a suitable site for the installation would be major time and economic challenges.

# ECONOMIC EVALUATION

## General

The alternatives can be evaluated for their economic efficiency to provide information about their initial capital costs and comparative long-term economic effectiveness.

## Initial Capital Costs

Table A summarizes the initial capital required for each reservoir alternative.

**TABLE A**
**SUMMARY OF INITIAL CAPITAL COSTS**

| Alternative | Description | Welded $ | Bolted $ |
|---|---|---|---|
| 1 | Rehabilitate existing reservoir | 3,232,000 | 2,984,000 |
| 2 | Replace existing reservoir with two new tanks | 4,816,000 | 4,214,000 |
| 3 | Replace existing reservoir with a new reservoir located further north on the ridge | 3,563,000 | 2,679,000 |
| 4 | Replace existing reservoir with a new reservoir on existing site | 4,154,000 | 3,497,000 |

The capital costs for Reservoir Alternatives 2 and 4 are substantially greater than that of Alternatives 1 and 3. Alternative 1 is the rehabilitation strategy, but in order to increase the seismic performance the water height must be reduced, which in turn requires that a second reservoir be constructed to restore the storage volume to 400,000 gallons. Alternative 1 does not mitigate the potential for damage due to ridgetop fracturing.

Alternative 2 requires construction of two new 200,000-gallon tanks. But, in order to fit on the ridge between two suspected active fractures, the tank shell dimensions become 28 feet in diameter and 48 feet tall. These proportions are inefficient from a seismic performance perspective, resulting in anchored designs on thick concrete slab foundations. For both the welded and bolted versions of Alternative 2, the cost of the foundations would be approximately half of the total cost of the project.

Alternative 3, the replacement strategy at a new site, has the lowest capital cost due to its not having to deal with the ridgetop fracturing potential faced by Alternatives 1 and 2. A replacement reservoir at the site further up the ridge would not have a restricted diameter. The diameter would be selected to optimize resistance to the effects of earthquakes.

Alternative 3would require additional property, which is not included in the cost estimates. Alternative 2 would require additional property for one of the two potential site layouts.

Alternative 1 has an initial cost competitive with that of Alternative 3, but carries a burden of uncertain performance with respect to potential ridgetop fracturing and lack of a concept for a responsive design. Alternative 4 is in a similar situation, in that it would require a design that does not have a clear basis. Due to these limitations, it is not recommended to continue consideration of Alternatives 1 and 4. Alternative 2 suffers from some of the same limitations as Alternatives 1 and 4, but the plan definition is to construct two tanks of relatively small diameter to fit between potential ridge fractures, which would be a more responsive design than that of Alternative 1.

## Long-Term Economic Effectiveness

The present worth calculation has been selected as an indicator of economic efficiency over a study period of 200 years. The economic study period for facilities such as reservoirs is typically 50 years or greater, depending on the objectives of the evaluation. The Environmental Protection Agency recommends a range of 50 to 100 years. For this evaluation, a study period of 200 years is recommended because this length of time represents the minimum estimated service life of a welded steel reservoir with advanced design features.

The service life of a bolted tank has been assumed at 40 years for versions that use the conventional bolted tank floors and 50 years for tanks that can use reinforced concrete floors. These are aggressive estimates for service lives but both can be realized with suitable design and construction details. Both of these service life estimates assume advanced corrosion protection measures such as sealant strips for plate edges, bolt head encapsulation, and periodic maintenance painting of the interior surfaces. Without these measures, service lives will be in the range of 15 to 20 years, based upon observations of existing bolted steel tanks.

The "present worth" can be visualized as the lump sum payment at year 2024 necessary to provide for all the capital, maintenance, and replacement costs necessary to implement and sustain operation of each alternative over the 200-year study period 2024-2224. Alternatives that produce comparatively low present worth values are more cost-effective than those that yield higher values.

The present worth values have been calculated using a minimum attractive rate of return of 6.0 percent. This rate has been set based upon the average annual yield of ten-year term treasury securities over the 1963 to 2022 period. Treasury bonds are an available alternative investment for the District ratepayers.

