

Sustainable Groundwater Management Act *GSP Preparation*

Madera Subbasin

Technical Workshop

2:00 p.m. to 4:00 p.m., May 29, 2019

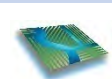
Madera County Board of Supervisors

Madera, CA

Agenda

1. Introduction
2. Sustainability Goal
3. Monitoring Network
4. Minimum Thresholds
5. Measurable Objectives and Interim Milestones
6. Next Steps

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

Stillwater Sciences



Madera Subbasin Technical Workshop
May 29, 2019

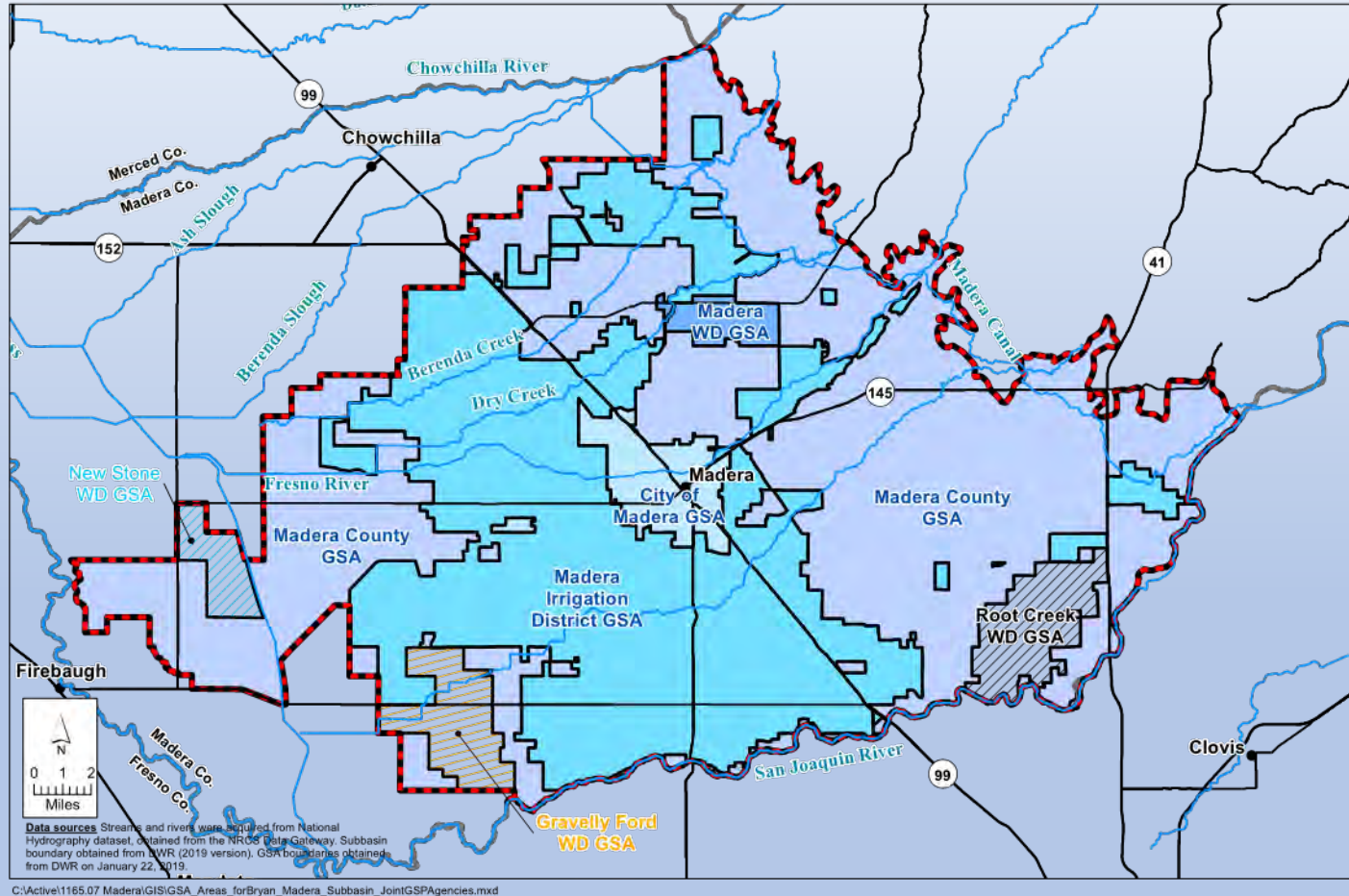
Madera Subbasin GSA and GSP Overview

- **Seven (7) GSAs**
 - Madera County GSA
 - Madera Irrigation District GSA
 - City of Madera GSA
 - Madera Water District GSA
 - Gravelly Ford Water District GSA
 - Root Creek Water District GSA
 - New Stone Water District GSA
- **Four (4) GSPs**

Groundwater Sustainability Plan (GSP)	Groundwater Sustainability Agency (GSA)
Joint Madera Subbasin GSP	Madera County GSA Madera Irrigation District GSA City of Madera GSA Madera Water District GSA
Gravelly Ford GSP	Gravelly Ford Water District GSA
Root Creek GSP	Root Creek Water District GSA
New Stone GSP	New Stone Water District GSA

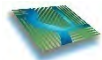
DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS

Madera Subbasin GSA Map



- Total area
~ 348,000 ac
- Irrigated
(2015)
~ 216,000 ac

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

Stillwater Sciences



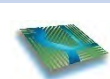
Madera Subbasin Technical Workshop

May 29, 2019

Elements Requiring Coordination

- **Sustainability goal**
- Same data
 - Groundwater elevation data
 - Water budget data
 - Sustainable yield for the basin
- **Methodologies yield compatible results**
 - **Minimum Thresholds**
 - **Measurable Objectives**
 - **Interim Milestones**
- **Monitoring Network**
- Process for submitting plans
- Coordinate data management systems

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

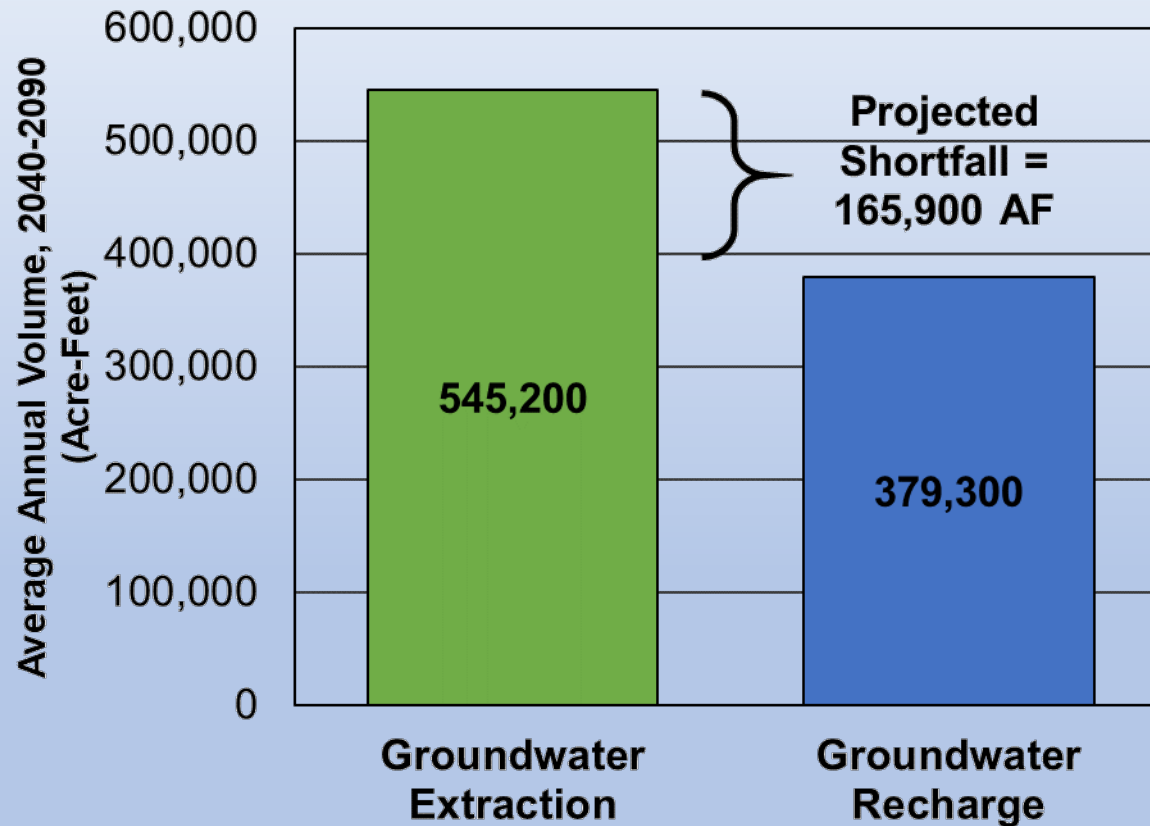
Stillwater Sciences



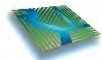
Madera Subbasin Technical Workshop

May 29, 2019

Simplified Groundwater Condition No Action 2040-2090



DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

Stillwater Sciences

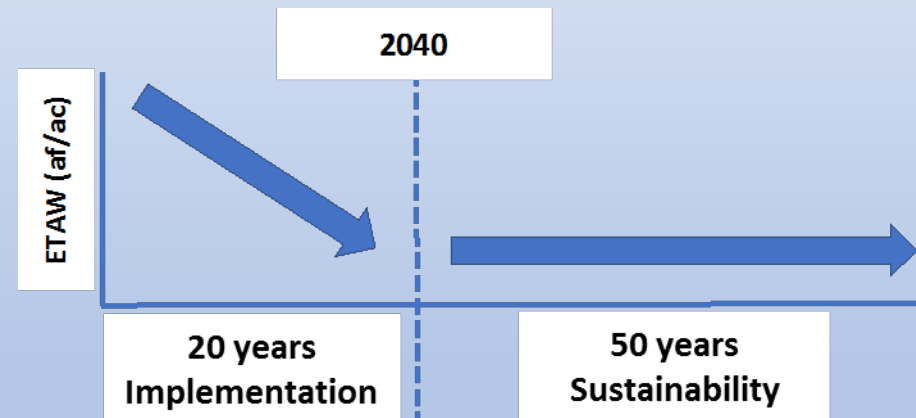


Madera Subbasin Technical Workshop

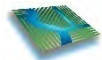
May 29, 2019

Plan for Meeting the Shortfall

- Recharge projects
- Incremental reduction from current consumptive use
- Continued use of stored groundwater (lowering levels) during project implementation period as long as this does not cause undesirable results
- Use GW model to estimate future



DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture
Stillwater Sciences



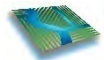
Madera Subbasin Technical Workshop
May 29, 2019

Sustainability Goal

Sustainability Goal: Three Aspects

- Implement projects and management actions through 2040 to reach sustainability
- Ground Water System inflows approximately equal outflows over a 50-year (2040-2090) representative hydrology time period
- No significant and unreasonable undesirable results estimated to occur during 50-year representative time period

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

Stillwater Sciences



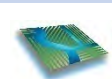
Madera Subbasin Technical Workshop

May 29, 2019

Sustainability Goal

- **Goal description**
 - Implement a package of projects and management actions to balance groundwater system inflows with outflows
 - No economic, social, and environmental undesirable results
- **Discussion of measures**
 - Recharge projects,
 - Projects that replace groundwater use with surface water use (in lieu) and
 - Management actions that reduce demand
- **Explanation of how the goal will be achieved in 20 years**
 - Increase recharge
 - Decrease groundwater extraction
 - Use more surface water
 - Reduce crop consumptive use

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

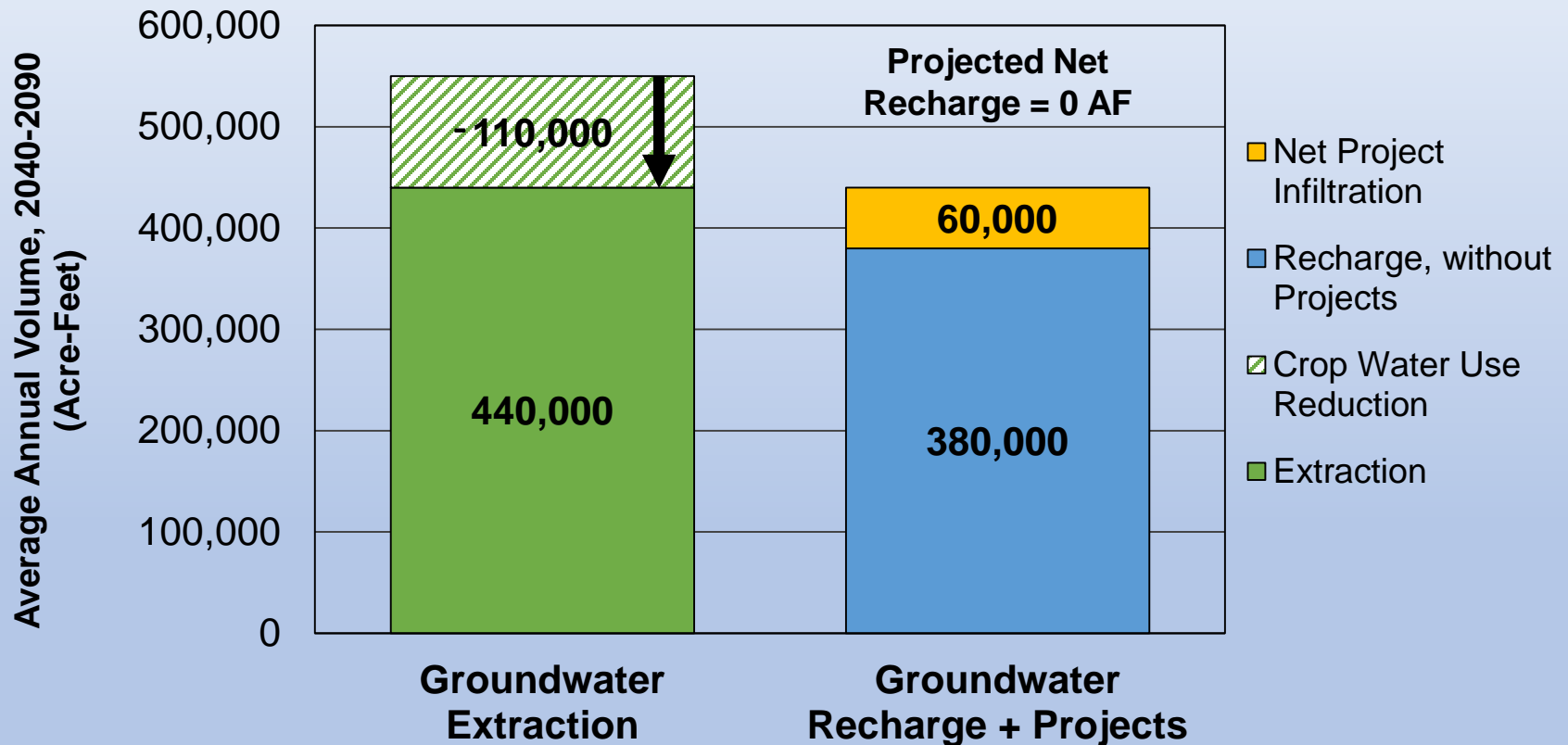
ERA Economics
Environment • Resources • Agriculture
Stillwater Sciences



Madera Subbasin Technical Workshop

May 29, 2019

Simplified Groundwater Condition With Projects (2040-2090)

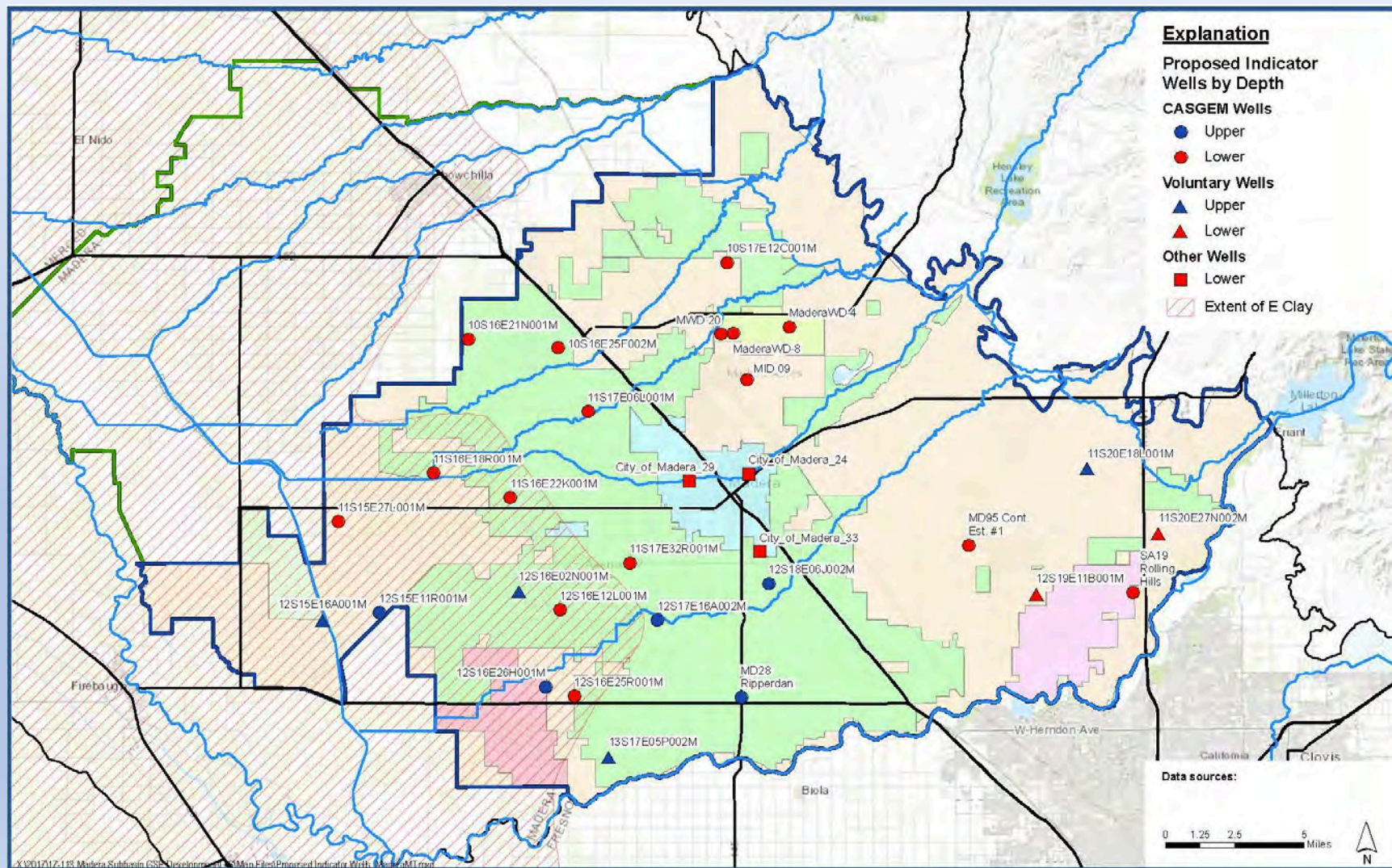


Crop Water Use Reduction Program: Madera County GSA 90,000 af. Remaining reduction in groundwater extraction due to permanent recharge basins replacing irrigated area and increased use of surface water in lieu of groundwater.

