# TAC RECOMMENDATION REPORT

DATE: December 12, 2024

TO: Board of Directors
*Borrego Springs Watermaster*

FROM: Technical Advisory Committee
*Borrego Springs Watermaster*

SUBJECT: Scope-of-Work to Redetermine the 2030 Sustainable Yield
*Water Years 2026 - 2029*

## BACKGROUND AND OBJECTIVES

Section III.F of the Judgment outlines the process and schedule for redetermining the Sustainable Yield of the Borrego Springs Basin (Basin) every five years. The Sustainable Yield is to be redetermined through the Technical Advisory Committee (TAC) processes and be based on best available science, including the use of the Borrego Valley Hydrologic Model (BVHM) and consideration of all sources of Basin replenishment and outflow. In tandem with each redetermination, a future scope of work and budget must also be prepared for the technical work to redetermine the Sustainable Yield over the subsequent five-year period through a process that includes: collecting additional data, refining the BVHM, and using model runs to update the Sustainable Yield.

The Borrego Springs Watermaster (Watermaster), with TAC input, must develop and approve a scope of work and budget to implement over the next four years (water years [WYs] 2026-29) to establish the 2030 Sustainable Yield by January 1, 2030.

## POTENTIAL SCOPE-OF-WORK TO REDETERMINE THE 2030 SUSTAINABLE YIELD

West Yost, the Watermaster's Technical Consultant, and the TAC have prepared options for a scope-of-work to redetermine the 2030 Sustainable Yield. Attachment A is a technical memorandum that describes the options for the scope of work for the 2030 Sustainable Yield, which includes:

1. **Minimum Required Scope-of-Work.** This is the minimum scope-of-work required to redetermine the 2030 Sustainable Yield and represents the lowest cost option. The budget-level estimate, given what we know today, is about $100,000. The minimum required scope does not include efforts to incorporate other new data/information that could be used to further validate the BVHM and/or improve its ability to simulate the hydrology of the Basin. Therefore, executing this task alone may not be applying "best available science" for the redetermination of the 2030 Sustainable Yield.
2. **Additional/Optional Tasks.** These are additional/optional tasks to redetermine the 2030 Sustainable Yield and *could* be implemented to further validate the BVHM and/or improve its ability to simulate the hydrology of the Basin. The additional/optional tasks are focused on reviewing/evaluating new data and information and include:
    - **Task 1. Airborne Electromagnetic Survey (AEM) Results.** These results can be reviewed to determine if updates should be made to the hydrogeological conceptual model (HCM) to improve the aquifer geometry, structure, and properties assigned in the BVHM.

- **Task 2. Groundwater Dependent Ecosystem (GDE) Study Results.** These results can be reviewed to determine if improvements should be made to the BVHM to improve its ability to simulate the evapotranspiration of shallow groundwater.
- **Task 3. Monitoring Program Data.** These data (measured groundwater levels and metered pumping data) can be analyzed to determine if improvements should be made to the BVHM to improve its ability to estimate pumping and/or simulate groundwater levels.
- **Task 4. Estimates of Natural Inflows**. New methods can be investigated for the estimation of natural inflows to improve the ability of the BVHM to simulate these inflows.
- **Task 5. Other Model Platforms** will be evaluated to determine if the current model platform should be upgraded.

Following the selection of one or more of these additional/optional tasks, a step-wise workflow can be implemented with logical decision points throughout. The workflow is shown graphically in Figure 1 of Attachment A and is summarized below.

- Step 1. Review New Data and Compare to the BVHM
  *Note: The results of Step 1 will be used to determine (i) if the model should be updated (proceed to Step 2) or (ii) that no updates are needed and the BVHM can be used to redetermine the 2030 Sustainable Yield (skip to Step 5).*
- Step 2. Develop Methods
- Step 3. Update and Validate the BVHM
  *Note: The results of Step 3 will be used to determine: (i) if the model needs to be recalibrated (proceed to Step 4) or (ii) that model recalibration is not needed and the BVHM can be used to redetermine the 2030 Sustainable Yield (skip to Step 5).*
- Step 4. Recalibrate the BVHM
- Step 5. Redetermine the 2030 Sustainable Yield

At a minimum, the workflow would include performing Steps 1 and 5. The need to perform steps 2 through 4 is dependent on the outcome of the prior step (*e.g.,* Steps 2 and 3 are depending on the results of Step 1; Step 4 is dependent on the results of Step 3).

## ORGANIZATION OF THE TAC RECOMMENDATION REPORT

The remainder of this TAC Recommendation Report includes the following sections:

- **TAC Recommendation.** This section describes the TAC recommendations for the scope-of-work to redetermine the 2030 Sustainable Yield (including any differences in TAC opinions).
- **Supplemental Information**. This section describes the purpose of and requirements for supplemental information prepared by TAC members to support the basis of their recommendations. The supplemental information, if any, is included as an attachment.

## TAC RECOMMENDATION

This section describes the TAC recommendations on the scope-of-work to redetermine the 2030 Sustainable Yield (including a description of any differences in TAC member opinions).

- **Consensus TAC Recommendation:** The Minimum Required Scope-of-Work should not be performed. Instead, Additional/Optional Tasks should be performed.
- TAC members have differing opinions on which Additional/Optional Tasks should be performed to redetermine the 2030 Sustainable Yield.