An annual inflation rate of 4.5 percent has been used for reservoir construction. An analysis has been made of historic construction costs using the Engineering News-Record 20 Cities Average Construction Cost Index. Between 1963 and 2022 this index increased at an annual compounded rate of 4.5 percent.

Although bond interest and inflation rates have been extremely low for last several years due to intense stimulation of the economy by the Federal Reserve Board, the long-term data show that the influence of recessions, economic policies, and other economic factors have relatively transitory effects on the long-term average rate.

Table B contains the results of the present worth analysis. The table illustrates the long-term cost impact of the greater effort for coatings maintenance and structure replacements anticipated for the bolted tank alternatives. Alternative 3, with bolted construction, has the lowest initial cost in Table A, but loses this advantage to its twin welded Alternative 3 when the long-term costs are considered.

**TABLE B**
**RESULTS OF ECONOMIC ANALYSIS**
**PRESENT WORTH METHOD**

| Alternative | Description | Welded, $ | Bolted, $ |
|---|---|---|---|
| 2 | Replace existing reservoir with two new tanks | 5,447,000 | 6,432,000 |
| 3 | Replace existing reservoir with a new reservoir located further north on the ridge | 4,151,000 | 5,005,000 |

Tables 2W, 2B, 3W, and 3B at the end of this memorandum contain the detailed economic analysis calculations.

## EVALUATION OF ADDITIONAL FACTORS

### General

Not all decision factors can be expressed in economic terms. To assist in evaluation of the two alternatives a brief review of non-economic factors is summarized in the following paragraphs. These factors have been contributed by the District staff during its review of an initial draft of this memo. Also included are factors that are difficult to evaluate for economic impacts at this stage of project development.

- Property acquisition
- Environmental processes
- System hydraulic conditions

- Facilitation of maintenance activities
- Construction sequences and duration

### Property Acquisition

Alternative 3 will involve acquisition of property from two different land owners. The process for acquisition will extend the times for design and construction. Due to the uncertainties about the cost of property, the costs have not been included in the project cost estimates. Alternative 2 can be implemented without acquisition of additional property if the site of the existing tank is used for one of the two tanks. If the two replacement tanks are located to the northeast from the existing tank, in the space now occupied by the two auxiliary tanks, some property acquisition may be necessary to fit the two new tanks within the expanded property lines.

### Environmental Processes

Alternative 3 will require a full environmental review at a site that is relatively undisturbed at the present time. The review and subsequent environmental process will require time and budget. The costs for the environmental processes have not been included in the project cost estimates. Alternative 2 is expected to require environmental review, but the project is expected to be considered a system maintenance and replacement project.

### System Hydraulic Conditions

Alternative 2 will provide two separate reservoirs with higher operating water surface elevations than will exist for Alternative 3. The higher water surfaces elevations will provide additional service pressure that is needed for the pumps that serve the next higher service zone.

### Facilitation of Maintenance Activities

Alternative 2 will provide two tanks for service. This will allow one to be taken out of service for inspection and maintenance of the other. Alternative 3 does not provide this feature.

### Construction Sequences and Durations

Between Alternatives 2 and 3, Alternative 3 provides the greatest possibility for project delay and an extended construction period. In addition, construction of Alternative 3 at a new site offers more opportunity for discovery of unknown conditions. The environmental review processes and mitigation measures will typically add substantial time and expense to this type of project. The time requirements for a full environmental review process can add a year or more to a project implementation schedule.

## PROJECT SELECTION

Based upon review of the economic and additional factors, the District staff has selected Alternative 2, replacement with two new tanks, for implementation.

Development of an appropriate design will be dependent on geologic and geotechnical engineering work to locate the ridge fractures, assess their potential future movements, and establish geotechnical and structural design criteria for the tank foundations. This geologic and geotechnical work should the first activity during the next phase of the project to confirm the technical basis for implementation of Alternative 2.