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS

Monitoring Network

Monitoring Network: CASGEM, Voluntary and Other Wells



© 2017/2018 Madera Subbasin GSIS Development and 30-Min Fixed-Interval Indicator Well Monitoring Program

DATA PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS

Minimum Thresholds for all Sustainability Indicators

Minimum Thresholds: Metrics







Sustainability Indicators	 Lowering GW Levels	 Reduction of Storage	 Seawater Intrusion	 Degraded Quality	 Land Subsidence	 Surface Water Depletion
Metric(s) Defined in GSP Regulations	<ul style="list-style-type: none"> Groundwater Elevation 	<ul style="list-style-type: none"> Total Volume 	<ul style="list-style-type: none"> Chloride concentration isocontour 	<ul style="list-style-type: none"> Migration of Plumes Number of supply wells Volume Location of isocontour 	<ul style="list-style-type: none"> Rate and Extent of Land Subsidence 	<ul style="list-style-type: none"> Volume or rate of surface water depletion

Figure 2. Minimum Threshold Metrics

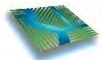
DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS

Definition of Undesirable Results

Added Slide

- Define for each sustainability indicator
- Exceedance of Minimum Threshold to yield undesirable result will be defined by:
 - Two consecutive fall measurements below Minimum Threshold
 - 30 percent of wells below Minimum Threshold

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

Stillwater Sciences

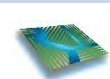


Madera Subbasin Technical Workshop
May 29, 2019

Setting Minimum Thresholds for Groundwater Levels

- Primary factors considered:
 - Existing beneficial uses
 - Drinking water (private wells, small community, etc.)
 - Irrigation
 - Environment
 - Human right to water (AB 685)
 - Importance of agriculture to County economy
- GSAs recognize inter-connection of these factors
- GSAs need time to transition and complete projects and actions – the time required will result in lower groundwater levels during implementation
- Discussing mitigation for impacts can address concerns of lowered groundwater levels during implementation

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

Stillwater Sciences



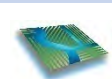
Madera Subbasin Technical Workshop

May 29, 2019

Method used for Groundwater Level Minimum Thresholds

- Using the groundwater model:
 - Prepare hydrographs of expected future conditions at various wells...with planned projects and actions
 - Use “average” hydrology for 2020 through 2040
 - Removes extreme impacts from starting wet or dry
 - Use 1965-2015 to represent 2041 through 2090
- Follow steps and adjustments for each representative monitoring well
 - Create artificial '10-year drought'
 - Check against lowest point during implementation and sustainability
 - Evaluate potential impact to drinking wells and develop mitigation

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



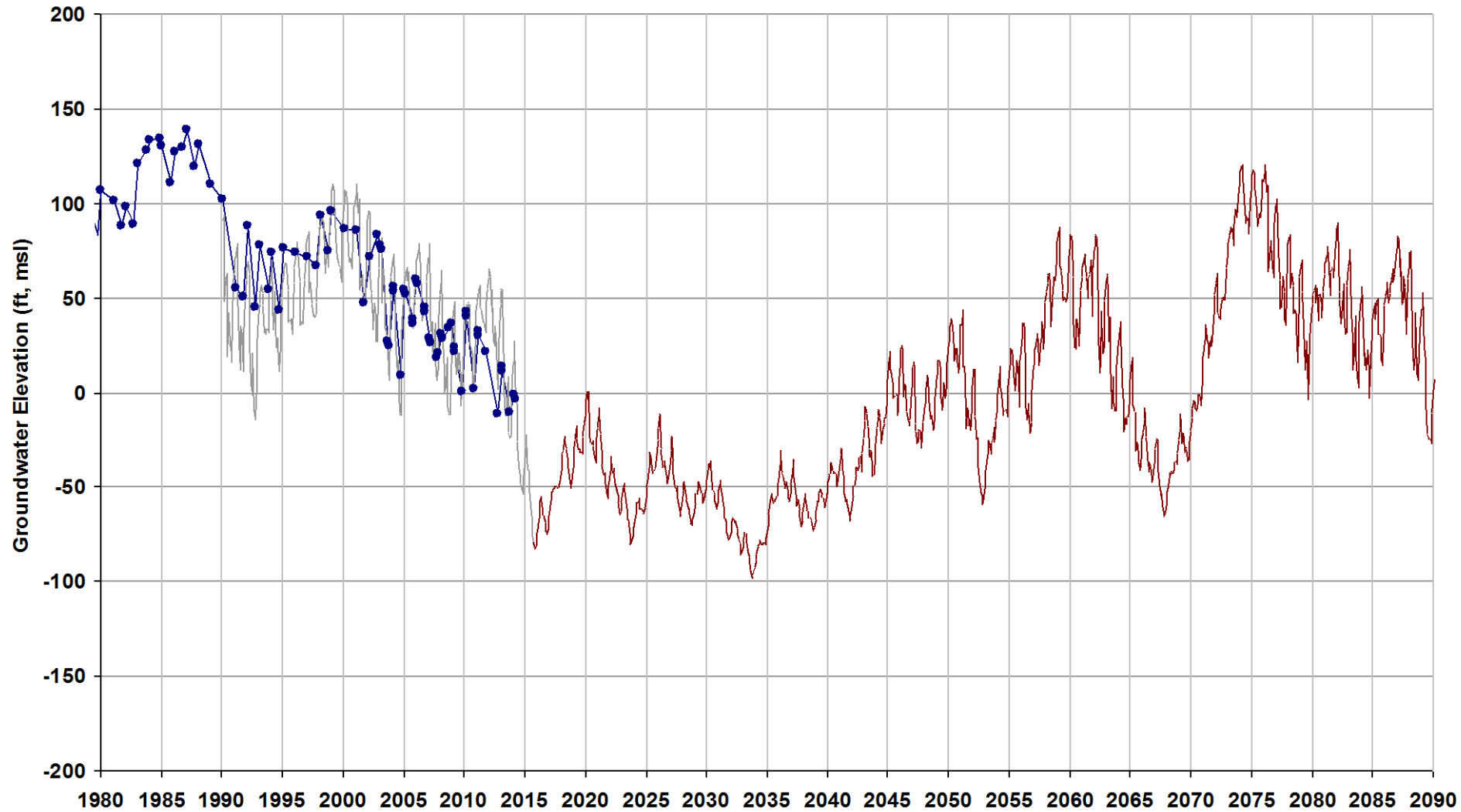
**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture
Stillwater Sciences

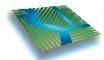


Madera Subbasin Technical Workshop
May 29, 2019

Step 1: plot measured and modeled results



DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



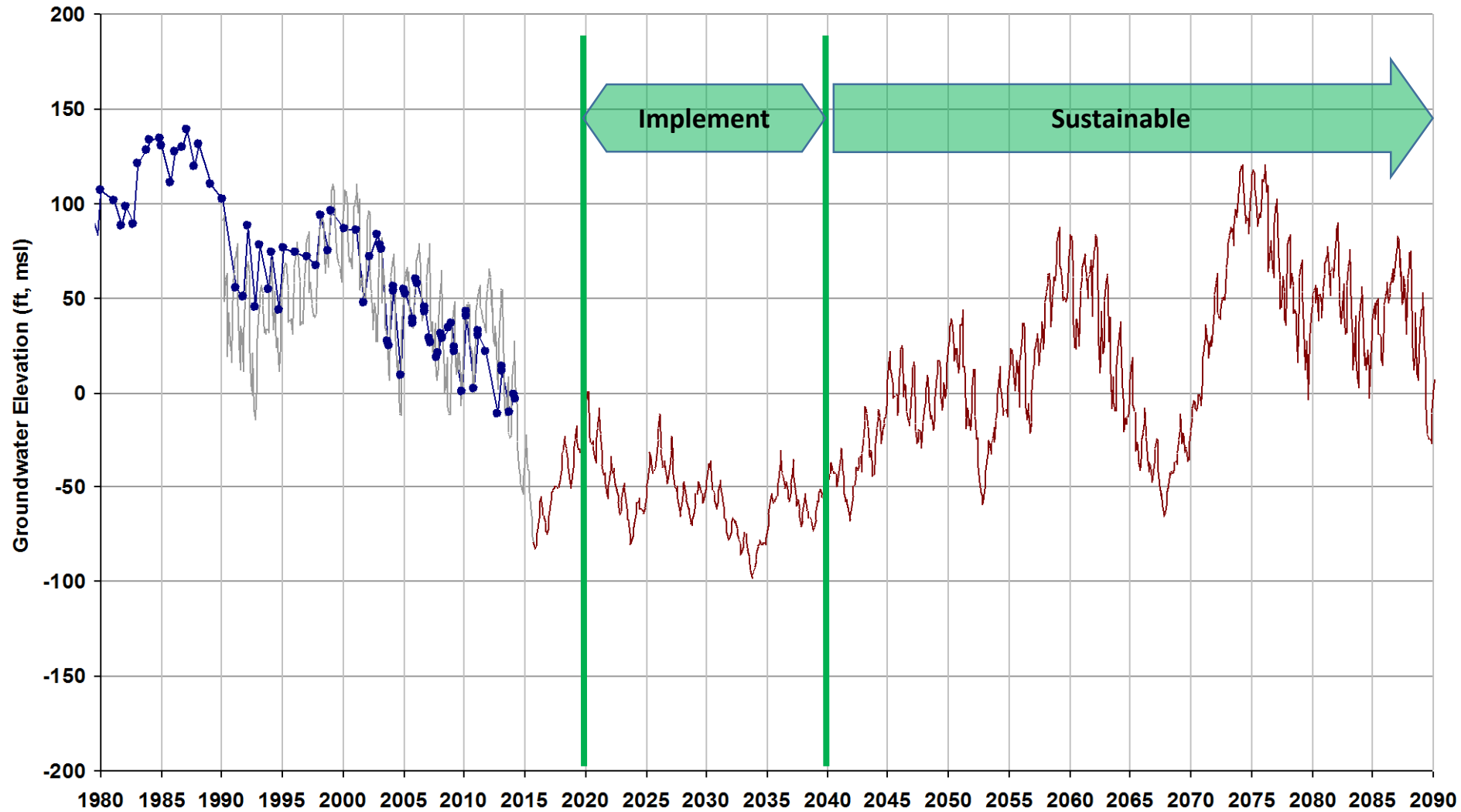
**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture
Stillwater Sciences