  Table 1 is a summary that shows each TAC member's recommendation of whether to perform each Additional/Optional Task (Yes "Y", Yes but only if grant-funding available "G", or No "N"). Also shown in Table 1 is summary of the estimated cost to perform Step 1 of the Additional/Optional Task, which would be performed in WY 2026-2027. As shown in Table 1:

  - **Consensus TAC Recommendation:** The following Additional/Optional Tasks should be performed as part of the scope-of-work:
    - Task 2 - *GDE Study Results* (recommended by all 6 TAC members)
    - Task 3 – *Monitoring Program Data* (recommended by all 6 TAC members)
  - **Majority TAC Recommendations:**
    - Task 1 – *AEM Results* should be performed as part of the scope-of-work (recommended by 5 of 6 TAC members). However, 2 of the 5 TAC members who recommended performing this task, recommend it be performed only if grant funding is available.
    - Task 5 – *Other Model Platforms*, should be performed as part of the scope-of-work (recommended by 4 of 6 TAC members). However, 3 of the 4 TAC members who recommended performing this task, recommend it be performed only if grant funding is available.
    - Task 4 – *Estimates of Natural Inflows* should not be performed as part of the scope-of-work (recommended by 2 of 6 TAC members).

  The TAC also ranked the Additional/Optional Tasks in order of priority. Table 2 below is a summary that shows each TAC member ranking of the Additional/Optional Tasks. As shown in Table 2, the TAC priorities for performing Step 1 of the Additional/Optional Tasks in WY 2026-2027 are as follows:

  - #1 Rank*:* Task 3 – *Monitoring Program Data*
  - #2 Rank: Task 2 – *GDE Study Results*
  - #3 Rank: Task 1 – *AEM Results*
  - #4 Rank: Task 4 – *Estimates of Natural Inflows*
  - #5 Rank: Task 5 – *Other Model Platforms*

  Table 3 documents each TAC member's justifications or other considerations for their recommendations.

**Table 1. TAC Recommendations for a Scope-of-Work to Redetermine the 2030 Sustainable Yield**
*WY 2026-29*

| Task No. | Task | Cost Estimate for Step 1 | TAC Member Recommendations (Y/G/N)?[1] | | | | | | Tally of TAC Member Recommendations | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | AAWARE | Borrego Springs Community | BWD | County of San Diego | Rams Hill | Roadrunner Club | Yes | Yes, if Grant Funded | No |
| 1 | AEM Results | **$55,000** | N | G | Y | Y | Y | G | 3 | 2 | 1 |
| 2 | GDE Study Results | **$40,000** | Y | Y | Y | Y | Y | Y | 6 | 0 | 0 |
| 3 | Monitoring Program Data | **$55,000** | Y | Y | Y | Y | Y | Y | 6 | 0 | 0 |
| 4 | Estimates of Natural Inflows | **$50,000** | N | G | Y | N | N | N | 1 | 1 | 4 |
| 5 | Other Model Platforms | **$60,000** | G | G | N | N | Y | G | 1 | 3 | 2 |
| | **Total Cost of Tasks** | **$260,000** | **$95,000** | **$95,000** | **$200,000** | **$95,000** | **$210,000** | **$95,000** | | | |

Notes:
1. Y = "Yes"
   G = "Yes, but only if grant-funding available"
   N = "No"

**Table 2. Summary of TAC Rankings of Additional/Optional Tasks**
*Scope-of-Work to Redetermine the 2030 Sustainable Yield*

| Task No. | Task | TAC Member Task Ranking | | | | | | Average Ranking |
|---|---|---|---|---|---|---|---|---|
| | | AAWARE | Borrego Springs Community | BWD | County of San Diego | Rams Hill | Roadrunner Club | |
| 1 | AEM Results | NR | 3 | 3 | 1 | 2 | 3 | **3** |
| 2 | GDE Study Results | 2 | 2 | 3 | 1 | 1 | 2 | **2** |
| 3 | Monitoring Program Data | 1 | 1 | 2 | 2 | 1 | 1 | **1** |
| 4 | Estimates of Natural Inflows | NR | 4 | 1 | NR | NR | 5 | **4** |
| 5 | Other Model Platforms | NR | 5 | NR | NR | 3 | 4 | **5** |

Notes:
NR = "Not Recommended"