TABLE 2W
ECONOMIC ANALYSIS FOR ALTERNATIVE 2-WELDED
Present Worth Method

| Item | Description | Year | 2023 Cost | Rate of Inflation | Present Worth |
|---|---|---|---|---|---|
| 1 | Const Welded Tan | 2024 | 2,408,000 | 4.50 | 2,516,360 |
| 2 | Recoat Welded Re | 2064 | 174,000 | 4.50 | 102,821 |
| 3 | Recoat Welded Re | 2104 | 174,000 | 4.50 | 58,143 |
| 4 | Recoat Welded Re | 2144 | 174,000 | 4.50 | 32,879 |
| 5 | Recoat Welded Re | 2184 | 174,000 | 4.50 | 18,592 |
| | Residual Value | 2224 | 87,000 | 4.50 | -5,257 |
| 6 | Const Welded Tan | 2024 | 2,408,000 | 4.50 | 2,516,360 |
| 7 | Recoat Welded Ta | 2064 | 174,000 | 4.50 | 102,821 |
| 8 | Recoat Welded Ta | 2104 | 174,000 | 4.50 | 58,143 |
| 9 | Recoat Welded Ta | 2144 | 174,000 | 4.50 | 32,879 |
| 10 | Recoat Welded Ta | 2184 | 174,000 | 4.50 | 18,592 |
| | Residual Value | 2224 | 87,000 | 4.50 | -5,257 |
| | TOTAL PRESENT WORTH | | | | 5,447,078 |
| | Capital and Replacement Cost Items | | | 5,032,720 | |
| | Energy Cost Items | | | 0 | |
| | Operation and Maintenance Cost Items | | | 424,871 | |
| | Revenue and Benefit Items | | | -10,514 | |
| | Total | | | 5,447,078 | |

Minimum Attractive Rate of Return - 6.00 Percent
Study Life - 200 Years First Year of Study - 2024
File Identifier - BETH2W
File Date - 10/6/2023

TABLE 2B

ECONOMIC ANALYSIS FOR ALTERNATIVE 2-BOLTED

Present Worth Method

| Item | Description | Year | 2023 Cost | Rate of Inflation | Present Worth |
|---|---|---|---|---|---|
| 1 | Const Bolted Tan | 2024 | 2,107,000 | 4.50 | 2,201,815 |
| 2 | Recoat Bolted Ta | 2044 | 130,000 | 4.50 | 102,157 |
| 3 | Replace Bolted T | 2064 | 703,000 | 4.50 | 415,421 |
| 4 | Recoat Bolted Ta | 2084 | 130,000 | 4.50 | 57,768 |
| 5 | Replace Bolted T | 2104 | 703,000 | 4.50 | 234,912 |
| 6 | Recoat Bolted Ta | 2124 | 130,000 | 4.50 | 32,666 |
| 7 | Replace Bolted T | 2144 | 703,000 | 4.50 | 132,838 |
| 8 | Recoat Bolted Ta | 2164 | 130,000 | 4.50 | 18,472 |
| 9 | Replace Bolted T | 2184 | 352,000 | 4.50 | 37,612 |
| | Residual Value | 2224 | 290,000 | 4.50 | -17,523 |
| 10 | Const Bolted Tan | 2024 | 2,107,000 | 4.50 | 2,201,815 |
| 11 | Recoat Bolted Ta | 2044 | 130,000 | 4.50 | 102,157 |
| 12 | Replace Bolted T | 2064 | 703,000 | 4.50 | 415,421 |
| 13 | Recoat Bolted Ta | 2084 | 130,000 | 4.50 | 57,768 |
| 14 | Replace Bolted T | 2104 | 703,000 | 4.50 | 234,912 |
| 15 | Recoat Bolted Ta | 2124 | 130,000 | 4.50 | 32,666 |
| 16 | Replace Bolted T | 2144 | 703,000 | 4.50 | 132,838 |
| 17 | Recoat Bolted Ta | 2164 | 130,000 | 4.50 | 18,472 |
| 18 | Replace Bolted T | 2184 | 352,000 | 4.50 | 37,612 |
| | Residual Value | 2224 | 290,000 | 4.50 | -17,523 |
| | TOTAL PRESENT WORTH | | | | 6,432,279 |
| | Capital and Replacement Cost Items | | | 4,403,630 | |
| | Energy Cost Items | | | 0 | |
| | Operation and Maintenance Cost Items | | | 2,063,694 | |
| | Revenue and Benefit Items | | | -35,045 | |
| | Total | | | 6,432,279 | |