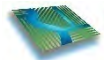


Madera Subbasin Technical Workshop
May 29, 2019

Step 2: Show 'implementation' and 'sustainability' periods



DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC



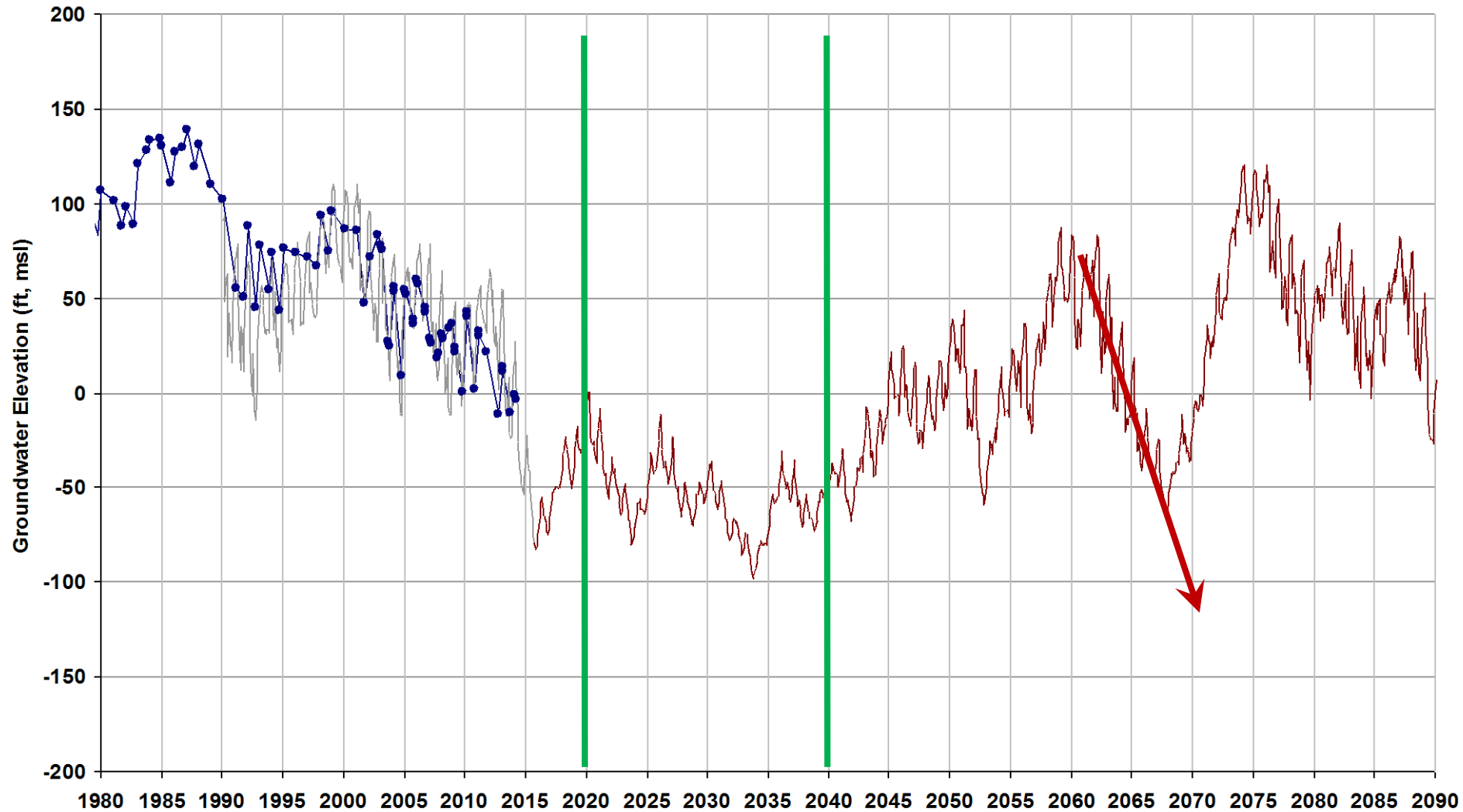
Luhdorff & Scalmanini
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture
Stillwater Sciences

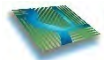


Madera Subbasin Technical Workshop
May 29, 2019

Step 3: Extend 2060's drought



DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



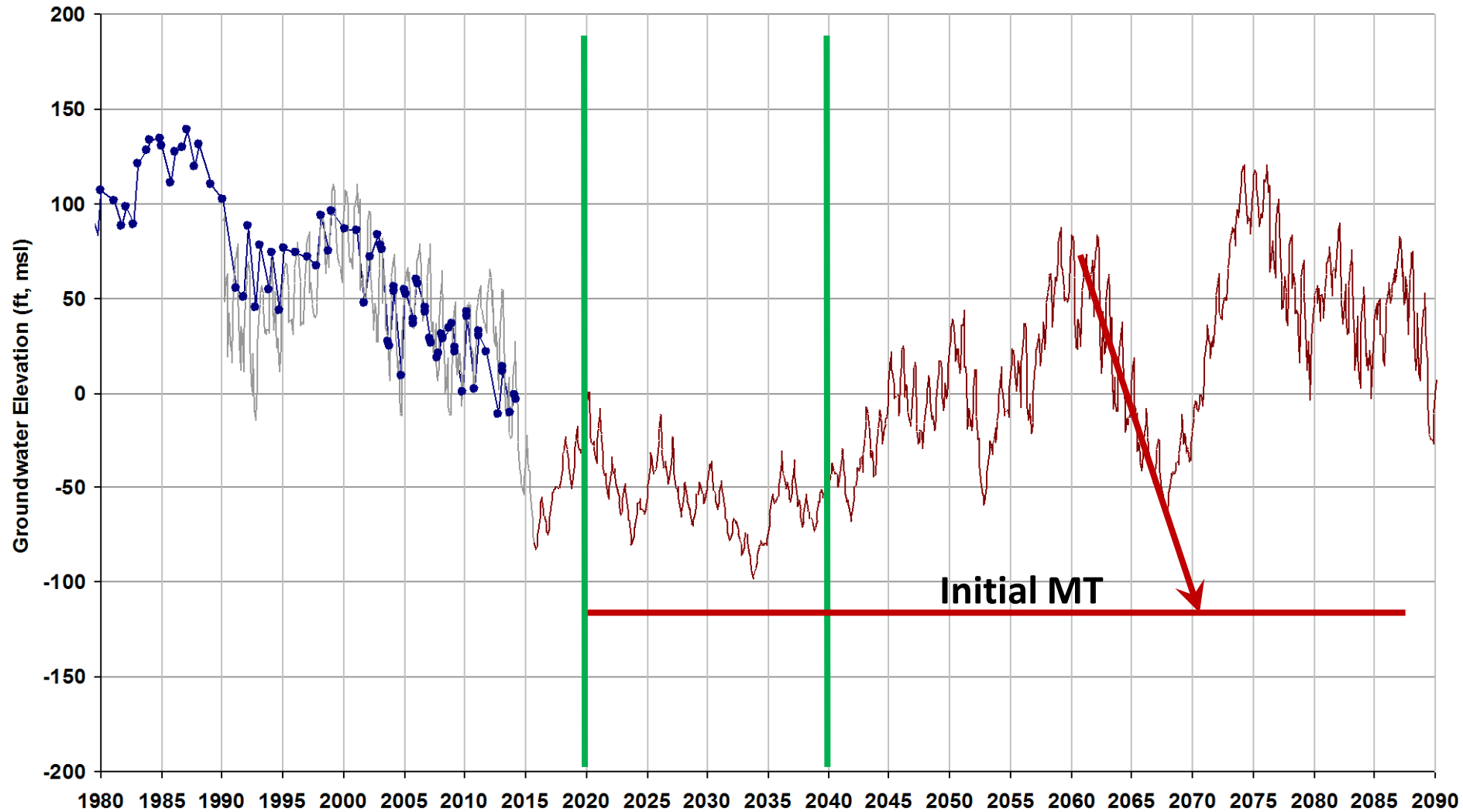
Luhdorff & Scalmanini
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture
Stillwater Sciences