**Table 3. TAC Justifications and Other Considerations**
*Scope-of-Work to Redetermine the 2030 Sustainable Yield*

| TAC Member and Appointing BPA Party | Justifications/Considerations | | | | |
|---|---|---|---|---|---|
| | Task 1. AEM Results | Task 2. GDE Study Results | Task 3. Monitoring Program Data | Task 4. Estimates of Natural Inflows | Task 5. Other Model Platforms |
| **Bob Wagner** ***AAWARE*** | Not recommended. | Recommend TAC to conduct an initial review. Then decide how to proceed with the results. Cost estimate should be less than $40,000 for this task. | This should be the priority for the next years. Since wells are already almost fully metered, emphasis should be on improving groundwater level monitoring. | Difficult to perform. Not recommended | Recommended only if outside funding is available. The new version of the model platforms will likely not provide different results when recalculating the 2030 Sustainable Yield. |
| **Russell Detwiler** ***Borrego Springs Community*** | If outside funding is available, it is possible the AEM results could provide useful improvements to the basin conceptual model. | The GDE study should be reviewed and major findings compared to the current BVHM | Comparing model to results to newly available measured data is a high priority for continuing to assess the appropriateness of the currently determined sustainable yield. | It is unclear what methods would be used and it seems unlikely these efforts would lead to significant improvements in what are difficult parameters to estimate. Not recommended. | I do not see a clear benefit in migrating to a new modeling platform. It would entail a significant effort for nominal benefit. Not recommended. |
| **Trey Driscoll** ***Borrego Water District*** | INTERA has performed preliminary review of the AEM data. While the data may better constrain localized hydrostratigraphy and improve local estimates of aquifer properties, it is unlikely to result in a Subbasin-wide change to the current hydrogeological conceptual model and drive changes to the water budget. As such, this task is of lower priority. | The study should be reviewed and the consumptive use of identified groundwater dependent ecosystems, if present, and other native vegetation should be compared to the water use estimates derived in the BVHM. | BVHM results should be compared to future observed data as a check on the redetermined sustainable yield by comparing pumping, change in groundwater levels and change in groundwater storage. | Recommend documenting the scaling that was used to derive the inflows to the Subbasin using the Basin Characterization Model. | We reached out to the USGS (Scott Boyce) in regard to updating BVHM to the latest version of MODFLOW One-Water Hydrologic Flow Model—Conjunctive Use Simulation Software (MF-OWHM). At this time, we have not identified a substantial reason to update to the latest model code. We recommend setting up an informational meeting with USGS to discuss the pluses and minuses of updating the software prior to any further deliberation on this matter. |
| **Jim Bennett** ***County of San Diego*** | A review of the AEM would be expected by DWR and could likely cause issues during the next five-year update if there isn't a legitimate discussion addressing the AEM survey and the rationale for either using or not using it. | The study should be reviewed | It is recommended to compare the BVHM to actual pumping data, use pumping data from WY2022 to WY2027, and conduct the evaluation in WY2028. Additionally, do not include a comparison to groundwater levels, as this was never discussed at the TAC and is unnecessary. | This task not recommended as it will not change the uncertainty associated with natural inflows. New numbers will be similarly uncertain and potentially force a $100k-230K recalibration effort. | The current model has been debugged during redetermination of sustainable yield and is adequate. |
| **Tom Watson** ***T2 Borrego, Rams Hill*** | A review of the AEM would be expected by DWR, but this s a secondary priority. | The study should be reviewed | It is recommended to compare the BVHM to actual pumping data, use pumping data from WY2022 to WY2026 | This task not recommended at this time | Recommended as a third order priority |
| **John Peterson** ***Roadrunner Club*** | As Jim Bennett stated a Review of the AEM is expected from DWR | I believe that the UCI work will be very valuable to understanding our biological systems in Borrego | This has the highest priority for me. It is critical data set that must be expanded. | This is extremely difficult to quantify and it has a low priority for me. | I trust the work that we are using. Low priority for me. |

## SUPPLEMENTAL INFORMATION

The TAC guidelines[1] allow TAC members to prepare supplemental materials to support the basis of their recommendation, such as memoranda or PowerPoint presentation slides that describe their analyses and recommendations. To be included in the TAC Recommendation Report, all supplemental information must be reviewed and discussed by the TAC.

No supplemental information was provided by a TAC member.

## ATTACHMENTS

Attachment A. Potential Scope-of-Work to Redetermine the 2030 Sustainable Yield – *Water Years 2026 – 2029*

[1] Available on the Watermaster's website at: https://borregospringswatermaster.com/wp-content/uploads/2023/03/Resolution-23-01-Guidelines-for-TAC-Process-Executed.pdf

# ATTACHMENT A.

DATE: November 25, 2024

TO: Technical Advisory Committee
*Borrego Springs Watermaster*

FROM: West Yost Associates
*Watermaster Technical Consultant*

SUBJECT: **Potential Scope-of-Work to Redetermine the 2030 Sustainable Yield – *Water Years 2026 - 2029***

## POTENTIAL SCOPE-OF-WORK TO REDETERMINE THE 2030 SUSTAINABLE YIELD

The potential scope of work is described below by task, including: a problem statement, the objective of the task, a description of the work to complete the task, a high-level cost estimate, an approximate schedule, and a description of the consequences of not performing each task. The potential scope-of-work options include the following and are described in the subsequent sections:

1. **Minimum Required Scope-of-Work.** This option for a potential scope of work represents the minimum required scope of work to redetermine the 2030 Sustainable Yield, and therefore, the lowest cost option.
2. **Workflow for Additional/Optional Tasks.** This option follows a workflow for various additional/optional tasks that could be executed as the scope of work.

## Minimum Required Scope-of-Work

This task is considered the minimum effort required to redetermine the 2030 Sustainable Yield and represents the lowest cost option.

### REDETERMINE 2030 SUSTAINABLE YIELD WITH NO IMPROVEMENTS TO THE BVHM

***Problem Statement:*** The Sustainable Yield must be redetermined every five years (through the TAC process) based on best available science including BVHM runs and consideration of all sources of Basin replenishment and outflow. The Watermaster has limited resources to perform this work, so this work requires efficiency.