Minimum Attractive Rate of Return - 6.00 Percent

Study Life - 200 Years    First Year of Study - 2024

File Identifier - BETH2F

File Date – 10/6/2023

TABLE 3W
ECONOMIC ANALYSIS FOR ALTERNATIVE 3-WELDED
Present Worth Method

| Item | Description | Year | 2023 Cost | Rate of Inflation | Present Worth |
|---|---|---|---|---|---|
| 1 | Const Welded Res | 2024 | 3,563,000 | 4.50 | 3,723,335 |
| 2 | Recoat Welded Re | 2064 | 359,000 | 4.50 | 212,143 |
| 3 | Recoat Welded Re | 2104 | 359,000 | 4.50 | 119,962 |
| 4 | Recoat Welded Re | 2144 | 359,000 | 4.50 | 67,836 |
| 5 | Recoat Welded Re | 2184 | 359,000 | 4.50 | 38,360 |
| | Residual Value | 2224 | 180,000 | 4.50 | -10,876 |
| | TOTAL PRESENT WORTH | | | | 4,150,760 |
| | Capital and Replacement Cost Items | | | 3,723,335 | |
| | Energy Cost Items | | | 0 | |
| | Operation and Maintenance Cost Items | | | 438,301 | |
| | Revenue and Benefit Items | | | -10,876 | |
| | Total | | | 4,150,760 | |

Minimum Attractive Rate of Return - 6.00 Percent
Study Life - 200 Years First Year of Study - 2024
File Identifier - BETH3W
File Date - 10/6/2023

TABLE 3B

ECONOMIC ANALYSIS FOR ALTERNATIVE 3-BOLTED

Present Worth Method

| Item | Description | Year | 2023 Cost | Rate of Inflation | Present Worth |
|---|---|---|---|---|---|
| 1 | Const Bolted Tan | 2024 | 3,510,000 | 4.50 | 3,667,950 |
| 2 | Recoat Bolted Ta | 2044 | 458,000 | 4.50 | 359,907 |
| 3 | Replace Bolted T | 2074 | 805,000 | 4.50 | 412,509 |
| 4 | Recoat Bolted Ta | 2094 | 458,000 | 4.50 | 176,487 |
| 5 | Replace Bolted T | 2124 | 805,000 | 4.50 | 202,281 |
| 6 | Recoat Bolted Ta | 2144 | 458,000 | 4.50 | 86,543 |
| 7 | Replace Bolted T | 2174 | 805,000 | 4.50 | 99,192 |
| | TOTAL PRESENT WORTH | | | | 5,004,868 |
| | Capital and Replacement Cost Items | | 3,667,950 | | |
| | Energy Cost Items | | 0 | | |
| | Operation and Maintenance Cost Items | | 1,336,918 | | |
| | Revenue and Benefit Items | | 0 | | |
| | Total | | 5,004,868 | | |

Minimum Attractive Rate of Return - 6.00 Percent

Study Life - 200 Years    First Year of Study - 2024

File Identifier - BETH3B

File Date - 10/6/2023

SUMMARY

SUMMARY REPORT

Present Worth Method

| Alternative | Present Worth |
| --- | --- |
| ALTERNATIVE 2-WELDED | 5,447,078 |
| ALTERNATIVE 2-BOLTED | 6,432,279 |
| ALTERNATIVE 3-WELDED | 4,150,760 |
| ALTERNATIVE 3-BOLTED | 5,004,868 |

Study Life - 200 Years    First Year of Study - 2024

Minimum Attractive Rate of Return - 6.00 Percent