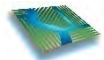


Madera Subbasin Technical Workshop
May 29, 2019

Step 4: Draw initial Minimum Threshold (MT) level at base of extended drought



DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



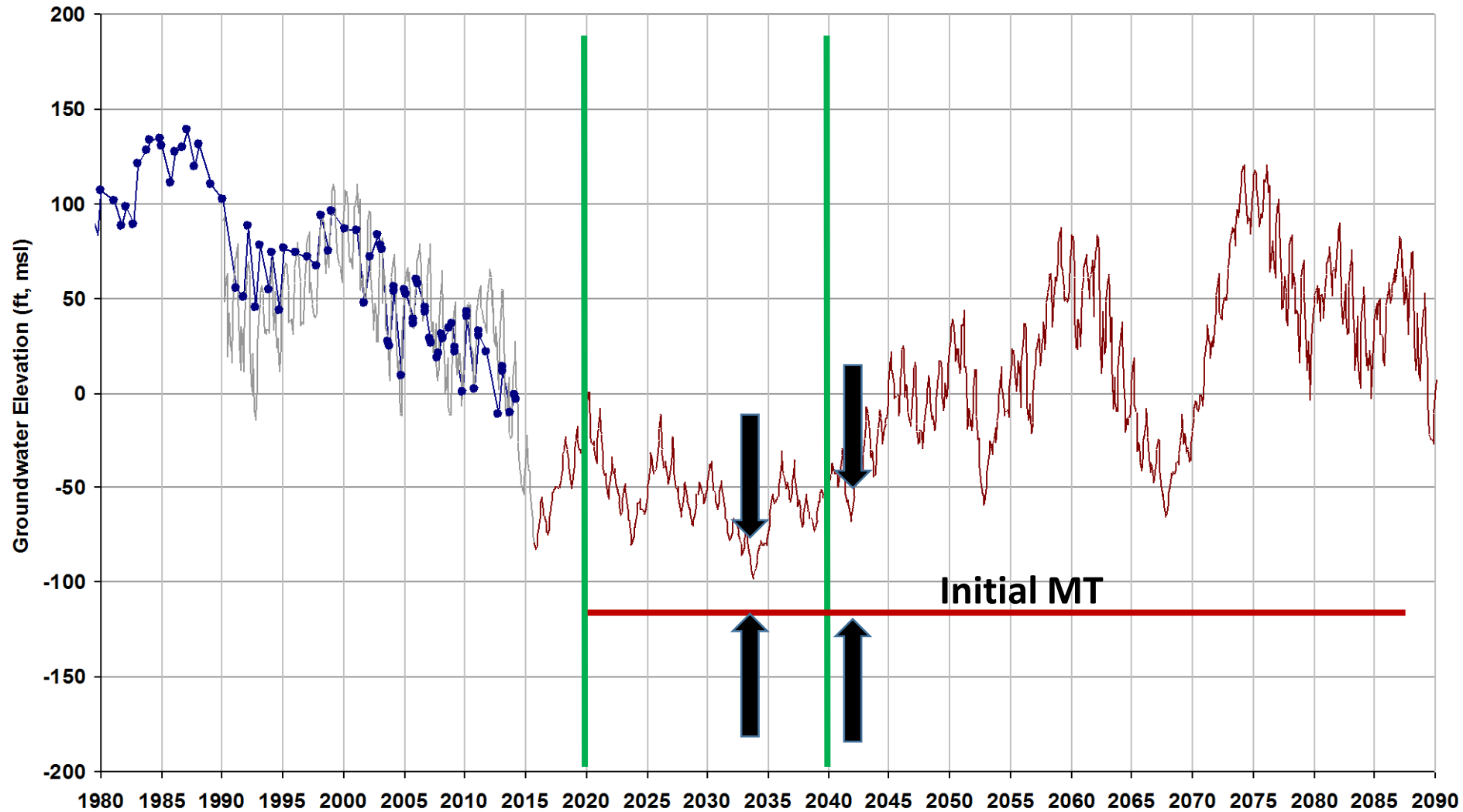
Luhdorff & Scalmanini
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture
Stillwater Sciences

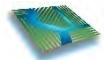


Madera Subbasin Technical Workshop
May 29, 2019

Step 5: Check if below lowest point during implementation and sustainability periods; adjust downward if necessary



DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



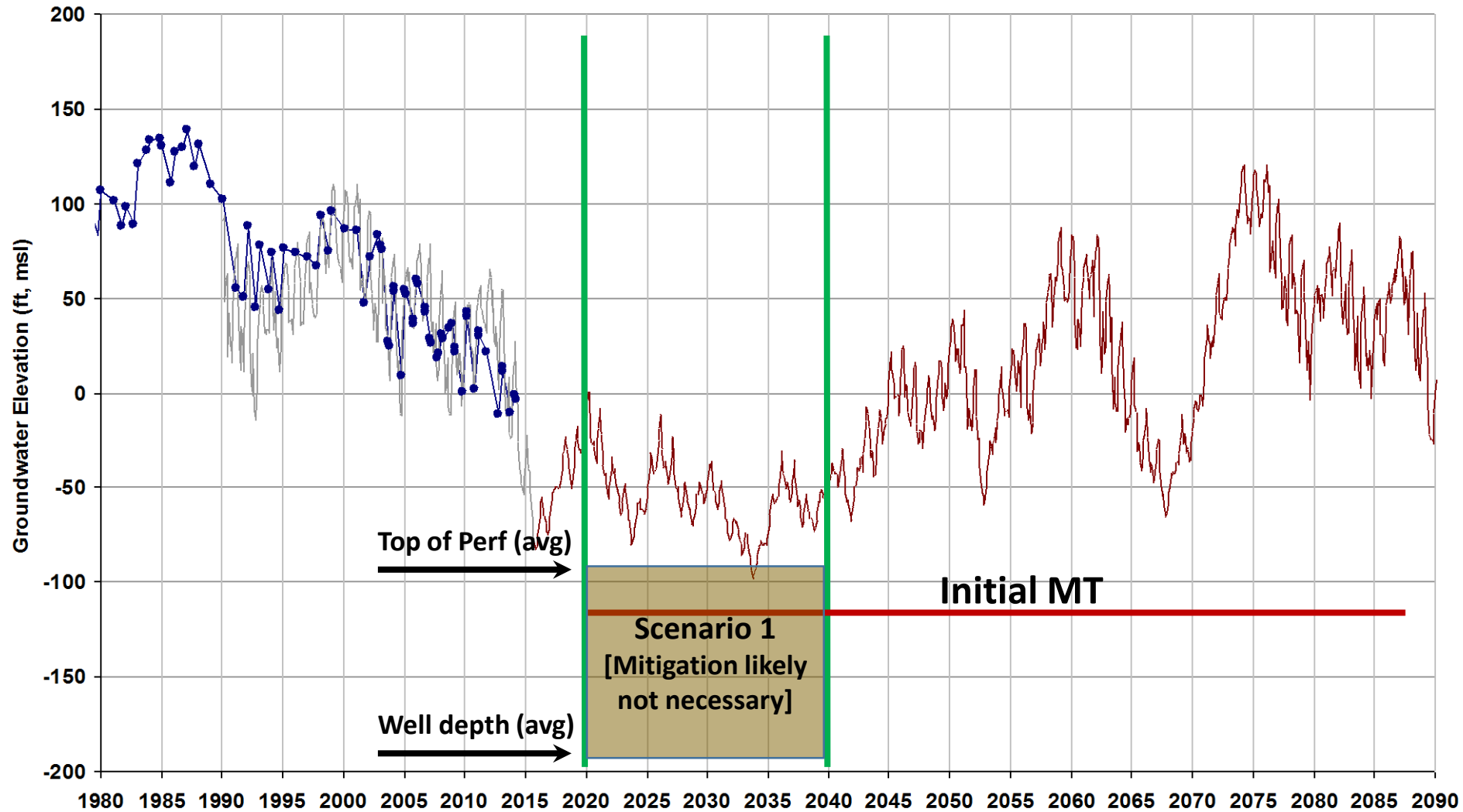
Luhdorff &
Scalmanini
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture
Stillwater Sciences