***Objective:*** Redetermine the 2030 Sustainable Yield in the most efficient manner possible.

***Task Description:*** In this task, the BVHM will be extended from WY 2022 to WY 2028 with the following data/information: metered pumping data; land use; crop type; temperature; potential evapotranspiration; precipitation; and surface water inflows. No improvements will be made to the model. The BVHM will be run over the historical period of WY 1930 through WY 2028 to produce an annual water budget for the Basin. The 2030 Sustainable Yield will be determined using the following formula:

2030 Sustainable Yield = Long-term Natural Inflows – Short-term Natural Outflows

***Cost Estimate:*** $75,000 - $100,000.

***Schedule:*** This task must be completed in WY 2029.

***Consequence of Not Completing the Minimum Scope:*** The Judgment requires this task to be performed.

***Additional Considerations:*** The minimum scope does not include efforts to incorporate other new information/data that could be used to further validate the BVHM and/or improve its ability to simulate the hydrology of the Basin. Therefore, executing this task alone may not be applying "best available science" for the redetermination of the 2030 Sustainable Yield.

## Workflow for Additional/Optional Tasks

This section describes a proposed workflow to execute various additional/optional tasks during the redetermination of the 2030 Sustainable Yield. These additional/optional tasks *could* be implemented to validate and/or improve the BVHM and its ability to estimate the water budget. The potential tasks include:

> **Task 1. Airborne Electromagnetic Survey (AEM) Results** will be reviewed to determine if updates should be made to the hydrogeological conceptual model (HCM) to improve the structure and aquifer properties assigned in the BVHM.
>
> **Task 2. Groundwater Dependent Ecosystem (GDE) Study Results** will be reviewed to determine if improvements should be made to the BVHM to improve its ability to simulate the evapotranspiration of shallow groundwater.
>
> **Task 3. Monitoring Program Data (groundwater-levels and metered pumping)** will be analyzed to determine if improvements should be made to the BVHM to improve its ability to estimate pumping and/or simulate groundwater levels.
>
> **Task 4. Estimates of Natural Inflows,** specifically those estimated by the Basin Characterization Model (BCM), will be investigated to determine if a reproducible method of estimating natural inflows can be developed and used as input data to the BVHM.
>
> **Task 5. Other Model Platforms** will be evaluated to determine if the current model platform should be upgraded.

For each task, a workflow would be implemented containing up to five steps. These steps are sometimes interdependent; meaning that the results of one step may require performing another step. As such, the steps are presented as a workflow as illustrated graphically in Figure 1. The workflow allows each task to be performed in logical steps with "off-ramps" that allow the TAC/Board to recommend whether the next step be performed (or not). The workflow is organized as follows:

> **Step 1. Review New Data and Compare to the BVHM**
> *Note: The results of Step 1 will be used to determine (i) if the model should be updated (proceed to Step 2) or (ii) that no updates are needed and the BVHM can be used to redetermine the 2030 Sustainable Yield (skip to Step 5).*
>
> **Step 2. Develop Methods**
>
> **Step 3. Update and Validate the BVHM**

*Note: The results of Step 3 will be used to determine: (i) if the model needs to be recalibrated (proceed to Step 4) or (ii) that model recalibration is not needed and the BVHM can be used to redetermine the 2030 Sustainable Yield (skip to Step 5).*

**Step 4. Recalibrate the BVHM**

**Step 5. Redetermine the 2030 Sustainable Yield**

Table 1 contains a high-level cost estimate for each step (Steps 1-5) for each additional/optional task. Except for Step 1, all other steps are dependent on the performance and results from prior steps. As such, the cost of Step 1 is considered the most certain, since this is the only step that will be performed in the first two years of the scope (WY 2026 and 2027). The costs for all other tasks are high-level cost estimates that will be refined if the TAC recommends and the Board approves developing a detailed scope and cost estimate.

Each additional/optional task is described below:

### Task 1. Airborne Electromagnetic Survey (AEM) Results

***Problem Statement:*** In 2024, the DWR flew an AEM survey across the Basin to develop new information on the structure and composition of the aquifer system. The survey results may provide improved information on the hydrogeologic conceptual model (HCM) of the Basin, which could then be used to update and improve the BVHM—particularly in areas of the Basin where complex hydrogeology is not well represented in the BVHM.

***Objective:*** Use improved understanding of Basin hydrogeology to update the BVHM and improve its ability to simulate the water budget and groundwater levels.

***Task Description:*** If implemented, this task will follow the proposed workflow:

- *Step 1:* The AEM survey results are reviewed and compared against the current HCM of the BVHM to determine if there are significant differences and, therefore, model updates are recommended. Based on the comparison, the TAC may recommend to the Board that either (i) the differences between the AEM survey data and the current HCM are significant and methods should be developed to update the HCM (proceed to Step 2) *or,* (ii) the differences are not significant, no changes to the model are recommended, and the BVHM can be used to redetermine the 2030 Sustainable Yield (skip to Step 5). ***Estimated cost: $55,000***
- *Step 2:* If the results of Step 1 indicate that the HCM should be updated, then methods for updating the HCM (and associated cost estimates) are developed and recommended for Board approval through the TAC process.
- *Step 3:* The methods developed in Step 2 are implemented and the BVHM is run over the historical simulation period of 1945-2022. The model results are then compared against the model results from the 2025 Redetermination of the Sustainable Yield. Based on the comparison, the TAC may recommend to the Board that either (i) the differences are significant and the model should be recalibrated (proceed to Step 4) *or,* (ii) the differences are not significant and the updated BVHM can be used to redetermine the 2030 Sustainable Yield (skip to Step 5).