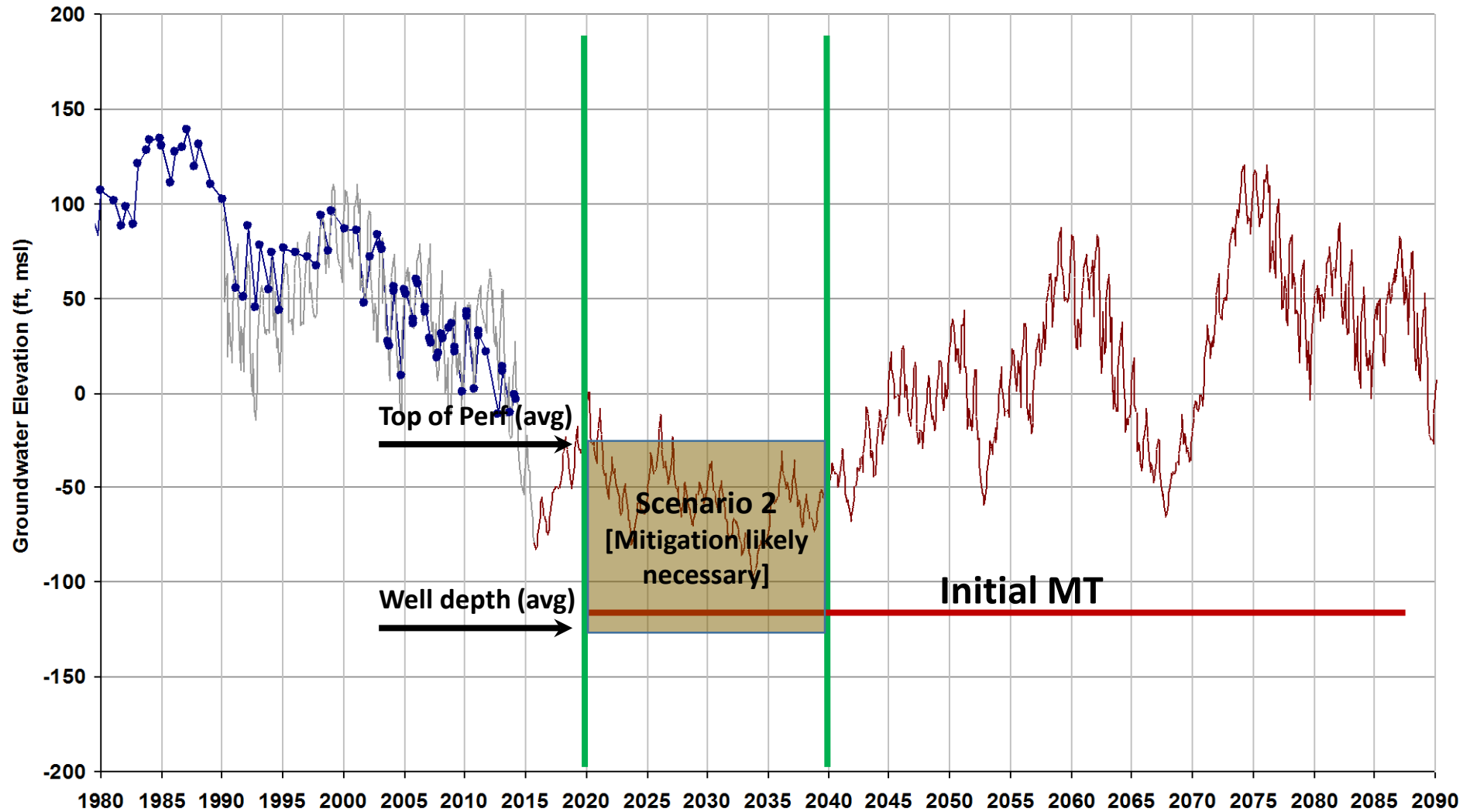
Madera Subbasin Technical Workshop
May 29, 2019

Step 6: Assess local drinking water well information for potential impact; plan for mitigation where Minimum Threshold is lower

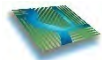


DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS

Step 6: Assess local drinking water well information for potential impact; plan for mitigation where Minimum Threshold is lower



DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



Luhdorff & Scalmanini
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture
Stillwater Sciences

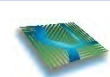


Madera Subbasin Technical Workshop
May 29, 2019

The GSAs are discussing a mitigation program for impacted drinking water wells

- Details developed during first year of implementation
- Possible mitigation actions
 - Replace/lower existing well
 - Connect to community water system
- Possible types of support
 - Low interest loans
 - Grants
- Likely will require well owners to sign up for program

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

Stillwater Sciences

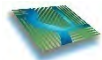


Madera Subbasin Technical Workshop
May 29, 2019

Setting Minimum Threshold for Reduction in Groundwater Storage

- The proposed Minimum Threshold is no long-term reduction in groundwater storage volume during the sustainability period
- Reduction in groundwater storage volume will be quantified based on measured groundwater levels in monitoring network wells

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

Stillwater Sciences



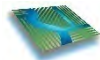
Madera Subbasin Technical Workshop

May 29, 2019

Setting Minimum Thresholds for Land Subsidence

- 1) Implement groundwater level Minimum Threshold methodology to set initial Minimum Threshold;
- 2) Evaluate ongoing benchmark (and other) subsidence surveys during the Implementation Period and conduct adaptive management (modify Minimum Thresholds to account for subsidence if warranted).

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

Stillwater Sciences

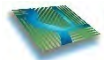


Madera Subbasin Technical Workshop
May 29, 2019

Setting Minimum Thresholds for Groundwater Quality

- MCL = Maximum Contaminant Level
- Applicable drinking water standards (e.g., MCL) will serve as Minimum Thresholds for key constituents (e.g., nitrate, arsenic, Total Dissolved Solids (TDS)):
 - Nitrate = 10 mg/L (as nitrogen) (or, if greater, existing level)
 - Arsenic = 10 ug/L (or, if greater, existing level)
 - TDS = 1,000 mg/L (or, if greater, existing level)
- MCLs are standards set by U.S. EPA and the State for drinking water quality
- MCLs are allowable limits for public water systems under Safe Drinking Water Act
- Setting GW level MTs above depth of reduced sediments helps reduce likelihood of arsenic exceedances (next slide)

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

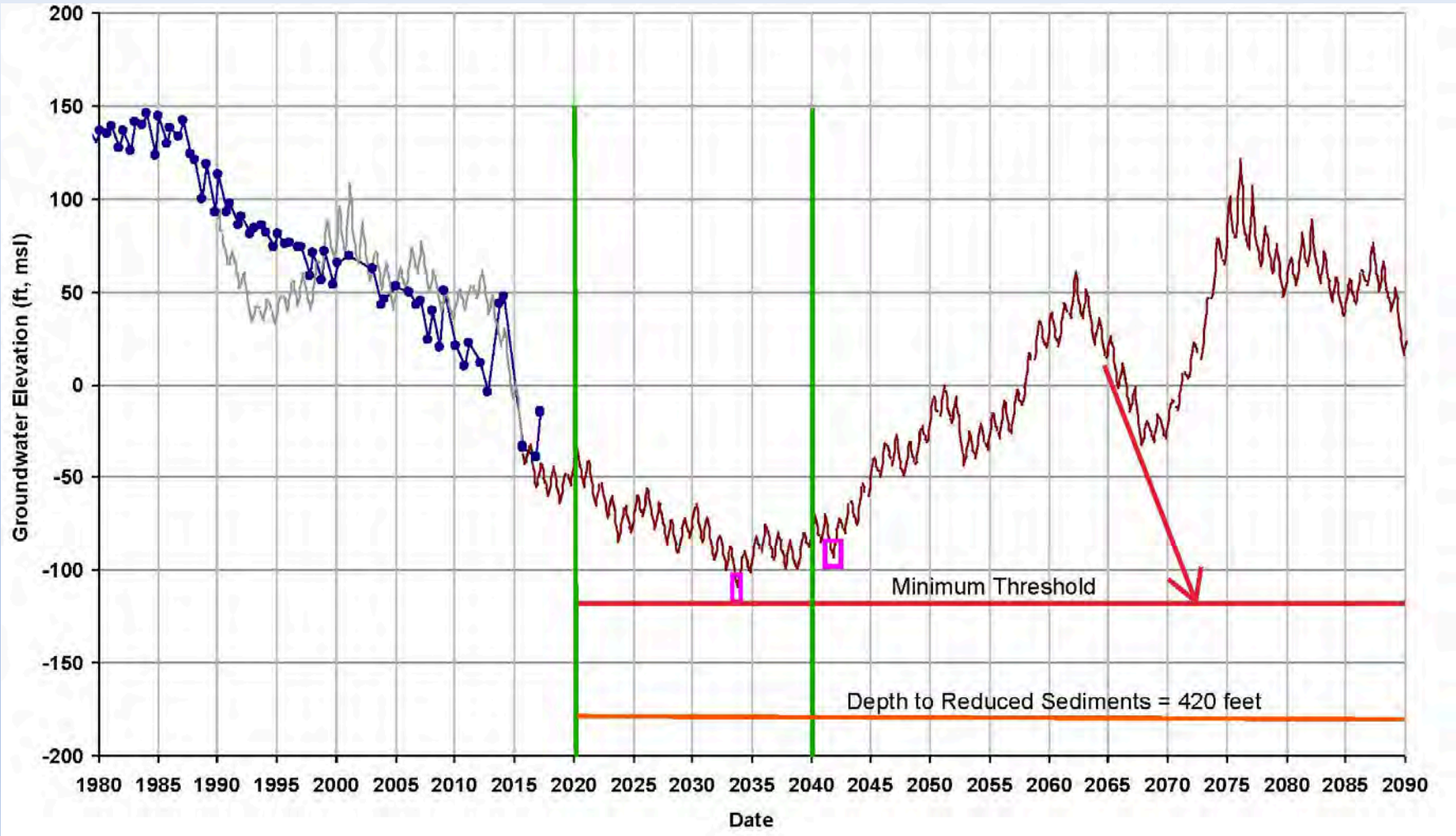
Stillwater Sciences



Madera Subbasin Technical Workshop

May 29, 2019

Setting Minimum Thresholds for GW Quality: Arsenic - Depth to Reduced Sediments

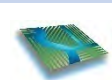


DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS

Setting Minimum Thresholds for Groundwater Quality: Nitrate and TDS

- 1) Nitrate concentrations may be trending upward over time unrelated to GSP implementation actions;
- 2) Focus on impacts from GSP projects and management actions;
- 3) Coordinate with Central Valley RWQCB Salt and Nitrate Control Program and Irrigated Lands Program - work with others to develop plan during Implementation Period;
- 4) Develop plans for monitoring water quality impacts related to individual projects as part of project design process, utilizing existing monitoring to the extent possible.

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture
Stillwater Sciences

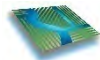


Madera Subbasin Technical Workshop
May 29, 2019

Setting Minimum Thresholds for Surface Water Depletion

- 1) Surface water depletion a function of surface water levels/flow and groundwater levels;
- 2) GW levels far below subbasin streams except portions of San Joaquin River (SJR);
- 3) Available data indicate GW levels below SJR channel bottom are relatively shallow in some places but still disconnected as of 2015;
- 4) MTs will not be set for surface water depletion

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

Stillwater Sciences

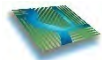


Madera Subbasin Technical Workshop
May 29, 2019

Evaluation of Groundwater Dependent Ecosystems

- 1) Certain vegetation is dependent on shallow depths to groundwater;
- 2) Rooting depth for vegetation species present in shallow GW areas being evaluated;
- 3) GW levels within 30 feet of ground surface are a consideration for initial screening of potential GDEs;
- 4) Occur in small areas (generally less than 10 acres) of south and west Madera Subbasin boundary (next slide); possibly also in far eastern shallow bedrock area

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

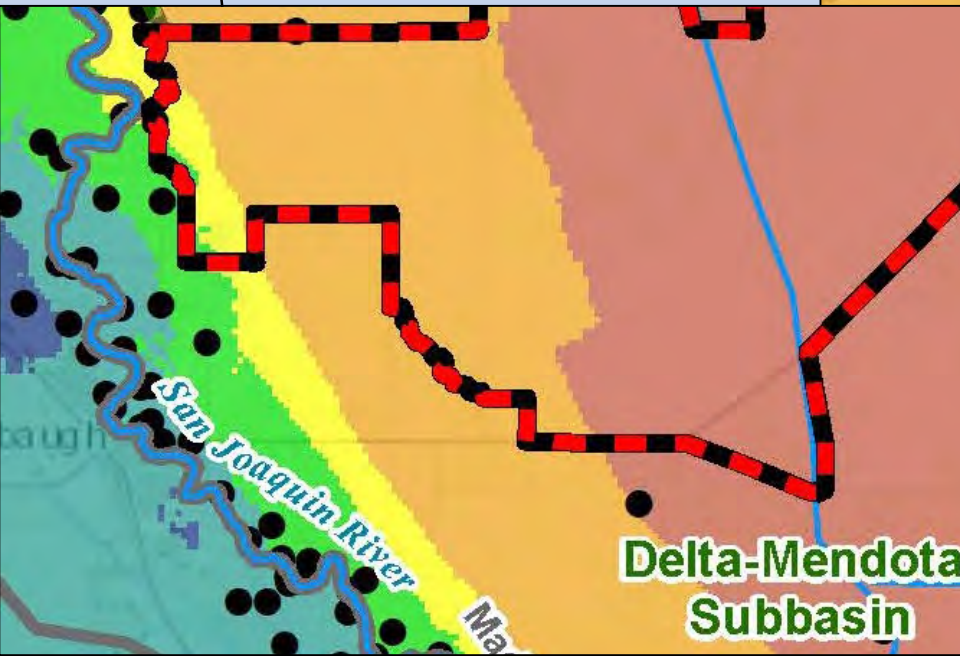
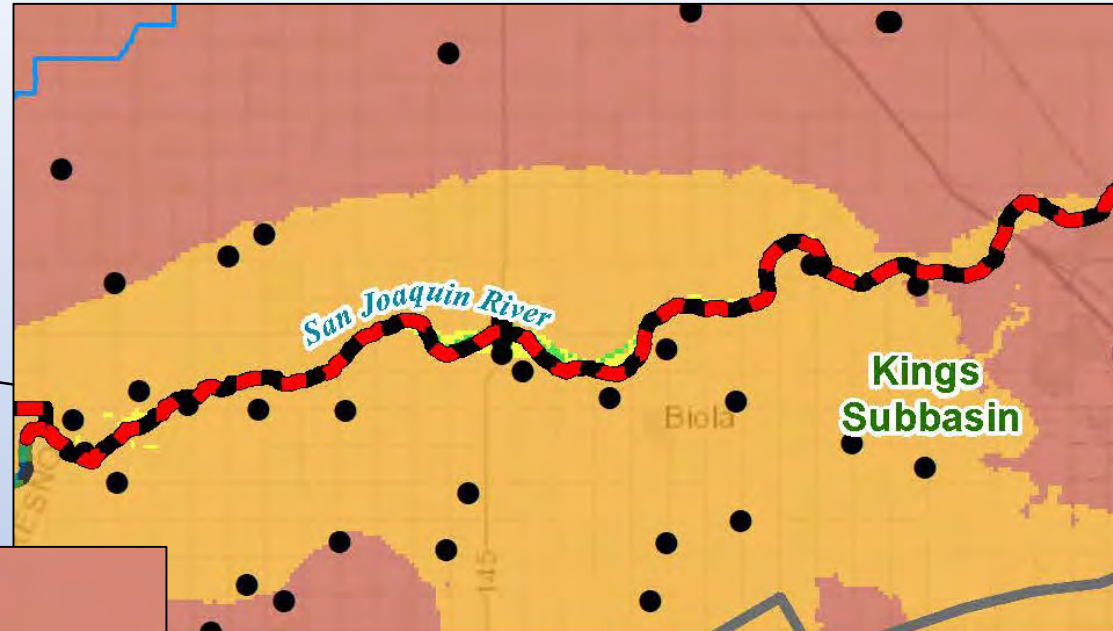
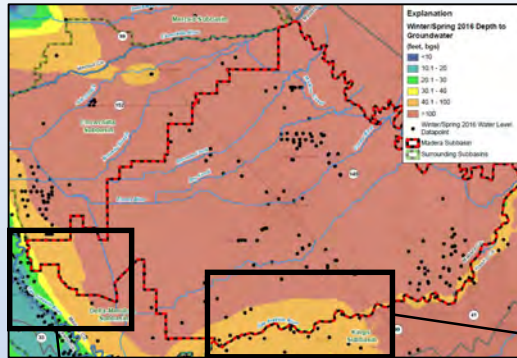
Stillwater Sciences



Madera Subbasin Technical Workshop

May 29, 2019

Areas for Initial Screening of Potential GDEs



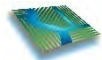
DEVELOPMENT PROCEEDS

Measurable Objectives and Interim Milestones for all Sustainability Indicators

Measurable Objectives

- 1) **GW Levels – Average of modeled monthly GW levels from 2040 to 2090 (see next slide);**
- 2) **GW Storage – Use GW level Measurable Objectives to calculate storage volume;**
- 3) **Land Subsidence – Use GW level Measurable Objectives;**
- 4) **GW Quality – Current constituent concentrations**
- 5) **Surface Water Depletion – Not required;**

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

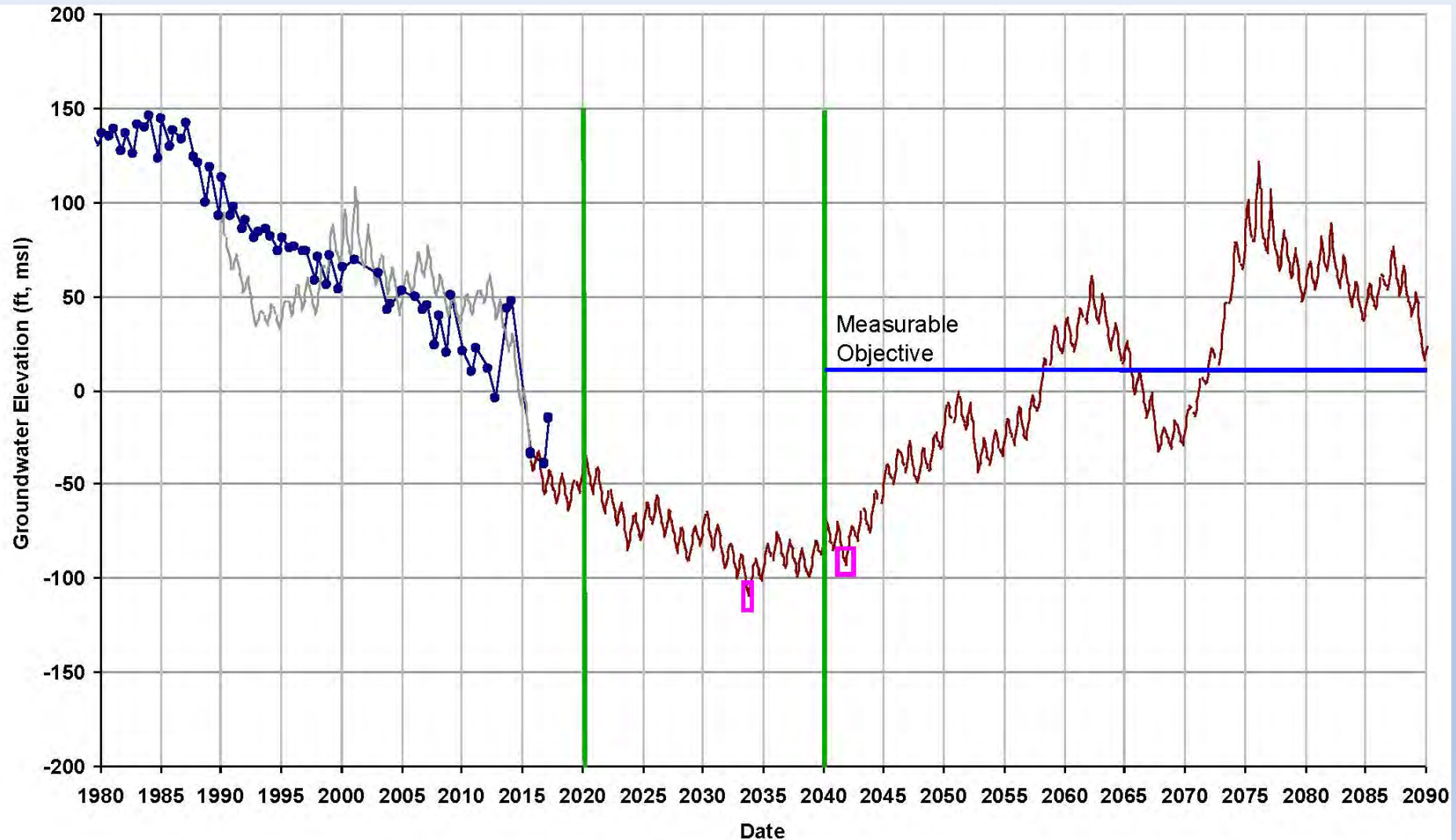
Stillwater Sciences



Madera Subbasin Technical Workshop

May 29, 2019

Measurable Objective: GW Levels

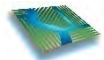


DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS

Interim Milestones

- 1) **GW Levels – Modeled GW levels during Implementation Period (see next slide);**
- 2) **GW Storage – Use GW levels as basis for calculating storage volumes;**
- 3) **Land Subsidence – Same as Subsidence Minimum Thresholds;**
- 4) **GW Quality – Current constituent concentrations;**
- 5) **Surface Water Depletion – Not required;**