- *Step 4:* If the results of Step 3 indicate the need for model recalibration, then the BVHM is extended through WY 2028 and recalibrated.
- *Step 5:* The BVHM is extended from WY 2022 to WY 2028 (if not already extended in Step 4) and run over the historical period of WY 1930 through WY 2028 to produce an annual water budget for the Basin, which is then used to redetermine the 2030 Sustainable Yield.

***Consequence of Not Completing Task 1:*** The value and usefulness of the AEM survey results would not be analyzed and not be used to redetermine the 2030 Sustainable Yield. Not completing this task may bypass the application of "best available science."

### Task 2. Groundwater Dependent Ecosystem (GDE) Study Results

***Problem Statement:*** Currently, the BVHM simulates evapotranspiration of shallow groundwater with the FMP and reports this information as a natural outflow of groundwater. By April 2025, the results of a GDE study being performed by UCI in the Mesquite Bosque area near the Borrego Sink will be complete. The GDE study may provide new data and improved understanding of evapotranspiration of shallow groundwater that occurs in the Basin. The new data and improved understanding could potentially be used to improve the BVHM and its ability to estimate the water budget for the Basin.

***Objective:*** Use improved understanding of GDEs in the Basin to update the BVHM and improve its ability to simulate the water budget and groundwater levels.

***Task Description:*** If implemented, this task will follow the proposed workflow:

- *Step 1:* The GDE study results are reviewed and compared against the current BVHM to determine if there are significant differences and, therefore, model updates are recommended. Based on the comparison, the TAC may recommend to the Board that either (i) the differences between the GDE study results and the current BVHM are significant and methods should be developed to update the BVHM (proceed to Step 2) *or,* (ii) the differences are not significant, no changes to the model are recommended, and the BVHM can be used to redetermine the 2030 Sustainable Yield (skip to Step 5). ***Estimated cost: $40,000***
- *Step 2:* If the results of Step 1 indicate that the BVHM should be updated, then methods for updating the BVHM (and associated cost estimates) are developed and recommended for Board approval through the TAC process.
- *Step 3:* The methods developed in Step 2 are implemented and the BVHM is run over the historical simulation period of 1945-2022. The model results are then compared against the model results from the 2025 Redetermination of the Sustainable Yield. Based on the comparison, the TAC may recommend to the Board that either (i) the differences are significant and the model should be recalibrated (proceed to Step 4) *or,* (ii) the differences are not significant and the updated BVHM can be used to redetermine the 2030 Sustainable Yield (skip to Step 5).
- *Step 4:* If the results of Step 3 indicate the need for model recalibration, then the BVHM is extended through WY 2028 and recalibrated.

- *Step 5:* The BVHM is extended from WY 2022 to WY 2028 (if not already extended in Step 4) and run over the historical period of WY 1930 through WY 2028 to produce an annual water budget for the Basin, which is then used to redetermine the 2030 Sustainable Yield.

***Cost Estimate:*** $40,000

***Consequence of Not Completing Task 2:*** The value and usefulness of the GDE study results would not be analyzed and not be used to redetermine the 2030 Sustainable Yield. Not completing this task may bypass the application of "best available science."

### Task 3. Monitoring Program Data (groundwater-levels and metered pumping)

***Problem Statement:*** The Watermaster has developed and implemented groundwater monitoring programs, which include the collection of metered groundwater pumping data and measured groundwater-levels. The version of the BVHM used to estimate the 2025 Sustainable Yield used the first two years of metered pumping data from the Watermaster's metering program to improve the ability of the BVHM to simulate groundwater pumping. Additionally, groundwater-level measurements collected through 2022 were used during model calibration. The data collected under these monitoring programs since WY 2022 could be used to improve the ability of the BVHM to estimate groundwater pumping and simulate groundwater levels (or as model validation).

***Objective:*** Use newly collected groundwater data to update the BVHM and improve its ability to estimate groundwater pumping and simulate groundwater levels.

***Task Description:*** If implemented, this task will follow the proposed workflow:

- *Step 1:* The BVHM is extended from WY 2022 to 2025 (or the latest year with data) and run over the historical period of WY 1930 through 2025. The model results are compared to the metered groundwater pumping data and measured groundwater-levels. Based on the comparison, the TAC may recommend to the Board that either (i) the differences are significant and methods should be developed to improve the BVHM (proceed to Step 2) *or,* (ii) the differences are not significant, no changes to the model are recommended, and the BVHM can be used to redetermine the 2030 Sustainable Yield (skip to Step 5). ***Estimated cost: $55,000***
- *Step 2:* If the results of Step 1 indicate that the BVHM should be updated, then methods for updating the BVHM (and associated cost estimates) are developed and recommended for Board approval through the TAC process.
- *Step 3:* The methods developed in Step 2 are implemented and the BVHM is run over the historical simulation period. The model results are then compared against the groundwater monitoring program data to evaluate the need for model recalibration. Based on the comparison, the TAC may recommend to the Board that either (i) the differences are significant and the model should be recalibrated (proceed to Step 4) *or,* (ii) the differences are not significant and the updated BVHM can be used to redetermine the 2030 Sustainable Yield (skip to Step 5).
- *Step 4:* If the results of Step 3 indicate the need for model recalibration, then the BVHM is extended through WY 2028 and recalibrated.