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

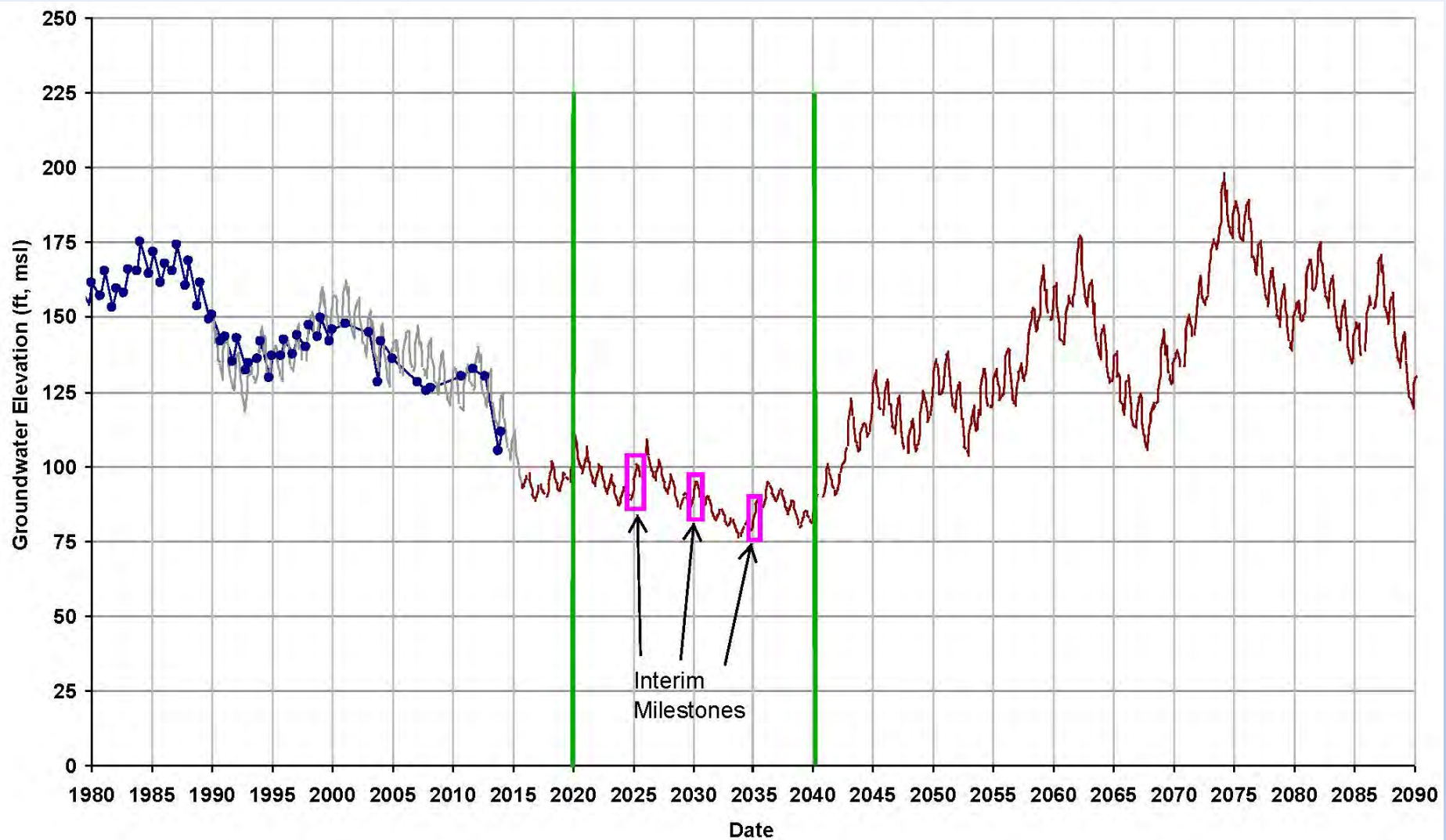
ERA Economics
Environment • Resources • Agriculture

Stillwater Sciences



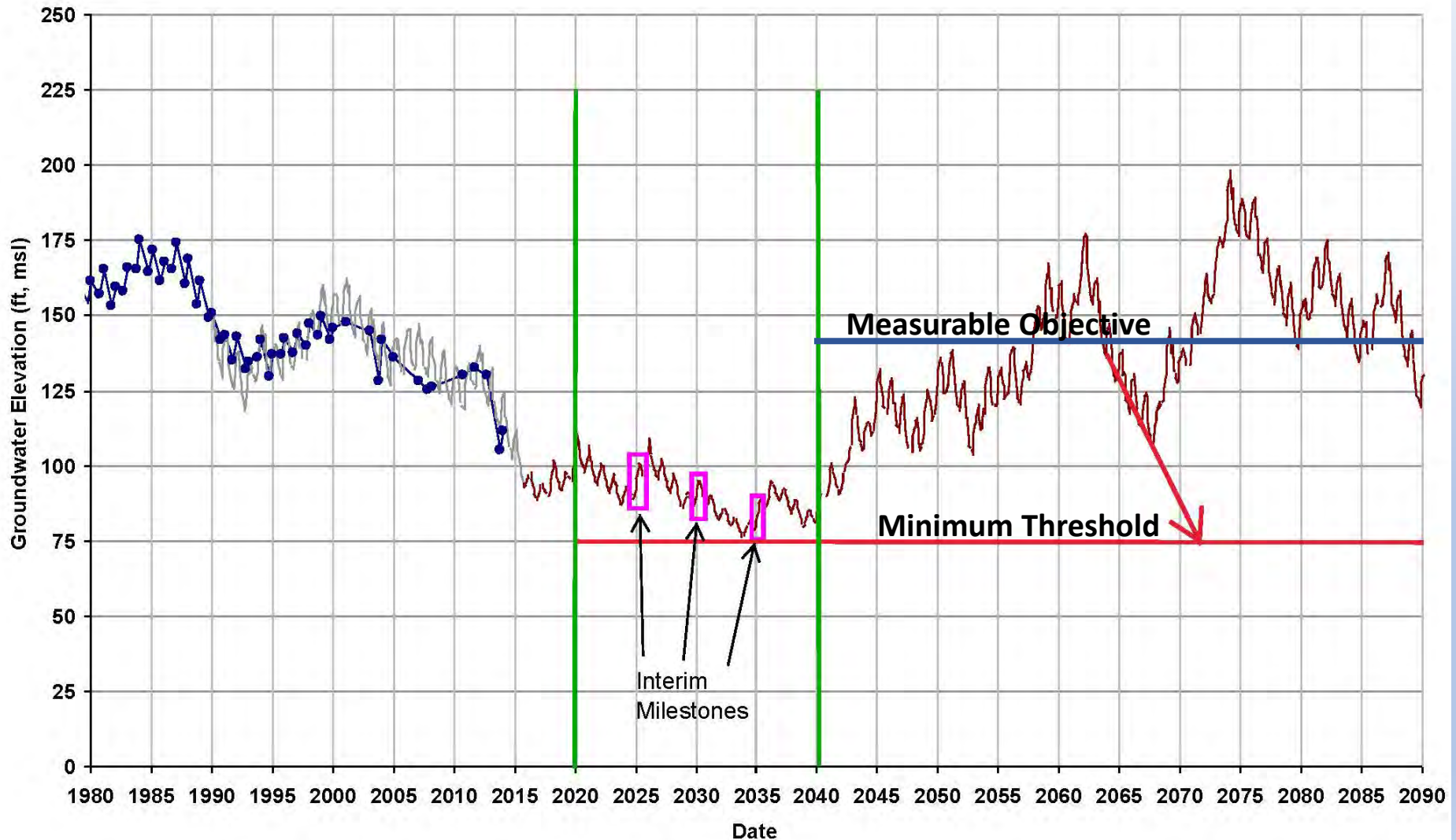
Madera Subbasin Technical Workshop
May 29, 2019

Interim Milestones: GW Levels



DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS

Interim Milestones, Minimum Threshold, and Measurable Objective for GW Levels

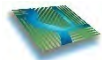


DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS

Next Steps

- Discuss proposed methodologies for setting Minimum Thresholds and Measurable Objectives and Interim Milestones at upcoming GSA Board meetings
- Incorporate Minimum Thresholds and Measurable Objectives and Interim Milestones into the GSP
- Complete draft GSP and release for public review

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

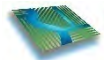
Stillwater Sciences



Madera Subbasin Technical Workshop
May 29, 2019

Questions

DRAFT PRELIMINARY ANALYSIS AND RESULTS TO BE REFINED AS GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT PROCEEDS



DAVIDS
ENGINEERING, INC.



**Luhdorff &
Scalmanini**
Consulting Engineers

ERA Economics
Environment • Resources • Agriculture

Stillwater Sciences



Madera Subbasin Technical Workshop
May 29, 2019