- *Step 5:* The BVHM is extended from WY 2022 to WY 2028 (if not already extended in Step 4) and run over the historical period of WY 1930 through WY 2028 to produce an annual water budget for the Basin, which is then used to redetermine the 2030 Sustainable Yield.

***Consequence of Not Completing Task 3:*** The Watermaster has developed and implemented its groundwater monitoring programs with the stated objective of using the data to improve the BVHM. If the data collected from these programs are not used to evaluate and/or improve the BVHM and redetermine the 2030 Sustainable Yield, then the Watermaster is not utilizing the data as intended. Not completing this task may bypass the application of "best available science."

### Task 4. Estimates of Natural Inflows

***Problem Statement:*** The natural recharge to the Basin occurs primarily via stream inflow from the surrounding watersheds (that translate into streambed infiltration overlying the Basin) and subsurface inflow from the surrounding mountain fronts. These sources of natural recharge are key components of the Sustainable Yield. The TAC has identified two issues relating to the estimates of natural recharge that have historically been simulated in the BVHM:

1. Past modeling efforts by the United States Geological Survey (USGS) (Initial BVHM), Dudek (2016 BVHM), and West Yost (2021 BVHM) have used inconsistent and non-reproducible methods for estimating stream inflows to the BVHM domain. As documented in the TM entitled *Extension of the Borrego Valley Hydrologic Model through Water Year 2021* (2021 BVHM TM)[1], the method for estimating stream inflow by the USGS could not be reproduced by Dudek during the 2016 BVHM extension, which resulted in Dudek developing a new methodology, which in turn, could not be reproduced by West Yost during the 2021 or 2022 BVHM extensions. The inability to reproduce methods and results may produce inaccurate estimates for these sources of natural recharge.
2. In all past modeling efforts, the rates of subsurface inflow have been applied at a constant rate of 1,367 acre-feet per year (afy). This rate was first established in the *Initial BVHM* developed by the USGS as a "simplified" average rate of subsurface inflow over the simulation period (Faunt et al., 2015).[2] A constant rate of subsurface inflow does not account for hydrologic variations in the watershed (*e.g.,* more subsurface inflow to the Basin occurs during and after wet years/periods, and less subsurface inflow occurs during and after dry years/periods).

Developing reproducible methods for estimating natural recharge to the Basin was identified as a need by the TAC in its review of the 2021 BVHM TM. This task was considered, but ultimately not recommended by the TAC, for the scope of work to redetermine the 2025 Sustainable Yield.

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[1] West Yost. 2022. *Extension of the Borrego Valley Hydrologic Model through Water Year 2021.* Available at: https://borregospringswatermaster.com/wp-content/uploads/2022/12/TM-940-2021-BVHM-Extension-220921.pdf

[2] Faunt, C.C., C.L. Stamos, L.E. Flint, M.T. Wright, M.K. Burgess, M. Sneed, J. Brandt, P. Martin, and A.L. Coes. 2015. Hydrogeology, hydrologic effects of development, and simulation of groundwater flow in the Borrego Valley, San Diego County, California: U.S. Geological Survey Scientific Investigations Report 2015-5150. Available at: https://pubs.usgs.gov/sir/2015/5150/sir20155150.pdf

***Objective:*** Develop improved and reproducible methods for estimating stream and subsurface inflows to the Basin and use the methods to generate input data for the streamflow routing (SFR) and flow and head boundary (FHB) packages in the BVHM.

***Task Description:*** If implemented, this task will follow the proposed workflow:

- *Step 1:* Methods of estimating stream and subsurface inflows are evaluated, including estimates from the Basin Characterization Model (BCM). If multiple methods are evaluated, a white paper is prepared that compares the different data sources and methods. Estimates of natural inflows are compared against the estimates of inflows from the current BVHM to determine if there are significant differences and, therefore, model updates are necessary. Based on the comparison, the TAC may recommend to the Board that either (i) the differences are significant and methods should be developed to improve the BVHM (proceed to Step 2) *or,* (ii) the differences are not significant, no changes to the model are recommended, and the BVHM can be used to redetermine the 2030 Sustainable Yield (skip to Step 5). ***Estimated cost: $50,000***
- *Step 2:* If the results of Step 1 indicate that the BVHM should be updated, then methods for updating the BVHM (and associated cost estimates) are developed and recommended for Board approval through the TAC process.
- *Step 3:* The methods developed in Step 2 are implemented and the BVHM is run over the historical simulation period of WY 1930 to 2022. The model results are then compared against the model results from the 2025 Redetermination of the Sustainable Yield. Based on the comparison, the TAC may recommend to the Board that either (i) the differences are significant and the model should be recalibrated (proceed to Step 4) *or,* (ii) the differences are not significant and the updated BVHM can be used to redetermine the 2030 Sustainable Yield (skip to Step 5).
- *Step 4:* If the results of Step 3 indicate the need for model recalibration, then the BVHM is extended through WY 2028 and recalibrated.
- *Step 5:* The BVHM is extended from WY 2022 to WY 2028 (if not already extended in Step 4) and run over the historical period of WY 1930 through WY 2028 to produce an annual water budget for the Basin, which is then used to redetermine the 2030 Sustainable Yield.

***Consequence of Not Completing Task 4:*** The TAC and West Yost have previously noted that the methods used by the USGS, Dudek, and West Yost to estimate stream and subsurface inflows have been inconsistent, non-reproducible, not representative of the hydrologic variability that occurs in the watershed over time, and hence, the historical estimates of stream and subsurface inflows used as inputs to the BVHM may not be accurate.

### Task 5. Different Model Platforms

***Problem Statement:*** The BVHM uses the first version of the model code One-Water Hydrologic Flow Model (MODFLOW-OWHM 1 [version 1.0.0]) that was released in 2014 and includes Farm Process 3. During the 2016 and 2021 extensions of the BHVM, several “bugs” were identified in MODFLOW-OWHM 1. Examples of bugs identified in the current version of the BVHM include discrepancies between calculations produced by ZoneBudget and model listing file results and differences in the pumping estimated by individual packages vs. pumping reported in the model listing files (West Yost, 2022). The

2021 BVHM TM documented several of these "bugs" and identified that further investigation was warranted to identify why these inconsistencies exist.

The most recent version of MODFLOW-OWHM as of this writing was released in January 2024, known as MODFLOW-OWHM 2 (version 2.3.0). MODFLOW-OWHM 2 includes Farm Process 4 which offers several advancements over Farm Process 3, including: (i) improved water use and allocation between water sources and agricultural demands; (ii) improved support of dynamic land use changes over time; (iii) enhanced crop and irrigation modeling; and (iv) improved handling of water allocation rules.

Another potential model platform is MODFLOW 6, which is the most recent version of the MODFLOW variants. The most recent version of MODFLOW 6 as of this writing was released in May 2024, known as MODFLOW 6 (version 6.5.0). Furthermore, by the time this scope of work is implemented, a newer model version may be available.

This task was proposed, but ultimately not recommended by the TAC, for the scope of work to redetermine the 2025 Sustainable Yield.

***Objective:*** Upgrade the BVHM from MODFLOW-OWHM 1 to a new platform, such as MODFLOW-OWHM 2 or MODFLOW 6.

***Task Description:*** If implemented, this task will follow the proposed workflow:

- *Step 1:* Potential new modeling platforms are researched and a "white paper" is prepared that evaluates and compares the different modeling platforms and the level of effort to convert the BVHM to these platforms. The white paper may also evaluate structural changes to the existing BVHM, such as removing the FMP. The white paper will be reviewed by the TAC and the TAC will have the opportunity to recommend to the Board that either (i) the model platform should be upgraded/migrated to another platform, and hence, methods should be developed for this migration (proceed to Step 2) *or,* (ii) the model platform should not be upgraded/migrated and the BVHM can be used to redetermine the 2030 Sustainable Yield (skip to Step 5). ***Estimated cost: $60,000***
- *Step 2:* If the TAC recommends that the model platform be upgraded in Step 1, then methods for changing the model platform (and associated cost estimates) are developed and recommended for Board approval through the TAC process.
- *Step 3:* The methods developed in Step 2 are implemented and the BVHM is run over the historical simulation period of WY 1930-2022. The model results are then compared against the model results from the 2025 Redetermination of the Sustainable Yield. Based on the comparison, the TAC may recommend to the Board that either (i) the differences are significant and the model should be recalibrated (proceed to Step 4) *or,* (ii) the differences are not significant and the updated BVHM can be used to redetermine the 2030 Sustainable Yield (skip to Step 5).
- *Step 4:* If the results of Step 3 indicate the need for model recalibration, then the BVHM is extended through WY 2028 and recalibrated.
- *Step 5:* The BVHM is extended from WY 2022 to WY 2028 (if not already extended in Step 4) and run over the historical period of WY 1930 through WY 2028 to produce an annual water budget for the Basin, which is then used to redetermine the 2030 Sustainable Yield.

***Consequence of Not Completing Task 5:*** The BVHM will continue to use MODFLOW-OWHM 1, which contains bugs in the code and is no longer maintained by the USGS.

***Other Considerations:*** All models have bugs. West Yost and the TAC are now familiar with the bugs in MODFLOW-OWHM 1, whereas bugs in other model platforms are not yet known.

## ATTACHMENTS

Figure 1. Workflow for Additional/Optional Tasks to Redetermine the 2030 Sustainable Yield

Table 1. Cost Estimates for Additional/Optional Tasks

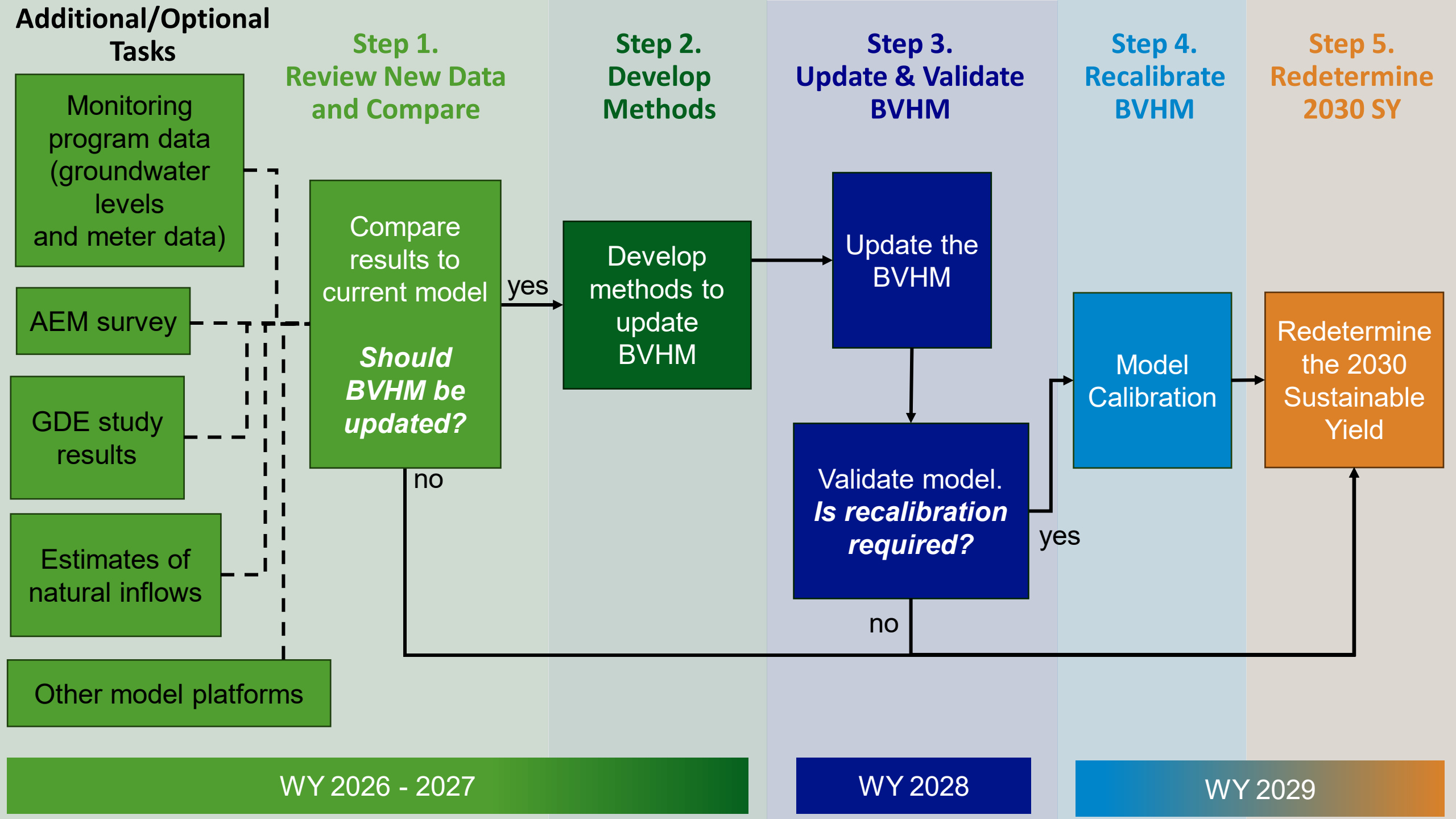
Additional/Optional Tasks
Monitoring program data (groundwater levels and meter data)
AEM survey
GDE study results
Estimates of natural inflows
Other model platforms
Step 1. Review New Data and Compare
Compare results to current model
Should BVHM be updated?
yes
no
Step 2. Develop Methods
Develop methods to update BVHM
Step 3. Update & Validate BVHM
Update the BVHM
Validate model. Is recalibration required?
yes
no
Step 4. Recalibrate BVHM
Model Calibration
Step 5. Redetermine 2030 SY
Redetermine the 2030 Sustainable Yield
WY 2026 - 2027
WY 2028
WY 2029

**Table 1. Cost Estimate for Additional/Optional Tasks**

| Step 1. Review New Data and Compare | | | | Step 2. Develop Methods | | | Step 3. Update & Validate | | Step 4. Recalibrate the BVHM | | Step 5. Redetermine the 2030 Sustainable Yield |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Task 1 | AEM Results | **$55,000** | + | AEM Results | **$30,000** | + | **$50,000 - $75,000** | + | **$100,000 - $230,000** | + | **$5,000 - $100,000** |
| Task 2 | GDE Study Results | **$40,000** | | GDE Study Results | **$30,000** | | | | | | |
| Task 3 | Monitoring Program Data (groundwater-level and metered pumping data) | **$55,000** | | Monitoring Program Data (groundwater-level and metered pumping) | **$30,000** | | | | | | |
| Task 4 | Estimates of Subsurface Inflow and Stream Inflow | **$50,000** | | Estimates of Subsurface Inflow and Stream Inflow | **$30,000** | | | | | | |
| Task 5 | Other Model Platforms | **$60,000** | | Other Model Platforms | **$30,000** | | | | | | |
| **Total Cost:** | | **$40,000 - $260,000** | | | **$30,000 - $150,000** | | **$50,000 - $75,000** | | **$100,000 - $230,000** | | **$5,000 - $100,000** |